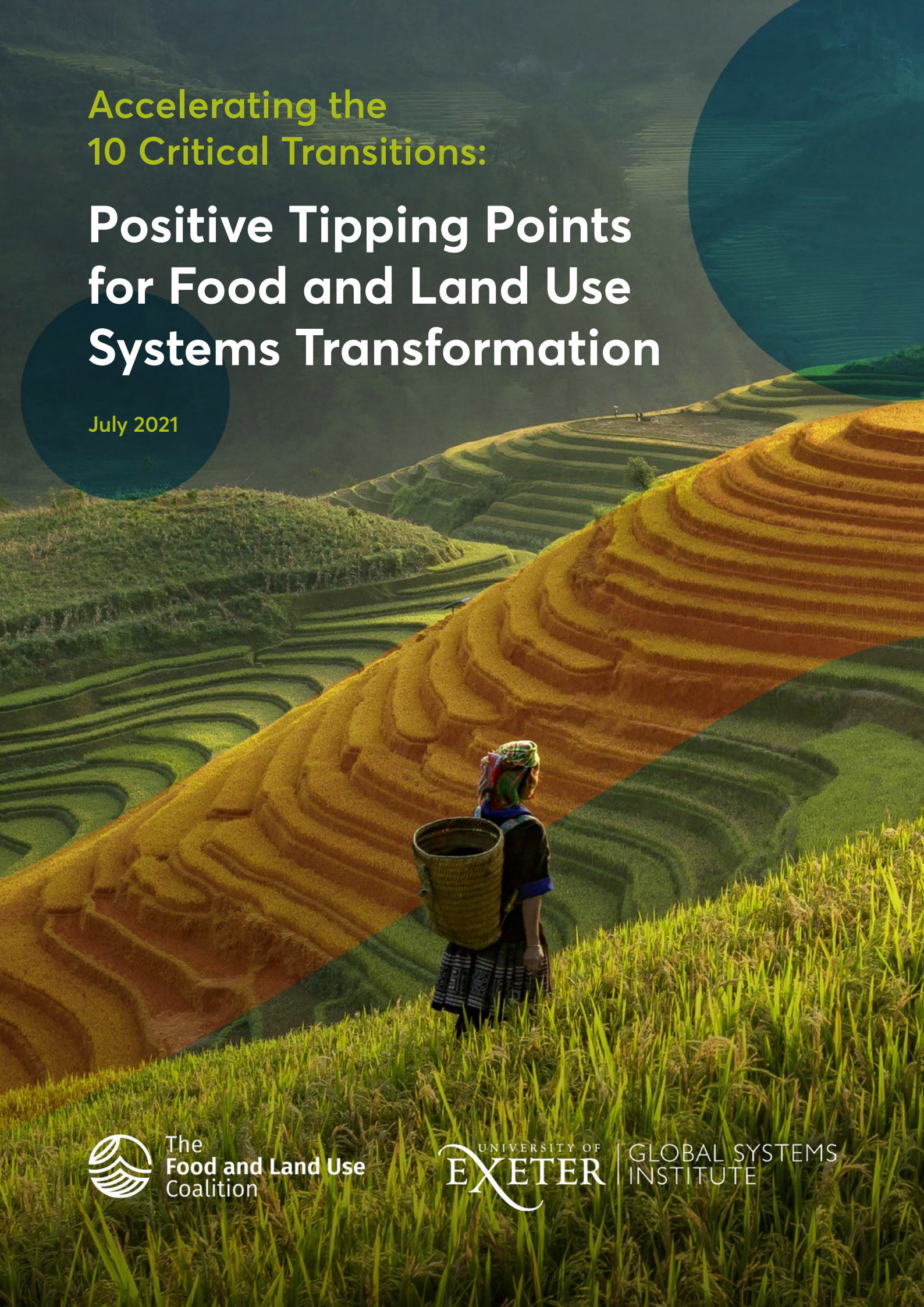
Accelerating the
10 Critical Transitions:

Positive Tipping Points for Food and Land Use Systems Transformation

July 2021



The Food and Land Use Coalition

University of Exeter | Global Systems Institute

Contents

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Please note that FOLU intends to publish a series of briefing papers that will further explore the topics in this report. Please click here to sign up to FOLU's newsletter to receive updates.

Executive Summary

Mekle Wunete, the beneficiary of The Debre Yacob Watershed Learning Restoration Project in Bahir Dar, Ethiopia/ Abbie Trayler-Smith for Panos Pictures/Food and Land Use Coalition

In 2019 the Food and Land Use Coalition (FOLU) produced a Global Consultation Report, Growing Better: Ten Critical Transitions to Transform Food and Land Use. The report set out why a global transformation is needed in the next decade, and it provided a vision for a better future along with a proposed reform agenda to achieve it. This action agenda – anchored around ten critical transitions – is necessary to deliver climate mitigation, safeguard biological diversity, ensure healthier diets for all, improve food security and create more inclusive and resilient rural economies. Achieving these goals would generate a societal return of around $5.7 trillion annually, more than 15 times the related investment cost of $300–350 billion per year (less than 0.5 percent of global GDP), and would create new business opportunities worth up to $4.5 trillion a year by 2030.[1]

Global transformation of food and land use systems is needed now more than ever as we rebuild the economy in the wake of COVID-19. The pandemic has exposed the fragility and inequity of our food systems, magnifying the problem of hunger for low-income families, and shining a spotlight on the increased risk factors resulting from overnutrition as well as the link between zoonotic diseases and habitat destruction. As such, the experiences of the past 24 months have reaffirmed and renewed FOLU's commitment to delivering against the ten critical transitions set out in the *Growing Better* report.

The world is at a critical inflection point with rising awareness of the need for change and progress on several fronts. There is a growing realisation that food and land use systems transformation is central to tackling the urgent challenges of our time – from COVID-19 recovery to action on climate. As a result, both governments and companies are increasingly setting ambitious net zero emissions targets in ways which protect nature and address food and land use systems' contribution to the climate crisis. Twenty-four countries have now joined the COP26 Forest Agriculture Commodity Trade (FACT) Dialogues which seeks to address deforestation linked to the trade of soft commodities – with the UK, EU, and US also exploring legislative enhancements to support these efforts. Investors are also recognising the opportunity associated with the transformation of these systems. In 2020, for example, $527 million was invested into alternative proteins in Europe, more than quadrupling investment flows in 2019.[2] Many other examples offer similar stories of hope.

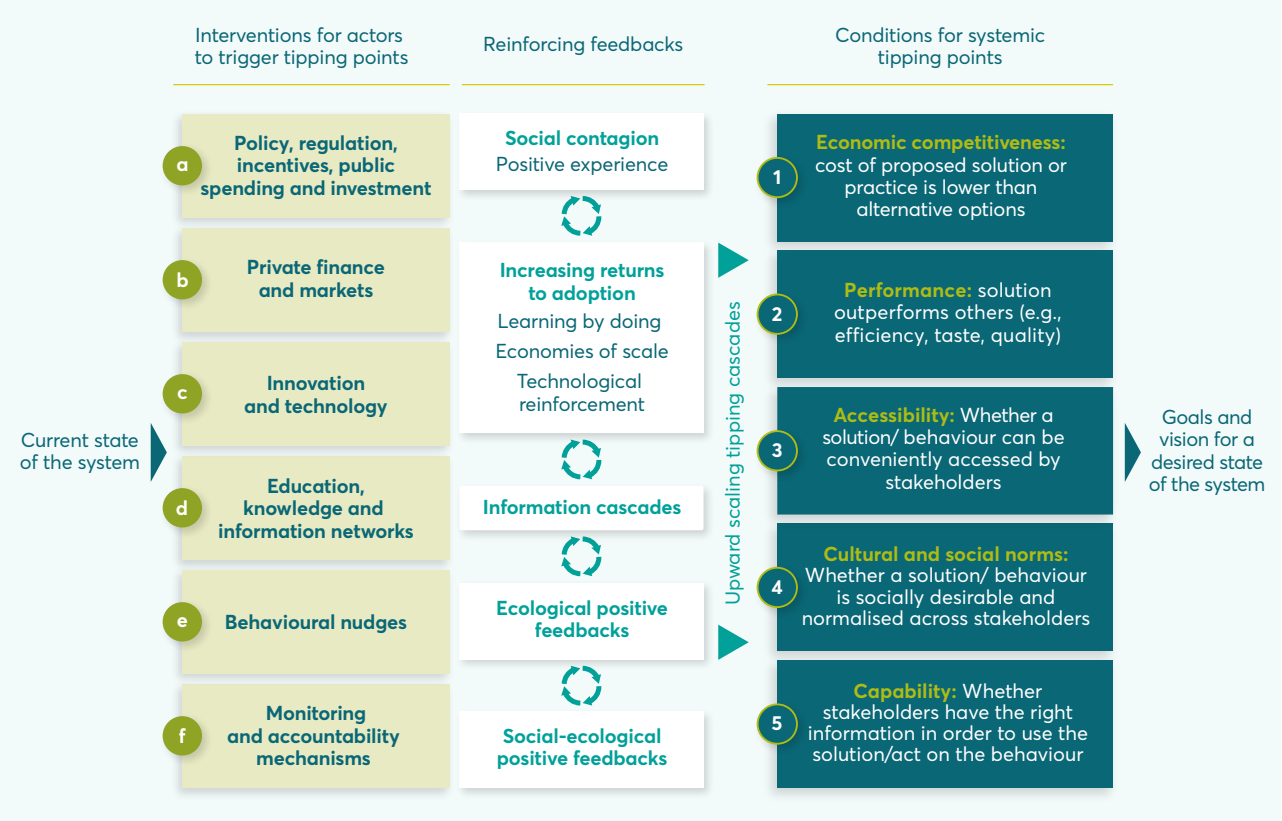
But the pace of progress is not sufficient; the world must unlock rapid change at scale to achieve our vision for sustainable food and land use systems in the next decade. As such, FOLU is interested in the role of positive, systemic "tipping points" in triggering and accelerating change across socio-technical, ecological and market/economic systems, and how this can be applied to the transformation of food and land use systems. Tipping points can be defined as critical points in a system where targeted interventions lead to large and long-term consequences on the evolution of that system, profoundly altering its modes of operation.[3,4,5,6] Interventions can foster the emergence of positive feedback loops and activate small tipping points which, in turn, can trigger wider systemic tipping points. Positive, systemic tipping points have most widely been explored in the energy and transport systems but so far this approach has not been widely applied in the context of food and land use systems.

We have developed a framework to guide actors in the triggering of positive tipping towards a desired system state (Figure 1). This framework has been co-developed by FOLU and the Global Systems Institute at the University of Exeter. We intend to test and refine the framework over the next 24 months through further consultation and development of methods for identifying early signs of an incumbent system being susceptible to positive tipping. If so, this can identify where modest interventions can be most effective at tipping a system towards a desired state.

We believe this framework has much broader applicability, but we focus in this report on applying it to food and land use systems transformation. The framework - shown in Figure 1 below - comprises:

- **Goals and visions:** Having an alternative vision of system characteristics and associated goals – if they are widely and democratically agreed upon – is a powerful and necessary motivator of transformative change.
- **Conditions:** We propose five key conditions that need to be met for an enabling environment capable of fostering the emergence of large-scale systemic tipping points.
- **Positive/reinforcing feedback loops:** Meeting the above conditions typically occurs through the implementation of self-amplifying feedback loops in a system, progressively pushing a stable system towards tipping points beyond which the system shifts towards the desired sustainable state.
- **Interventions:** Reinforcing feedback loops can be stimulated through a set of multiple interventions by different actors. Sequencing of interventions should be prioritised such that early interventions create enabling conditions for feedback loops.
- **Actors:** These are the different stakeholder groups that can either accelerate or hamper the tipping of systems. Note that not all actors have the same agency as others.

Figure 1: Framework for triggering positive tipping points



Please note: this framework does not include exogenous factors directly, but we recognise that they exist and can have fundamental impacts on the systems we are exploring here.

Workers do harvesting Banana in the fields at Tandalwadi village in Jalgoan/ Atul Loke for Panos Pictures/Food and Land Use Coalition

We have applied this framework to explore the potential for policymakers to trigger tipping points across four of FOLU's ten critical transitions. These four were selected for initial analysis through consultation with the broader FOLU coalition, given their importance to the 2021 "Super Year" and also their relevance to coalition efforts around the world. While the delivery of the ten critical transitions requires collective action across the system – from farmers and fishers to financiers to scientists – we believe that policymakers have a critical role in creating an enabling environment for change and that the tipping point framework set out in this report can be a useful tool in this context.

In applying the framework to each of these critical transitions, we have come up with a proposal for how intervention by policymakers can accelerate rates of change by sequencing the recommendations set out in *Growing Better*. This approach to sequencing of interventions builds on the work of Lukas Fesenfeld and fellow researchers at ETH Zürich.[7] It has yet to be fully tested and we acknowledge that it will undoubtedly differ across geographies and cultures.

1

Critical Transition 1 on Promoting Healthy Diets and **Critical Transition 5 on Diversifying Protein Supply:** We focus this deep dive specifically on the required shift towards increasingly plant-based diets in Europe given the current patterns of meat consumption across the continent. Investing in innovation to improve the taste, quality, affordability and social acceptance of alternative protein sources is a critical early-stage policy intervention required to accelerate reinforcing feedback loops. There is also a major role of public procurement in signalling demand and creating incentives, as well as regulatory interventions relating to national dietary guidelines and governance of corporate advertising and marketing. These earlier interventions are also designed to limit backlash associated with the sudden implementation of stringent policy measures that seek to encourage consumers to reduce meat consumption. Positive feedback from these initial interventions allows more stringent policies to be added over the longer term, including tax and regulation.

2

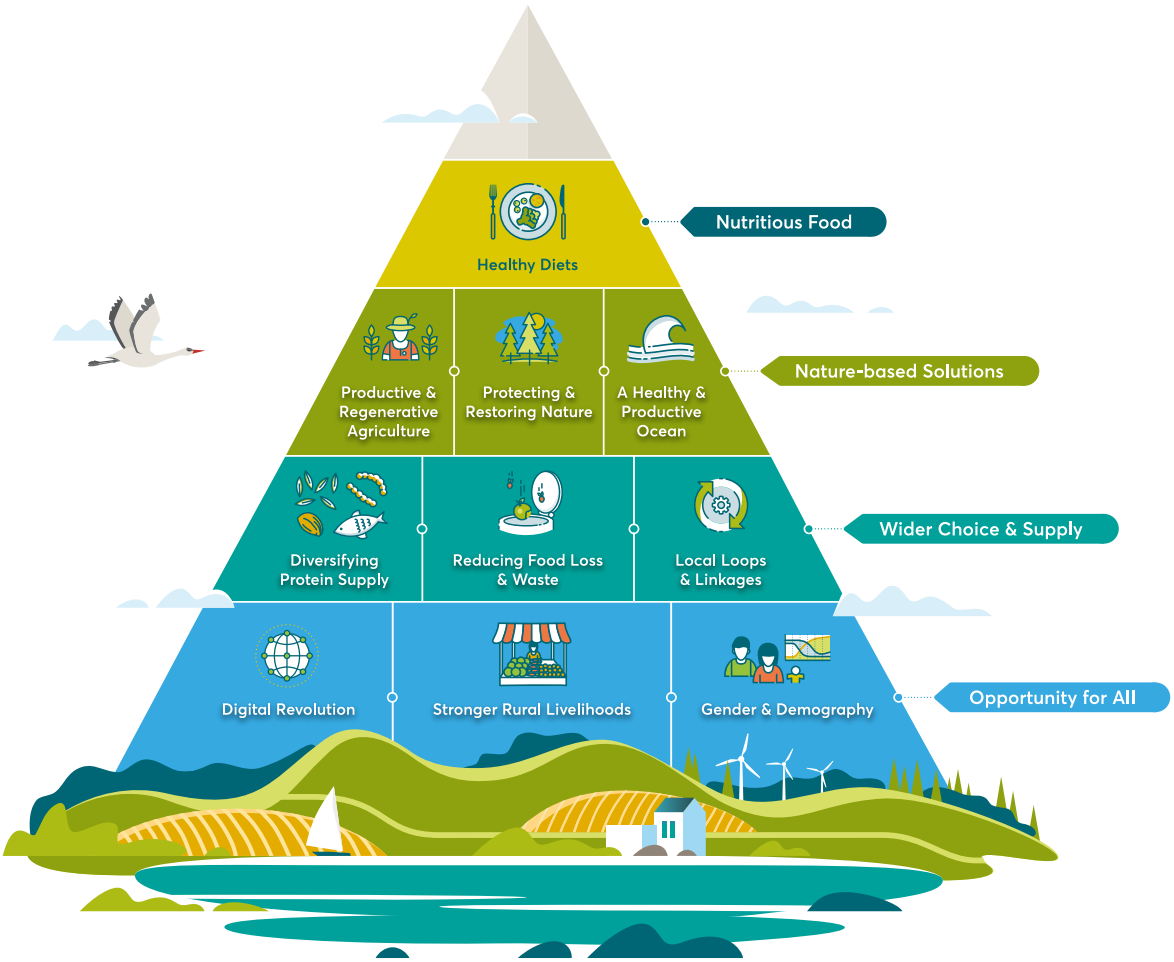
Critical Transition 2 on Scaling Productive and Regenerative Agriculture: We chose India as a case study due to a mix of historical and contemporary factors. While the recommendations would need to be tested in a national and sub-national context, we propose that early interventions could be focused on a combination of increasing public investment and catalysing private investment to promote sustainable agriculture since these interventions can trigger reinforcing feedback loops progressing towards a tipping point. This investment would also need to be coupled with efforts to ensure that agricultural subsidies provide incentives to shift towards more productive and sustainable production. Agricultural support policies would need to ensure that safety nets and financial support are available to de-risk the transition for farmers, currently a major barrier to adoption of alternative practices. There is also a key role for governments and private sector actors to support demand for more sustainable products in India, including through public procurement as well as consumer awareness.

3

Critical Transition 3 on Protecting and Restoring Nature: We focused this deep dive specifically on commodity-driven tropical forest loss and the opportunity of shifting towards deforestation-free and forest-positive commodity value chains. We provide recommendations for policymakers in both forest-country governments and non-forest country governments. Proposed early-stage interventions are those which we believe are easier to implement and which provide the foundation for later stage interventions – for example spatial planning, natural capital accounting and investment in transparency mechanisms as well as the timely recommendation to include forests and land use in updated Nationally Determined Contributions (NDCs) to the Paris Agreement ahead of COP26. Later stage interventions – which are often the most effective but also difficult to implement – include subsidy reform, carbon pricing and scaling of other payments for ecosystem services models.

While this still needs to be tested and no doubt refined, we hope that this framework and the report provide a message of optimism and a source of empowerment that our actions can make a big difference in delivering a more desirable future. We should all feel a sense of agency and autonomy to be part of tipping towards positive change. Policymakers and public authorities are a major focus given their role in setting and enacting economic and social rules. Financial actors have considerable leverage to change the global economy. The civil society organisations can hold them all to account. Citizens forming social movements can trigger positive tipping points and start upward-scaling tipping cascades. Researchers and technological innovators are the creators of novel alternatives and entrepreneurs can help propel their upscaling. Citizens as consumers are key to their uptake. The private sector can actively engage in innovation trajectories and help build an innovation "ecosystem". Marketing can help tip change in public attitudes. The media can help communicate it. The faith sector can help tip hearts and minds. We all have a role.

Figure 2: Growing Better's 10 Critical Transitions for Food and Land Use Systems Transformation



Economic Prize

$5.7 trillion economic prize by 2030 and $10.5 by 2050 based on avoided hidden costs

Investment Requirements

$300-$350 billion required each year for the transformation of food and land use systems to 2030

Business Opportunity

$4.5 trillion annual opportunity for businesses associated with the ten critical transitions by 2030

Cross Cutting Reforms to Transform Food and Land Use

Government: Establish targets; break down governmental silos; put a price on carbon; land use planning; repurpose agricultural support and public procurement; massively increase R&D and target it on healthy, natural solutions.

Business & Farmers: Organise pre-competitively to support government reform agendas and set internal standards for specific sectors; establish true cost accounting for food and land use.

Investors & Financial Institutions: Build on the Task Force on Climate-related Financial Disclosures to cover nature; develop a set of financing principles for food and land use; develop innovative finance instruments, including blended finance, to manage risks and leverage opportunities.

Participants in multilateral processes and multi-stakeholder partnerships: Raise ambition in the United Nations Framework Convention on Climate Change 2020 stock-take and ensure an ambitious outcome in the 2020 Convention on Biological Diversity in Kunming, China.

Civil Society: Drive information campaigns for food and land use reform and direct campaigns against serial offenders (public and private).

FINANCIALS KEY

Economic prize by 2030 | Annual additional investment requirements to 2030 | Business opportunity by 2030

Ten Critical Transitions		Essential Actions	Financials (by 2030)
 Healthy Diets	Global diets need to converge towards local variations of the "human and planetary health diet" – a predominantly plant-based diet which includes more protective foods (fruits, vegetables and whole grains), a diverse protein supply, and reduced consumption of sugar, salt and highly processed foods. As a result, consumers will enjoy a broader range of high-quality, nutritious and affordable foods.	**Government:** Establish and promote planetary and human health dietary standards through repurposed agricultural subsidies, targeted public food procurement, taxes and regulations on unhealthy food **Business:** Redesign product portfolios based on the human and planetary health diet	$1.28 trillion $30 billion $2 trillion
 Productive & Regenerative Agriculture	Agricultural systems that are both productive and regenerative will combine traditional techniques, such as crop rotation, controlled livestock grazing systems and agroforestry, with advanced precision farming technologies which support more judicious use of inputs including land, water and synthetic and bio-based fertilisers and pesticides.	**Government & Business:** Scale up payments for ecosystem services (soil carbon/health and agrobiodiversity) plus improve extension services (training and access to technology, seeds, etc.) **Business & Investors:** Shift procurement from buying commodities to investing in sustainable supply chains; deploy innovative finance to reach currently underfinanced parts of supply chains	$1.17 trillion $35-40 billion $530 billion
 Protecting & Restoring Nature	Nature must be protected and restored. This requires an end to the conversion of forests and other natural ecosystems and massive investment in restoration at scale; approximately 300 million hectares of tropical forests need to be put into restoration by 2030.	**Government:** Put in place and enforce a moratorium on the conversion of natural ecosystems, and give legal rights and recognition to the territories of indigenous peoples **Government:** Scale REDD+ to $50 billion per year by 2030 if results delivered and establish a Global Alliance Against Environmental Crime **Business:** Establish transparent and deforestation-free supply chains and demand the same of suppliers	$895 billion $45-65 billion $200 billion
 A Healthy & Productive Ocean	Sustainable fishing and aquaculture can deliver increased supply of ocean proteins, reducing demand for land and supporting healthier, and more diverse diets. This is only possible if essential habitats – estuaries, wetlands, mangrove forests and coral reefs – are protected and restored and if nutrient and plastic pollution are curbed.	**Government:** Protect breeding grounds, end both illegal fishing and overfishing, and provide title/ access rights to artisanal fishers **Government & Investors:** Develop new approaches and business models for insurance against catastrophic events affecting fisheries (storms, warming events, reef collapse) and for compensating poor fishermen for the cost of fish stock recovery	$350 billion $10 billion $345 billion
 Diversifying Protein Supply	Rapid development of diversified sources of protein would complement the global transition to healthy diets. Diversification of human protein supply falls into four main categories: aquatic, plant-based, insect-based and laboratory-cultured. These last three sources alone could account for up to 10 percent of the global protein market by 2030 and are expected to scale rapidly.	**Government:** Use public procurement to secure long-term offtake for alternative protein sources **Government:** Increase R&D spending in alternative proteins (especially those with large benefits for lower-income consumers) and ensure that the resulting intellectual property remains in the public domain	$240 billion $15-25 billion $240 billion
 Reducing Food Loss & Waste	Approximately one third of food produced is lost or wasted. To produce this food that is never eaten by people requires an agricultural area almost the size of the United States. Reducing food loss and waste by just 25 percent would therefore lead to significant benefits relating to environmental, health, inclusion and food security.	**Government:** Regulate and incentivise companies to report on and reduce food loss and waste **Investors:** Finance income-sensitive, climate-smart storage technologies	$455 billion $30 billion $255 billion
 Local Loops & Linkages	With 80 percent of food projected to be consumed in cities by 2050, what urban dwellers choose to eat and how their needs are supplied will largely shape food and land use systems. This transition sets out the opportunity to strengthen and scale efficient and sustainable local food economies in towns and cities.	**Investors:** Invest in emerging technologies and innovations which will close the food system loop **Government:** City governments to foster local circular food economy through targeted public procurement and zoning	$240 billion $10 billion $215 billion
 Harnessing the Digital Revolution	Digitisation of food and land use systems is occurring through gene-editing techniques, precision farming, and logistics and digital marketing tools, enabling producers and consumers to make better, more informed choices, and to connect to the value chain rapidly and efficiently.	**Government:** Open access to public sector data (e.g. on national land registries, fisheries, agriculture, soil health etc.) and regulate and incentivise the private sector to provide open source data where appropriate **Civil Society:** Create, maintain and communicate results from real-time platforms for transparency, as is currently done through Global Forest Watch	$540 billion $15 billion $240 billion
 Stronger Rural Livelihoods	Underlying all ten critical transitions is a vision of rural areas transformed into places of hope and opportunity, where thriving communities can adapt to new challenges, protect and regenerate natural capital and invest in a better future. Ensuring a just transition.	**All:** Establish public-private-philanthropic partnerships to train a new generation of young farmer entrepreneurs over the next decade **All:** Scale up rural roads and digital investments to drive productivity, end rural isolation, and, in particular, initiate a global campaign for renewable electricity access for all **Government:** Safety nets for individuals and stranded communities to ensure a just transition	$300 billion $95-110 billion $440 billion
 Gender & Demography	Women can be enormously powerful in shaping food and land use systems, thanks to their central role in agriculture and in decisions concerning nutrition, health and family planning. Making sure women have equal access to resources, such as land, labour, water, credit and other services, should be central to policies concerning the ten critical transitions, including by accelerating the demographic transition to a replacement rate of fertility in all countries.	**All:** Invest in maternal and child health and nutrition as well as education for women and girls **All:** Ensure access to reproductive health services and products	$195 billion $15 billion n/a

Source: Food and Land Use Coalition (FOLU). 2019. *Growing Better: Ten Critical Transitions to Transform Food and Land Use. London:* FOLU. https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf

Introduction

Ducks allowed to roam freely in harvested fields that have been flooded with water to keep the ducks happy on an organic rice and duck farm/ Ian Teh for Panos Pictures/Food and Land Use Coalition

Introducing FOLU and the 2019 Growing Better report

The Food and Land Use Coalition (FOLU) is a community of organisations and individuals committed to the urgent need to transform the way humankind produces and consumes food and use land for people, nature and climate. FOLU's work divides between (i) making the strategic case for rapid change, (ii) supporting key countries – Colombia, China, Ethiopia, India and Indonesia – with their food and land use planning, policy and market redesign, (iii) empowering diverse change leaders across public, private and civil society sectors, (iv) developing evidence-based transformation pathways and (v) accelerating shifts throughout the private sector.

In our 2019 Global Consultation Report, Growing Better: Ten Critical Transitions to Transform Food and Land Use, we set out a vision and an associated reform agenda for transformed food and land use systems which deliver climate mitigation, safeguard biological diversity, ensure healthier diets for all, improve food security and create more inclusive and resilient rural economies. Implementing this reform agenda reaps a societal return that is more than 15 times the related investment cost (estimated at less than 0.5 percent of global GDP) and creates new business opportunities worth up to $4.5 trillion a year by 2030. This transformation is critical if the world is to deliver against the Sustainable Development Goals (SDGs) and the Paris Agreement targets on climate change.[8]

While Growing Better establishes clear recommendations structured across 10 critical transitions (Figure 2), FOLU fully recognises the challenge that lies ahead since there are no "silver bullet" solutions or universal blueprints for transforming complex food and land use systems, just as there are none for solving climate change or eliminating poverty. Change will look different from one country to the next, and from one food and land use system to the next. And yet change is more critical and more urgent than ever; the world is going through a period of unprecedented disruption due to the COVID-19 pandemic and the escalating impacts of climate change – both of which are driven by and impact upon how we grow, process, trade, distribute and consume food.

Freshly plucked organic cherries from the Tianfu Garden Farm (God's Grace Garden) plucked by volunteers/ Ian Teh for Panos Pictures/Food and Land Use Coalition

Introduction to this report

This report seeks to reaffirm FOLU's commitment to delivering against the 10 critical transitions. Over the past 20 months, we have consulted on *Growing Better's* vision with a wide range of scientists, farmers, representatives of indigenous peoples' groups, policymakers, business, financiers, and more. This process has confirmed that we have many of the right ingredients for systemic transformation. But we need to better understand the political economy of change as well as how this plays out in local contexts. As such, FOLU's strategy for the next four years is focused on **generating national proof points** against each of the 10 critical transitions, as well as fostering **opportunities for learning** across our networks which can create reinforcing feedback loops and accelerate transformation at scale.

We intend to identify opportunities for "**positive systemic tipping points**" where interventions overcome the natural resilience of a complex system to drive the system into a new configuration that works in a better way.[9,10,11] These tipping points are needed to unlock rapid rates of change across market/economic systems, socio-political systems and Earth systems. By exploring opportunities around such tipping points, we seek to provide hope and to empower our audience by showing that our actions can make a big difference in delivering a more desirable future.

The "2021 Super Year"[i] represents a significant opportunity to accelerate systemic change across food and land use systems. As such, we are primarily targeting this report at actors involved in these summits with an emphasis on policymakers. While the delivery of the 10 critical transitions requires collective action across the system – from farmers and fishers to financiers to scientists – we believe that policymakers have a critical role in creating an enabling environment for change and that the tipping point framework set out in this report can be a useful tool in this context.

In Chapter 1 we set out our framework for tipping point analysis and propose a framework for triggering tipping points. In Chapters 2–4 we provide three deep dives into four of the 10 critical transitions: Critical Transition 1 on Promoting Healthy Diets (which is linked to Critical Transition 5 on Investing in Diversified Sources of Proteins); Critical Transition 2 on Scaling Productive and Regenerative Agriculture; and Critical Transition 3 on Protecting and Restoring Nature. Finally, we conclude with a call to action and a reiteration that the challenges that lie ahead are indeed surmountable.

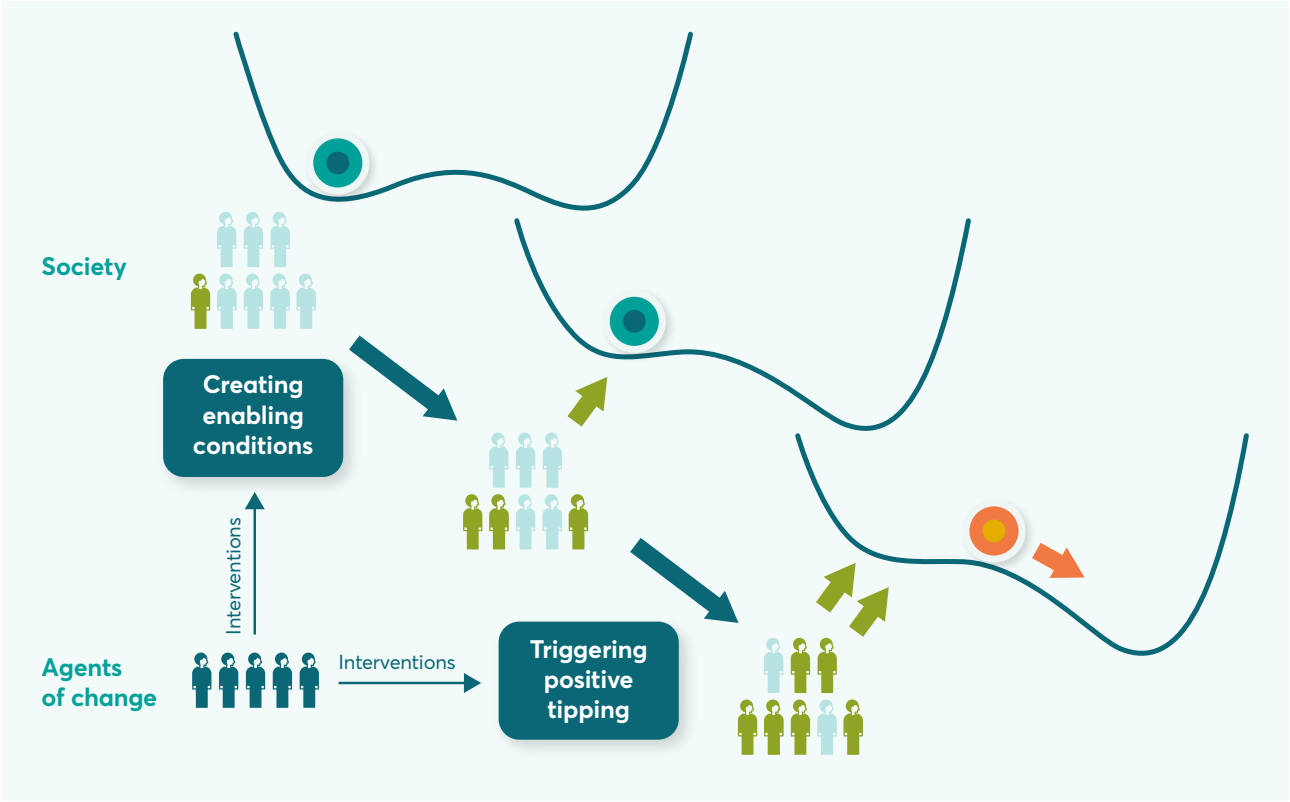
Please refer to our publication on the University of Exeter's Global Systems Institute website a more detailed elaboration of the tipping framework described in Chapter 1 including a detailed literature review.

[i] The 2021 Super Year relates to the several important international summits scheduled to take place including CBD COP15 in Kunming, the United Nations Food Systems Summit in New York, the UNFCCC COP26 in Glasgow and the Nutrition for Growth Summit in Tokyo.

Chapter 1: A conceptual framework for triggering positive tipping points

Tipping points offer hopeful opportunities for rapid change in line with the vision and goals set out in FOLU's *Growing Better* report. Tipping points are defined as critical points in a system where targeted interventions lead to large and long-term consequences on the evolution of that system, profoundly altering its modes of operation.[12,13] They are complex, uncertain, highly non-linear, and hard to reverse cumulative processes which can interact across systems, and across spatial and temporal scales.[14] Figure 3 provides a conceptualisation of systemic tipping points, including how interventions and agents can create enabling conditions for system tipping. Figure 4 offers a framework for understanding systemic tipping points and identifying interventions to intentionally trigger cascading and reinforcing feedback loops in a system. We believe this framework has much broader applicability, but we focus in this report on applying it to food and land use systems transformation.

Figure 3: A dynamical systems conceptualisation of positive tipping points[15]



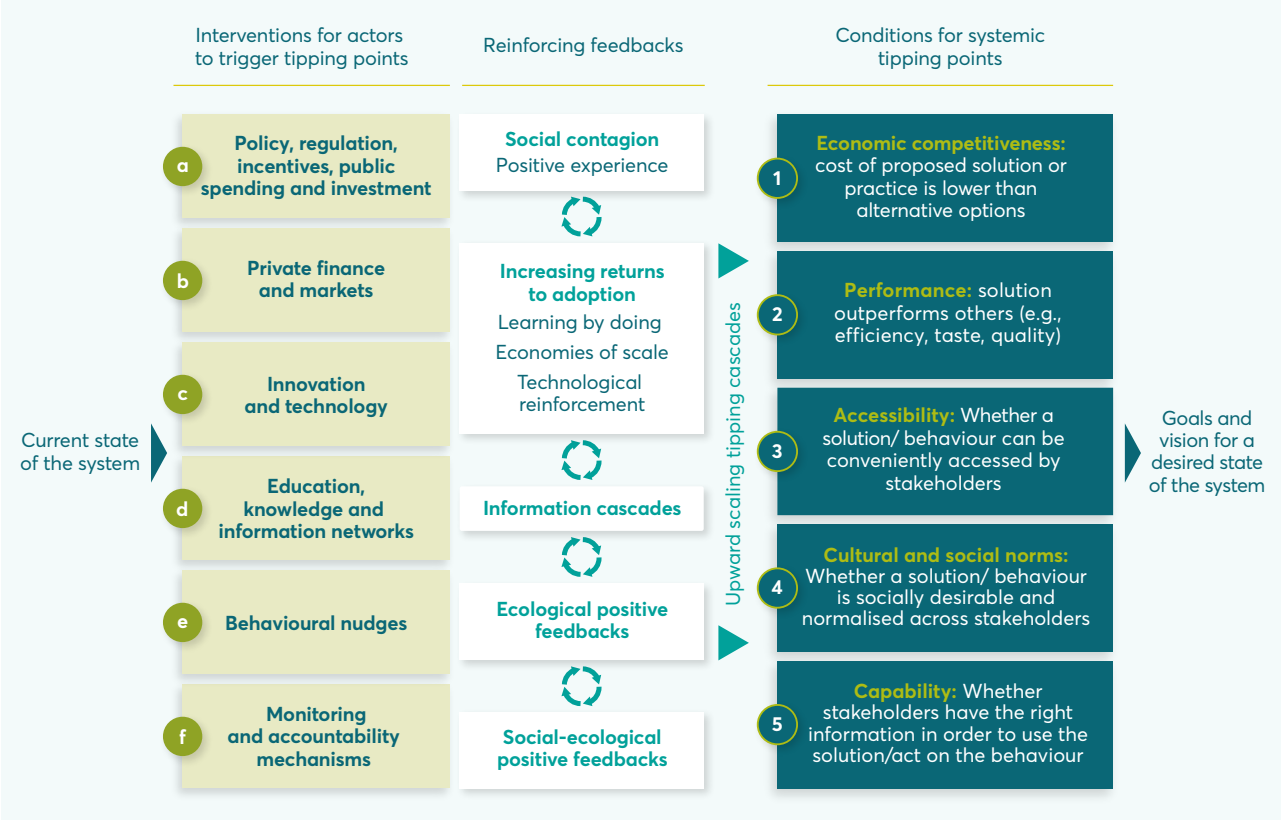
In this conceptualisation of systemic tipping points, the current state of the system is the "ball" and the shape of the "valley" it sits in describes its resilience to perturbations. The schematic shows how interventions by agents of change can create enabling conditions and then trigger the system to be tipped into an alternative state (the other valley).

Existing work on food and land use systems tipping points tends to focus on "negative" tipping points in social-ecological regime shifts. Infamous historical examples include the collapse of several major ocean fisheries and the Dust Bowl in 1930s North American prairies, which left a legacy of outmigration and economic depression still felt today.[16] The terms Neolithic *revolution*, agricultural *revolution*, and green *revolution* all hint that the original transition to – and subsequent transformations of – agriculture also involved profound switches between alternative modes of operation, with associated tipping points. Whether these were "good" or "bad" revolutions depends somewhat on the beholder. Suffice to say, the green revolution was a major effort which enabled a tipping point in twentieth-century food production systems through increased agricultural productivity. It did so by driving adoption of high yield varieties of rice, maize and sharply increasing the use of agricultural inputs (irrigation, fertiliser) that has created defining features of many food systems around the world today.[17]

This report focuses on economic, political or technological changes – coupled with socio-ecological changes – that lead to positive, outsized effects on a system. The point at which this occurs is what we refer to as a "positive tipping point". **There is evidence from beyond food and land use systems that targeted policy interventions can foster the emergence of positive feedback loops and activate small (sub-system) tipping points which, in turn, can trigger wider systemic tipping points.**[18,19] For example, the rapid growth in solar markets has been supported by social feedback loops accelerating a positive tipping point in adoption. Evidence has shown how important social networks and geographic proximity of households within neighbourhoods of California have been to the rapid adoption of solar installations.[20] Few would have predicted (including the International Energy Agency) that solar would have become – together with wind power – the dominant new source of generation as of 2019.[21]

In exploring the role of positive, systemic tipping points for unlocking food and land use systems transformation, we have developed a conceptual framework for triggering tipping towards a desired system state (Figure 4). This framework has been co-developed by FOLU and the Global Systems Institute at the University of Exeter and was informed by literature review of existing models of tipping dynamics (see box 1 on page 21 for a description of one such model)[ii] and consultation with a diverse group of experts from academia, policy and the wider FOLU coalition network (see page 4 for a list of acknowledgements). We describe the components of this framework in this chapter before testing its applicability across a selection of FOLU's critical transitions in the subsequent chapters.

Figure 4: Framework for triggering tipping cascades



Please note: this framework does not include exogenous factors directly, but we recognise that they exist and can have fundamental impacts on the systems we are exploring here.

[ii] For more information, see accompanying paper here which includes a more detailed literature review.

The organic food market in Armenia, Colombia. Every week there is a special market where organically produced foods from the agroecology farm in Quindío, Colombia, are being sold to customers from the region/ Chris de Bode for Panos Pictures/ Food and Land Use Coalition

1.1 Vision and goals

The most powerful interventions are those that change the intent of a system.[22] Typically, some actors are discontented with or disempowered by the current state of a system and have a vision of an alternative desired system – such as net zero greenhouse gas emissions. They may also have some specific goals they want to achieve to realise their vision – such as halving greenhouse gas emissions by 2030 and reaching net zero by 2050. Having an alternative vision of system characteristics and associated goals – if they are widely and democratically agreed upon – is a potentially powerful motivator of transformative change (recognising that transformative change can also happen without anyone willing it to happen). For example, the green revolution was an intentional attempt to boost food production, but the much earlier Neolithic revolution was not. Future food and land use systems transformations will likely involve a mix of intentional and unintentional change (as well as unintended consequences), and of course different actors often have different intents.

Germination room in the greenhouses at Gullele Botantical Gardens, Addis Ababa, Ethiopia/ Abbie Trayler-Smith for Panos Pictures/ Food and Land Use Coalition

1.2 Five conditions for emergence of large-scale systemic tipping points

We propose five key conditions that need to be met to create an enabling environment capable of fostering the emergence of large-scale systemic tipping points. The five elements are:

1. **Economic competitiveness:** The proposed solution is economically competitive (e.g. signalled by competitive pricing or business models) to alternative solutions which can stimulate demand.
2. **Performance:** The proposed alternative meets the required level of performance or quality – or it outperforms existing solutions on essential features such as efficiency and quality.
3. **Accessibility:** The solution, or the change in behaviour proposed by the alternative, can be conveniently accessed by stakeholders.
4. **Cultural norms:** The alternative is also socially desirable and normalised across stakeholders.
5. **Capability:** The stakeholder has the right information to use the solution, or act on the behaviour.

There are other considerations and features related to these elements which are discussed in greater detail in our companion paper published here. For example, linked to performance is the importance of complementarity of technologies or practices with established infrastructure, information systems, and socio-political systems.[23,24,25]

1.3 Positive/reinforcing feedback loops for achieving the five conditions

Multiple events and policy interventions can create cumulative and reinforcing feedback effects among actors in a system. The partial, full or sequential achievement of the abovementioned conditions typically occurs through the implementation of self-amplifying feedback loops, progressively pushing a stable system into evolution towards tipping points – reflecting a transformed state of a system.

Reinforcing feedback loops that can trigger tipping points:

1. **Increasing returns to adoption:**

   Economies of scale – the more something is made, the cheaper it can be made and distributed;

   Learning by doing – the more something is made or used, the better we make it or use it; coupled with

   Technological reinforcement – the more something is used, the more technologies emerge that make it more useful.

2. **Social contagion:** The rapid and widespread propagation of new solutions, low-carbon innovation and behaviours through imitation of others in a group, facilitated by increasing information flows across networks as well as positive experiences of user groups with a solution or behaviour.

3. **Ecological positive feedbacks:** Where an ecological change is self-reinforcing, such as reforestation creating a micro-climate that facilitates further tree growth.

4. **Social-ecological positive feedbacks:** Reinforcing interaction between social intervention and ecological change, such as where marine protected areas rejuvenate fisheries causing people to in turn create additional marine protected areas.

Farmers pruning leaves from pear trees at Shared Harvest Farm. Shared Harvest is an organic farm promoting the CSA / Community Shared Agriculture model. Since the program started in May 2012, Shared Harvest has developed and now posseses 66 acres based in Tongzhou and Shunyi Districts in Beijing, planting organic vegetables, fruit and grains and also breeding livestock/ Ian Teh for Panos Pictures/Food and Land Use Coalition

1.4 Interventions for triggering positive feedback loops and activate tipping points

Reinforcing feedback loops can be stimulated through a set of multiple interventions by different actors.

a **Policy, regulation, incentives, public spending and investment:** Taxes, subsidies, regulation, public spending and investment, global trade regimes and other policy mechanisms that create an enabling environment and delimit feasible choices for actors to develop sustainable behaviours and facilitate emergence of new and more sustainable solutions.

b **Private finance and markets:** Private sector investment into sustainable systems and markets for sustainable products and services.

c **Innovation and technology:** Facilitation of an "innovation ecosystem" through incentives to shape talent flows, regulation to tilt the playing field towards better societal outcomes, by calibrating standards to accelerate new business models, and public investment and procurement spend to support innovation and R&D.

d **Education, knowledge and information networks:** Effective communication, tailored education programmes and peer-to-peer learning.

e **Behavioural nudges:** Targeting consumer behaviour through changing choice architecture and positive reinforcement.

f **Monitoring and accountability mechanisms:** Data and monitoring systems to measure the state of the system and to hold actors to account.

There are also human interventions into ecological systems, which are deliberate actions to trigger ecologically positive feedback(s) in a desired direction. Such interventions seek to create less ecologically harmful feedback loops – for example, where protecting tropical forests would break a negative ecological feedback loop of destabilising Earth's climate system.[33] Without creating the space for positive tipping points, negative environmental feedbacks such as these will force negative tipping points, such as ecological collapse in the Amazon.[34]

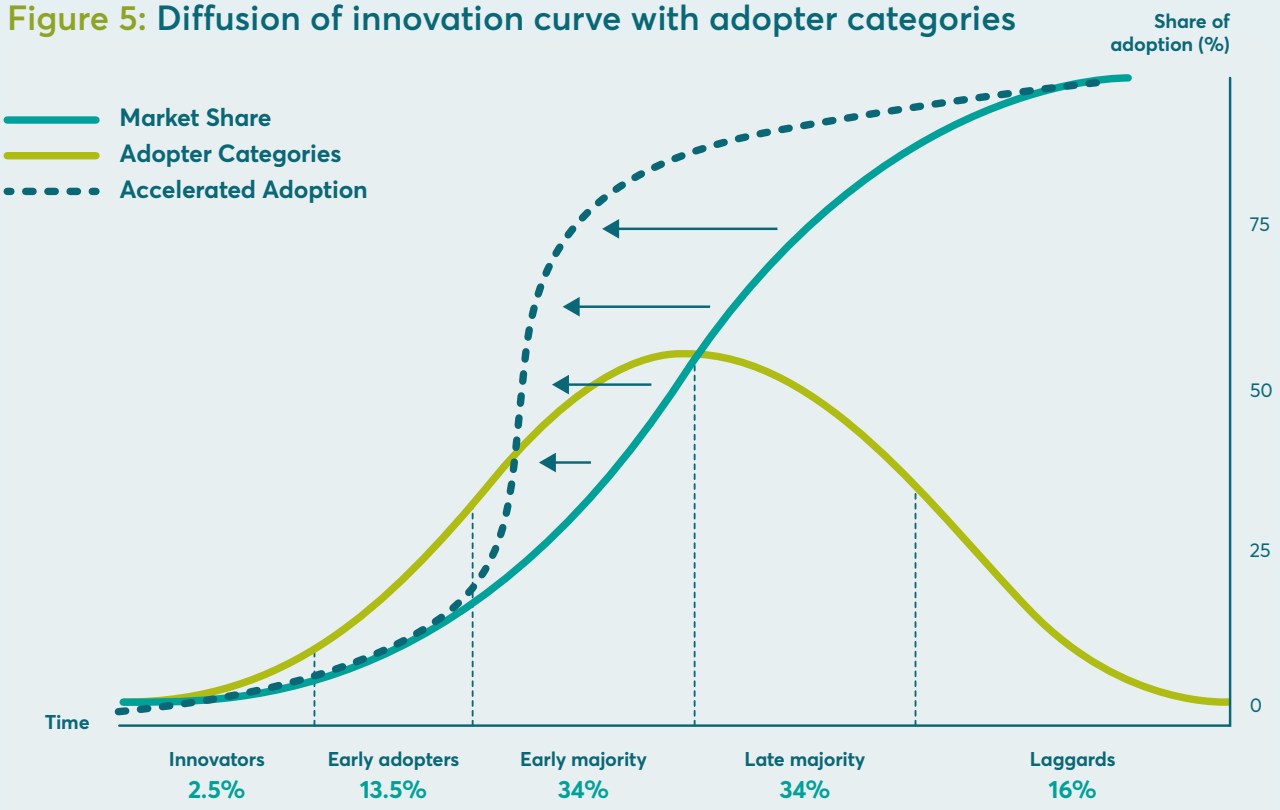
It is worth noting, however, that transformational change can occur without deliberate intervention or humans willing it to happen (and therefore without targeted intervention). Moreover, change does not happen only endogenously within systems. Exogenous events – including external shocks/crises in ecological, political or social systems – also play an important role in reconfiguring system dynamics.

Box 1: Example of tipping point model – the Diffusion of Innovation theory

There are several models which capture different yet overlapping aspects of tipping point dynamics.[26] One example is the "diffusion" of new norms, behaviours, and technologies through society.[27] Several models of diffusion point to a dynamic in which a critical mass of people can tip most (or all) of the population to adopt new norms, behaviours or technologies. The concept of a critical mass is central to Diffusion of Innovations (DOI) theory, which emerged from studies of the spread of agricultural technologies in the United States in the 1920s and 1930s.[28] It characterises the uptake of innovations as an "S-curve" and classifies human populations into successive fractions defined in terms of their propensity to adopt innovations. New ideas, products or behaviours start with innovators, then early adopters, followed by an early majority, then a late majority, and finally the laggards. Along this trajectory, the products mature, and their functionality improves as a result.

Qualitative studies have proposed a wide range of possible thresholds for a sufficiently large minority group to create a tipping point, ranging from 10 percent to 40 percent of the population, with a 25 percent threshold considered as a rough rule of thumb for where the majority can be tipped by the minority.[29] Diffusion of innovation is assumed to follow a normal distribution, but with targeted communication and interventions you can achieve a higher adoption rate among people who are normally late to a new idea.[30] One limitation of the DOI theory is that it works better with adoption of behaviours rather than cessation or prevention of behaviours.[31]

Figure 5: Diffusion of innovation curve with adopter categories



Sourced from Gonera et al (2021) and inspired by Rogers (2003) and Dearing (2009).[32]

1.5 Political economy of change – addressing resistance to systems change

A critical consideration in any attempt to tip positive change is that it will meet resistance from the incumbent way of doing things, creating lock-ins. Existing regimes, whether social or ecological, are stabilised by damping feedbacks that resist change and restore the status quo. This can take many forms. Cultural norms, sunk costs, subsidies, ease of raising finance, lobbying groups, and many other factors can act to maintain the status quo. In the case of food systems, most policymakers are primarily focused on keeping food as cheap as possible – given the importance of food security. There is not (yet) a widespread recognition of the need for transformational change, despite the fact that food and land use systems generate close to $12 trillion in hidden costs each year including $4.5 trillion of costs relating to obesity and undernutrition.[35]

However, intervening in a system that is already in a state of disruption – for example where climate change, soil degradation and biodiversity loss are undermining the resilience of food systems – can reduce the power of these lock-ins and create opportunities for tipping positive change. For example, with increasing citizen awareness of the need for transformation of food and land use systems, social movements can help innovations spread. If/when transformative change takes off, the original incumbent way of doing things will decline – often in an accelerated way propelled by reinforcing feedbacks.

In any transition, what is most important is that vulnerable groups most impacted by the change are considered. This means governments must provide social safety nets and other support mechanisms to ensure a just transition.

1.6 Operationalising positive tipping points

There is increasing scientific evidence acknowledging the role of interventions which drive positive tipping points and unlock systemic transformation (see our publication on the University of Exeter's Global Systems Institute website for more information on this framework).[36] However, the framework set out in this report is still an emerging hypothesis of change that needs to be rigorously and scientifically tested. FOLU, the University of Exeter's Global Systems Institute and ETH Zürich intend to test both the framework and the intervention sequencing over the next 24 months. This will entail further consultation with experts and the development of methods for identifying early signs of an incumbent system being susceptible to positive tipping (including testing the theory that the proximity of a system to a tipping point can be sensed from social data). If so, this can identify where modest interventions can be most effective at tipping a system towards a desired state. We aim to combine this generic approach with models of specific systems to identify the type of intervention that can bring about tipping in each case.

The next three chapters offer examples across four of FOLU's 10 critical transitions. These four were selected for initial analysis through consultation with the broader FOLU coalition, given their importance to the 2021 "Super Year" and also their relevance to coalition efforts around the world. In each of these examples, we identify promising locations and niches for initial tipping, additional tipping points that can expand the scale of change, and interactions across the critical transitions.

Chapter 2: Tipping systems towards healthier diets and diversified protein supply

Healthy Diets

Critical Transition 1: Promoting Healthy Diets

A transformation of global diets towards local variations of the "human and planetary health diet" (see box 2). As a result, consumers will enjoy a broader range of high-quality, nutritious and affordable foods, and global land use would be transformed providing numerous positive tipping point opportunities for regenerating ecosystems.

Diversifying Protein Supply

Critical Transition 5: Diversifying Protein Supply

Rapid development of diversified sources of protein would complement the global transition to healthy diets. Diversification of human protein supply falls into four main categories: aquatic, plant-based, insect-based and laboratory-cultured.

2.1 State of the system and the case for transformation

While land used for livestock farming and livestock feed accounts for 77 percent of global farming land, it only produces 18 percent of the world's calories and 37 percent of total protein.[37] The livestock sector is responsible for 14.5 percent of global GHG emissions.[38] In addition to the negative environmental externalities, a number of studies have also shown that high consumption of red meat (both ruminant meats and pork) is correlated with damage to health.[39] The exact connections remain debated, with some research focusing the concern more on processed meats such as bacon and sausages. However, nutritionists generally agree that current levels of meat consumption in most high-income countries, in some emerging economies and in segments of developing countries qualify as overconsumption from a health perspective.[40] With global demand for animal-based foods expected to grow by 70 percent by 2050, diversifying protein sources is critical for both human and planetary health.[41]

Soybeans and tempeh

Box 2: Key parameters of a human and planetary health diet[42]

Achieving human and planetary health means that our diets:

- converge to predominantly plant-based diets, though with still significant room for consumption of animal proteins (farmed in high-welfare, sustainable farming systems), as well as oceanic and other forms of alternative proteins;
- include more protective foods like fruits, vegetables, whole grains, legumes, and nuts;
- limit unhealthy food consumption, such as ultra-processed foods, salt, sugar and trans fats;
- include moderate consumption of red meat and processed meat – meaning a reduction in settings currently consuming beyond their fair share but increases where consumption is below dietary recommendations;
- transition to increased consumption of whole, rather than refined, staple crops.

Every country, region and city will need to make the transition towards a human and planetary diet in its own way, in accordance with its own cultural and socio-economic environment and unique starting point. For example, in parts of sub-Saharan Africa, many people – in particular, children and young women – need to eat more animal-sourced foods, including red meat, to fill protein and micronutrient gaps in their diets. In most other places, particularly North America and Europe, red meat consumption needs to fall significantly.[43]

2.2 Vision and goals

Shifting to a human and planetary health diet is fundamental to achieving the SDGs and the Paris Agreement targets on climate change. Analysis conducted as part of FOLU's *Growing Better* report shows the benefits of a transition to healthy diets with diversified protein supply:

Environment.

Zero gross expansion in land area under cultivation for food production by 2025, reduction in total territories used for livestock of about one-third by 2030, and a consequent freeing up of nearly 500 million hectares of land by the same date. If this ambitious goal were achieved, it could open up vast opportunities for positive tipping points of natural ecosystem restoration. It would lead to reductions in greenhouse gas emissions and the potential for net biodiversity gain.[44]

Inclusion.

Greater food security through increased availability of healthy, nutritious food – particularly for lower-income communities, both rural and urban. As an example, alternative proteins can be produced in a wide range of locations and using new technology and thus have the potential to improve food security in food-importing regions. For example, many protein-importing countries in the Middle East could be excellent locations for producing laboratory-based, insect and algae proteins.

Health.

Reductions in micronutrient deficiencies, including deficiencies in iron, zinc, vitamin A, folate and iodine (which lead to stunting and wasting when combined with deficiencies in protein, fat or carbohydrates). This would improve cognitive development in children. It would also reduce the incidence of obesity and diet-related non-communicable diseases, particularly in higher-income countries. Globally, 11 million diet-related mortalities would be prevented per year by 2050, approximately 20 percent of total deaths among adults.[45]

Economy.

The annual economic gain from the critical transitions on healthy diets and diversifying protein supply is an estimated $1.5 trillion by 2030, and $2.4 trillion by 2050.

Vicia faba (broad bean)

2.3 Tipping the transition in Europe

Dietary trends vary across the world, and as with the example of solar panels described in Chapter 1, a prospective global dietary transformation must start somewhere. We focus on Europe as there is evidence to suggest that targeted interventions in the near-term could trigger a systemic tipping point towards increasingly plant-rich diets in this region. In 2020, $527 million was invested into alternative proteins in Europe, more than quadrupling investment flows in 2019.[46] Consumers are reporting that they are open to or are actively seeking to change their behaviours; over 20 percent of Europeans now consider themselves flexitarian, vegetarian or vegan and among flexitarians, and over 57 percent say they want to become vegetarians.[47] One recent study suggests that these trends indicate that Europe could reach "peak meat" by 2025.[48] But while the market for alternative protein products is booming, we are not yet seeing a significant corresponding reduction in meat consumption in Europe overall.[49]

In this chapter we apply the framework set out in the previous chapter to identify potential interventions for triggering systemic tipping points towards plant-based diets and away from animal products. By overlaying the Diffusion of Innovation Theory (see Box 1 in Chapter 1) with current meat consumption habits (Table 1 below) we can identify the priority consumer segments most likely to have the biggest impact and the corresponding critical interventions that "pull" consumers towards alternatives, and those that "push" consumers away from meat consumption. This application of the DOI theory to sustainable dietary shift has been applied by others including the Good Food Institute and most recently by the Faculty of Health Science, Oslo Metropolitan University.[50,51]

Table 1: Diffusion of Innovation theory classifications mapped against meat consumption habit consumer segmenatations

Diffusion of Innovation (DOI) Theory Classifications	Estimated population % according to DOI	Meat consumption habit consumer segmentation[52]
Innovators are the first to try a new behaviour, product or idea (and may even be its creator).	**2.5%**	**Meat avoiders** who may place higher value on animal welfare and/ or environmental and health concerns. Not the primary target segment if the goal is to increase adoption of plant-rich diets.
Early adopters are comfortable with innovations and cognisant that change is often inevitable.	**13.5%**	**Meat reducers** are open to behaviour change but change needs to be easy, affordable, appealing and convenient.
The early majority must see evidence of the innovation's worth prior to their adoption of it.	**34%**	
The late majority is sceptical and more reluctant to embrace change, only adopting an innovation once it becomes the norm in their society.	**34%**	**Traditional meat eaters** which are the most difficult segment to reach. Health considerations might in this instance be the primary driver for reducing meat consumption.
Laggards are bound by tradition and suspicion and dislike change.	**16%**	

2.4 Five conditions for dietary shift tipping points

As discussed in Chapter 1, there are five conditions needed for a systemic tipping point to take place. In **bold** below we describe the state of the system when each of the five conditions has been met. We provide a discussion of the critical barriers preventing the realisation of this state as well as growing evidence of innovation and progress which suggests that these barriers can be overcome, and that the system can be tipped towards a desired state.

1 Economic competitiveness: tasty and convenient alternative proteins are at price parity or cheaper than conventional meat.

Meat mimicking products are at an early stage of development and tasty plant-based substitutes can cost twice as much as the equivalent meat alternative.[53] This is because of a lack of economies of scale; large production costs and small supply chains are resulting in high prices.[54] In addition, perverse subsidies that currently fail to account for negative externalities of livestock farming (e.g. methane emissions, manure mismanagement, etc.) keep production costs for animal agriculture artificially low.[55]

However, there are several innovative alternative protein companies working in this space. One such example is Plant & Bean which has established a European Hub in the UK to manufacture 55,000 tonnes of plant-based products per year, with a stated aim of bringing down the costs and enhancing the performance of plant-based foods.[56] As such, prices for alternative proteins are beginning to fall due to competitive pressure and economies of scale. It is estimated that plant-based meats could reach price parity between 2023 and 2025,[57] and cultured meat by 2030–2032.[58] It is important to note, however, that these projections rely on ambitious R&D and innovation assumptions, which will entail government and corporate leadership to send the right market signals, drive innovation and bring down costs.

2 Performance: alternative proteins have the same or better sensory and health properties as conventional meat.

Meat mimicking products could be a way to shift "meat reducers" (i.e. the early adopters and early majority in the DOI theory classifications) away from conventional meat. Their traditional palates mean that alternatives need to be familiar and match in taste and texture. However, at present, the mass-market consumer does not think that meat mimicking alternatives meet these requirements.[59] Reinforcing feedback loops of positive taste experiences and health benefits are thus essential to engage consumers when they first try a product to ensure re-purchase and avoid negative perceptions.

Plant-based meat developers are continuing to find ways to make products tastier and more nutritious. Companies are stepping up ambition and innovating in this space to secure market share; for example, Nestlé has launched its own R&D accelerator and conventional meat companies such as JBS and Tyson Foods are developing their own plant-based product lines.[60] Governments are also stepping up to help drive innovation and examples from beyond Europe demonstrate this: Singapore has built a robust regulatory pathway for cultivated meat, and in December 2020, became the first country in the world to approve cultivated meat for sale. The government has also established industry partnerships and training programmes at its Global Innovation Centre.[61]

Recent evidence shows that plant-based meat offers benefits in dietary fibre and lower levels of saturated fat than similarly processed conventional meats.[62] Meatless burgers, which have benefited from the most innovation, compete with conventional burgers on protein, vitamins and minerals, and the Impossible Burger has even been fortified with vitamins that can be lacking in vegetarian diets.[63] That said, alternatives often have lower protein content, which is often a red flag for consumers. However, since Europeans overconsume protein by 30 percent, increasing the availability of lower-protein alternative products is unlikely to result in protein deficient diets.[64] Yet marketeers of meat mimicking products need to be cautious about signposting products as "healthy" as they are often heavily processed and high in both saturated fat and sodium[65] and can lack key micronutrients present in traditional meat products.[66] False claims on the health of these products can create significant backlash and limit the potential

for the industry to scale.[67] Consumption of conventional plant-based protein (e.g. whole grains, pulses) has substantial health benefits compared to conventional and processed plant-based meats,[68] but this category faces different challenges to uptake and will require slightly different interventions to shift consumer behaviour (see Table 2).

Table 2: Different types of alternative protein product and their role in the transition in Europe

Type of protein product		Role in the transition
Raw Plant Protein	  **Protein rich plants including** pulses, whole grains, nuts and seeds.	Critical part of healthy and diverse diets and expose consumers to a world of new and exciting tastes and textures. However, cultural norms and cooking skills make shifting to these products from meat more challenging.
	  **Traditionally processed products**, e.g. those made from condensed or fermented soy milk or protein, such as Tofu or Tempeh.	
Meat Mimicking	  **Plant-based meats** produced through precision fermentation and mycoprotein technology that uses plant protein to create products with the same or similar sensory properties as conventional meat.	Critical way to shift "meat reducers" (and to some extent "traditional meat eaters") as consumers seek familiarity and tradition.
	  **Cultured meat** developed through use of cell culture of animal cells to create genetically identical meat products.	Recognises that there is space for meat in the diet; cultured meat can be a lower impact source.

3 Accessibility and convenience: alternatives are observable, accessible, and easy to purchase in stores, online, and in restaurants, whilst choice architecture limits the convenience and availability of unsustainable produced meat.

Consumers often base their food choices on habitual processes associated with convenience, access and familiarity.[69] Conventional meat is often given preferential shelf space, listed at the top of menus, and provided as default in catering facilities. At the same time, alternative proteins are often limited in variety, placed in the back of supermarkets, or not easily observable on menus.[70] Most consumers are time-poor and are seeking easy-to-cook or ready-made, convenient food, and animal-based products are often the most readily available.[71] The term "fast food" is used to imply convenient and quick food; these outlets are predominantly unhealthy and sell cheap meat products that are extremely easy to access. For convenient healthy food, such as ready-cooked falafel, pre-marinated tofu and pre-cooked lentils, consumers can pay a premium of up to five times per kg,[72] making the healthiest, most convenient plant-based meals unaffordable to many consumers. In addition, a significant majority of advertising is spent towards unhealthy and processed foods which subconsciously impacts food choices.[73]

Evidence points to the impact of supermarket location on food choice, and supermarkets are increasingly putting alternative products in more prominent positioning to increase sales,[74] as well as launching and marketing their own white label plant-based products. Unilever and supermarket chain Tesco have been the first to set sales targets for plant-based alternatives,[75] and plant-based meats are now available in nearly all prominent fast-food joints, with Beyond Meat and Impossible securing deals with key fast-food giants such as McDonald's and Burger King.[76] In the UK, vegan options on menus increased by 237 percent in one year (from 2017 to 2018),[77] and observational and experimental studies show that doubling the proportion of vegetarian meals available on a menu increases vegetarian sales by 41–79 percent.[78]

Dietary transition can also occur as an unintended consequence. A survey conducted by the European Institute of Innovation and Technology (EIT) in September 2020 with 5000 consumers across ten European countries showed that the COVID-19 impacted behaviours around food shopping, cooking and consumption. Respondents reported an increased appetite for more varied cooking and dining experiences at home and rising demand for healthy, plant-rich food and local and sustainable options. The survey indicated that these shifts were also reflected in respondents' intentions post-pandemic. However, while the rise in fruit and vegetable consumption was the most significant of all food categories, meat consumption also rose a small amount everywhere except in France and Germany.[79]

4 Cultural and social norms: it is socially unacceptable to over consume meat and alternatives are socially desirable and normalised throughout society.

Significant cultural associations and traditions are attached to eating meat, which is reinforced as a cultural "norm". Our everyday behaviour is reinforced by what we see around us, and this is especially prominent when it comes to food. Although among some demographics we are seeing increased awareness and interest in plant-based foods, negative stereotypes about vegetarians and vegans being preachy or joyless are still present. And for men, not eating meat can be perceived as lacking in masculinity.[80] Consumers also feel that plant-based food can be bland and boring, with particularly negative associations with raw plant protein such as pulses, likely driven by lack of advertising and promotion. Language has a huge impact on appeal and familiarity – two major drivers for purchase.[81] The proposed EU bill that sought

to prevent alternative milk products from being called "milk" would have been a significant barrier to familiarity.[82] In addition, significant amounts of advertising spend towards conventional meat influences social norms and consumer food choice, especially for children. Fortunately, the proposed EU bill on milk alternatives has been dropped after mounting pressure from NGOs, plant-based milk companies, as well as activist Greta Thunberg.[83]

In 2019, food companies spent $11 billion on advertising with 80 percent spent on adverts for fast food, confectionary, sugary drinks and unhealthy snacks,[84] and in the UK junk food brands spent close to 30 times more on advertising than the amount available for the government's healthy eating campaign.[85] The EU's agricultural promotion policy is also responsible for funding meat marketing campaigns to reverse the decline in meat eating, with almost double the budget exclusively spent on meat and dairy compared to fruit and vegetables.[86] Without a shift in advertising and marketing, any campaigns to reduce meat consumption will be costly and ineffective as consumers continue to be bombarded with advertisement for conventional animal-based products.

Documentaries such as Game Changers which was featured on Netflix can play a role in changing consumer norms; this particular documentary featured successful athletes promoting plant-based diets which in some consumer groups has helped to break down stereotypes around masculinity and meat consumption.[87] Studies show that social media users "copy" friends' eating habits and are subconsciously accounting for how others behave when making personal food choices.[88] Younger generations who are particularly influenced by social media will be more exposed to "social contagion" feedback loops which can increase the rate of adoption.[89] As such, environmental campaigners are increasingly using social media to encourage a shift towards more sustainable behaviour.

5 Capability: consumers and food service providers have the knowledge and skills on how to cook with alternative proteins, and consumers are aware of the health and environmental impact of their food choice.

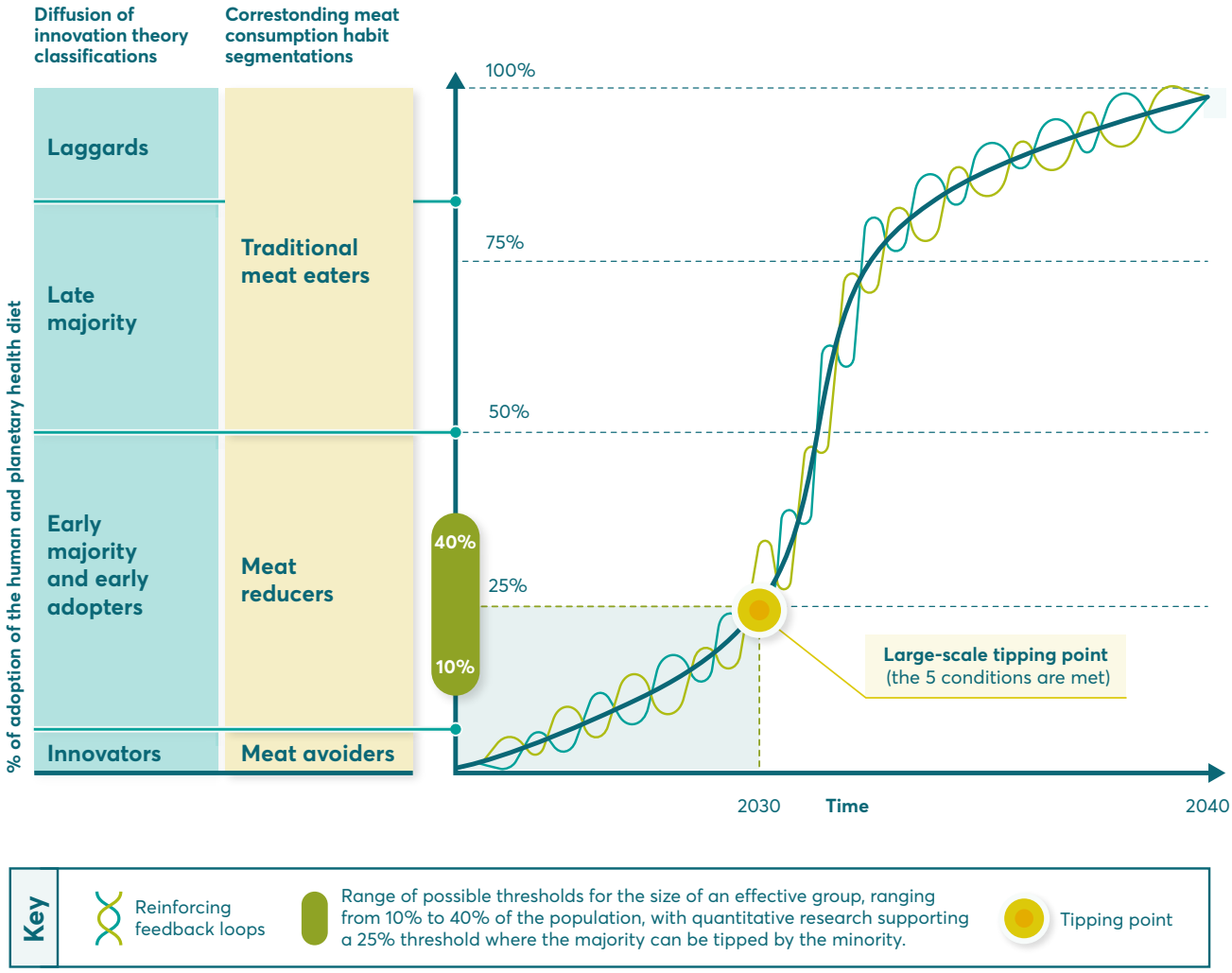
Cooking with conventional meat is often part of habit and tradition. Moreover, meat alternatives can be – or are perceived to be – more time-consuming to cook. Consumers could also be lacking in skills, equipment, or knowledge to cook these alternatives; indeed, this is a particular issue with raw plant protein products.[90] Well implemented national dietary guidelines (NDGs) may have a role in influencing and shifting product development, consumer perceptions, healthcare, and the media, but currently rarely make the link between health, sustainability, and protein consumption.[91] Public awareness of the link between animal product consumption and climate change is low, and the relative lack of media coverage of this link has contributed to it.[92] It is thus critical that governments facilitate messaging alignment between NDGs and media outlets to help build consumer awareness and consensus among stakeholders.

There has been a significant rise in social media influencers promoting plant-based diets and recipes, and an increase in vegan cooking shows to build skills among consumers, for example on Amazon Prime and ITV.[93] To make the transition as easy as possible, meat mimicking foods have been made so that they can be cooked in the same way as conventional meat so that new skills and capabilities do not act as a critical barrier to uptake. Foodservice and restaurants are recognising the benefits of plant-based diets and encouraging staff to cook with exciting new flavours. For example, Hilton Hotels' education campaign to help chefs to create blended burgers reported excitement and energy among staff for the creative opportunity.[94] Another example is the Cool Food Pledge which supports more than 30 facilities that serve 935 million meals each year, including hospitals, cities, universities, restaurants and companies, to reduce their GHG emissions by 25 percent by 2030, with a shift to plant-based foods enabling a GHG emissions reduction of 4.6 percent.[95]

2.5 Feedback loops for accelerating tipping

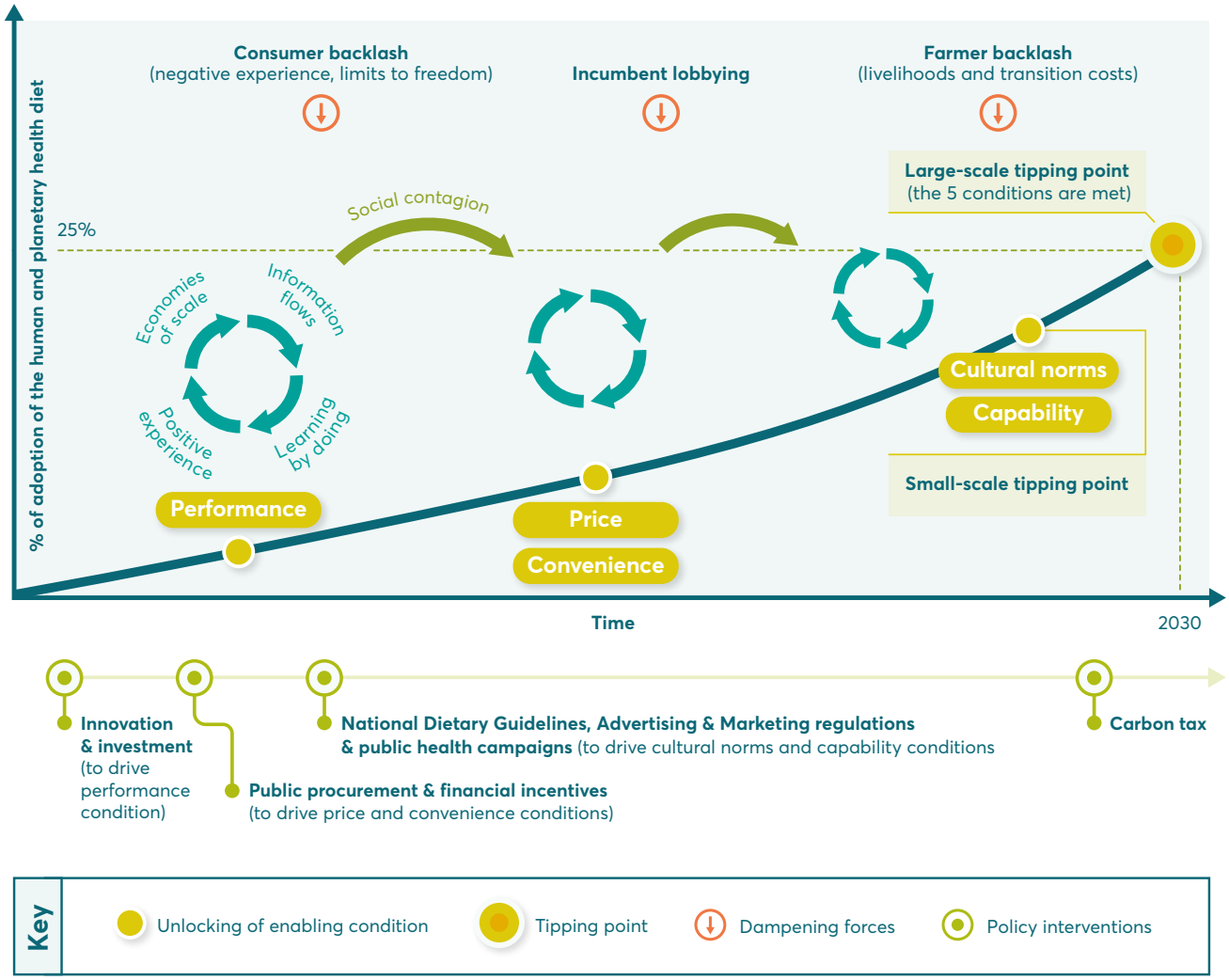
The **illustrative** image below (Figure 6) shows how the reinforcing feedback loops described in Chapter 1 might accelerate the shift of European consumers towards alternative protein products and away from meat consumption. The Y axis shows the rate of adoption of the human and planetary health diet. As discussed in Chapter 1, once approximately 25 percent of the population adopts this behaviour, we would expect a larger scale tipping point, accelerating change – which we have nominally placed in 2030.

Figure 6: Illustrative visualisation of dietary shift transition in Europe



Zooming in to the bottom left-hand of Figure 6, we suggest how policy interventions and positive feedback loops may enable the five conditions for large-scale/systemic tipping points to be met, in Figure 7. This approach to sequencing of interventions builds on the work of Lukas Fesenfeld and fellow researchers at ETH Zürich.[96]

Figure 7: Figure 6 zoomed in to this decade



While this is purely illustrative – the ordering may differ somewhat, and the rate of adoption (the shape of the S-curve) will be distinct for different demographics and geographies - this sequencing is plausible, but not yet rigorously tested as to the optimal sequencing of interventions. For example, a recent study shows that most Dutch citizens are in favour of meat reduction policies,[97] which means more stringent policies such as meat tax may be more politically acceptable at an earlier stage in this context.

Critically, a transformation to planetary and human health diets in Europe would open many opportunities for cascading tipping points in other critical transitions. Much meat and dairy consumption is sourced within Europe where biodiversity is still in systematic decline due to current farming practices[98], but these livestock are also dependent on primary biomass harvest with a footprint that is increasingly imported, and increasingly concentrated in Latin America.[99] A reduction in land demand would open up opportunities regenerating natural ecosystems in Europe and globally, and especially in tropical biomes that provide critical functions for biodiversity and the climate system. Analysis for FOLU's Growing Better report showed that the dietary shift was one of the key levers in freeing up almost 1.2 billion hectares of agricultural land for natural ecosystem restoration by 2050.[100] To indicate the potential of dietary shift in a country context, one simple and illustrative study shows that if all US consumption of beef was substituted with beans, it would free up 42 percent of US cropland (692,918 km^2) offering significant climate change mitigation and other environmental benefits.[101]

2.6 Mitigating backlash and compensating losers

While FOLU's critical transition 1 does entail a plateauing and then a reduction in red meat supply over the next three decades in Europe, it does not mean that all livestock farmers or dairy producers will be driven out of business. Demand for meat would be reduced to a level where sustainable agriculture – comprising integrated landscapes, extensive grazing and nutrient cycling – is possible. As a result, sustainable livestock producers will thrive – and they will do so through producing higher quality meat, doing so in a more sustainable way, often working in more local supply chains, and getting paid for their contributions to nature.

That said, the meat and dairy lobbies in both the EU and the US are particularly powerful.[102] It is likely that pushback from the meat and dairy sector will be most significant at the early stages of reform, where policymakers start to implement incentives to create market signals for the industry.

We call for appropriate investments in human capital and "stranded communities" to enable them to create or access different opportunities. For example, California has introduced a bill to support farmers who want to transition to growing crops that serve as inputs to plant-based foods, rather than as crops to feed livestock.[103] Programmes like this could be replicated on a larger scale to mitigate negative consequences of the transition wherever possible. Evidence also suggests that "policy packaging" of complementary measures are effective for both impact and public acceptance; this can involve hard policy interventions such as financial disincentives, over the longer term, combined with soft policy interventions such as information measures, nudges, and descriptive social norms.[104,105]

Any intervention to shift consumers away from meat-intensive diets which impacts food and nutritional security and/or affordability of food will face significant backlash, as seen in the emergence of diets as a "wedge issue" in elections in France and Germany.[106] The National Food Strategy in the UK aims to address this by reviewing the effect of different farm support, land use and dietary policies on food affordability and distribution.

2.7 Sequencing of policy interventions

Growing Better sets out recommendations for a range of actors but acknowledges the particular importance of policymakers in creating the enabling environment for the shift towards the human and planetary health diet. Investing in innovation to unlock the conditions relating to performance, accessibility and economic performance are critical early-stage interventions required to accelerate feedback loops progressing towards a tipping point. There is also a major role of public procurement in signalling demand, as well as regulatory interventions governing national dietary guidelines and regulating advertising and marketing. These earlier interventions are also designed to limit backlash associated with the sudden implementation of stringent measures against the meat industry.[107] Positive feedback from these initial interventions allows more stringent policies to be added over the longer term, including tax, regulation, and restrictions.

Table 3 sets out high-level recommendations on the sequencing of policy interventions.

Table 3: Possible sequencing of policy interventions to catalyse critical transitions on healthy diets and diversifying protein supply

Recommendation	Which of the five conditions does this address?
1. Innovation and investment: • Stimulate open access innovation and R&D for meat mimicking products. • Create fair and standardised regulatory pathway for innovation.	✓ **Performance** ✓ **Price** ✓ **Accessibility**
2. Public procurement: • Establish public procurement policy that favours alternative proteins to create demand and drive down costs. • Apply behavioural insights to policy design to nudge consumers towards healthy and sustainable diets (see example from the UK Government Behavioural Insights Team).[108]	✓ **Price** ✓ **Cultural norms**
3. National dietary guidelines (NDGs): • Ensure that NDGs link health, sustainability, and animal protein consumption to bring consensus and help to inform policy, education, product development, media and consumers. • Adopt integrated national food strategies, similar to the UK, which address food systems' impact on health, inclusion and environment in a holistic way.	✓ **Cultural norms** ✓ **Capability**
4. Advertising and marketing (A&M) policies and regulations: • Withdraw regulations that prevent use of familiar language on alternative products. • Limit A&M funding that promotes the consumption of animal products and allocate funding for alternative proteins.	✓ **Cultural norms** ✓ **Accessibility** ✓ **Capability**
5. Financial incentives favouring alternative proteins: • Reform subsidies to address perverse incentives and pricing distortions that externalise environmental costs in meat and milk production, and support those at risk to transition into alternative proteins or other sectors.	✓ **Price** ✓ **Cultural norms**
6. Public health and education campaigns: • Engage with traditional and social media to build consumer awareness and consensus. • Engage with corporates and develop education programmes that increase cooking capability for plant based foods.	✓ **Cultural Norms** ✓ **Capability**
7. Financial disincentives: • Phase out Common Agricultural Policy support for intensive livestock farming. • Introduce carbon taxes on animal products (note, this can only be effective when price of alternatives is at parity to ensure food is affordable).	✓ **Price**
8. Restrictions and regulations on animal products sold: • Establish restrictions on certain products and create regulation on pricing strategies so that supermarkets are not incentivised to add high premiums to healthy, plant-based products.	✓ **Price** ✓ **Cultural norms** ✓ **Accessibility** ✓ **Capability**

The last two interventions relating to carbon taxing and bans are more stringent and would likely be high impact but may not be politically and socially feasible in the near to mid-term.

Chapter 3: Tipping systems towards more productive and regenerative agriculture

Women works in the field of Kahansingh Bhai in Sankdi village in Narmada district in Gujrat/ Atul Loke for Panos Pictures/Food and Land Use Coalition

Productive & Regenerative Agriculture

Critical Transition 2: Scaling Productive and Regenerative Agriculture

Agricultural systems that are both productive and regenerative will combine traditional techniques, such as crop rotation, controlled livestock grazing systems and agroforestry, with advanced precision farming technologies which support more judicious use of inputs including land, water and synthetic and bio-based fertilisers and pesticides.

3.1 State of the system and the case for transformation

The world has already witnessed a global tipping point in agriculture in the second half of the twentieth century. Government policies, scientific research and the agri-food sector increased yields from a few major staple crops to provide enough calories for a burgeoning global population. Through a combination of research and development (R&D), subsidies and innovations in seeds, fertilisers and irrigation, agricultural output has grown steadily.

Despite successes of the past half century, global agriculture incurs significant hidden costs to the environment, health,[iii] economy and society. Agriculture and associated land-use change is responsible for roughly one-quarter of global greenhouse gas emissions.[109] Half of the planet's topsoil has been lost in the past 150 years,[110] with degraded soils more susceptible to flood damage and reduced yields, with negative consequences for farmers' livelihoods.[111] The loss of agrobiodiversity (the species, varieties and breeds of animals, plants and micro-organisms used in agriculture to produce food) increases agriculture's vulnerability to pests and local weather extremes. Additionally, the near extinction of certain pollinators jeopardises 5–8 percent of agricultural production and $235 billion to $577 billion worth of annual output.[112]

Just four crops – wheat, rice, corn and potatoes – account for around 60 percent of calories consumed by humans.[113] This poses risks to food security as production is concentrated in particular regions of just a handful of countries.[114] These risks are exacerbated by increasingly volatile weather brought about by climate change.

It is clear that business as usual is not working for people or planet. We therefore need another systemic shift to drive positive social, economic and environmental outcomes in agriculture. We recommend a critical transition towards more productive and regenerative agriculture. Many definitions of regenerative agriculture exist, so for the purposes of this report, we follow Growing Better's definition which includes: a set of practices that regenerate soil; that reduce but do not necessarily eliminate synthetic fertilisers and pesticides; and that go beyond the reduction of negative impacts.[115] It seeks to maintain high levels of productivity (or boost them in areas where productivity is currently low) while reducing inputs, to restore soil health, to increase agrobiodiversity and to reduce negative effects on freshwater and the ocean. It includes agroforestry and is supported by related techniques such as sustainable land management and integrated water resource management.[116]

[iii] See information on estimated deaths from air-borne related disease associated with agricultural emissions from Domingo et a. (2021). Air quality-related health damages of food. PNAS. And also the Global Burden of Disease study (2019).

Dr Balakrishna Reddy, Head of Research and Development measuring fruit at a farm which incorporate Jain micro-irrigation techniques at Tandalwadi village in Jalgaon, Maharashtra, India/ please credit: Atul Loke for Panos Pictures/Food and Land Use Coalition

3.2 Vision and goals

Scaling productive, regenerative agriculture could deliver five main potential benefits:

Environment.

Improvements from rebuilding soil health and carbon content, lowering greenhouse gas emissions (from synthetic fertilisers, enteric methane, rice methane, etc.), protecting biodiversity through reduced use of pesticides, herbicides and fungicides, and reduced negative impacts on freshwater and the ocean. This creates significant socio-ecological feedback loops between a healthy soil biome and plant productivity.

Health.

Improvements from better air quality (by reducing nitrous oxide released from chemical fertilisers and inadequate manure management, and reducing particulate matter by cutting down on tillage) and reduced exposure to chemical toxins.

Inclusion.

Gains from developing more diversified, profitable markets for agricultural produce, creating more skilled roles in farming, and lowering dependency on chemical inputs. This last dependency creates a significant cost for most farmers and a major risk for smaller farmers. Production risk would decrease due to improved resilience against disease and drought associated with healthier soils and more regenerative forms of agriculture.

Food security.

Healthy soils can store more water and, according to some studies, deliver more nutrients to food crops. Greater agrobiodiversity and more diverse systems of crop production increases resilience to pests and weather instability and diversifies nutrition. Boosting productivity is also vital in places where productivity is low.

Economy.

The annual economic gain from this transition is an estimated $1.17 trillion by 2030, and $3 trillion by 2050. A reduction in public health costs of $850 billion a year by 2030 would be the biggest driver of the gain.

3.3 Tipping the transition in India

We chose India as a case study due to a mix of historical and contemporary factors. Around 43 percent of India's labour works in the agriculture sector, contributing 16 percent of the national gross domestic product.[117] The agriculture sector is characterised by slow value-added annual growth (3 percent) and labour productivity that lags behind other countries including Brazil, China, Mexico and Indonesia.[118] Despite this, India is the world's largest producer of milk, jute and pulses, and the second largest producer of rice, wheat, sugarcane, cotton, groundnuts, and fruits and vegetables.[119]

Although the Green Revolution began in Mexico, the transition in India is perhaps best known. Initiated in 1967 in the state of Punjab, India's Green Revolution programme aimed at rapidly increasing the agriculture sector's productivity by promoting the use of high-yielding seed varieties and associated with it, a reliance on subsidized fertilisers, water and cheap electricity (still primarily reliant on fossil fuels, but with increasing hydro and other renewables sources). While food security has significantly improved, the financial burden on small-scale farmers has increased since then, with techniques linked with the Green Revolution such as the costly dependence on irrigation systems and pesticides, requiring significant investments.[120] The dependence of farmers on chemical inputs required for the adoption of high yielding varieties has led to overuse of nitrogen which has been correlated with soil degradation, reduced water quality and reduced biodiversity.[121] We now witness negative reinforcing feedback loops in many Indian farming systems as a result of this situation, where farmers are locked into a cycle of increasing input requirements, increasing indebtedness and decreasing soil health. Regional disparities emerged, with farmers in well-irrigated regions benefitting most from the Green Revolution (above rainfed areas which were largely bypassed). Beyond increased social inequalities, the Green Revolution has resulted in unintended long-term negative impacts on agricultural land, production, and farmers' livelihoods. Despite being a powerhouse of agricultural production, Indian farmers experience high levels of indebtedness, low incomes and one of the highest number of suicides in the world.[122,123] All of these factors have contributed to a widespread rural crisis in India which is exemplified by the recent farmer protests in many parts of the country.

Given this negative cycle, farmers in some regions of the country are seeking alternative production models that can improve livelihoods through more sustainable production.[124] Today there are several examples where small-scale, localised sustainable and regenerative agricultural practices[iv] are being adopted more widely, demonstrating the viability and enhanced resilience offered by such systems of farming. According to a recent report by FOLU India, led by partners at the Council on Energy, Environment and Water (CEEW), more than 30 different types of sustainable agriculture practices are identified across the country (see below Table 4).[125] This includes places which are implementing state-wide measures to become 100 percent organic (Sikkim) or wholly based on natural farming (Andhra Pradesh).

[iv] Based on engagement and consultation led by the FOLU India platform, we understand the term "sustainable agriculture" is more frequently used in India than "regenerative agriculture". Therefore, in this case study on India, we use the term "sustainable agriculture" with specific reference to the suite of practices summarised in Table 3. Source: CEEW (2020).

Men and women work in the fields of Sagai forest villages in Narmada district, Gujrat, India/ Atul Loke for Panos Pictures/ Food and Land Use Coalition

Table 4: Sustainable agriculture practices and systems in India[126]

Systems	Practices
• Permaculture • Organic farming • Natural farming • System of Rice Intensification • Biodynamic agriculture • Conservation agriculture • Integrated farming system • Agroforestry • Integrated pest management • Precision farming • Silvopastoral farming • Vertical farming • Hydroponics/Aeroponics • Crop-livestock-fisheries farming system	• Vermicompost • Drip irrigation/sprinkler • Crop rotation • Intercropping • Cover crops • Mulching • Contour farming • Rainwater harvesting • Floating farming • Plastic mulching • Shade net house • Alternative wet and drying technique • Saguna rice technique • Farm pond lined with plastic film • Direct seeding of rice • Canopy management • Mangrove and non-mangrove bio-shields

As discussed in Chapter 1, the Diffusion of Innovation theory suggests that a large majority of a specific population can be tipped into a new model after a smaller group of the population have adopted that new model. We are using 25 percent as a rule of thumb for that critical threshold.[127] In addition to measures of adoption, we also must ensure practices are leading to key system-level outcomes, such as food security for all, reduced GHG emissions, improved biodiversity and water use. It is difficult to assess whether agricultural systems in regions of India are close to a tipping point towards sustainable agriculture but with robust data and analysis we could assess where on the S-curve of adoption India's farmers are and anticipate whether, where and how interventions can stimulate reinforcing feedback loops. According to the same FOLU India/CEEW study mentioned above, no single sustainable agriculture practice (except crop rotation) is in adoption by more than 4% of Indian farmers,[128] suggesting that there is still a long way to go before the population of sustainable farmers reach the inflection point. But successful examples can create confidence among policymakers in the viability of sustainable agricultural practices, and thus facilitate the development and implementation of policies which favour them.

3.4 Five conditions for a tipping point towards sustainable agriculture in India

In **bold** below we set out the state of the system when each of the five conditions discussed in Chapter 1 has been met. We provide a discussion of the critical barriers preventing the realisation of this state as well as growing evidence of innovation and progress which suggests that these barriers can be overcome, and that the system can be tipped towards a desired state.

1 Economic competitiveness: sustainable agriculture business models are more economically attractive than high-input conventional models. This includes de-risking the transition for farmers.

At present Indian agriculture is dependent on government support for farming to be a viable business. In India, budgetary support to agriculture increased from $16 billion in 2000 to $70 billion in 2019 – mainly driven by large input subsidies such as fertiliser subsidies.[129,130] Farmers' dependence on fertiliser subsidies creates negative feedback loops: incentivising the production of calorie-rich but nutrient-poor food to be produced in large quantities at affordable prices,[131] which in turn require increasing amounts of fertilisers due to the degradation of the natural production capacity of soils as a result of overuse of chemical fertilisers.[132] In addition, irrigation subsidies in India include large electricity subsidies of up to $12 billion per year as well as free access to water.[133,134] These subsidies are vital to support access of poorer farmers to water in rural areas, but they also heighten the risk of overusing already stretched groundwater resources.

There are examples where sustainable agricultural models in India outcompete conventional ones in economic terms, based on yields and net returns, whilst also reducing dependence on subsidised inputs. For example, integrated pest management (IPM) reduces the cost of inputs for farmers and creates environmental co-benefits. By using natural alternatives to synthetic pesticides (based on neem tree seeds or chili-garlic solution), IPM controls diseases, insects and weeds specifically for rice, cotton and horticultural crops.[135] Studies from Andhra Pradesh have estimated farmers earned on average more

than 10,000 rupees/acre in contrast to 1,000–2,000 rupees/acre for farmers using chemical fertilisers and insecticides.[136] CEEW estimates that there are currently around 5 million farmers using IPM on 5 million hectares across India. Despite promotion, adoption has slowed over the past decade in part because of the barrier of technical knowledge (capacity and capability) required to switch.[137]

De-risking the transition to more sustainable and regenerative agriculture is also key to unlocking the economic benefits of a transition. This includes the government's provision of safety nets providing financial support and stability for farmers in transition. There is also a strong role for the private sector in providing longer-term contractual arrangements/off-take agreements as well as de-risking financial instruments (for example, as is currently provided by the AGRI3 Fund).[138] Such transition support is currently limited both in scale and in terms of the specific practices eligible.[139]

2 Performance: sustainable agriculture outperforms conventional agriculture based on yield, strengthening rural livelihoods, and increasing diversity and supply of more nutritious, resilient crops.

There exists a growing body of evidence suggesting that sustainable agriculture models in India can help increase yields, improve soil health and optimise nutrients.[140] While fewer than 5 million farmers in India are practicing agroforestry,[v] it has been shown to have a positive impact on yields for fruits, timber and crops.[141] In Uttar Pradesh for example, the soil-quality enhancing and nitrogen-fixing characteristics of agroforestry have led to better yields in maize, wheat and pulses without relying on the use of fertilisers.[142] In some cases, this has generated higher incomes for farmers, while enhancing the resilience of their crops and providing multiple environmental benefits such as the improvement of soils and better protection of ecosystems.[143] In India, the practice has also been found to be a useful tool in shifting attitudes towards natural resource management in rural communities.[144] Similarly, the system of rice intensification is an approach that has led to between 20–50 percent increase in rice yields while decreasing input costs, improving soil health and reducing irrigation requirements.[145] Overall, more evidence is needed to assess performance of sustainable agricultural models and inform decision-making to shift from current conventional practices.

Performance criteria should also include the production of more diverse and nutritious crops that meet India's major nutrition security challenges. Anecdotal evidence shows a positive impact of sustainable agriculture in India on health through increased dietary diversity as well as reduced exposure to harmful chemicals through practices such as natural farming, agroforestry, conservation agriculture, intercropping, integrated pest management and biodynamic farming.[146] More research on the impact of increasing agricultural diversification on health and nutritional outcomes is needed.

[v] CEEW estimates that agroforestry in India is practiced by up to 5 million farmers on up to 25 million hectares across the country. However, this is an estimate as there are gaps in evidence/data around practices across the subcontinent.

3 Accessibility and convenience: farmers have a market and access for their sustainably and regeneratively produced products.

Two important enablers for a systemic tipping point in Indian agriculture are a) creating differentiated markets for sustainably produced food (supported by consumer information) and b) facilitating farmers' market access for such products through investments in infrastructure and shorter supply chains. These enablers create feedback loops encouraging farmer adoption of more sustainable practices and supplying consumers with more sustainably produced – and often more diverse and nutritious – products.

On the demand side, there is already growing demand for healthier, sustainably produced food in India.[147,148] The retail value of India's market for healthy food products is estimated at around $1.5 billion today and potentially growing at a rate of 10% each year.[149] Governments can also shape demand through public procurement, i.e. where they make large food purchases for food assistance, hospitals or schools and beyond creating demand for sustainably produced agricultural products.[150] For example, in the United States the "Farm to School Programme" seeks to increase consumption of fresh produce by sourcing from local producers.[151] This could be expanded to farmers employing sustainable practices. Further, there is a powerful role for the private sector in driving sustainable procurement and demand through value chains (especially as companies are increasingly setting science-based targets for carbon and nature).

On the supply side, farmer cooperatives and community organisations are facilitating farmer access to downstream customers, which has already proven effective in many areas across India.[152] Improved data and information on consumer trends and decision-support tools are important to encourage a shift to productive and sustainable agriculture.[153] Investment in supply chain infrastructure – although not unique to sustainable agricultural products - is critical for improved market access across the agriculture sector as it lowers inefficiencies especially in the post-harvest and handling stages. In the wake of the COVID-19 crisis, India's finance minister has launched a $13 billion fund to improve the infrastructure and facilities needed to procure, store and market agricultural produce.[154] Other types of infrastructure investments, such as in roads and markets would have the potential of minimising efficiencies and intermediaries, ultimately bringing producers and consumers closer to each other.[155]

4 Cultural and social norms: it is culturally and socially undesirable to continue producing agriculture conventionally. Farming sustainably provides equal opportunities for all, including women. Farming appeals to youth and attracts a new generation of Indian farmers.

At the community level, social pressure can influence a shift in practices for farming communities. A study conducted on Colombian farming communities showed that farmers are more likely to adopt sustainable techniques of farming if other farmers in their community are doing so too.[156] There are other studies which have shown similar peer-pressure type effects.[157] Findings may be transferrable to India. Other essential cultural and social factors affect behavioural decisions of farmers to adopt sustainable practices. This includes farmers' perceptions of their social usefulness to community, as well as the perceptions about how others in the community think they should perform their work.[158] Women play a particularly important role, as women make up more than 70 percent of the labour force in Indian agriculture.[159] Women are associated with leading sustainable practices of composting, rainwater harvesting and integrated farming systems.[160]

Given roughly half of India's population is under 25 years old, the social norms and aspirations of India's youth is important for the future of farming societies.[161] Participation in Indian agriculture is declining, as rural youth move to cities in search of job prospects beyond the farm.[162] A new generation of young rural entrepreneurs is needed to take advantage of the opportunities offered by the transformation of Indian food and land use systems and create decent jobs in agriculture and in the processing of agricultural products.[163]

Consumer cultural and social norms in India also play an important role. Consumer awareness and behaviour change can send a strong demand signal to farmers for sustainable products and enable reinforcing feedback loops in support of practice adoption.

5 Capability: Knowledge networks facilitate dissemination of evidence for sustainable agriculture. Farmers have access to knowledge, tools and the capital needed to shift to sustainable farming.

Knowledge, skills and resources are necessary to facilitate adoption of sustainable practices.[164] Such knowledge and training occurs at field level, given the context specificity of agriculture. Extension services, peer-to-peer networks, initiatives from civil society organisations including farmers cooperatives and informal networks all contribute towards this condition.[165] Support throughout the early years of a transition is important. During this period, farmers' communities and cooperatives, and other civil society organisations play an essential role in providing farmers with financial and technical support as well as useful information on the institutional schemes available from local, sub-national and national governments. Farmers in The International Small-group and Tree Planting (TIST) programme in Africa report that peer-to-peer support and sharing both knowledge and the risks of adopting new practices is a key benefit of membership of the programme. TIST's network structure, based on local "clusters" supported by a national network, ensures that farmers can easily access training and are well supported to develop best-practices for sustainability that are adapted to local contexts (see TIST case study on page 48).

The Zero Budget Natural Farming (ZBNF) and Karnataka Rajya Raitha Sangha movements have greatly contributed to the implementation and spread of sustainable agriculture across several states in India. These movements set up large-scale training camps to promote sustainable agriculture at grassroot level and train existing and future farmers. By demonstrating that sustainable agriculture can reduce the long-term production costs of farmers, the efforts manage to attract several thousands of participants at their training sessions.[166] Beyond these initial training sessions, peer-to-peer learning occurs throughout production and is often led by "master farmers" or "community resource persons". This demonstration effect plays a strong role in farm to farmer dissemination.[167]

A wealth of programmes and initiatives have already been set up by the government to promote a nationwide transition to sustainable agriculture. Under the National Action Plan on Climate Change, the National Mission for Sustainable Agriculture seeks to promote progress on food security and equity, livelihoods generation and economic stability through the promotion of sustainable agriculture. The National Project on Organic Farming works to create awareness, promote organic fertilisers and provide training and capacity building amongst farming communities. It simultaneously offers the Capital Investment Subsidy Scheme to support farmers in purchasing agro-waste compost production units, bio-fertilisers and bio-pesticide production units, as well as to help farmers access skilled labour.[168] To complement public-sector-led programmes, the private sector has the opportunity to play a greater role in the dissemination of knowledge and techniques to implement sustainable agriculture.[169] Over time, the dissemination of successful techniques and practices, along with developing economies of scale, will drive down the costs of developing and implementing sustainable agricultural practices.

A farmer prepares 'dashparnikashayam' at his field as part of the Zero-Budget Natural Farming initiative in Andhra Pradesh, India/ Atul Loke for Panos Pictures/Food and Land Use Coalition

3.5 Feedback loops for accelerating tipping

In Chapter 2 on healthy diets, we included an illustrative graph that shows how reinforcing feedback loops might accelerate the adoption of behaviour towards reduced meat consumption. The same illustration applies for this example of shifting towards more sustainable agricultural practices. Further, there are important socio-ecological feedback loops whereby adoption of sustainable agricultural practices, including for example rainwater harvesting in India, can accelerate the ecological feedback loops associated with water resources and agricultural productivity.[170] FOLU intends to do further quantitative work over the next 24 months to better understand the rate of adoption (the shape of the S-curve) as well as the optimal sequencing of interventions for triggering reinforcing feedbacks in the context of India's transition towards sustainable agriculture.

3.6 Mitigating backlash and compensating losers

While evidence suggests that sustainable and regenerative agriculture reduces overall production costs to the farmer, the potential costs of a transition – including investment requirements for training – is an important barrier to an effective transition, especially where farmers have limited resources and insurance mechanisms. The risk of failure or even a temporary short-term loss in income whilst in transition can be devastating for farmers' livelihoods – and therefore unacceptable. Consequently, this risk is a powerful disincentive to shift practices. This is especially true in India where on average farm sizes tend to be quite small (around 1 hectare), labour intensive (especially given the proportion reliant on agriculture sector employment) and dependent on production of one or very few crops.[171]

Safety nets and financial incentives can play a major role in providing those farmers with the right enabling environment to effectively engage in the transition and minimise risk of backlash. Policymakers should ensure robust communication, consultation and engagement with communities who might feel disadvantaged by a transition. This is one of the major criticisms made of the market and subsidy reforms introduced in 2020, which has resulted in widespread farmer protests across the country.[172]

Another group who might seek to flatten or decelerate adoption of sustainable practices are industry players – especially those related to the fertiliser and input industry. However, industry can become a leading actor in the development of alternatives to chemical inputs, including through the development of bio-fertilisers. Despite the business opportunity, without incentives incumbents may not seek a shift away from status quo.

3.7 Sequencing of policy interventions

Growing Better sets out recommendations for a range of actors but acknowledges the particular importance of policymakers in creating the enabling environment for the shift towards more productive and regenerative agriculture. We acknowledge that the specifics of the reform programme outlined in *Growing Better* will inevitably vary from one country to the next, and from one community to the next.

We have identified several high impact interventions for governments and policymakers in the table below. These are global recommendations and would need to be adapted and tested in a national or sub-national context. We propose that early interventions could focus on a combination of increasing public and private investment to promote sustainable agriculture since these interventions can trigger reinforcing feedback loops progressing towards a tipping point. This investment would also need to be coupled with efforts to ensure that agricultural subsidies provide incentives to shift towards more productive and sustainable production. Agricultural support policies would need to ensure that safety nets and financial support are available to de-risk the transition for farmers, currently a major barrier to adoption of alternative practices. There is also a key role for governments and private sector actors to support demand for more sustainable products in India, including through public procurement as well as consumer awareness.

Table 5: Possible sequencing of policy interventions to catalyse critical transitions on productive and regenerative agriculture

Recommendation	Which of the five conditions does this address?
Redirecting distorting subsidies, coupled with social safety nets and transition support: • Shift incentives from input-intensive to sustainable and regenerative practices. • Scale up payments for ecosystem services. • Provide off-take guarantees for sustainable agricultural produce. • Provide social safety nets and/or transition finance to de-risk transition for farmers.	✓ **Economic competitiveness** ✓ **Performance**
Market innovation: • Agree an industry standard for regenerative agriculture sourcing, along the lines being developed e.g. by OP2B and SAI Platform. • De-risk transition for farmers by providing longer-term off-take agreements and financial instruments for farmers. • Develop value chains and infrastructure that will help channel regenerative agriculture products to the market. • Facilitate open access innovation and R&D investment in bio inputs, irrigation systems, nutrient recycling.	✓ **Price** ✓ **Performance**
Public procurement: • Use public procurement to stimulate demand and encourage local producers using regenerative practices. • Develop public procurement standards that value natural capital.	✓ **Price** ✓ **Performance**
Consumer awareness and communication: • Engage with traditional and social media to build consumer awareness on the benefits of sustainable food on health, nature and livelihoods. • Work with media in large demand hubs to raise awareness on the role of sustainable farmers in providing healthy food, stewarding nature and mitigating climate change. • Develop comprehensive metrics – like the one being developed by Sustainable Food Trust – for assessing the sustainability of farm operations and conveying this information to consumers.	✓ **Accessibility** ✓ **Cultural norm**
Farmer training, information networks: • Provide ongoing support to the development and operation of grassroots initiatives that promote the inclusive and participatory transition of vulnerable and small-scale farmers to sustainable agriculture models. • Scale up extension services (training and access to technology, knowledge, seeds, etc.) • Monitor sustainable agriculture initiatives over the long-term to better understand how they create value at the landscape and regional levels, to inform more accurately the design of public policies and fiscal reforms. • Provide better documentation data and evidence surrounding regenerative farming practices.	✓ **Capability** ✓ **Accessibility** ✓ **Cultural norms** ✓ **Performance**

Case study: The International Small Group and Tree Planting Programme (TIST)

The International Small Group and Tree Planting Programme (TIST) is a farmer-led afforestation and regenerative agriculture initiative that provides smallholder farmers with the capability to access payments for ecosystem services via international voluntary carbon markets. Beginning in Tanzania in 1999, the programme rapidly spread to Kenya, Uganda, and India. Today's membership includes over 110,000 farmers. TIST was founded to address the soil erosion and loss of productivity in deforested landscapes that leaves millions of subsistence farmers vulnerable to poor harvests, food scarcity, and loss of livelihood. In these conditions, tree-planting and agroforestry can have multiple benefits including: stabilising soils; providing fuelwood, timber and additional fodder or food crops; establishing shade and windbreaks; generating habitat for biodiversity including pollinators and predators of crop pests; and giving cover for other activities like beekeeping. Although many farmers have a strong desire and incentive to re-green their landscapes and build more resilient and sustainable livelihoods, they face significant barriers in terms of access to information, the risks (perceived or real) or financial costs of transitioning to unfamiliar practices, and lack of peer support.

To tackle these challenges, TIST facilitates information sharing and peer support through a growing network of members. It makes tree-planting economically attractive by enabling smallholder farmers to receive payment for the carbon sequestered in the trees they plant. Farmers join TIST as members of a "Small Group" of 6–12 people, which in turn form part of a local "Cluster" of 30–40 Small Groups supported by a national leadership. Each Cluster is served by a trained local farmer who periodically revisits each Small Group to quantify tree growth, uploading data to a central database where it is packaged as carbon credits. This generates a financial return that allows the network to meet operational costs while returning 70 percent of profits directly to the farmers. Members can earn income from tree planting regardless of whether they own land as long as they have permission to plant and access to the trees once planted, which is particularly important in making the benefits accessible to women and others who may be excluded from land-tenure.

Farmers exchange knowledge and training at monthly Cluster meetings. Leadership roles in Clusters rotate between women and men, helping to build a community of experienced and empowered environmental leaders. Word of mouth has driven the rapid expansion of the TIST programme, especially in Kenya where membership now exceeds 80,000. Overall, more than 110,000 TIST Farmers have planted and sustained over 21 million trees, while gaining co-benefits from agro-forestry and regenerative agriculture practices valued at over $8 per tree planted – far exceeding the income from carbon credits. The greening effect of TIST farmers' practices is detectable in satellite imagery and spills beyond the boundaries of their farms to have landscape-level effects. These social and environmental co-benefits enable TIST to sell their high-quality carbon credits at a premium, further enhancing the returns to farmers and enabling continuing growth of the network.

Chapter 4: Tipping systems towards protection and restoration of nature

Protecting & Restoring Nature

Critical Transition 3: Protecting and Restoring Nature

Nature must be protected and restored. This requires an end to the conversion of forests and other natural ecosystems and massive investment in restoration at scale; approximately 300 million hectares of tropical forests need to be put into restoration by 2030.

4.1 State of the system and the case for transformation

For Critical Transition 3, we focus our exploration of tipping points on tropical rainforest protection and restoration because of their role in regulating climate and water cycles, protecting against flood, drought and erosion and maintaining soil and water health. Tropical rainforests are also the source of 80 percent of terrestrial biodiversity and source of livelihoods for over a billion people.[173] They are also under immediate threat; in 2020 alone, 12 million hectares of tree cover was lost in the tropics, including 4.2 million hectares of previously undisturbed primary rainforest (a 12 percent increase compared to 2019). Greenhouse gas emissions from tropical deforestation are now at least as large as total emissions from the European Union.[174]

The direct drivers of tropical forest loss vary across countries and regions. In Africa, deforestation is largely caused by shifting subsistence farming, driven by rural poverty. In (sub)tropical Asia, deforestation is mainly commodity-driven, caused by large plantations of crops such as oil palm. And in Latin America, commodity-driven deforestation (primarily soy and cattle) and shifting agriculture are both large drivers of loss.[175] Overall, approximately 90 percent of tropical deforestation is linked to agricultural expansion (either commodity-driven deforestation or where trees are cleared and burned for short-term cultivation of subsistence crops).[176] An estimated 30 percent of that deforestation relates to commodities that are then traded internationally, in particular beef and oilseeds.[177]

Satellite-based analysis of deforestation shows that the majority of loss occurs at the forest frontier, a 600-million-hectare belt of land made up of three categories of land use: relatively intact natural forest, active agricultural land and degraded areas.[178]

4.2 Vision and goals

In *Growing Better*, we argue that given the urgency of the climate crisis, the most carbon rich and geographically restricted biomes – tropical forests, mangroves and peatlands – should be protected fully and immediately. Tropical forest deforestation rates need to be slashed, starting with a radical reduction from 2020 onwards to achieve at least a 75 percent drop by 2025 and a near complete halt by 2030. Forest degradation needs to be cut at similar rates. At the same time, around 300 million hectares of tropical forests need to be restored by 2030. The protection and restoration of savannahs, wetlands and certain other forest types should follow a similar trajectory.[179]

Achieving these goals will deliver significant benefits:

Environment.

Reducing annual net greenhouse gas emissions by more than 5 $GtCO_2e$ by 2030 and more than 8 $GtCO_2e$ by 2050,[vi] which is consistent with limiting global heating to 1.5˚C[vii]; halting and reversing of biodiversity decline.

Resilience and food security.

By supporting natural ecosystems' continued ability to provide critical services like predictable rainfall, watershed management and pollination we reduce the otherwise increasing risk that events once considered extremely low probability would materialise – such as a full collapse of forest basins like the Amazon or concurrent crop failures in several of the world's main food-producing regions with profound implications for food security and peace.[180]

Health.

Enhancing human health and wellbeing by averting the worst impacts of climate change and nature loss; retaining the pharmaceutic potential of the biodiversity of the natural world; preventing the emergence and spread of zoonotic diseases and epidemics; reducing mortality and air pollution impacts of forest and peatland fires.

Inclusion.

Supporting the livelihoods and sociocultural heritage of the hundreds of millions of poor and often vulnerable people living in and off the forests, including indigenous peoples; preserving the wellbeing effects of protected natural systems on communities near them;[181] helping indigenous peoples and forest frontier communities prosper by establishing and scaling payments for ecosystem services and the sustainable forest frontier business models.

Economy.

The annual economic gain from this transition is an estimated $895 billion by 2030, and $1.3 trillion by 2050.[viii,182] A reduction in environmental costs of $440 billion a year by 2030 would be the biggest driver of the gain.

[vi] Note this benefit is derived solely from achieving the associated reductions in deforestation and increases in afforestation and does not include other "Natural Climate Solutions".

[vii] There is no pathway towards the Paris goals considered by the Intergovernmental Panel on Climate Change (IPCC) that does not assume a near immediate halt in forest conversion and significant forest restoration over the coming decades.

[viii] It is important to recognise that this is an extremely conservative estimate since it does not reflect tail-end risks, e.g. the risk of significant reductions in rainfall across the breadbaskets of Argentina, Brazil and potentially the mid-west of the United States which could result from Amazon dieback.

4.3 Tipping the transition on tropical deforestation-free and forest-positive supply chains

This chapter specifically focuses on tipping point analysis of tropical forest loss linked to commodity supply chains since we have identified growing evidence of a near-term opportunity to trigger a systemic tipping point that would accelerate a shift towards deforestation-free and forest-positive commodity value chains[ix]. Based on this assessment, we propose recommendations for policymakers (in both tropical and non-tropical countries) to unlock this opportunity.

4.4 Five conditions for tropical forest protection and restoration tipping points

As discussed in Chapter 1, we propose five conditions which need to be met for a systemic tipping point to take place. In **bold** below we describe the future state of the system at the point when each of five conditions has been met. We provide a discussion of the critical barriers preventing the realisation of this future state as well as growing evidence of innovation and progress which suggests that these barriers can be overcome, and that the system can be tipped towards our proposed vision.

Our tipping point analysis for this Critical Transition differs in two ways to the Transitions described above:

- Because of the disproportionate effect of international demand for deforestation-linked commodities on deforestation in tropical forest countries, we apply the five conditions to both the supply and demand side in this example.

- Linked to this, tipping towards this transition is intrinsically linked with success in tipping the critical transitions on healthy diets and diversifying protein supply, as well as the critical transition on regenerative and productive agriculture. For example, cattle farming and soy production for animal feed is the largest driver of deforestation in parts of Latin America. As such, reducing meat consumption domestically and in importing countries and shifting towards more regenerative cattle farming practices (such as silvopasture) will be critical to the protection of tropical forests in this region. Another example is palm oil for biofuel production where there is a need to transition towards alternative transport fuels (including direct electrification, electricity-based hydrogen and synthetic fuels).[183] This latter example sits outside of the FOLU 10 critical transitions but is central to the transition of the transport system and highlights the importance of an integrated systems approach.

[ix] Forest-positive business models derive social, economic and environmental value from the protection, restoration or sustainable management of forests and in doing so provide tangible incentives to keep forests standing or to regrow them.

1 Economic competitiveness

Supply: deforestation-free and forest-positive business models are more profitable than conventional models, i.e. governments, local communities and businesses gain more economically from keeping forests standing than they do from cutting them down.

Demand: deforestation-free and forest-positive products are at price parity.

Perhaps the most significant barrier to preventing tropical forest loss is that, by and large, there is limited monetary return for keeping forest standing, even though the benefit to society is overwhelming. This is because the estimated $450 billion of ecosystem services provided by forests are not adequately valued, distorting markets and allocation of capital.[184] Governments and international institutions have failed to protect global public goods such as tropical rainforests and, even worse, are incentivizing unsustainable economic activities that destroy them through subsidy regimes worth between $4–6 trillion a year.[185] As such, the environmental externalities linked to deforestation are not adequately reflected in commodity prices which distort the true cost of unsustainably produced products.

There are examples of where public support has created a powerful positive incentive for forest protection. Between early 2000s to 2012, the Brazilian government expanded protected areas, recognized indigenous territories, increased forest protection law enforcement, and increased agricultural productivity, reducing large-scale deforestation by over 75 percent relative to the 1996 to 2005 average.[186] This reduction, accompanied by continued rises in GDP, amounted to decoupling development from deforestation. Unfortunately, the Bolsonaro government reversed many of these policies, undoing much of the progress that was made. However, this example does show the art of the possible.

Emerging market-based mechanisms – namely payment for ecosystems services (PES) models – also have the potential to address this market failure. PES models work by paying communities or owners of the forest for the benefits that those forests provide e.g. in sequestering and storing carbon, in regulating climate, in filtering water or in protecting biodiversity. Secure land tenure or usufruct rights are key here – i.e. to ensure that these payments are directed to those actors with influence over forest protection. Corporate demand for carbon credits to compensate for or neutralize unabated or historic emissions by paying for forest sequestration is one avenue to scale PES models. Companies are setting increasingly ambitious targets in this regard – for example, Apple aims to remove 1 million metric tonnes of carbon a year through investments in forests, wetlands, and grasslands as part of its commitment to be 100 percent carbon neutral across its supply chain and products by 2030.[187] Unilever also plans to achieve net zero emissions from all products by 2039 and, linked to this, has set out plans for a $1 billion investment in a climate and nature fund.[188] The Lowering Emissions by Accelerating Forest finance (LEAF) Coalition launched this year seeks to accelerate and aggregate this corporate demand, mobilising at least $1 billion in financing, kicking off what they hope will become one of the largest ever public-private efforts to protect tropical forests.[189]

Another barrier to economic competitiveness is environmental crime; 69 percent of tropical deforestation is illegal of which 60 percent (or 46 million hectares) was the result of commercial agriculture,[190] eroding economic activity linked to job creation, tax revenue, production of forest products and the provisioning of ecosystem services. Globally, during the early 2000s forest countries suffered losses of more than $17 billion per year (at an estimated minimum of $4,000 per hectare) as a result of illegal deforestation for industrial agriculture.[191] There are, however, reasons to be hopeful as country governments increasingly acknowledge the importance of halting environmental crime. In September 2020, 79 countries endorsed the Leaders' Pledge for Nature including a commitment to ending environmental crime.[192] There is also a suite of new tools and technology innovations making it easier to identify and prosecute environmental crime. This includes forensic techniques for identifying timber and other products as well as remote sensing of land and sea.

Economic competitiveness is also undermined when capital is allocated without consideration of the financial risk associated with the destruction of tropical forests. For example, the food and agriculture sector faces sizable transition risks relating to pricing, regulation and changing consumer behaviour – one estimate suggests that global palm, beef, and soy producers face at least $19 billion in additional costs annually as a result of future greenhouse gas pricing and/or regulations.[193] Investors are waking up to this risk. In 2019, 254 investors representing approximately $17.7 trillion in assets signed a statement warning that rates of deforestation were placing their investments in Brazilian companies at risk.[194] In 2020, Nordea Asset Management renounced shares worth EUR 40 million from JBS, the world's largest meat company, due to issues including deforestation risk.[195] Moreover, the launch of the Taskforce on Nature-related Financial Disclosures in 2021 signals this positive direction of travel for investor pressure on nature.[196,x]

On the demand side, there are reasons to be hopeful with regards to economic competitiveness; research shows that consumer support and price premiums for deforestation-free products (e.g. sustainable palm oil) exist,[197] suggesting that informing consumers about the sustainability of a product can create economic demand and incentivise sustainable practices. The establishment of due diligence requirements in importing countries – namely the European Union and United Kingdom – are also cause for celebration as these shift demand signals and thus the economic incentive at a large scale towards deforestation-free products.

[x] In *Growing Better*, FOLU called for the establishment of a Task Force on Nature-Related Financial Disclosures (TNFD) to increase corporate and financial reporting of nature, biodiversity, public health and inclusion risks, building on the guidelines of the Task Force on Climate-related Financial Disclosures (TCFD).

Female community members plant newly matured seedlings at the Cinta Raja Rainforest Restoration Site in Gunung Leuser National Park (GNLP) in Sumatra, Indonesia/ Kemal Juffri for Panos Pictures/Food and Land Use Coalition

2 Performance

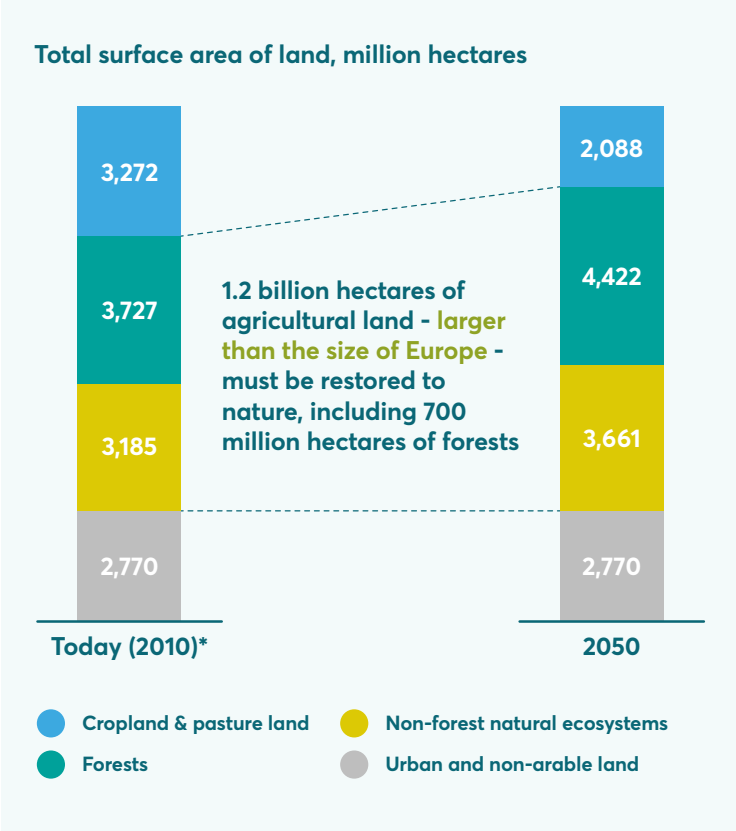
Supply: deforestation-free and forest-positive business models lead to stronger livelihoods and more profitable/prosperous, resilient and healthy forest communities – with benefits for the broader economy in tropical forest countries.

Demand: deforestation-free and forest-positive products are comparable or better in terms of quality (e.g. taste or shelf-life in the case of forest foods).

On the supply side, the main performance-related barrier lies in a commonly held misconception that there is a trade-off between halting deforestation and hampering economic development and food/resource security. For example, in Brazil, President Bolsonaro has claimed that interest in Amazon protection from the developed world is a mask for the true aspiration to pillage Brazil of their vast natural resources.[198] And in Indonesia, the recently introduced Omnibus Law will roll back environmental legislation in the name of employment generation and food security.[199] This trade-off between environmental protection, jobs and food security is a fallacy; the conversion of natural landscapes to produce food is not a necessity, but a result of failures in markets and governance.[200]

FOLU modelling demonstrates that it is both possible – and necessary – to halt tropical deforestation and protect other natural ecosystems while setting aside hundreds of millions of hectares of land for forest and ecosystem restoration, and to produce affordable, nutritious food for the global population (see Figure 8).[201] Indeed, there are a number of studies across the tropical belt which show that food production can be dramatically increased without need for further encroachment on the forest frontier. For example, one such study showed that Indonesia could profitably increase crude palm oil production potential by 25 million tonnes per year on existing plantations by closing the exploitable yield gap, exceeding Indonesia's production target of 60 million tonnes by 2030. The extra production potential is equivalent to saving seven million hectares of land from clearing for new palm oil cultivation.[202] The productivity potential in palm oil – and other parts of Indonesian agriculture – thus holds triple win potential for food security, livelihoods and the environment.

Figure 8: Agriculture land freed up for natural ecosystem restoration by 2050



Modelling by the Food and Land Use Coalition set out in *Growing Better* demonstrates that this can be achieved at the same time as:

- ✓ Halting biodiversity loss and restoring ocean fish stocks
- ✓ Eliminationg under-nutrition and halving the disease burden associated with consuming too many calories and unhealthy food
- ✓ Increasing food security
- ✓ Boosting income growth for the bottom 20% of the rural population

The freeing up of agricultural land for restoration is made possible due to a shift away from land-intensive protein diets, combined with faster productivity growth, lower food loss and waste and more efficient livestock management.

Both public and private sectors must work to address misconceptions about trade-offs between forest protection and economic development. Evidence exists from farmers and forest communities who have successfully transitioned their business models. Amplifying this growing evidence base for change must highlight the benefits of protecting and restoring forests and must emphasise benefits relating to economic activity, employment generation, public health, resilience, food and political security. In the wake of the COVID-19 crisis, articulating benefits to public health will be central. For example, in Indonesia there is growing political pressure to address forest fires (which have been linked to palm oil concessions) as research suggests a link between haze-related air pollution and COVID-19 mortality rates.[203]

On the demand side of the "performance" condition – i.e. where deforestation-free and forest-positive products need to be comparable or better in terms of quality - there is a risk that consumers perceive deforestation-free alternative products to be of lesser taste or quality. For example, certain consumer groups may resist shifting from beef burgers to chickpea burgers because of taste. However, as discussed in Chapter 2, plant-based meat developers are continuing to find ways to make products tastier and more nutritious.

3 Accessibility

Supply: forest communities and businesses have access to tools and knowledge to be able to produce deforestation-free and forest-positive products, including logistics infrastructure and long-term offtake agreements.

Demand: consumers have access to purchase deforestation free and forest-positive products.

The main accessibility-related barrier on the supply side is that smallholders and businesses often lack access to the right kind of finance (reflecting duration, needs and risk profile), tools and knowledge to transition to forest-positive business models. Forest-positive business models often have longer pay-back periods and therefore market failures, early-stage funding gaps and short-term financing cycles make such investments difficult. Moreover, the lack of large-scale projects also limits the investor attractiveness of nature as an asset class. In emerging markets these issues are compounded by perceptions of political, regulatory and currency risk, weaker local capital markets, information asymmetries and limited data.[204]

Even access to land can be a barrier – for example, since 2000, international buyers have acquired over ten million hectares of agricultural land in Africa.[205] While this can lead to a strengthening of productivity and improvements in rural livelihoods, there is a genuine risk that transactions will take place at the expense of the local population, especially where governance of land title is weak. This is particularly true for indigenous people who often lack legal title to their lands (and where they do it is often not adequately enforced).

It is therefore critical that forest-positive business models are scaled. These models derive social, economic and environmental value from the protection, restoration or sustainable management of forests and in doing so provide tangible incentives to keep forests standing or to regrow them. On the demand side, scaling these business models means increasing consumer access to forest-positive products, and on the supply side it means increasing forest communities', farmers' and businesses' access to knowledge, tools and finance to transition. In FOLU's 2019 report Prosperous Forests, we provide a catalogue of inspiring examples of these models and identify recommendations for scaling them. The Blended Finance Taskforce's 2020 *Better Finance, Better Food* report and associated case study catalogue (commissioned by FOLU) also provides a plethora of financial solutions which are mobilising capital for forest-positive business models.

Cocoa pod on pilot farm shows fleshy parts, which are used to produce cocoa butter, Ghana/ Stuart Clouth/P4F

4 Cultural and social norms

Supply: it becomes socially and politically unacceptable as a government, business or individual to destroy tropical forests.

Demand: it becomes socially unacceptable to purchase deforestation-linked products (for consumers, businesses and demand-side country governments).

As is the case with the "performance" condition, the main supply-side barrier here is the commonly held misconception that there is a trade-off between halting deforestation and economic development and food security. As such, the urgent economic and social case for protecting tropical forests needs to be clearly articulated and understood by policymakers in tropical forest countries.

On the demand side, a key barrier lies in the complexity and opacity of global supply chains, meaning that consumers – and indeed governments in demand-side countries – are largely unaware of the deforestation impacts of their purchasing decisions. But new technologies are enabling transparency and driving accountability. For example, global satellite monitoring tools such as Global Forest Watch and international trade and supply chain transparency initiatives such as TRASE are increasing our ability to track and tackle deforestation while technologies such as blockchain also offer the prospect of more detailed and reliable information on the provenance of goods being made available to customers.

There is clear evidence that consumer preference and citizen concern is shifting. More than 1.1 million people have urged the EU to introduce due diligence legislation for companies in forest-risk supply chains, in the largest-ever response to an EU public consultation on an environmental issue.[206] A recent WWF-UK poll found 67 percent of British respondents want the government to do more to tackle illegal deforestation and 81 percent want greater transparency about the origins of products imported into the UK.[207] Both the EU and UK, as well as the US, are now introducing or actively considering due diligence laws to ensure no illegal deforestation-linked imports enter their markets.

A farmer climbs up a palm sugar tree to collect the sap at a forest in Sintang regency, West Kalimantan, Indonesia/ Kemal Juffri for Panos Pictures/Food and Land Use Coalition

5 Capability

Supply: local communities, governments and businesses have knowledge about alternative business models that enable them to prosper while keeping forests intact. They also have finance and tools to enable a transition.

Demand: consumers have access to knowledge about deforestation-linked products (i.e. transparent supply chains).

With regards to capability, the barriers and the mechanisms for unlocking them on the supply side mirror those articulated in the condition related to accessibility.

The main demand-side barrier is the lack of clear labelling meaning that consumers lack the capability to distinguish between deforestation-free/forest-positive products and deforestation-linked products. Where certification/labelling exists, it is often misleading. Greenpeace's analysis of nine major certifications designed to tackled commodity-linked deforestation identifies the ways in which certification schemes for agricultural and forestry commodities can miss or even conceal companies' contribution to deforestation and related impacts on the broader environment and on people.[208] The lack of consistency and/or universal minimum standards between certifications also create confusion for the consumer, which can result in apathy and inaction.

There is, however, positive progress on this front with significant multi-sectoral initiatives to improve and increase labelling such as the Global Ecolabelling Network (GEN) and the International Social and Environmental Accreditation and Labelling Alliance (ISEAL). The proliferation of such labelling standards is a significant step in the right direction, but a formalisation and standardisation of the terms used to demarcate "positive" products is needed in a market landscape that is currently full of catchy, but vague terms such as "green", "eco-friendly", and "climate-friendly".

4.5 Feedback loops for accelerating tipping

In Chapter 2 on healthy diets, we included an illustrative graph that shows how the reinforcing feedback loops might accelerate the adoption of behaviour towards reduced meat consumption. The same illustration applies for this example of tropical deforestation-free and forest-positive value chains and is something that FOLU, GSI and other partners plan to test over the next 24 months.

4.6 Mitigating backlash and compensating losers

In many tropical forest countries, there are powerful agricultural and other sector lobbyists seeking to undermine efforts to halt deforestation. For example, in Brazil, President Bolsonaro is unlikely to receive strong political pressure to move toward forest-positive policies from his core constituency base that consists of miners, squatters, loggers, and ranchers, as well as a strong lobby from *bancada ruralista*, the agribusiness and mining faction of the National Congress. Business has been booming for many of these groups, but the long-term consequences of environmental degradation and deforestation will be inextricably linked to bottom-lines. For example, Brazilian scientists demonstrated a link between deforestation and the 2014 drought that led to a 15 percent production fall in Arabica coffee, one of Brazil's largest exports.[209] It is therefore necessary for governments to communicate the business risks linked to business as usual and to incentivise longer-term thinking towards more sustainable production models.

Despite this clear beneficiary context, the backlash against forest-positive policies can be far more insidious. In 2019, 212 land and environmental defenders were killed – an average of more than four people a week. More than two thirds of the killings took place in Latin America, which has consistently ranked the worst-affected region. Many of the culprits are operating with impunity. It is therefore critical that these groups – and all forest communities and workers – are protected by national and international law. An example of success on this front was the unanimous adoption of the UN Council of Human Rights resolution on environmental human rights defenders.[210]

It is not only those fighting against action on deforestation that cause harm to local people. Historically there has been evidence of conservation policies and carbon market projects restricting access for forest dependent people to forest resources that they depend upon. However, such protectionist models of conservation[xi] are outdated and there is now widespread recognition that forest communities, including the 370 million indigenous peoples inhabiting 3.8 billion hectares of land, are essential stewards of the most vital but vulnerable remaining natural resources. As such, supporting livelihoods of indigenous and forest-dependent people and ensuring they have legal title to their lands can have positive cascading effects on protection of biodiversity and carbon storage. It is also critical that they play a role in the design and implementation of upcoming and urgent global agreements and have Free, Prior and Informed Consent (FPIC) allowing them to give or withhold consent to a project that may affect them or their territories.

There is also the risk that efforts to reduce the pressure on the forest frontier through large improvements in agricultural productivity, through investing in technology and infrastructure, will displace agricultural workers. A just transition is thus critical with generation of "green" jobs in biodiversity and landscape conservation, forest rehabilitation and reforestation which safeguard labour standards and basic human rights.[xii]

[xi] Fortress conservation is a conservation model based on the belief that biodiversity protection is best achieved by creating protected areas where ecosystems can function in isolation from human disturbance. Fortress, or protectionist, conservation assumes that local people use natural resources in irrational and destructive ways, and as a result cause biodiversity loss and environmental degradation. https://sesmad.dartmouth.edu/theories/85

[xii] See here for a report commissioned by FOLU which shows that directing COVID-19 stimulus towards a set of nature-based interventions that have so far been largely overlooked by governments can generate more than 100 million short-term jobs globally.

A member of the Embera village of Chigorodó, Indigenous Reserves of Yaberaradó and Polines [Pueblo Embera de Chigorodó. Resguardos Indígenas de Yaberaradó y Polines] in Uraba, Colombia, holding a native plant, that has special significance to her/ Chris de Bode for Panos Pictures/Food and Land Use Coalition

4.7 Sequencing of policy interventions

Growing Better sets out recommendations for a range of actors but acknowledges the particular importance of policymakers in creating the enabling environment for the protection and restoration of nature – particularly in addressing the market and institutional failures driving its continued destruction. We propose here a sequencing of the *Growing Better* recommendations for government intervention. We hypothesise that this sequencing of interventions will have the highest chance of success through the triggering of positive feedbacks allowing cumulative (i.e. interventions that rely and build upon the successful implementation of earlier interventions) and more stringent policies to be introduced over time. We must underscore that this is a hypothesis and is something we are keen to test further.

Proposed early-stage interventions are those which we believe are easier to implement and which provide the foundation for later stage interventions – for example, spatial planning, natural capital accountancy and investment in transparency innovation as well as the timely recommendation to include forests and land use in updated Nationally Determined Contributions to the Paris Agreement ahead of COP26. Later stage interventions – which are often the most effective but also difficult to implement – include subsidy reform, carbon pricing and scaling of other payment for ecosystem services models. Recognising the critical nature of these later interventions, it is essential that action is taken now to consult on how these can be implemented with urgency whist ensuring a just transition.

Key	Recommendation for tropical forest-country governments	Recommendations for all governments

The below table sets out high-level recommendations on the sequencing of policy interventions.

Table 6: Possible sequencing of policy interventions to catalyse critical transitions on protecting and restoring nature

Recommendation	Which of the five conditions does this address?
1. Plan, protect and enforce:	✓ **Economic competitiveness** ✓ **Accessibility** ✓ **Social norms** ✓ **Capability**
• Use spatial planning to identify the optimal allocation of land for agriculture (based on yield, natural capital and soil health), the allocation of natural ecosystems for legal protection and large-scale restoration, and geographical boundaries of urban growth and infrastructure.	
• Grant indigenous peoples' groups legal title to their traditional lands, and the means to defend them.	
• Place an immediate and comprehensive moratorium on conversion of forests and other natural ecosystems to any other land use. Critically this must be done in tandem with supporting alternative sustainable livelihoods for communities that depend on forest resources.	
• Set aside and police areas for natural forest and ecosystem restoration, in particular the edges of forests.	
• Increase political attention, funding and action to substantially reduce criminal activities that harm natural resources and ecosystems, with a focus on illegal logging, fishing, gold mining, forest conversion and wildlife trafficking.	
• Integrate land use emissions into Nationally Determined Contributions under the Paris Agreement.	
2. Account for natural capital:	✓ **Economic competitiveness**
• Include natural capital in government budget documents (both domestic and international natural capital)	
3. Promote transparency and accountability:	✓ **Economic competitiveness** ✓ **Performance** ✓ **Accessibility** ✓ **Social norms** ✓ **Capability**
• Adopt high transparency standards and disclosure on tropical forest impacts e.g. due diligence reporting requirements.	
• Support open/low-cost access to data and monitoring (such as Global Forest Watch).[212]	
• Invest in R&D and innovation for transparency tools and networks.	
4. Public procurement and incentives	✓ **Accessibility**
• Use public procurement, tax regimes and transfer mechanisms to support deforestation-free products.	

Table 6: Possible sequencing of policy interventions to catalyse critical transitions on protecting and restoring nature - Continued

Recommendation	Which of the five conditions does this address?
5. Catalyse private sector finance: • Deploy public finance and catalytic instruments to mitigate investor risk.	✓ **Economic competitiveness** ✓ **Accessibility** ✓ **Capability** ✓ **Performance**
6. Support market mechanisms: • Support initiatives such as the Voluntary Carbon Market Integrity Initiative which are seeking to improve the integrity and scale of voluntary carbon markets. • Establish the legal basis for domestic ecosystem payment mechanisms. • Establish high-integrity investment frameworks and credible funding mechanisms to direct finance received by emission reduction sales transparently and in line with international standards. Investment should benefit local and indigenous communities who play critical roles in forest stewardship, and both enforce and incentivise forest protection and restoration. There is also a role for all governments (including donor countries) and private sector actors to work with forest countries to support these (LEAF Coalition is one example).	✓ **Economic competitiveness** ✓ **Performance**
7. Redesign public finances: • Rapidly scale up financial support for the new food and land use economy, including through instruments like debt for nature swaps, where appropriate. • Reform agricultural subsidies to ensure that they avoid perverse incentives for forest and ecosystem conversion. • Ensure a just transition by establishing safety nets for vulnerable groups and using public resources to support forest communities.	✓ **Economic competitiveness** ✓ **Performance** ✓ **Capability** ✓ **Social norms**
8. Price carbon • Introduce carbon pricing, starting at the World Bank shadow price of $40 per tonne of carbon dioxide equivalent (tCO2e) and rising significantly and predictably.[213]	✓ **Economic competitiveness** ✓ **Performance** ✓ **Capability**

Chapter 5: Conclusions

Farmer harvesting crops by hand in areas that are too difficult to access at an organic rice and duck farm/ Ian Teh for Panos Pictures/Food and Land Use Coalition

We provide in this report a strategic framework for triggering systemic, positive tipping points to transform food and land use systems – as well as other complex systems. The framework seeks to establish a systems approach to understanding and effecting complex change.

FOLU's *Growing Better* report articulated 10 critical transitions, with clear linkages and synergies between each, that could result in a transformation of food and land use systems. In applying this framework and exploring the role of policymakers across four of FOLU's critical transitions we offer a theory-driven approach for dynamic policy action.

FOLU, the University of Exeter's Global Systems Institute and ETH Zürich plan to further test this framework – as well as the proposed sequencing of policy interventions - over the next 24 months through consultation and through quantitative systems analysis of tipping points. This includes the development of methods for identifying early signs of an incumbent system being susceptible to positive tipping (including testing the theory that the proximity of a system to a tipping point can be sensed from social data). If so, this can identify where modest interventions can be most effective at tipping a system towards a desired state. We aim to combine this generic approach with models of specific systems to identify the types of intervention that can bring about tipping in each case.

That said, there is no time to lose. Unless food and land use systems are turned around in the next ten years, both the SDGs and the Paris Agreement targets will be out of reach. We need to learn as we go. While we are confident that we have many of the right ingredients for reform, we also know that they will play out differently in different contexts and as such we cannot delay action until the perfect framework for action exists – and it almost certainly never will.

We hope that this framework and the report provide a message of optimism and a source of empowerment that human actions can make a big difference in delivering a more desirable future. We should all feel a sense of agency and autonomy to be part of tipping towards positive change. Policymakers and public authorities are a major focus given their role in setting and enacting economic and social rules. Financial actors have considerable leverage to change the global economy. Civil society organisations can hold them all to account. Citizens forming social movements can trigger positive tipping points and start upward-scaling tipping cascades. Researchers and technological innovators are the creators of novel alternatives and entrepreneurs can help propel their upscaling. Citizens as consumers are key to their uptake. The private sector can actively engage in innovation trajectories and help build an innovation "ecosystem". Marketing can help tip change in public attitudes. The media can help communicate it. The faith sector can help tip hearts and minds. We all have a role.

We quote Yoda at the end of the *Growing Better* report and – since it seems more pertinent than ever – we will do so again:

> *"Do. Or do not. There is no try."*

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Chapter 4

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