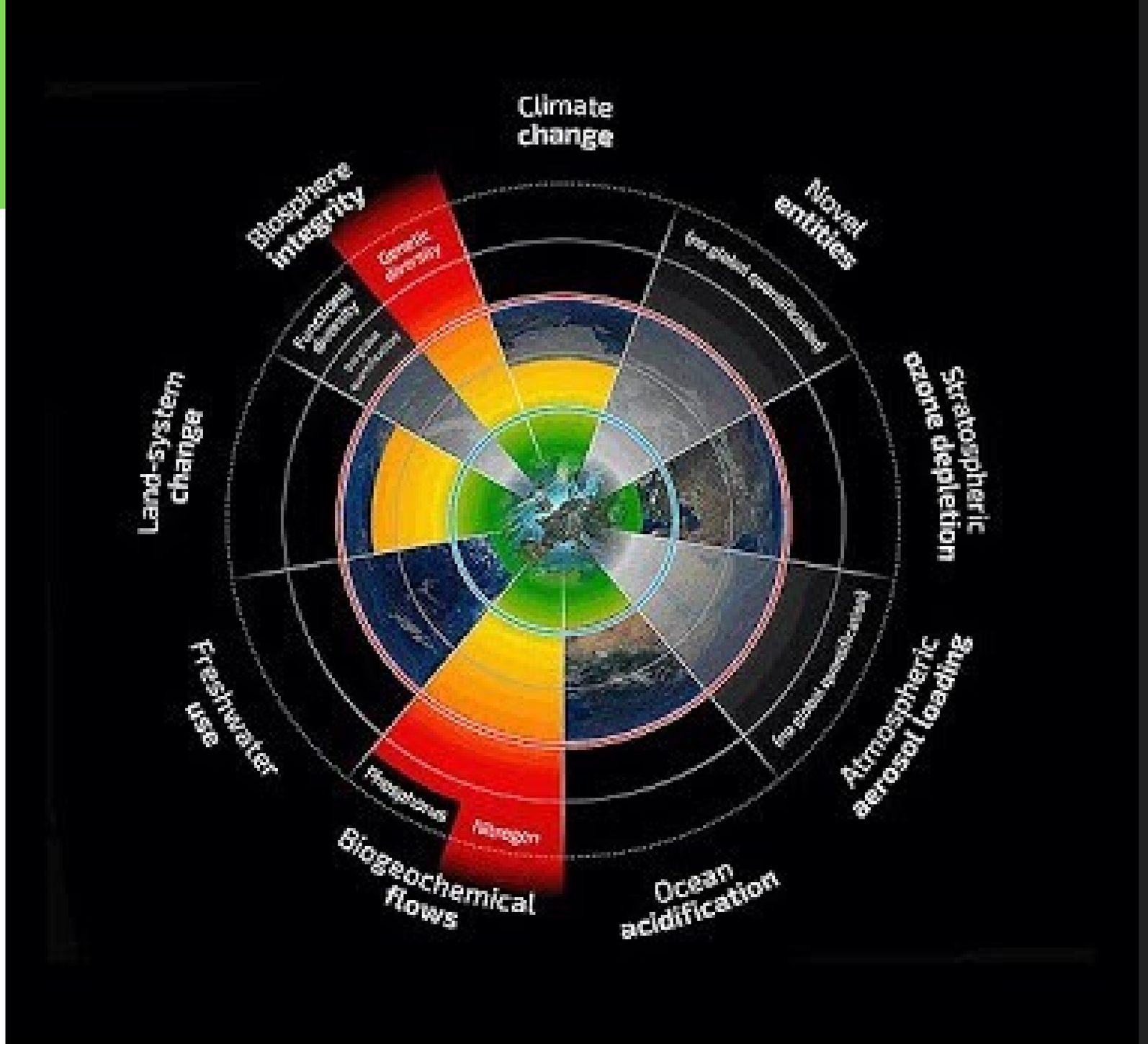
HUMBIO 14: Week 9

Solutions

PRESENTED BY CHARLIE HOFFS



"If today's levels of production efficiency were to remain constant through 2050, then feeding the planet would entail clearing most of the world's remaining forests, wiping out thousands more species, and releasing enough GHG emissions to exceed the 1.5°C and 2°C warming targets enshrined in the Paris Agreement—even if emissions from all other human activities were entirely eliminated."

Closing the Three Gaps

Food Gap

56% more food
by 2050

Land Gap

Need land double the
size of India by 2050

GHG Gap

Reduce CO2e by
11 gigatonnes

Menu of Solutions

"FIVE COURSES"

1. Reduce growth in demand for food and other agricultural products
2. Increase food production without expanding agricultural land
3. Protect and restore natural ecosystems and limit agricultural land-shifting
4. Increase fish supply
5. Reduce GHG emissions from agricultural production

1. Reduce demand

MENU ITEM	DESCRIPTION
DEMAND-SIDE SOLUTIONS	
Course 1: Reduce growth in demand for food and other agricultural products	
Reduce food loss and waste	Reduce the loss and waste of food intended for human consumption between the farm and the fork.
Shift to healthier and more sustainable diets	Change diets particularly by reducing ruminant meat consumption to reduce the three gaps in ways that contribute to better nutrition.
Avoid competition from bioenergy for food crops and land	Avoid the diversion of both edible crops and land into bioenergy production.
Achieve replacement-level fertility rates	Encourage voluntary reductions in fertility levels by educating girls, reducing child mortality, and providing access to reproductive health services.

Reduce food waste

Figure 4 | **Food loss and waste primarily occurs closer to the consumer in developed regions and closer to the farmer in developing regions**

Source: WRI analysis based on FAO (2011b).

Reduce demand for meat

Efficiency. Beef = 3% of calories in US, but 1/2 of land use & emissions.

Equity. 10% future reduction in animal-based food in wealthy regions would be necessary just to allow 6 billion people in Asia and Africa to consume even half of Europe's present consumption of animal-based foods

Environment. Swapping 30% of ruminant meat consumption to plant-based protein would close half the GHG mitigation gap and nearly all of the land gap.

Health: Half of the world's population already consumes 50 percent more protein than needed

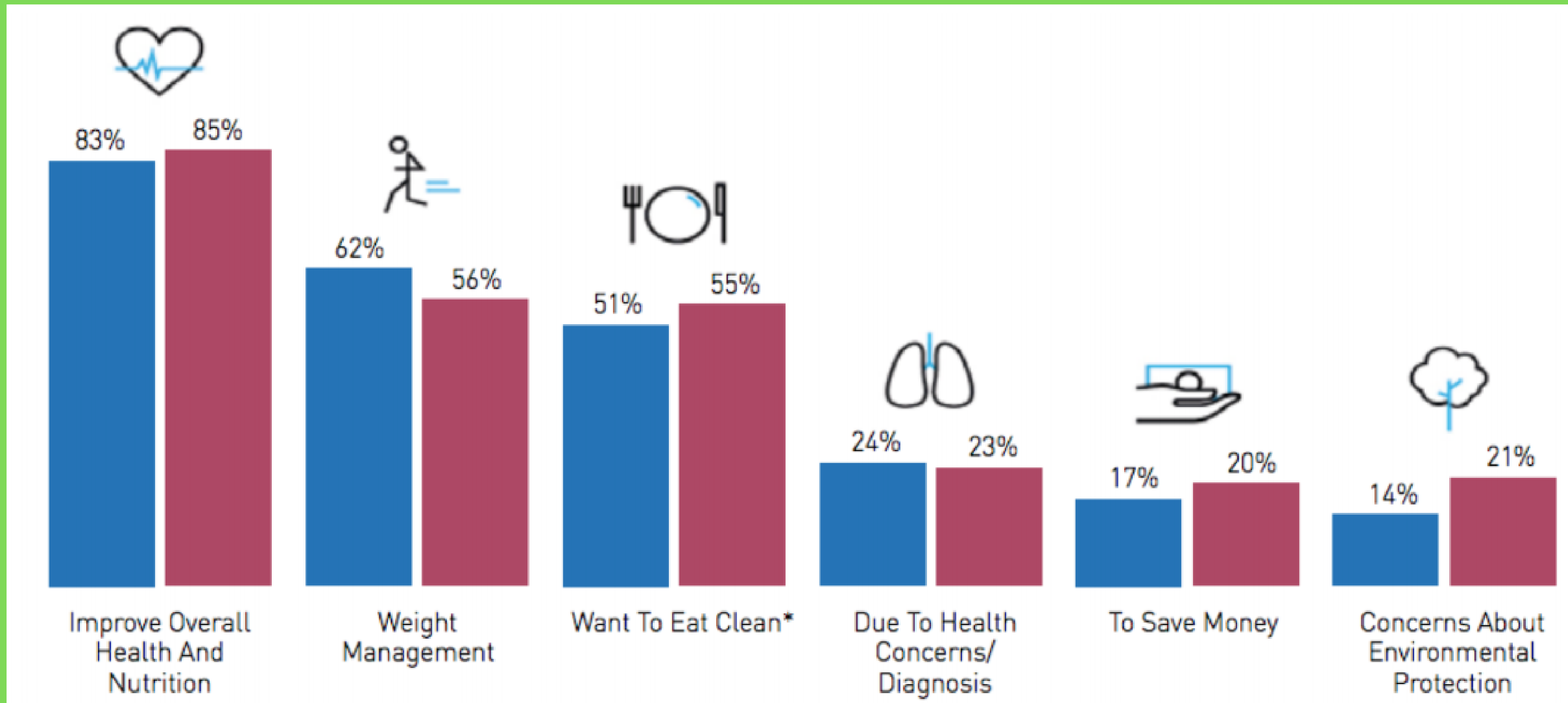
Shifting to Sustainable Diets

- Product Innovation
- Promotion and Marketing
- Policy and Pricing

PLANT-FORWARD TRENDS

- 39% of Americans are actively trying to incorporate more plant-based foods in their diets.
- 54% say they are "currently trying to consume fewer animals-based foods (meat, dairy, and/or eggs) and more plant-based foods (fruits,grains, beans, and/or vegetables)
- 30% of millenials eat meat alternatives every day
- 50% of millenials eat meat alternatives a few times a week

Reasons for eating more plant-based foods



Because cultivated meat is not yet produced commercially at large scale, estimates about its environmental impact are based on assumptions, which result in different conclusions about its efficiency. All three environmental studies of cultivated meat published so far show very promising results (Hanna L. Tuomisto, Ellis, and Haastrup 2014; H. L. Tuomisto and de Mattos 2011; Mattick et al. 2015). Cultivated chicken will use 35% to 67% less land than current chicken farms do and reduce nutrient pollution by 70%.[2] The impact of cultivated beef is even greater, reducing land use by over 95%, climate change emissions by 74% to 87%, and nutrient pollution by 94%.[3]

CULTIVATED CHICKEN		CULTIVATED BEEF		
35% – 67%	**70%**	**95%+**	**74% – 87%**	**94%**
% less land used	% of nutrient **pollution reduction**	% less land used	% of climate change **emissions reduction**	% of nutrient **pollution reduction**

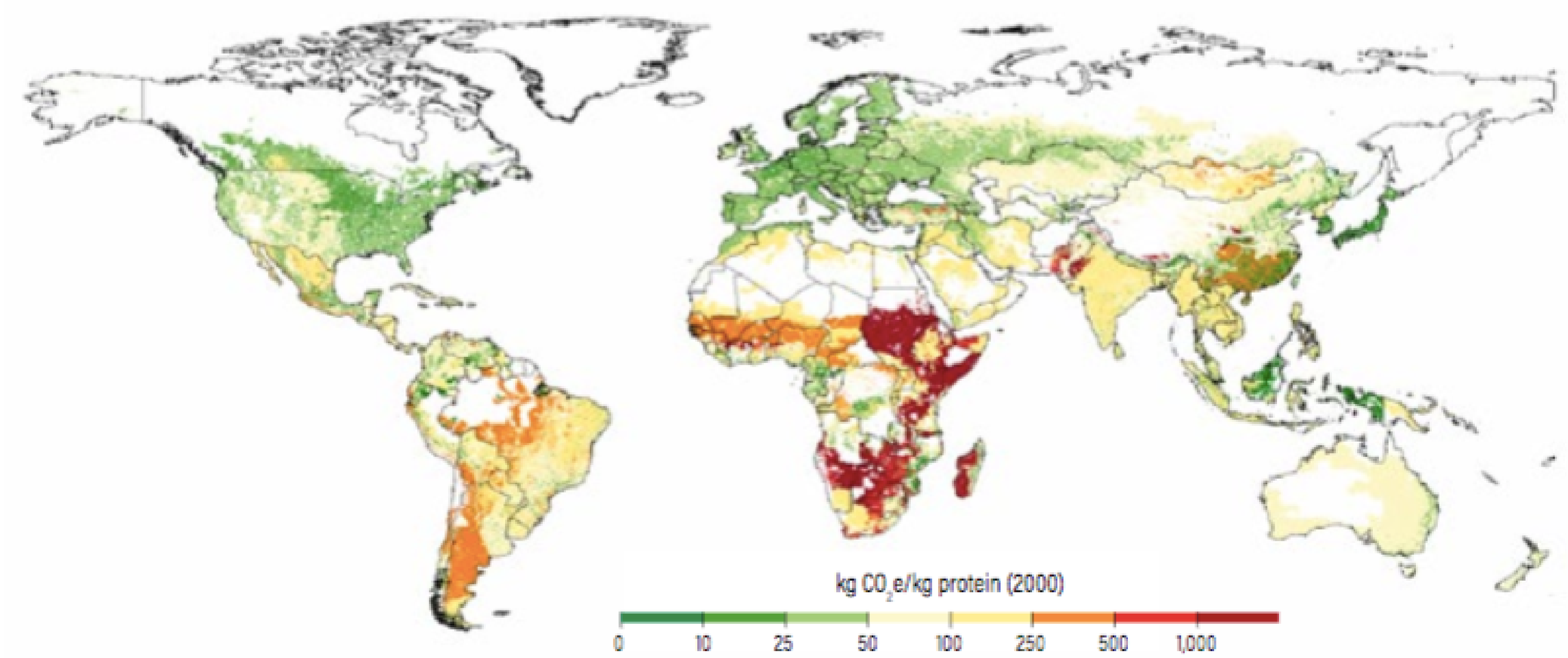
These figures are the result of comparisons with nine reputable life cycle analyses of conventional U.S. chicken and beef production (Putman et al. 2017; Nathan Pelletier, Pirog, and Rasmussen 2010; N. Pelletier 2008; Kebreab et al. 2016; Lupo et al. 2013; Capper 2012, 2011; Costello, Xue, and Howarth 2015; Gulli 2017). Moreover, these results do not account for the many efficiency-boosting measures that a commercial meat cultivation facility will almost certainly take to improve profitability and thus efficiency. Incorporating heat exchangers, nutrient recycling, and clean energy into meat cultivation facilities would dramatically reduce environmental impacts.

2. Increase production

MENU ITEM	DESCRIPTION
SUPPLY-SIDE SOLUTIONS	
Course 2: Increase food production without expanding agricultural land	
Increase livestock and pasture productivity	Increase yields of meat and milk per hectare and per animal through improved feed quality, grazing management, and related practices.
Improve crop breeding to boost yields	Accelerate crop yield improvements through improved breeding.
Improve soil and water management	Boost yields on drylands through improved soil and water management practices such as agroforestry and water harvesting.
Plant existing cropland more frequently	Boost crop production by getting more than one crop harvest per year from existing croplands or by leaving cropland fallow less often where conditions are suitable.
Adapt to climate change	Employ all menu items and additional targeted interventions to avoid adverse effects of climate change on crop yields and farming viability.

Beef production efficiency

Figure 10 | **Inefficient beef production systems result in far higher greenhouse gas emissions per unit of meat output**



Improving Crop Farming Efficiency

SOIL AND WATER MANAGEMENT

IMPROVE CROP BREEDING

PLANT CROPS MORE FREQUENTLY

ADAPT TO CLIMATE CHANGE

3. Protect and restore ecosystems

Course 3: Protect and restore natural ecosystems and limit agricultural land-shifting	
Link productivity gains with protection of natural ecosystems	Protect ecosystems by legally and programmatically linking productivity gains in agriculture to governance that avoids agricultural expansion.
Limit inevitable cropland expansion to lands with low environmental opportunity costs	Where expansion seems inevitable—such as for local food production in Africa—limit expansion to lands with the lowest carbon and other environmental costs per ton of crop.
Reforest abandoned, unproductive, and liberated agricultural lands	Protect the world's remaining native landscapes; reforest abandoned, unproductive, and unimprovable agricultural lands as well as lands potentially "liberated" by highly successful reductions in food demand or increases in agricultural productivity.
Conserve and restore peatlands	Avoid any further conversion of peatlands into agriculture and restore little-used, drained peatlands by rewetting them.

3. Protect ecosystems and limit land-system change

LINK PRODUCTION IMPROVEMENTS TO CONSERVATION

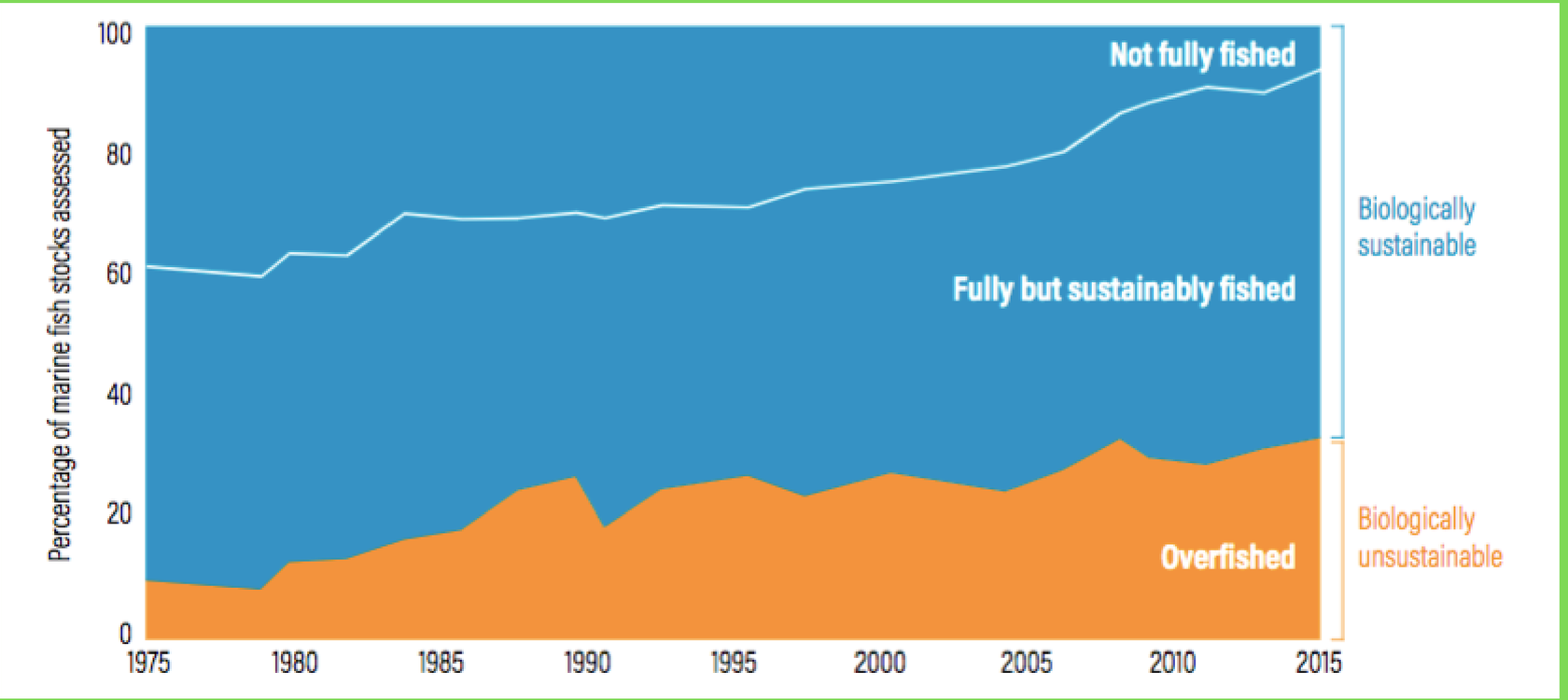
LIMIT INEVITABLE EXPANSION TO LOW AREAS W/ LOW ENVIRONMENTAL OPPORTUNITY COSTS

REFOREST ABANDONED AGRI-CULTURAL LAND

PROTECT AND RESTORE PEATLANDS

4. Increase fish supply

Course 4: Increase fish supply	
Improve wild fisheries management	Stabilize the annual size of the wild fish catch over the long term by reducing overfishing.
Improve productivity and environmental performance of aquaculture	Increase aquaculture production through improvements in breeding, feeds, disease control, and changes in production systems.



Improve wild fisheries and management

Improve aquaculture

5. Reduce GHGs of production

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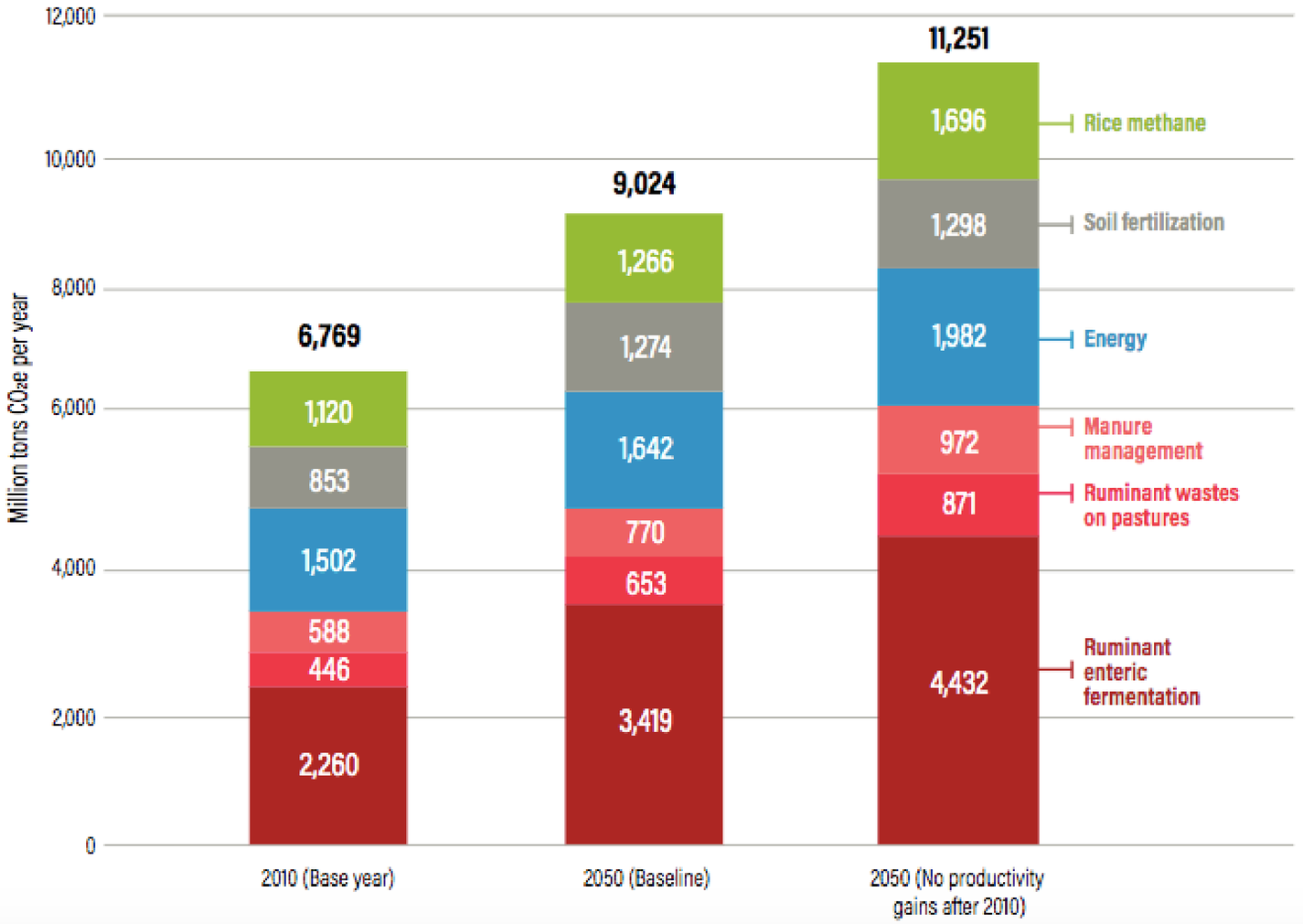
Sources of agricultural emissions

Figure 17 | **Annual agricultural production emissions reach 9 gigatons in our 2050 baseline projection**



Reduce agricultural GHG emissions

ENTERIC FERMENTATION

MANURE

NITROGEN USE EFFICIENCY IN FERTILIZER

REDUCE RICE EMISSIONS