

Animal Task Force, Brussels, November 6, 2019

# IPCC special report on climate change and land



**Which options for livestock farming?**

Agricultural landscape between Ankara and Hattusha, Anatolia, Turkey (40°00' N – 33°35' E)  
©Yann Arthus-Bertrand | [www.yannarthusbertrand.org](http://www.yannarthusbertrand.org) | [www.goodplanet.org](http://www.goodplanet.org)

**Jean-François Soussana, INRA, France**

[www.ipcc.ch/report/SRCCL](http://www.ipcc.ch/report/SRCCL)

**ipcc**  
INTERGOVERNMENTAL PANEL ON climate change

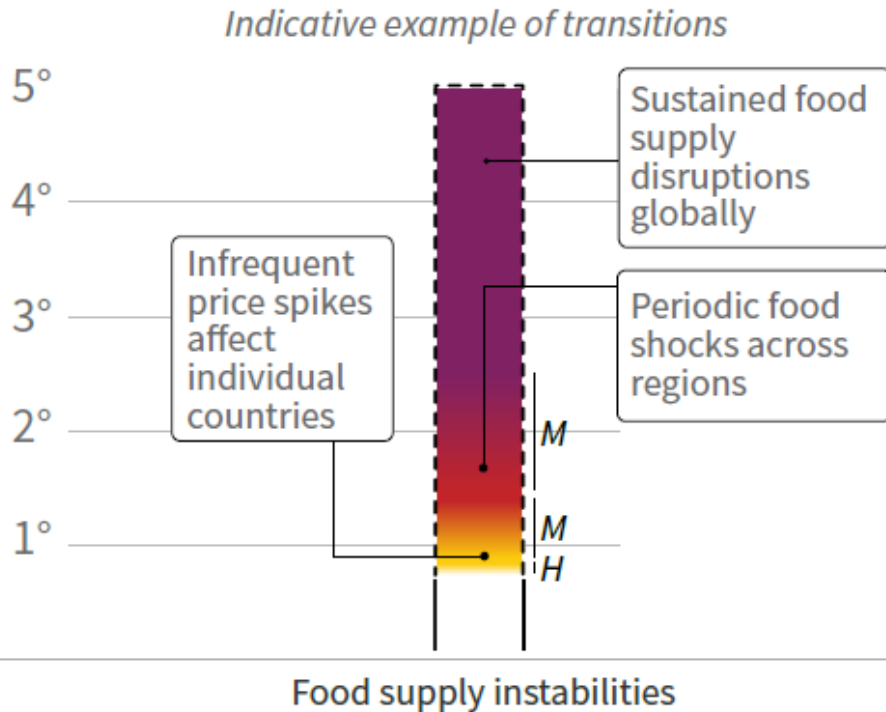


# Climate change has already affected food security



- **In many lower latitude regions, yields of some crops (e.g. maize and wheat) have declined, while in many higher-latitude regions yields of some crops (e.g. sugar beet) have increased over recent decades**
- **Climate change has reduced animal growth rates and productivity in pastoral systems in Africa**
- **There is robust evidence that agricultural pests and diseases have already responded to climate changes, resulting in both increases and decreases of infestations**

# Risks to food supply stability as a result of climate change



The stability of food supply is projected to decrease as the magnitude and frequency of extreme weather events that disrupt food chains increases

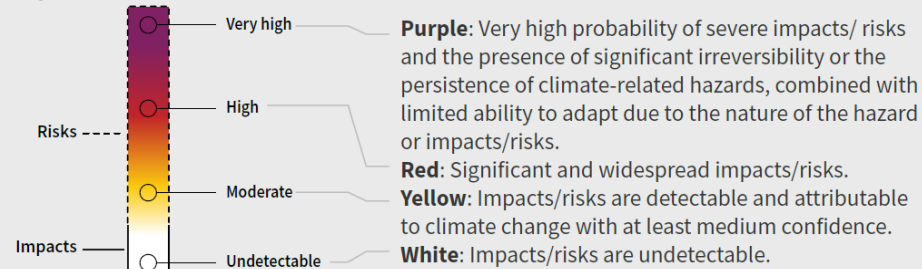
Increased atmospheric CO<sub>2</sub> levels can also lower the nutritional quality of crops

Median economic models project a 1-23 % increase in food prices due to climate change by 2050 leading to increased risks of food insecurity

The most vulnerable people will be more severely affected

Increased warming may amplify migration both within countries and across borders

Legend: Level of impact/risk



# Significant mitigation potential for response options in the global food system



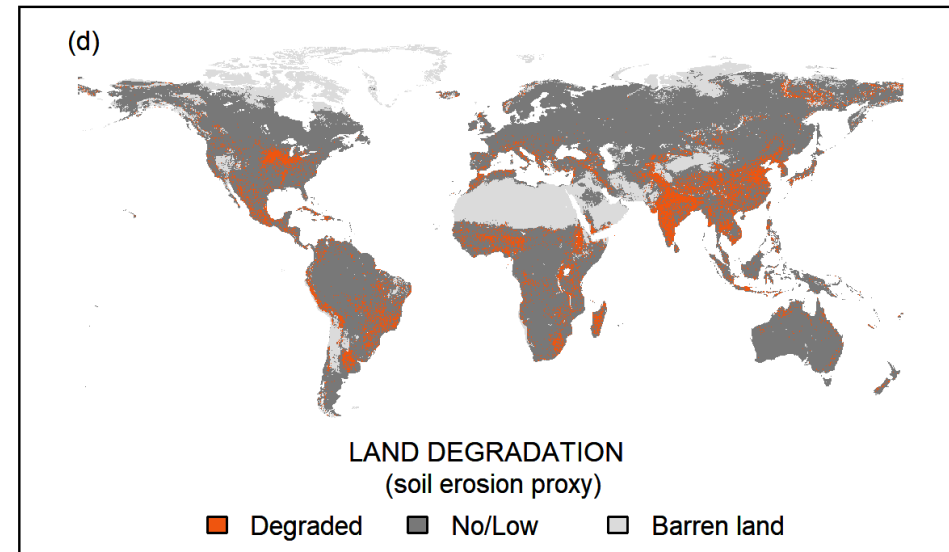
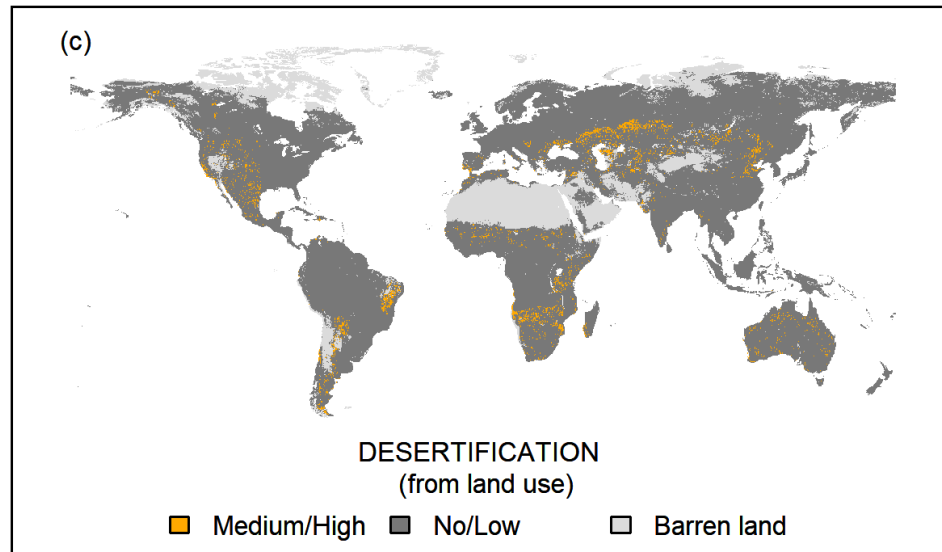
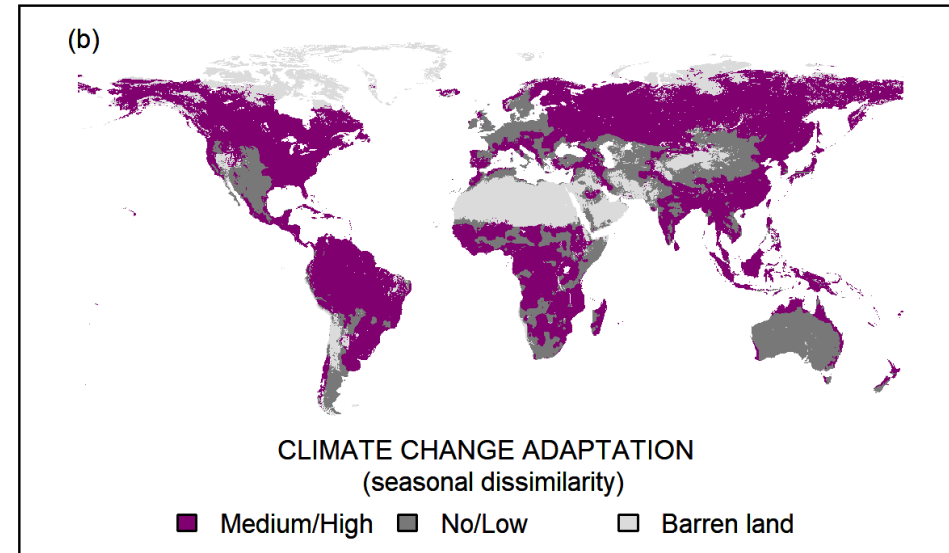
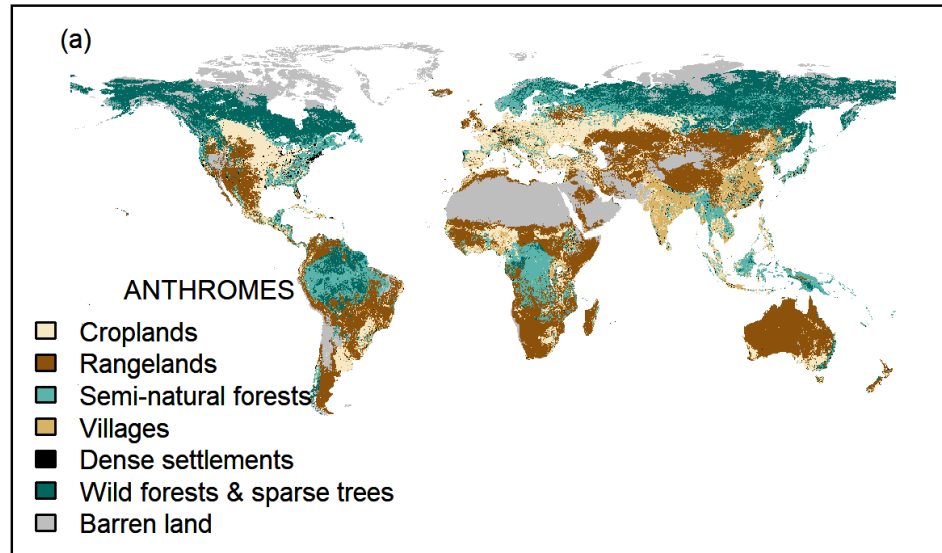
**Emissions from the global food system are estimated to be 21-37% of total net anthropogenic GHG emissions**

**Response options across the entire food system, from production to consumption, including food losses and wastes, can be deployed and scaled up to support adaptation and mitigation**

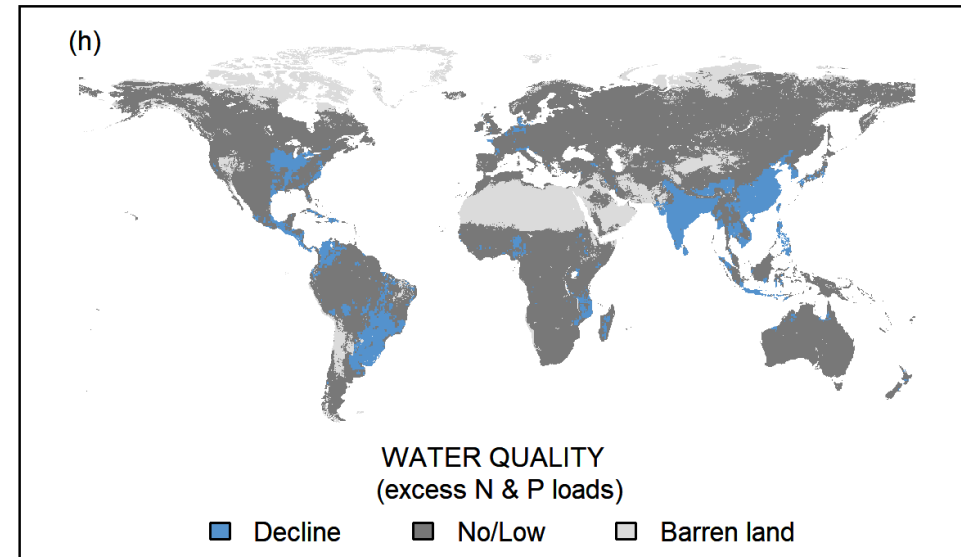
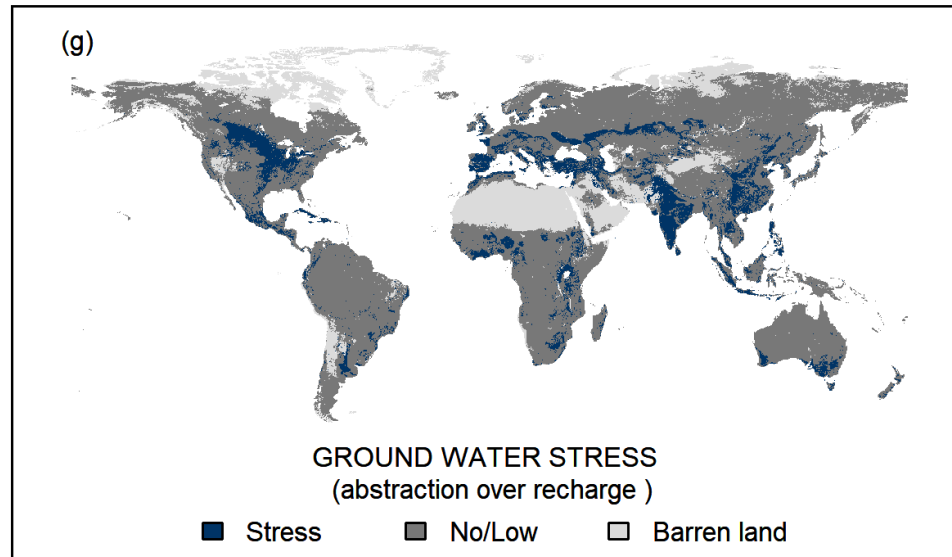
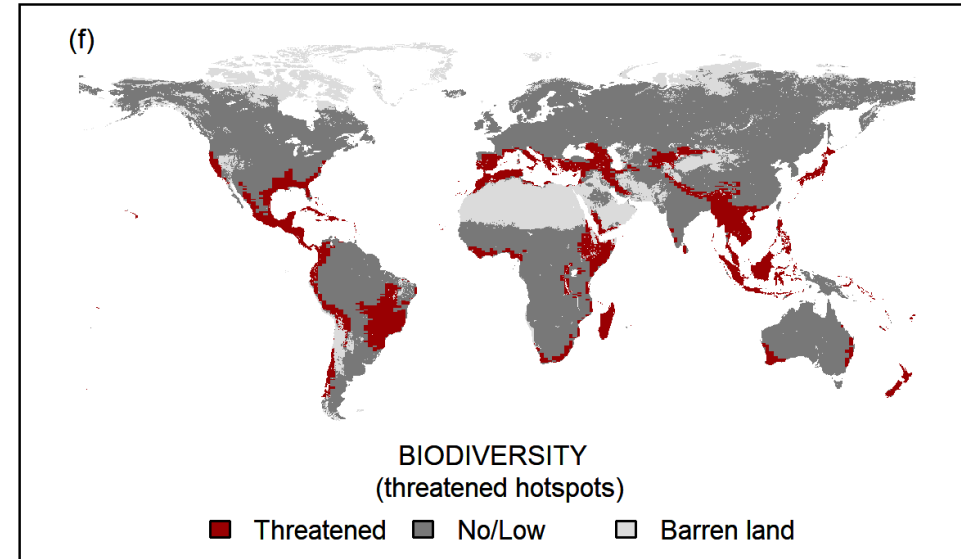
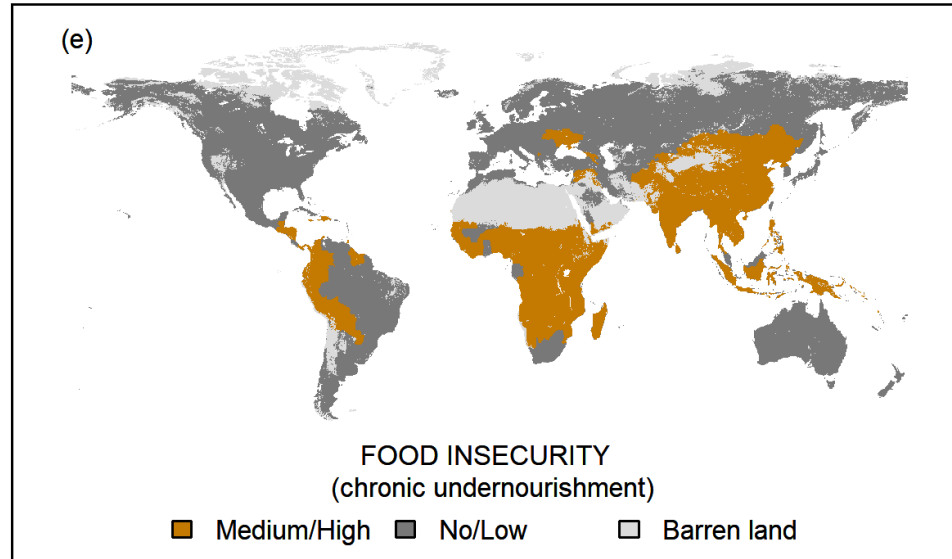
**A number of agricultural response options (e.g. soil carbon sequestration and agroforestry) deliver co-benefits across land-based challenges**

**The total technical mitigation potential from crop and livestock activities and agroforestry is estimated to be between 2.3 and 9.6 Gt CO<sub>2e</sub> per year by 2050**

# Land is subjected to interlinked challenges (1/2)

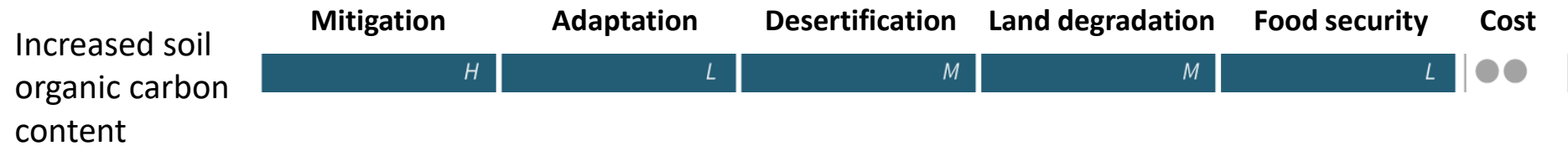


# Land is subjected to interlinked challenges (2/2)



# Potential global contribution of response options to mitigation, adaptation, combating desertification and land degradation, and enhancing food security

Example from Response options based on land management  
**INCREASED SOIL ORGANIC CARBON CONTENT**



**Key for criteria used to define magnitude of impact of each integrated response option**

	Mitigation <i>Gt CO<sub>2</sub>-eq yr<sup>-1</sup></i>	Adaptation <i>Million people</i>	Desertification <i>Million km<sup>2</sup></i>	Land Degradation <i>Million km<sup>2</sup></i>	Food Security <i>Million people</i>
<b>Positive</b>					
Large	More than 3	Positive for more than 25	Positive for more than 3	Positive for more than 3	Positive for more than 100
Moderate	0.3 to 3	1 to 25	0.5 to 3	0.5 to 3	1 to 100
Small	Less than 0.3	Less than 1	Less than 0.5	Less than 0.5	Less than 1
Negligible	No effect	No effect	No effect	No effect	No effect
<b>Negative</b>					
Small	Less than -0.3	Less than 1	Less than 0.5	Less than 0.5	Less than 1
Moderate	-0.3 to -3	1 to 25	0.5 to 3	0.5 to 3	1 to 100
Large	More than -3	Negative for more than 25	Negative for more than 3	Negative for more than 3	Negative for more than 100

Variable: Can be positive or negative       no data    na not applicable

**Confidence level**  
 Indicates confidence in the estimate of magnitude category.

*H* High confidence  
*M* Medium confidence  
*L* Low confidence

**Cost range**  
 See technical caption for cost ranges in US\$ tCO<sub>2</sub>e<sup>-1</sup> or US\$ ha<sup>-1</sup>.

●●● High cost  
 ●● Medium cost  
 ● Low cost  
 — no data

# Land management responses and their global impacts on land based challenges

## Co-benefits and trade-offs

Response options based on land management		Co-benefits and trade-offs						
		Mitigation	Adaptation	Land degradation or Desertification	Food Security	Biodiversity	Ground water stress	Water quality
Agriculture	Increased food productivity	Positive (co-benefit)	Positive (co-benefit)	Negligible	Positive (co-benefit)	Negligible	Negligible	Negative (trade-off)
	Agroforestry	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Negligible
	Improved cropland management	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Negligible	Negligible
	Improved livestock management	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Negligible	Negligible
	Improved grazing land management	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Negligible	Negligible
	Integrated water management	Positive (co-benefit)	Positive (co-benefit)	Negligible	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)
	Reduced grassland conversion to cropland	Positive (co-benefit)	Negligible	Negligible	Negative (trade-off)	Positive (co-benefit)	Negligible	Negligible
Forest	Forest management	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Negligible
	Reduced deforestation and degradation	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Negligible	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)
	Reforestation and forest restoration	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Negligible	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)
Soils	Increased soil organic carbon content	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)
Other ecosystems	Fire management	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Negligible
	Restoration & reduced conversion of coastal wetlands	Positive (co-benefit)	Positive (co-benefit)	Negligible	Negligible	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)
	Restoration & reduced conversion of peatlands	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)	Negative (trade-off)	Positive (co-benefit)	Positive (co-benefit)	Positive (co-benefit)
CDR	Bioenergy and BECCS	Positive (co-benefit)	Negative (trade-off)	Negative (trade-off)	Negative (trade-off)	Negative (trade-off)	Negative (trade-off)	Negative (trade-off)

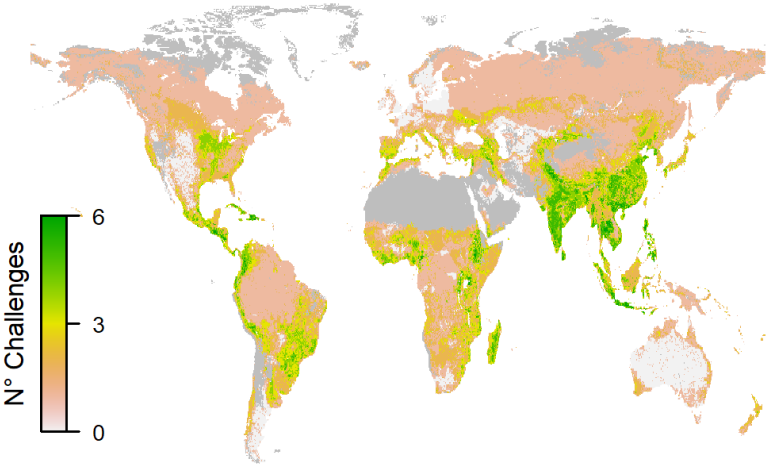
Impact of each response option

- Positive (co-benefit)
- Negligible
- Negative (trade-off)

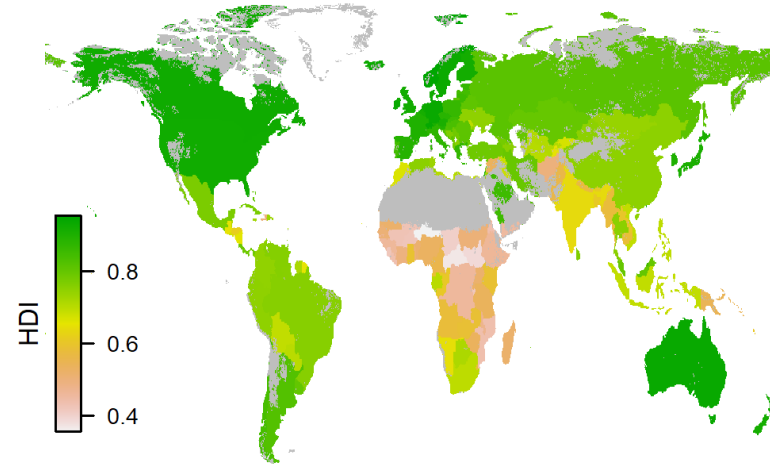


# Across countries, the greater the number of land challenges, the fewer the responses with only co-benefits and the lower the human development index (HDI)

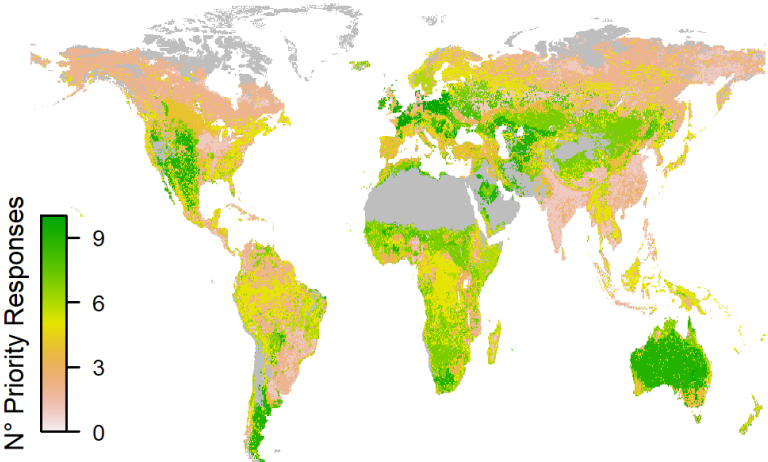
a Number of challenges



b Human Development Index



c Number of responses delivering co-benefits to all challenges

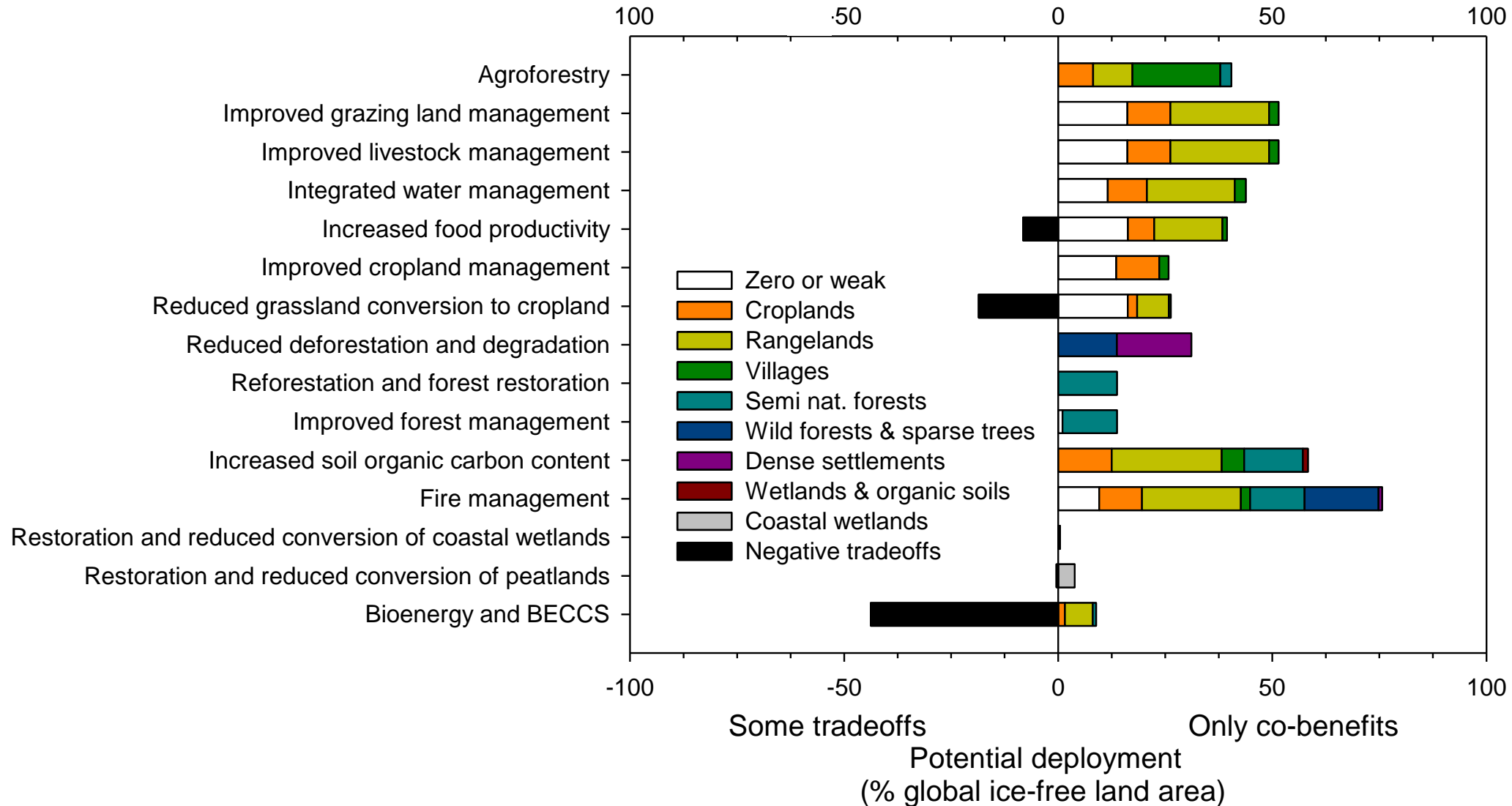


Correlation			
	Challenges	Responses	HDI
Challenges	-	-0,57***	-0,45***
Responses		-	0,04 (NS)

□ Barren land

After IPCC, SR CCL, SPM and Chap. 6, 2019

# Potential deployment area of land management responses with only co-benefits, or with some tradeoffs, for local challenges



# Combating desertification and land degradation: co-benefits for the climate

**The fight against land degradation has immediate and long-term co-benefits for adaptation and mitigation (high confidence)**

**Many activities to combat desertification can contribute to climate change adaptation and reduce biodiversity loss with positive spin-offs for sustainable development**

**Avoiding, limiting and reversing desertification would improve soil fertility, increase carbon storage in soils and biomass, while promoting agricultural productivity and food security (high confidence)**



# Some answers are not appropriate to all local challenges

**Large-scale deployment of mitigation options such as bioenergy and afforestation would have negative impacts on food security, biodiversity and land degradation:**

- From 0.1 to 1 million km<sup>2</sup> in scenarios with high population and low environmental policies (SSP3)**
- From 1 to 4 million km<sup>2</sup> in low population scenarios and strong environmental policies (SSP1)**



# Value chain and risk management response options

		Mitigation	Adaptation	Desertification	Land degradation	Food security
<b>Response options based on value chain management</b>						
Demand	Reduced post-harvest losses	H	M	L	L	H
	Dietary change	H	---	L	H	H
	Reduced food waste (consumer or retailer)	H	---	L	M	M
Supply	Sustainable sourcing	---	L	---	L	L
	Improved food processing and retailing	L	L	---	---	L
	Improved energy use in food systems	L	L	---	---	L

<b>Response options based on risk management</b>						
Risk	Livelihood diversification	---	L	---	L	L
	Management of urban sprawl	---	L	L	M	L
	Risk sharing instruments	L	L	---	L	L

# Food



**Food losses and waste contribute to 8-10% of anthropogenic GHG emissions. 25 to 30% of food production is lost or wasted (average confidence). A reduction of these losses and wastes could release millions of km<sup>2</sup> of land by 2050**



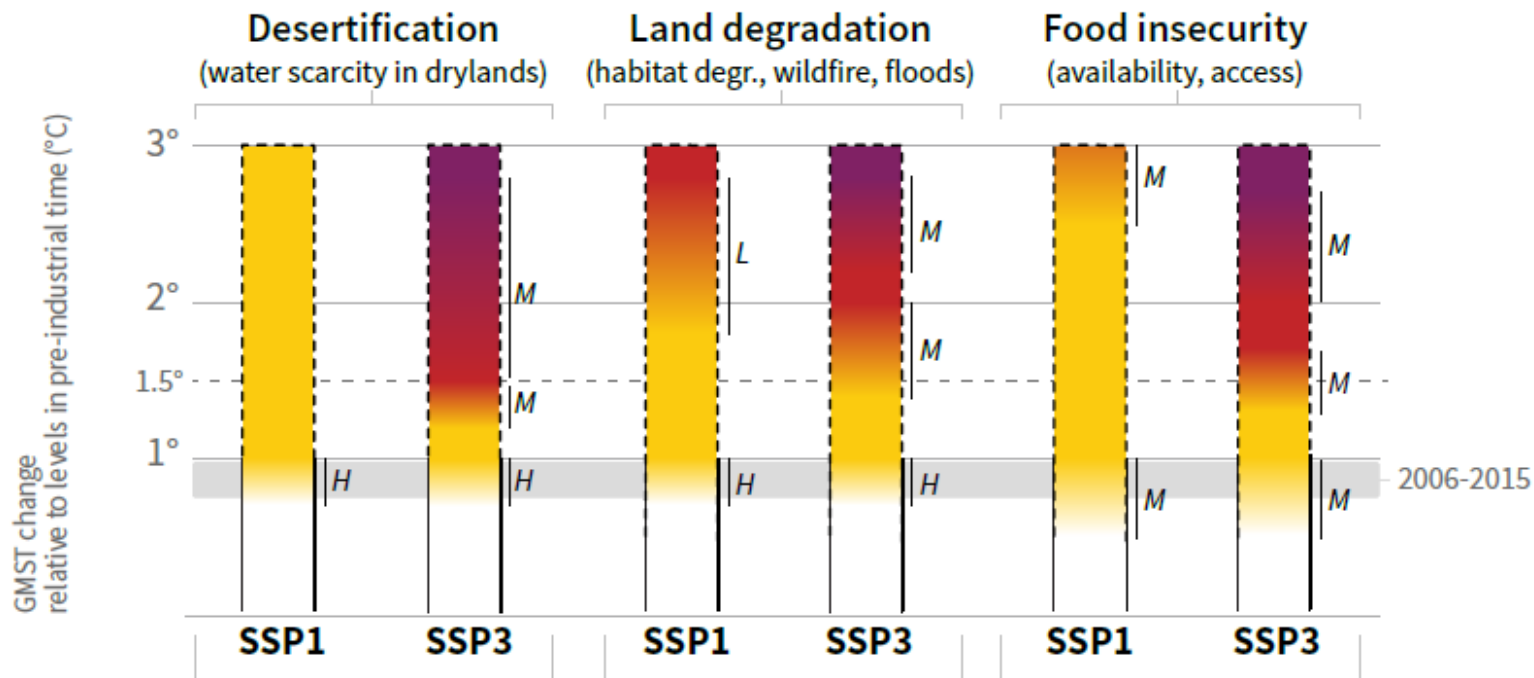
**Diversification of diets (more fruits, vegetables, protein crops and nuts) and production systems (integrated systems, diversified rotations, genetic diversity, resilient and low-emission livestock) supports climate change adaptation and 'mitigation**



**By 2050, food transitions towards healthy diets could release millions of km<sup>2</sup> of land with co-benefits for the environment and health and bring about an emission reduction of between 0.7 and 8.0 Gt CO<sub>2eq</sub>**

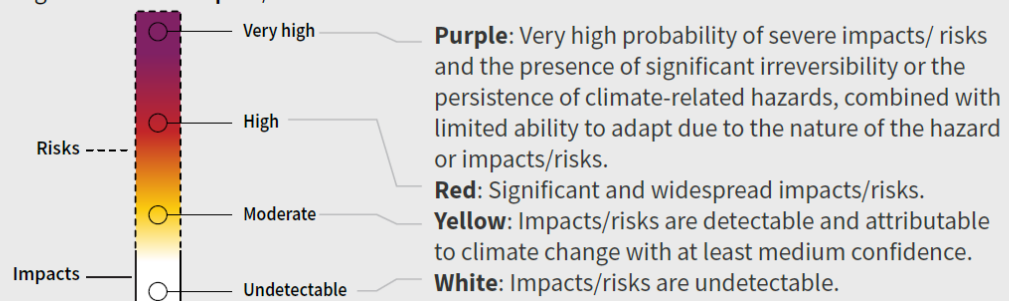
# Risks to humans and ecosystems of changes in land based processes as a result of climate change

## B. Different socioeconomic pathways affect levels of climate related risks



Socio-economic choices can reduce or exacerbate climate related risks as well as influence the rate of temperature increase. The SSP1 pathway illustrates a world with low population growth, high income and reduced inequalities, food produced in low GHG emission systems, effective land use regulation and high adaptive capacity. The SSP3 pathway has the opposite trends. Risks are lower in SSP1 compared with SSP3 given the same level of GMST increase.

### Legend: Level of impact/risk



IPCC, SR CCL, SPM, 2019

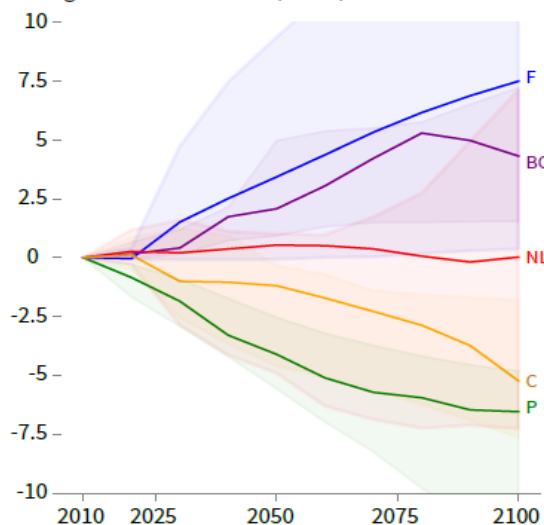
# Pathways linking socioeconomic development, mitigation responses and land

Socioeconomic development and land management influence the evolution of the land system including the relative amount of land allocated to **CROPLAND**, **PASTURE**, **BIOENERGY CROPLAND**, **FOREST**, and **NATURAL LAND**. The lines show the median across Integrated Assessment Models (IAMs) for three alternative shared socioeconomic pathways (SSP1, SSP2 and SSP5 at RCP1.9); shaded areas show the range across models. Note that pathways illustrate the effects of climate change mitigation but not those of climate change impacts or adaptation.

## A. Sustainability-focused (SSP1)

Sustainability in land management, agricultural intensification, production and consumption patterns result in reduced need for agricultural land, despite increases in per capita food consumption. This land can instead be used for reforestation, afforestation, and bioenergy.

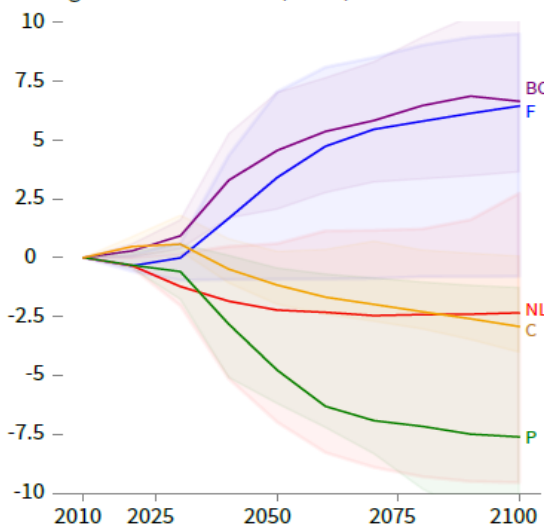
SSP1 Sustainability-focused  
Change in Land from 2010 (Mkm<sup>2</sup>)



## B. Middle of the road (SSP2)

Societal as well as technological development follows historical patterns. Increased demand for land mitigation options such as bioenergy, reduced deforestation or afforestation decreases availability of agricultural land for food, feed and fibre.

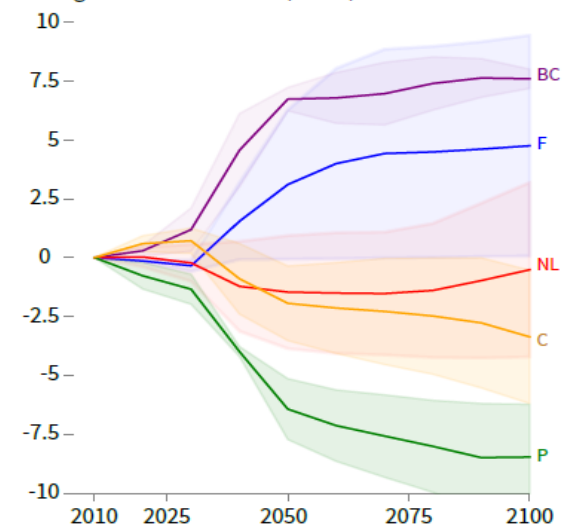
SSP2 Middle of the road  
Change in Land from 2010 (Mkm<sup>2</sup>)



## C. Resource intensive (SSP5)

Resource-intensive production and consumption patterns, results in high baseline emissions. Mitigation focuses on technological solutions including substantial bioenergy and BECCS. Intensification and competing land uses contribute to declines in agricultural land.

SSP5 Resource intensive  
Change in Land from 2010 (Mkm<sup>2</sup>)



■ CROPLAND 
 ■ PASTURE 
 ■ BIOENERGY CROPLAND 
 ■ FOREST 
 ■ NATURAL LAND



# Delaying climate change mitigation and adaptation measures in all sectors will have increasingly negative effects on land and reduce the prospects for sustainable development

**Late action in all sectors can reduce the potential of all these options in most parts of the world and limit their effectiveness (high confidence) - could also have irreversible impacts on some ecosystems**

**Rapid action on climate change mitigation and adaptation, aligned with sustainable land management and sustainable development, will reduce the risks to millions of people from climate extremes, desertification, land degradation and climate change. food insecurity and livelihoods (high confidence)**

**Postponing GHG emission reductions from all sectors leads to ever greater economic impacts for many countries in many parts of the world (high confidence)**



ipcc

INTERGOVERNMENTAL PANEL ON climate change

# Climate Change and Land

An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems

Summary for Policymakers



WG I WG II WG III



## FOR MORE INFORMATION:

Website: <http://ipcc.ch>

IPCC Secretariat: [ipcc-sec@wmo.int](mailto:ipcc-sec@wmo.int)

IPCC Press Office: [ipcc-media@wmo.int](mailto:ipcc-media@wmo.int)

## FIND US ON:



@IPCC\_CH



@IPCC



@IPCC



[www.vimeo.com/ipcc](http://www.vimeo.com/ipcc)



[www.youtube.com/c/ipccgeneva](http://www.youtube.com/c/ipccgeneva)

ipcc

INTERGOVERNMENTAL PANEL ON climate change

