Addressing slow onset events: Responses to land degradation, desertification and drought

First workshop on addressing loss and damage in the context of decisions 2/CP.27 and 2/CMA.4

Actions to address loss and damage and current gaps and challenges related to existing landscape of institutions providing support

United Nations Climate Change

United Nations Convention to Combat Desertification | United for land

Barron Joseph Orr | Chief Scientist
Bonn, Germany | 29 April 2023

Since I am a professor, we should begin with a couple of questions!

What is land degradation?

United Nations Convention to Combat Desertification
United for land

Time for a quiz!

- Spreading deserts
- Declining productivity of land
- Cracked, bare soil surfaces
- All of the above

What is land degradation?

United Nations
Convention to Combat Desertification
United for land

And the answer is:

- Spreading deserts
- ✓ Declining productivity of land
- Cracked, bare soil surfaces
- All of the above

What land degradation is not.

Examples of two land conditions mistakenly associated with the concept of desertification; (a–c) the ‘spreading desert’; (d–f) cracked, bare soil surfaces.

Photo credits: (a) UNCCD (b) Lao ; (c) Brooks ; (d) UNHCR ; (e) United Nations ; (f) UNCCD

Stephen D. Prince Pascal Podwojewski: Land Degradation & Development, Volume: 31, Issue: 6, Pages: 677-682, First published: 02 September 2019, DOI: (10.1002/ldr.3436)

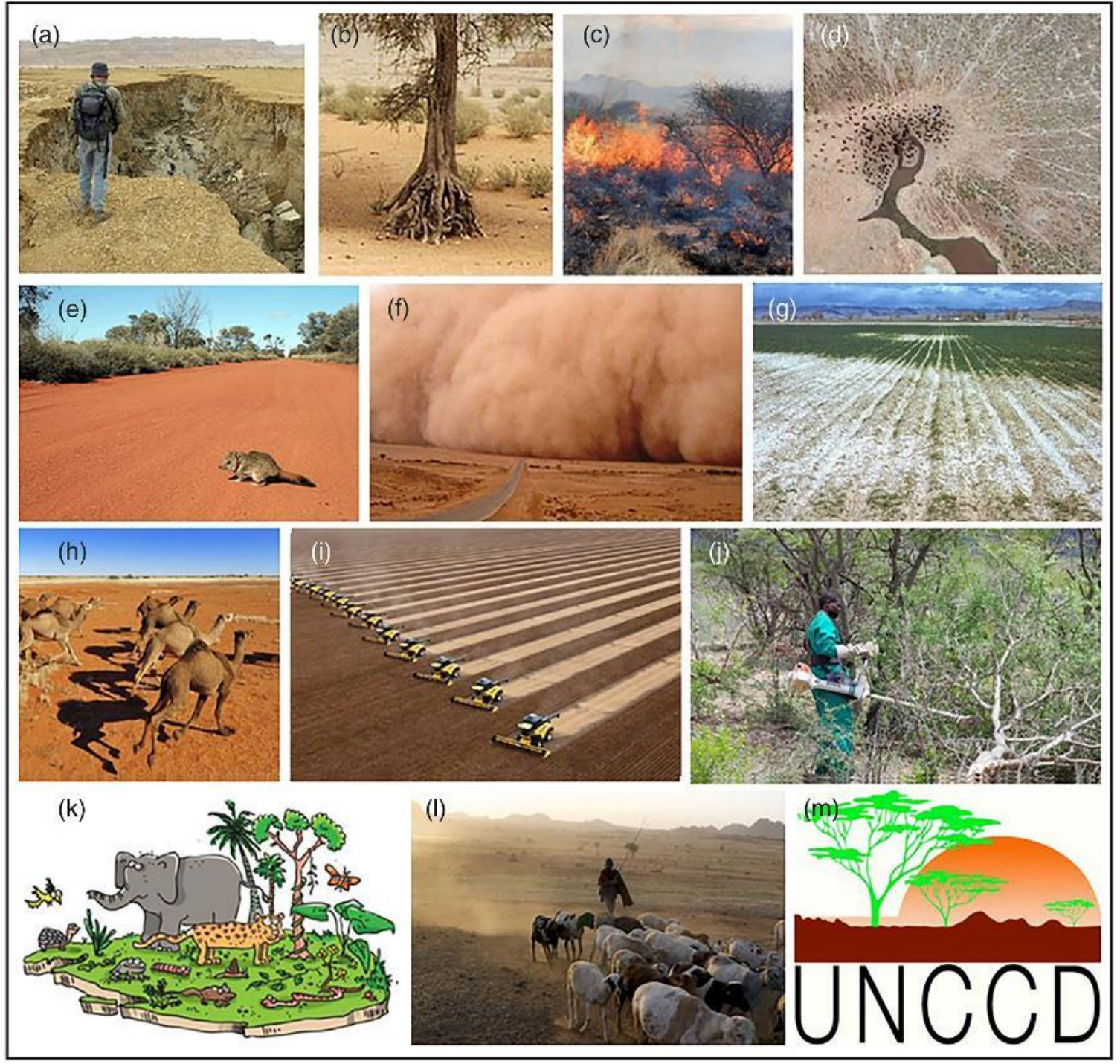
Land degradation is…

United Nations Convention to Combat Desertification
United for land

- Land degradation means reduction of the biological or economic productivity and complexity of land.
- It includes processes arising from human activities and habitation patterns such as: soil erosion caused by wind and/or water; deterioration of the physical, chemical and biological or economic properties of soil; and long-term loss of natural vegetation.
- Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.

Source: UNCCD

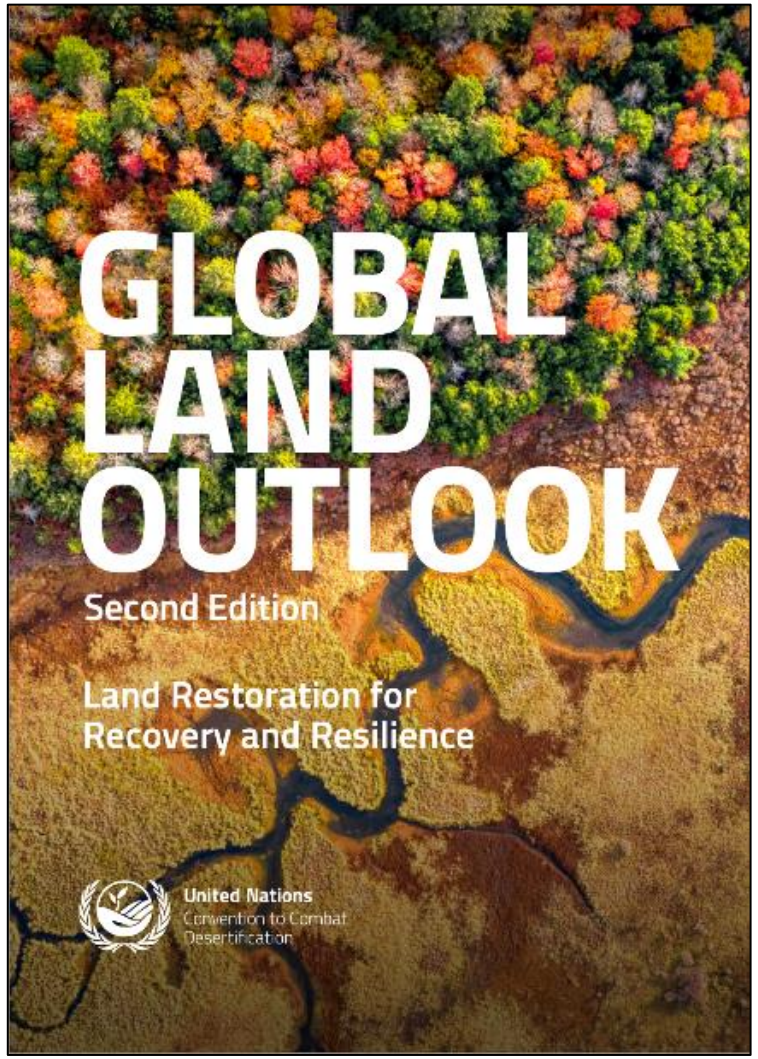
What is land degradation and desertification?



Stephen D. Prince Pascal Podwojewski:
Land Degradation & Development,
Volume: 31, Issue: 6, Pages: 677-682,
First published: 02 September 2019,
DOI: (10.1002/ldr.3436)

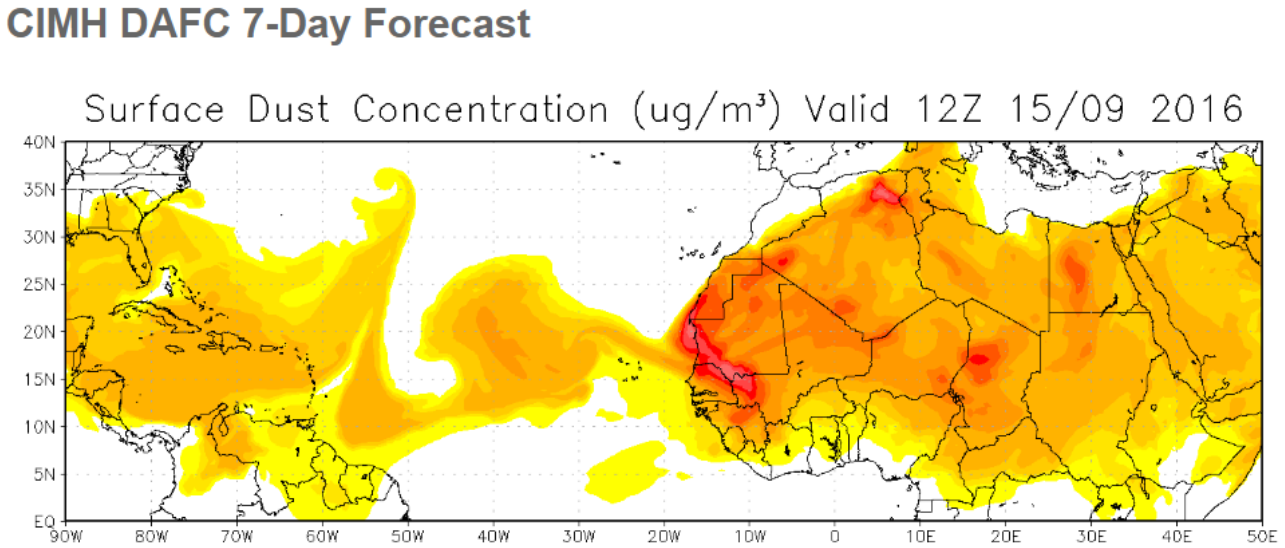
How significant is land degradation?

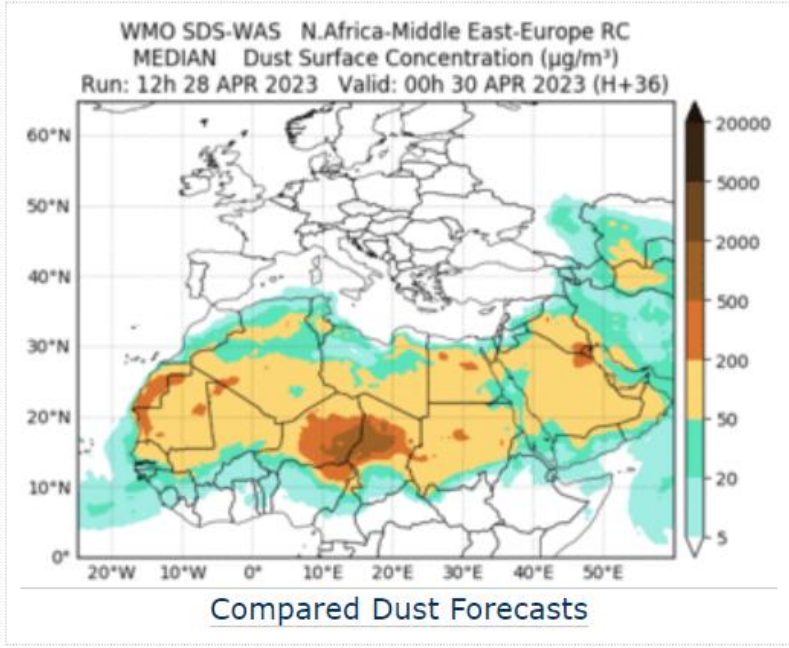
- Over **70%** of ice-free **terrestrial ecosystems** have been **transformed from their natural state for human use**.
- Governments have reported that **1 in 5 of those hectares** is no longer productive, undermining the well-being of **3.2 billion people**
- **$US 44 trillion** – roughly half the world's annual economic output – **is being put at risk by the ongoing degradation**
- If business as usual continues through 2050, GLO2 **projects the further degradation of 16 million square km** – an area the size of South America.

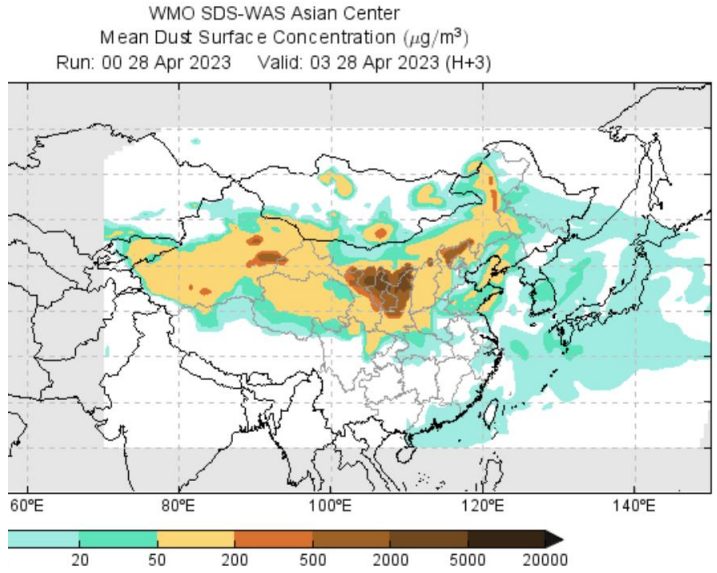


https://www.unccd.int/resources/global-land-outlook/glo2

Land degradation can be a transboundary challenge. Consider sand and dust storms…

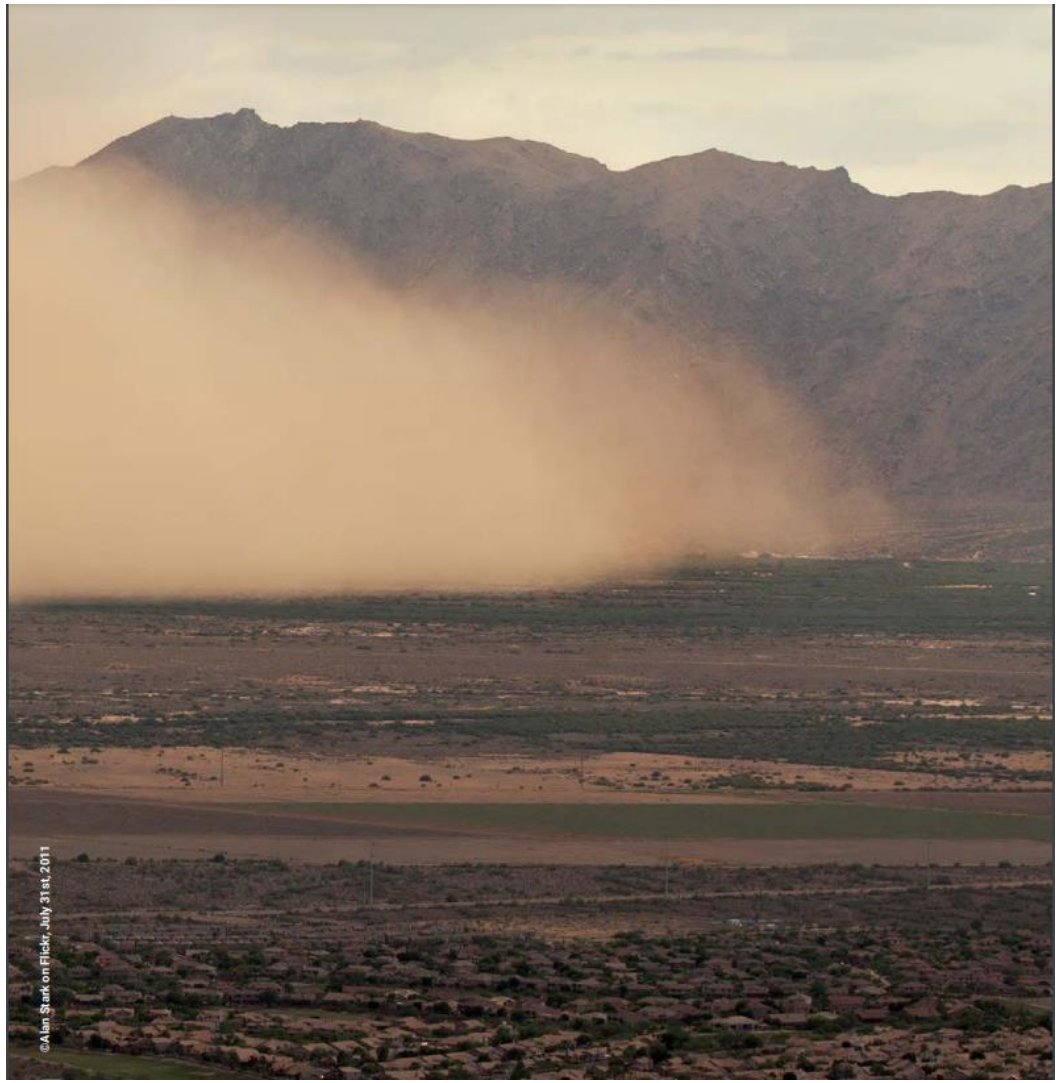






SDS leads to both on-site and off-site loss & damage

United Nations
Convention to Combat Desertification
United for land



On-site costs are usually in the form of loss of soil and sand and, in turn, the loss of soil nutrients and organic matter, including soil carbon.

Specific areas of **off-site cost** include transport, health, household cleaning, commerce and manufacturing, and agriculture.

Identifying the damage and costs of SDS

United Nations Convention to Combat Desertification
United for land

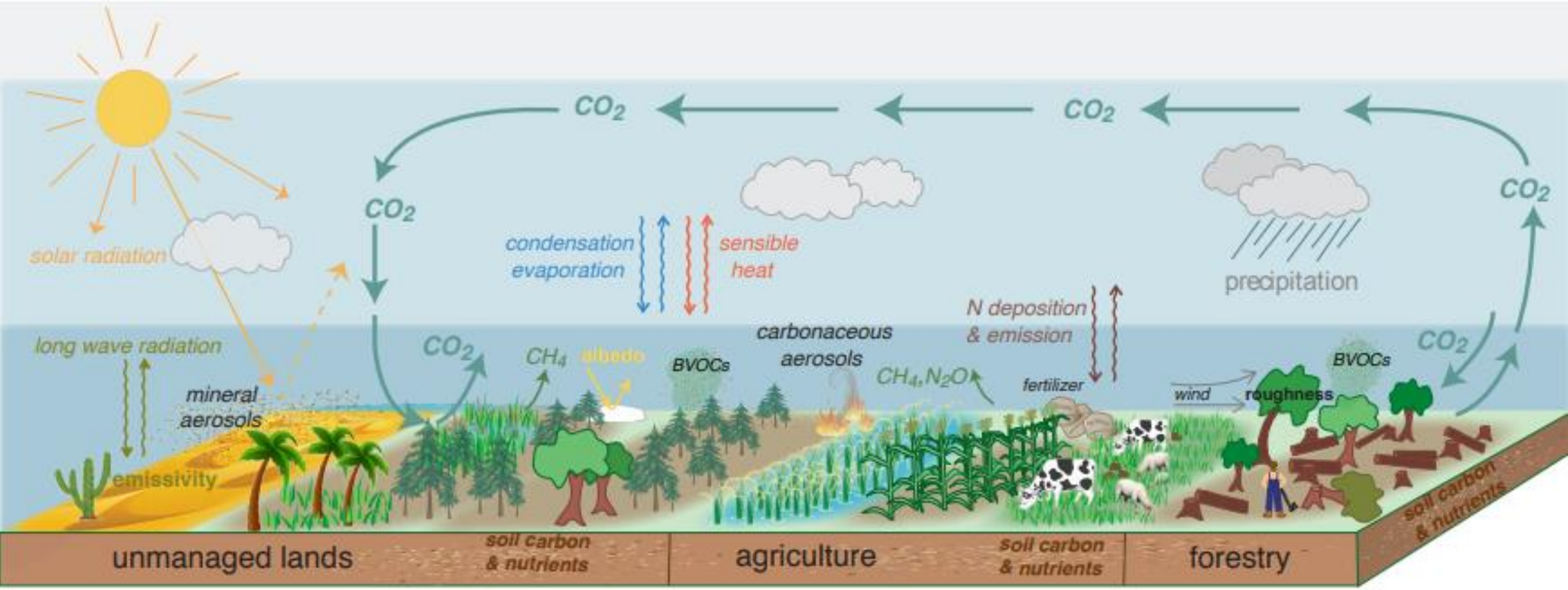
Tozer and Leys (2013) estimated **on-site costs** of approximately **$A 5.1 million** for a single severe dust storm that affected eastern Australia in 2009.

The Natural Disaster Relief Assistance request of **$ A4.5 million** to compensate landowners for **on-site** costs and losses due to the event

The **off-site costs** were considerably more**.**

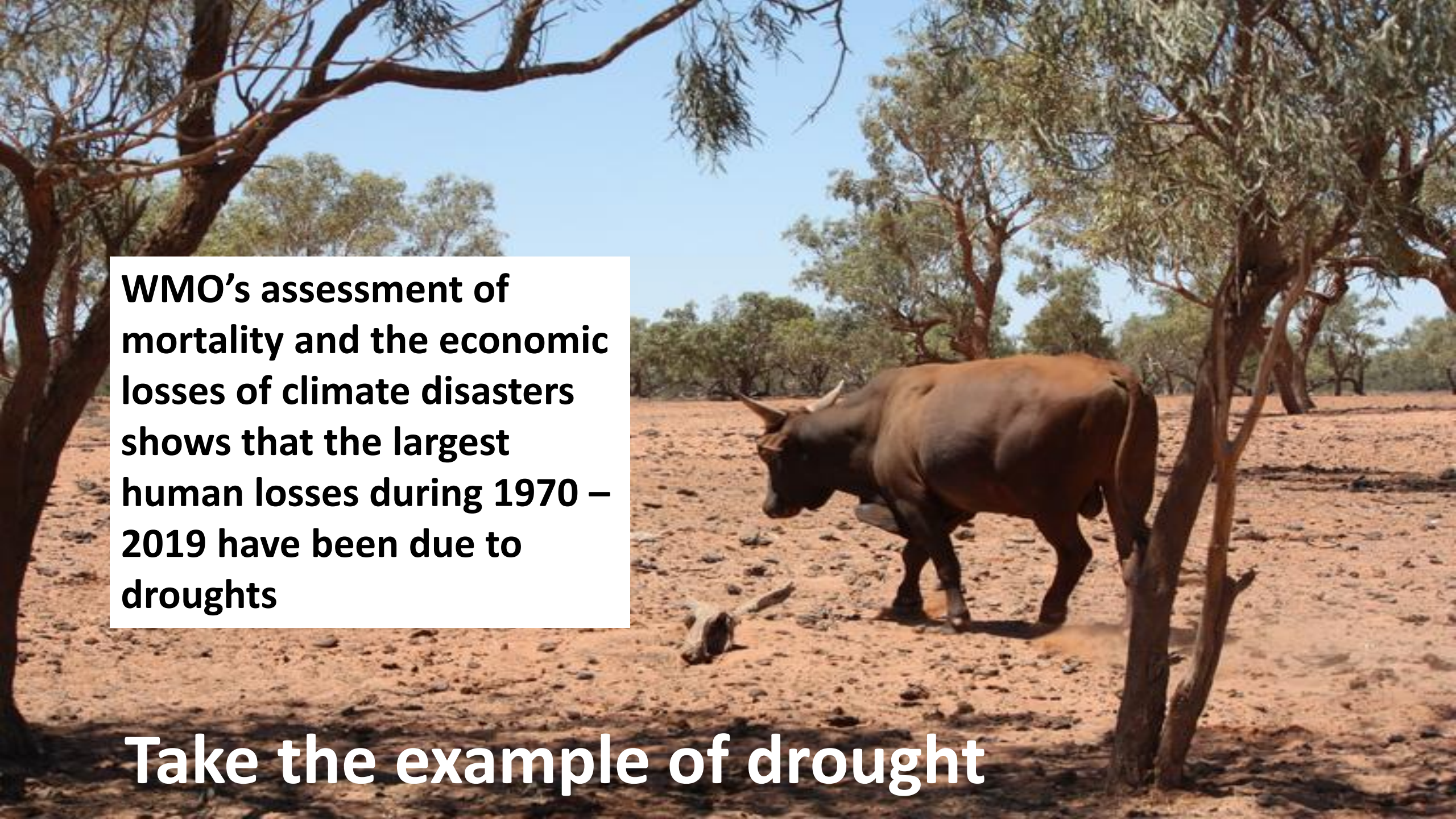
But there is more to this story…

Land-climate interactions



The structure and functioning of managed and unmanaged ecosystems that affect local, regional and global climate.

Source: IPCC SRCCL Technical Summary (2019)

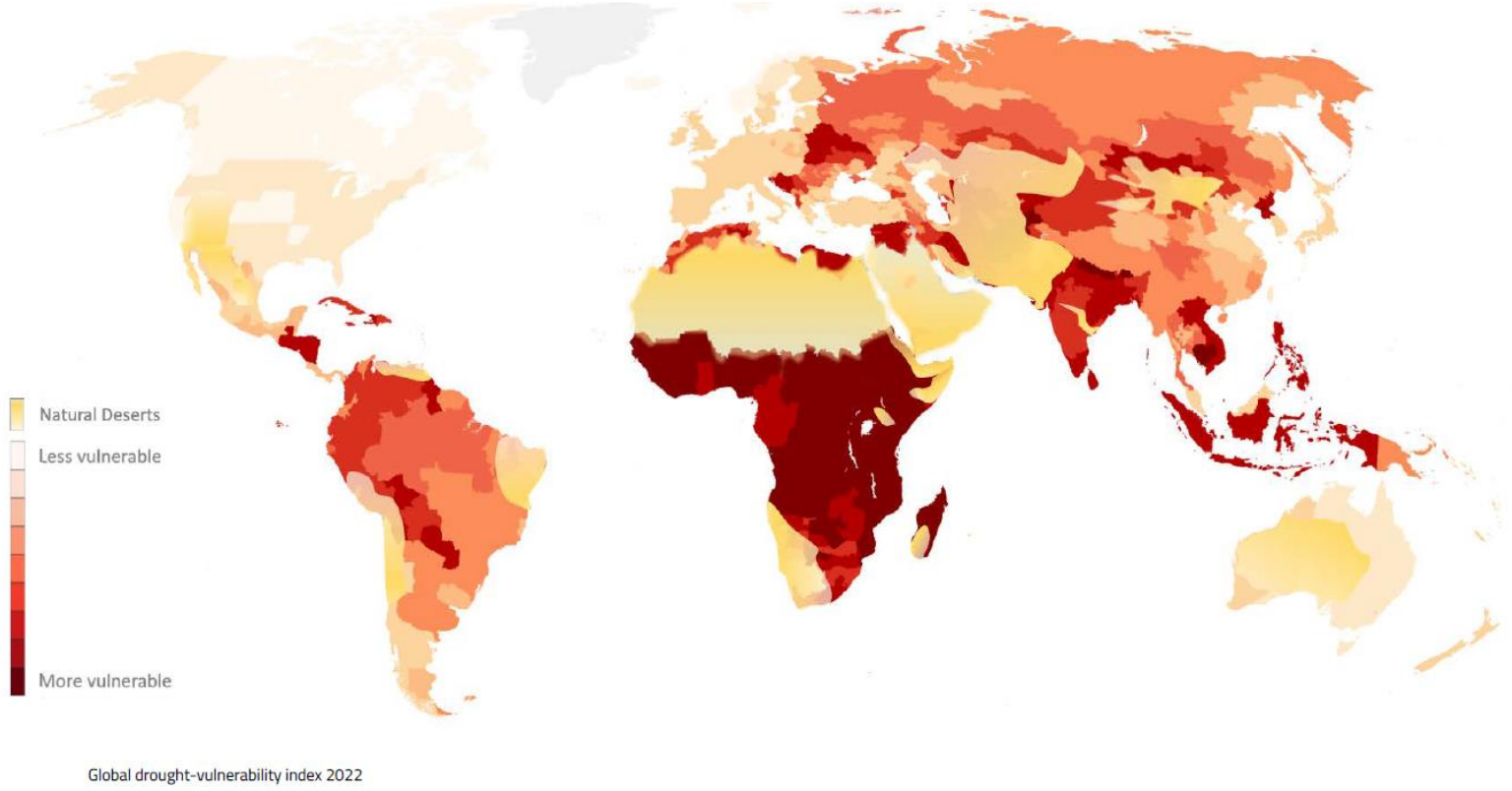


WMO's assessment of mortality and the economic losses of climate disasters shows that the largest human losses during 1970 – 2019 have been due to droughts

Take the example of drought

Drought impacts

United Nations
Convention to Combat Desertification
United for land



Global drought-vulnerability index 2022

Over 1.4 billion people were affected by drought in the period of 2000 to 2019. This makes drought the disaster affecting the second-highest number of people, after flooding

By 2050, between 4.8 and 5.7 billion people will live in areas that are water-scarce for at least one month each year, up from 3.6 billion today (UN Water, 2021)

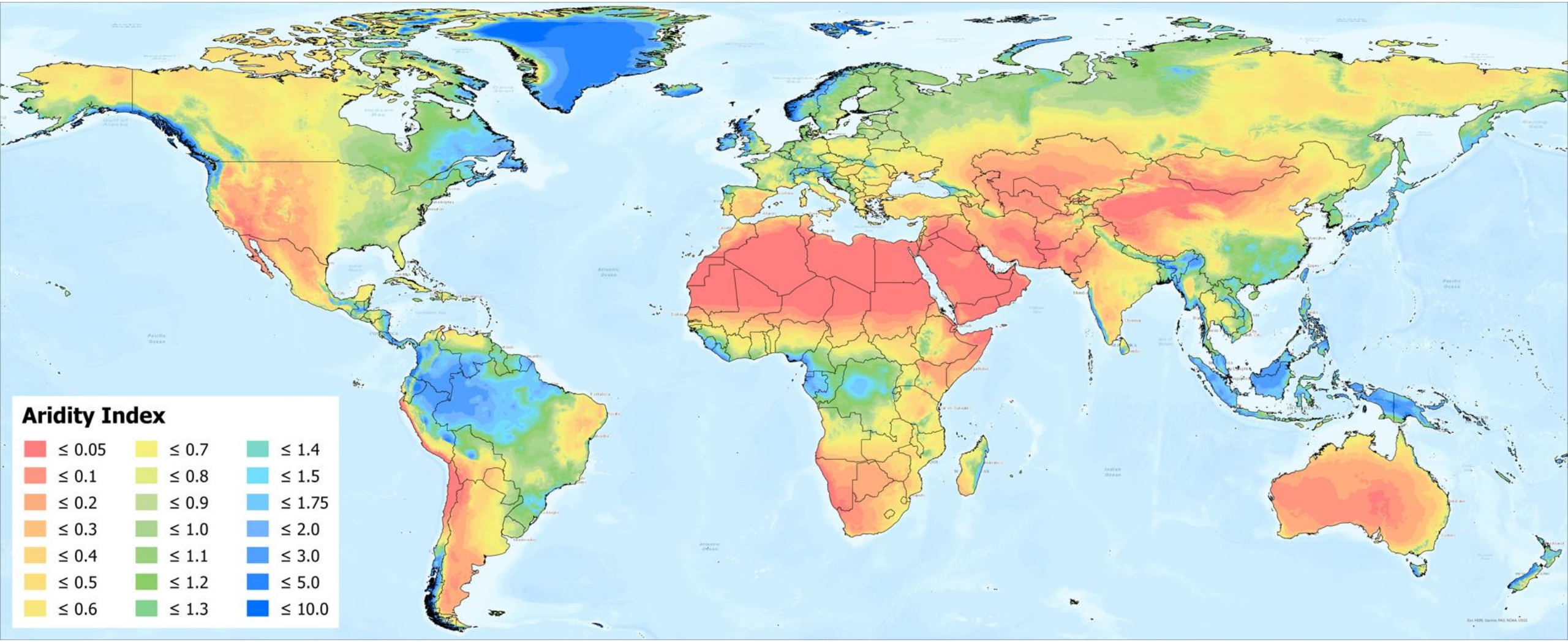
The land – drought nexus

Recognizing the strong linkages between land use and drought and that the **management of both land and drought is fundamentally connected through water use.**

Image source: Daniel Christian Wahl (2019)

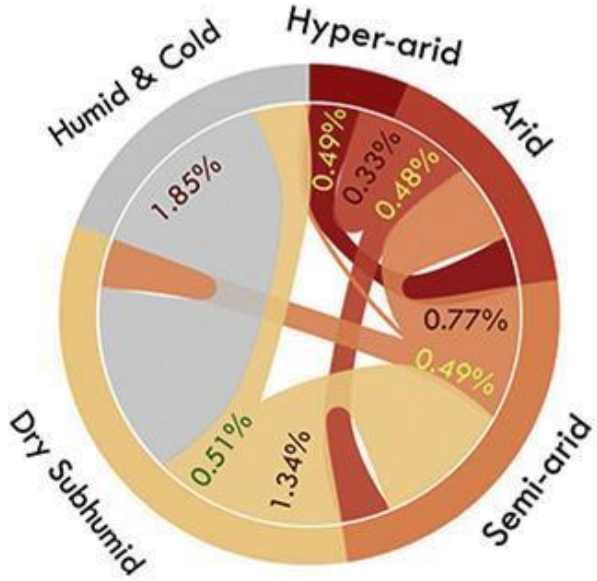

A word about a future train wreck too few are talking about:
Is the intersection of land degradation, climate change, aridity trends and drought trends

Aridification is evident and projected in all regions



Source: Zomer et al. 2022 https://www.nature.com/articles/s41597-022-01493-1

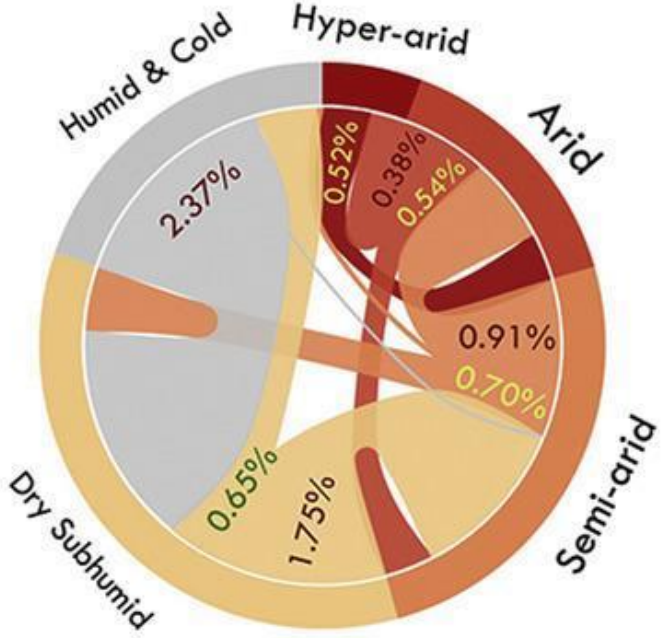
Dryland changes under different levels of global warming



+1.5°C

4.30% global land to drier types

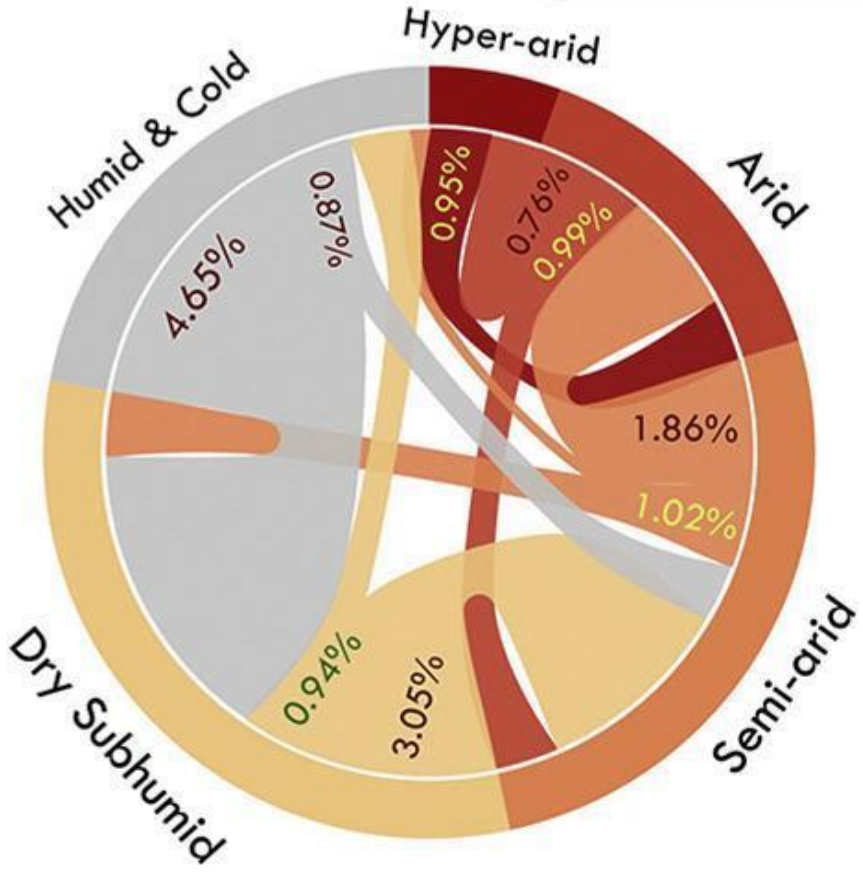
2.02% global land to wetter types



+2°C

5.45% global land to drier types

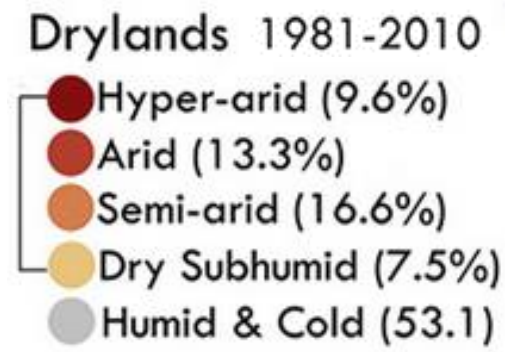
2.48% global land to wetter types



+4°C

11.20% global land to drier types

4.24% global land to wetter types



Source: Koutroulis 2019

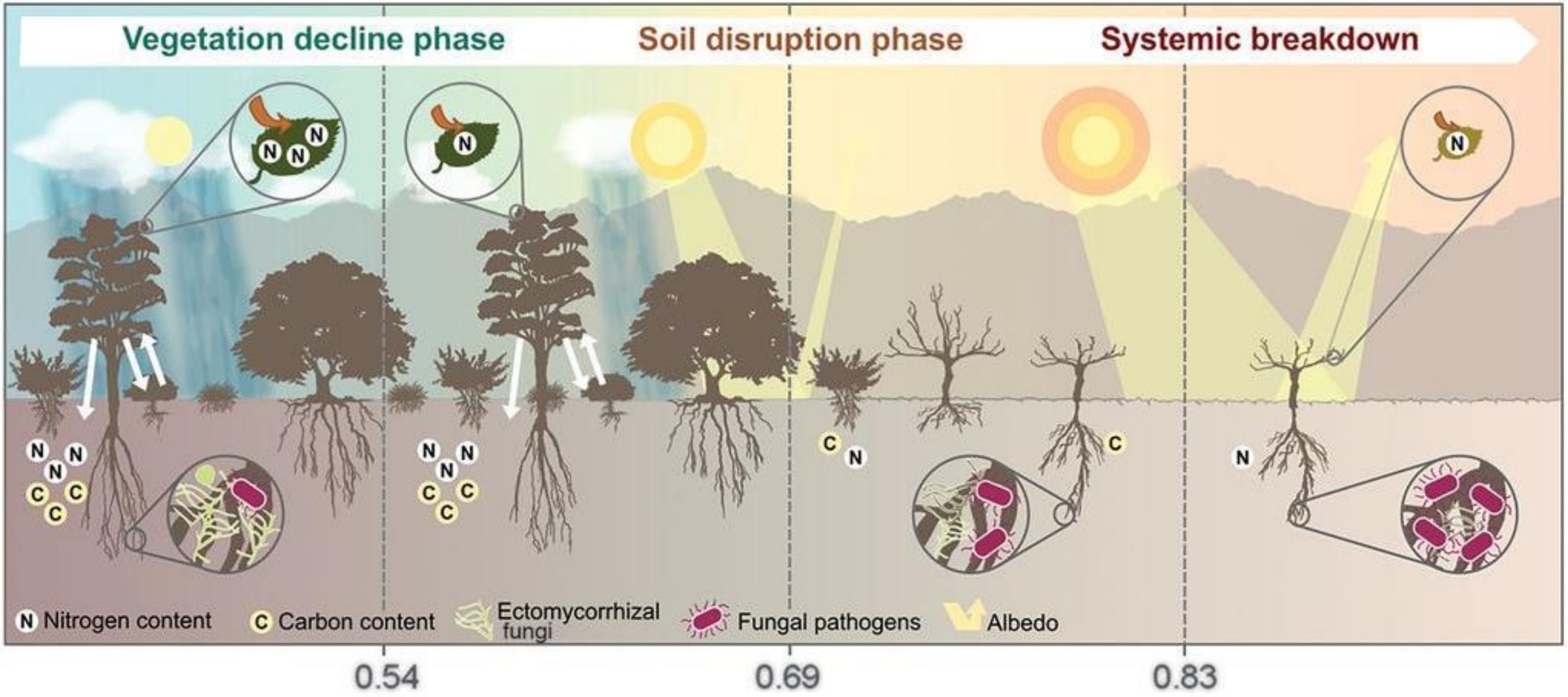
What do these aridity trends portend for drylands?

United Nations
Convention to Combat Desertification
United for land

- **Drylands** are vital ecosystems which cover **46% of the Earth's surface**, hosting **39% of the global population**.
- Dryland areas are **highly sensitive to climatic changes**.
- **The drylands could increase by an additional 7% of the global land surface by 2100.**
- With rapid climate change and population growth, anthropogenic **water demand in drylands is projected to increase by ~270% by the 2090s**, exacerbating current water resource scarcity.
- Up to **1.9 billion people could *avoid* living in drylands by keeping to 1.5 °C vs 4 °C.**

Sources: Koutroulis 2019 and Xu Lian, Shilong Piao et al. 2021

This will mean significant loss & damage



As aridity increases >>>>>>>

Source: Berdugo et al. 2020


Problems
Solutions

United Nations
Convention to Combat Desertification
United for land

What are the different existing approaches for addressing slow-onset events of land degradation, desertification and drought, taking into consideration climate change?

Land is the substrate

Published in May, the *Global Land Outlook*, 2nd Edition warns that **four of the nine planetary boundaries**, which define a "**safe operating space for humanity**" – **climate change, biodiversity loss, land use change, and geochemical cycles** – have already been **exceeded**. Land is the foundation for all of these.

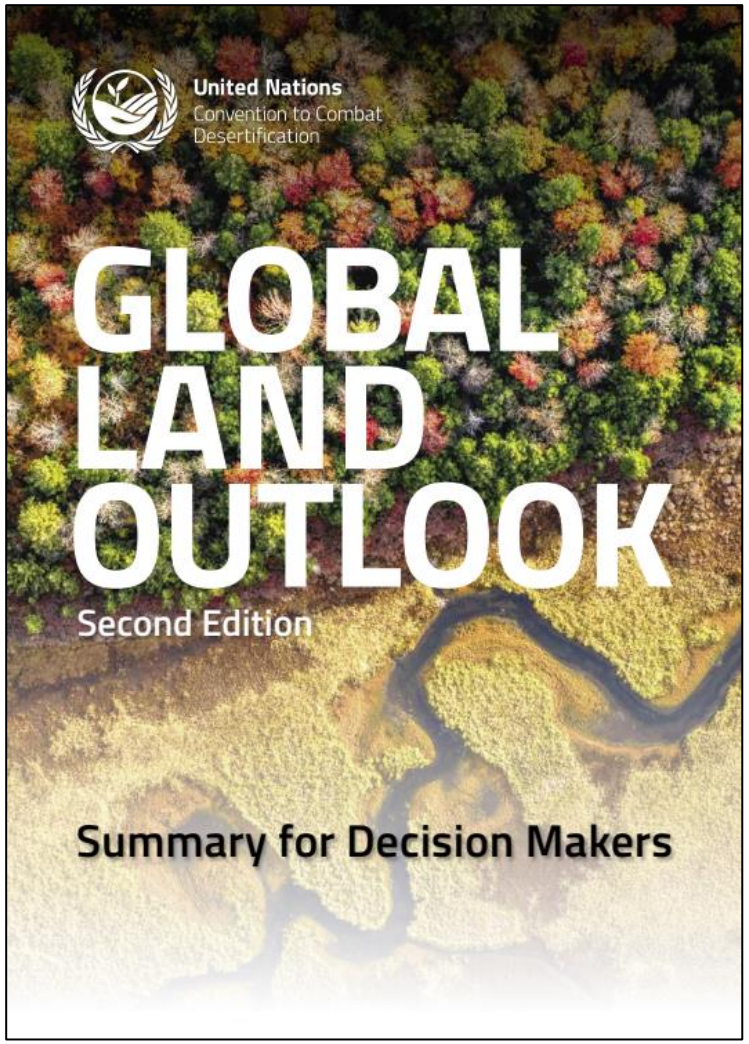
We cannot stop the climate crisis today, biodiversity loss tomorrow, and land degradation the day after. We need to tackle all these issues together.

— UNCCD Executive Secretary Ibrahim Thiaw

United Nations
Convention to Combat Desertification
United for land

https://www.unccd.int/resources/global-land-outlook/glo2

Does it pay to *reverse* land degradation?



- The **economic returns** of restoring land and reducing degradation, greenhouse gas emissions and biodiversity loss are estimated **at $US 125-140 trillion every year** - as much as 1.5 times global GDP in 2021 ($93 trillion).
- Nations have pledged to **restore 1 billion degraded hectares** (10 million square km – an area the size of the USA or China) by 2030.
- **Land is the substrate.** Bringing it back into balance can bring food, water, climate, energy and nature back into balance.

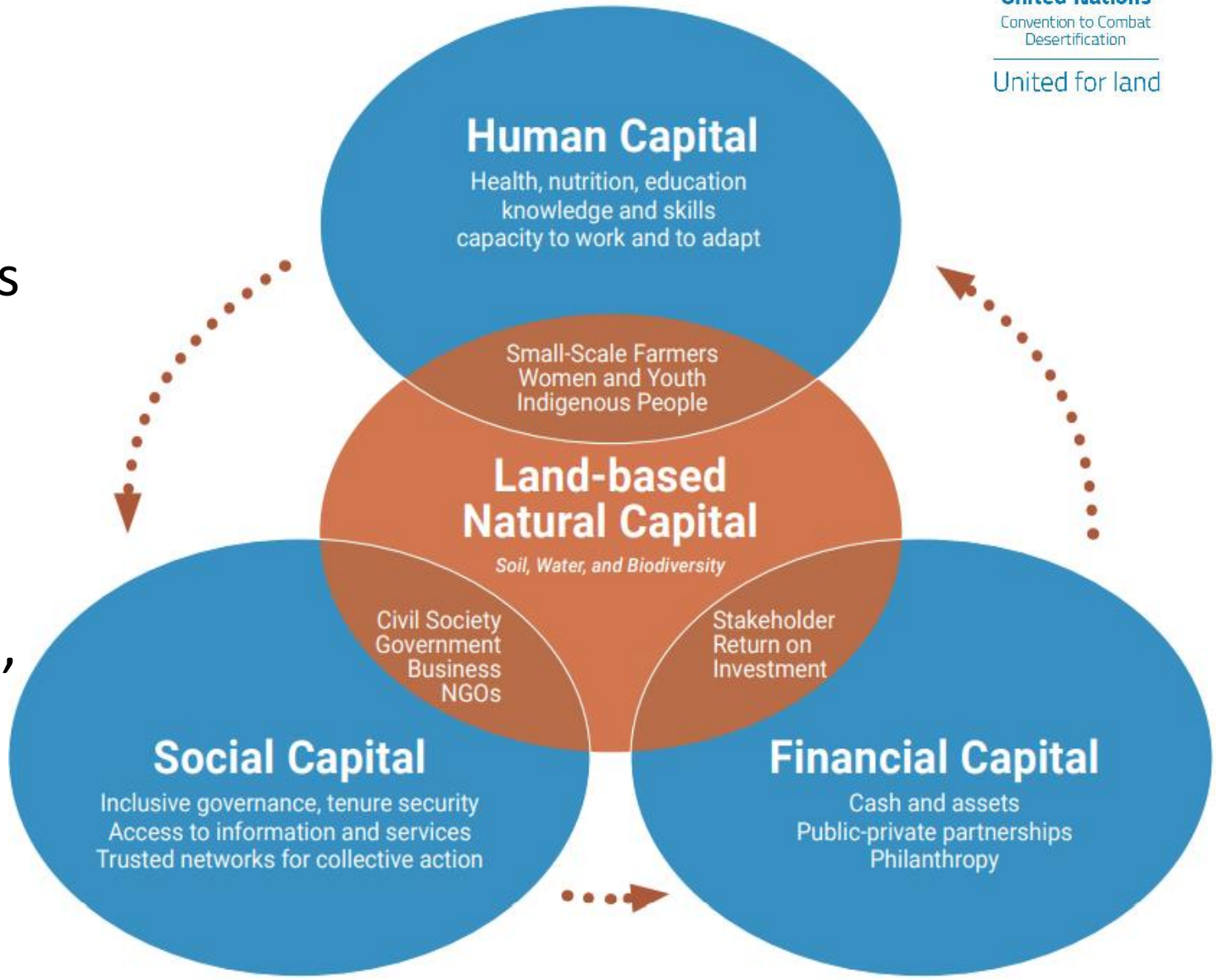
https://www.unccd.int/resources/global-land-outlook/glo2

Land is an integrator and accelerator

United Nations
Convention to Combat Desertification
United for land

By bringing together different forms of capital, **land restoration can create millions of green jobs** and other economic opportunities for a growing and youthful population.

The **restoration economy** can reach well beyond the agriculture, forestry, or conservation sectors to encompass **new business models and emerging technologies.**

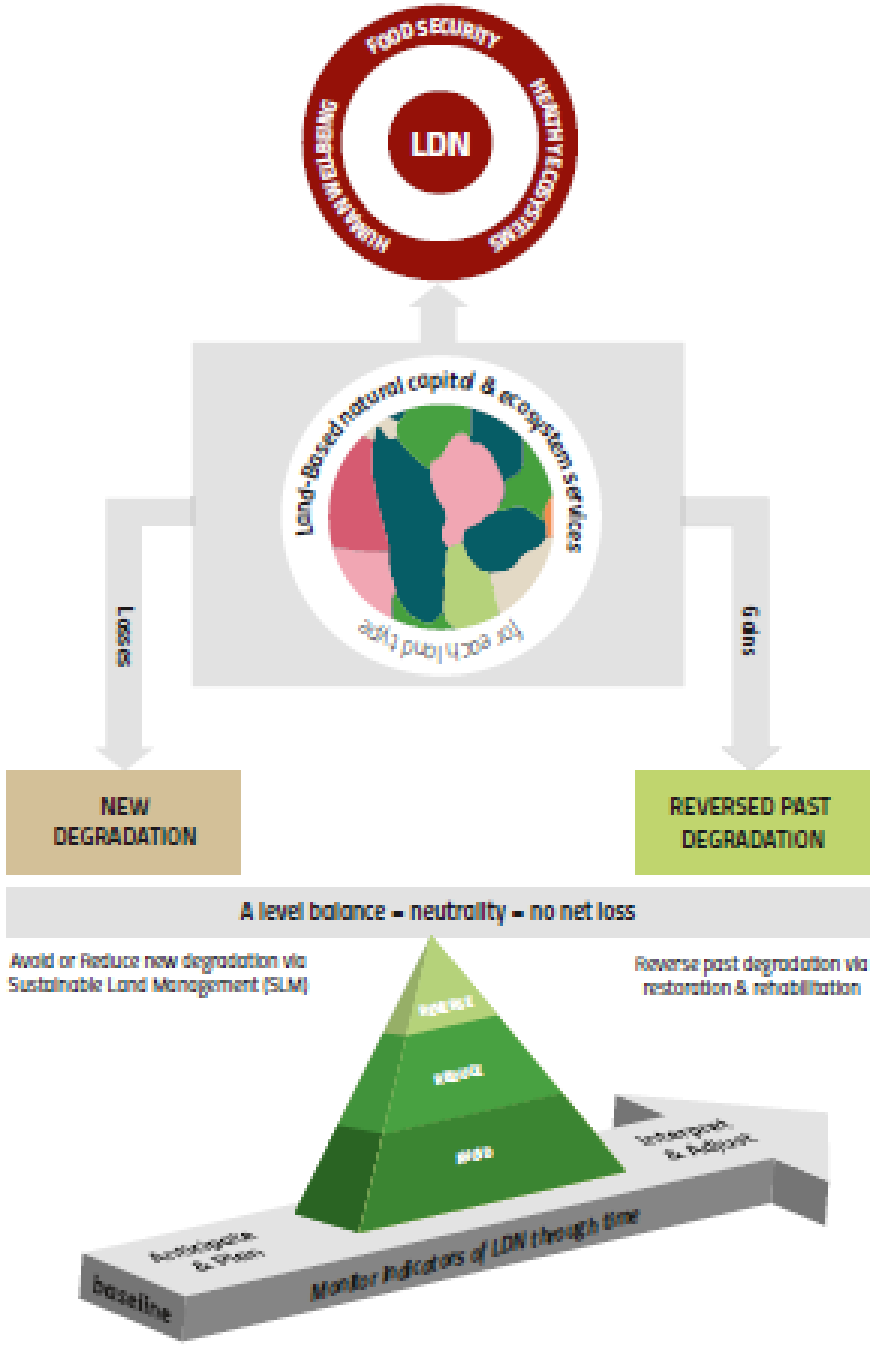


A balanced approach is needed.

- One that **anticipates new land degradation** even as we plan to reverse past degradation
- One that **considers tradeoffs** among competing interests across the landscape

LDN provides the framework for this.

Land Degradation Neutrality (LDN)

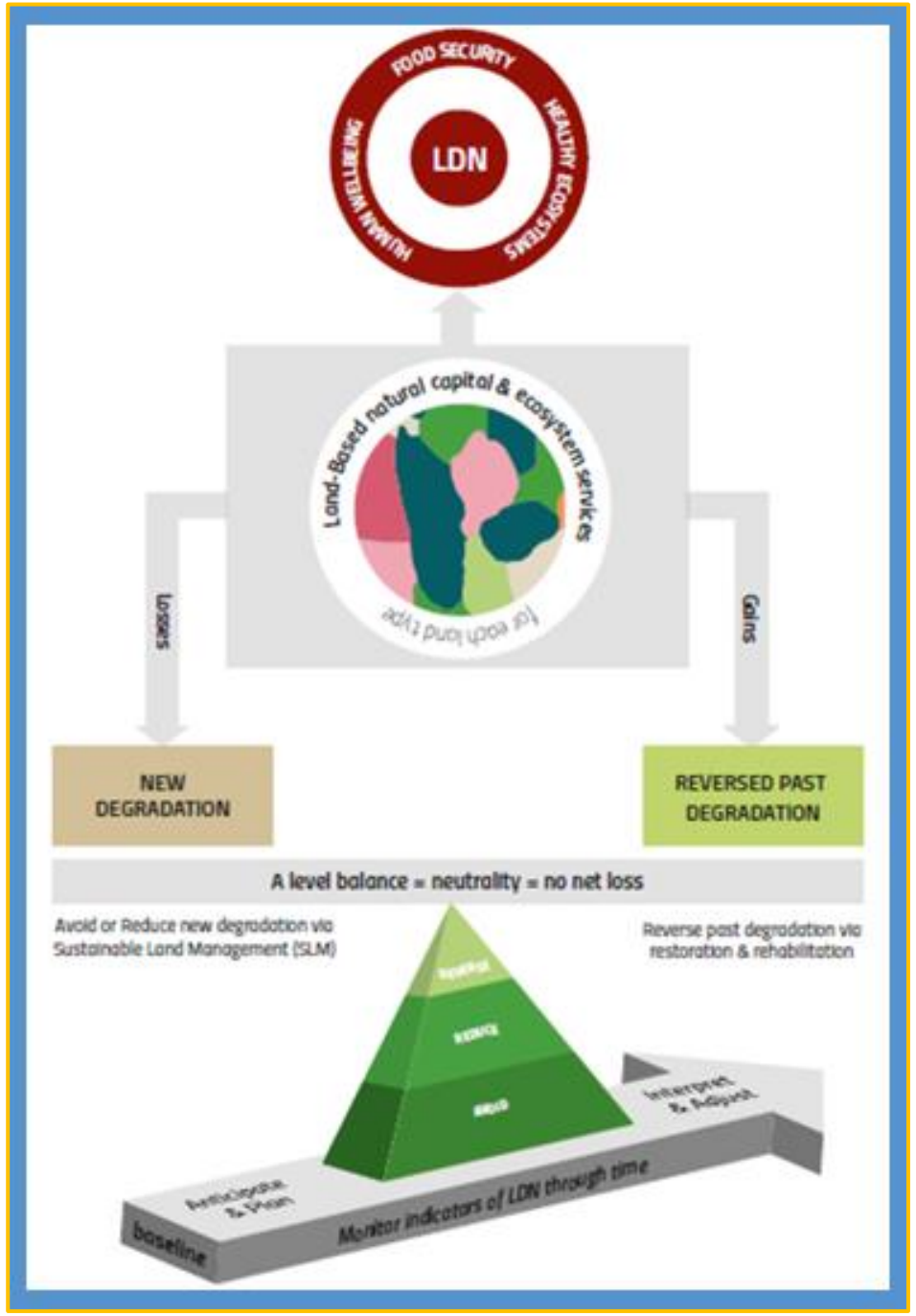


"A state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems"

LDN is integral to SDG Target 15.3

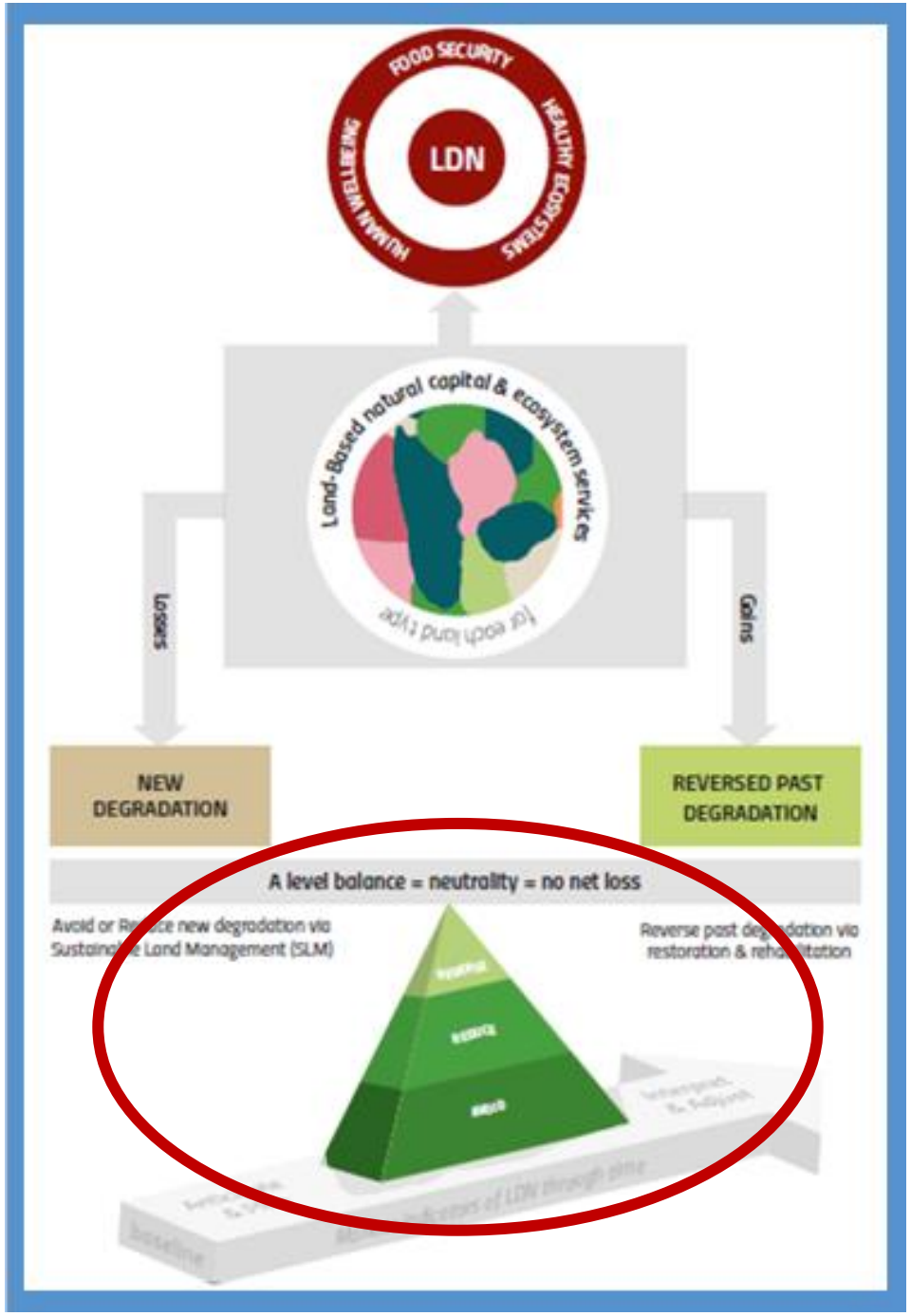
Land Degradation Neutrality

- LDN seeks to **maintain natural capital** and the **ecosystem services** that flow from it;
- LDN is about keeping **land in balance;**
- Keeping land in balance provides the basis for **keeping food, water, carbon and biodiversity in balance** as well;
- LDN is about achieving **multiple benefits;**
- LDN provides a framework with **multiple entry points** which facilitate **optimizing the synergies** among the Rio Conventions (Climate Change, Biodiversity, Land Degradation).



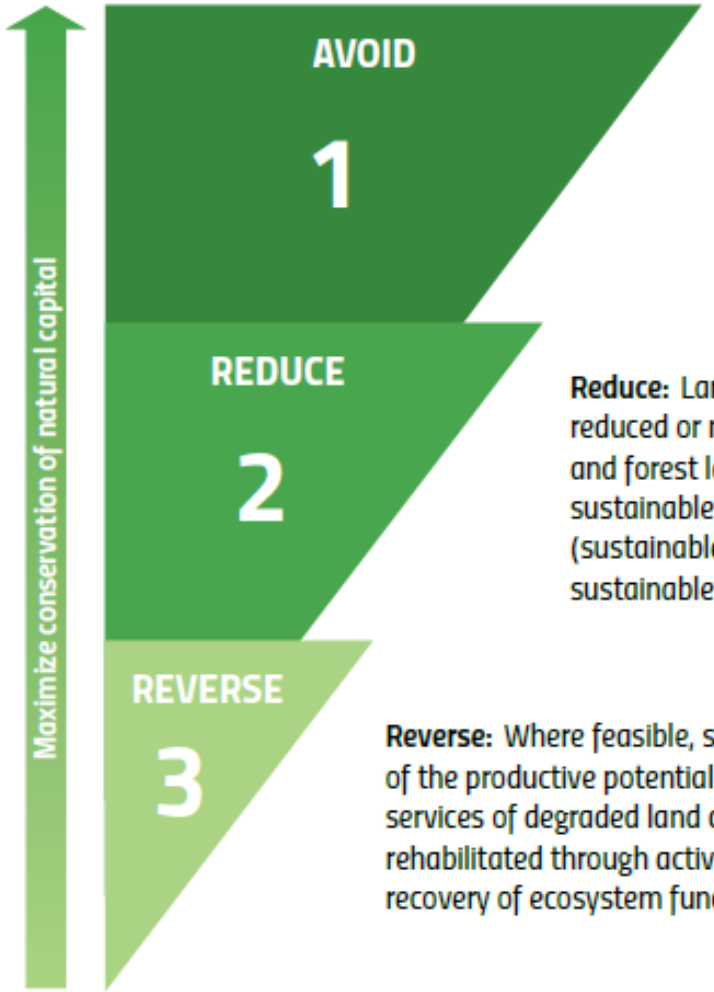
https://knowledge.unccd.int/publication/ldn-scientific-conceptual-framework-land-degradation-neutrality-report-science-policy

Land Degradation Neutrality is about doing the **right things** in the **right places** at the **right scale**



Land Degradation Neutrality

Prevention is better than cure



Avoid: Land degradation can be avoided by addressing drivers of degradation and through proactive measures to prevent adverse change in land quality of non-degraded land and confer resilience, via appropriate regulation, planning and management practices.

Reduce: Land degradation can be reduced or mitigated on agricultural and forest land through application of sustainable management practices (sustainable land management, sustainable forest management).

Reverse: Where feasible, some (but rarely all) of the productive potential and ecological services of degraded land can be restored or rehabilitated through actively assisting the recovery of ecosystem functions.

United Nations
Convention to Combat Desertification
United for land

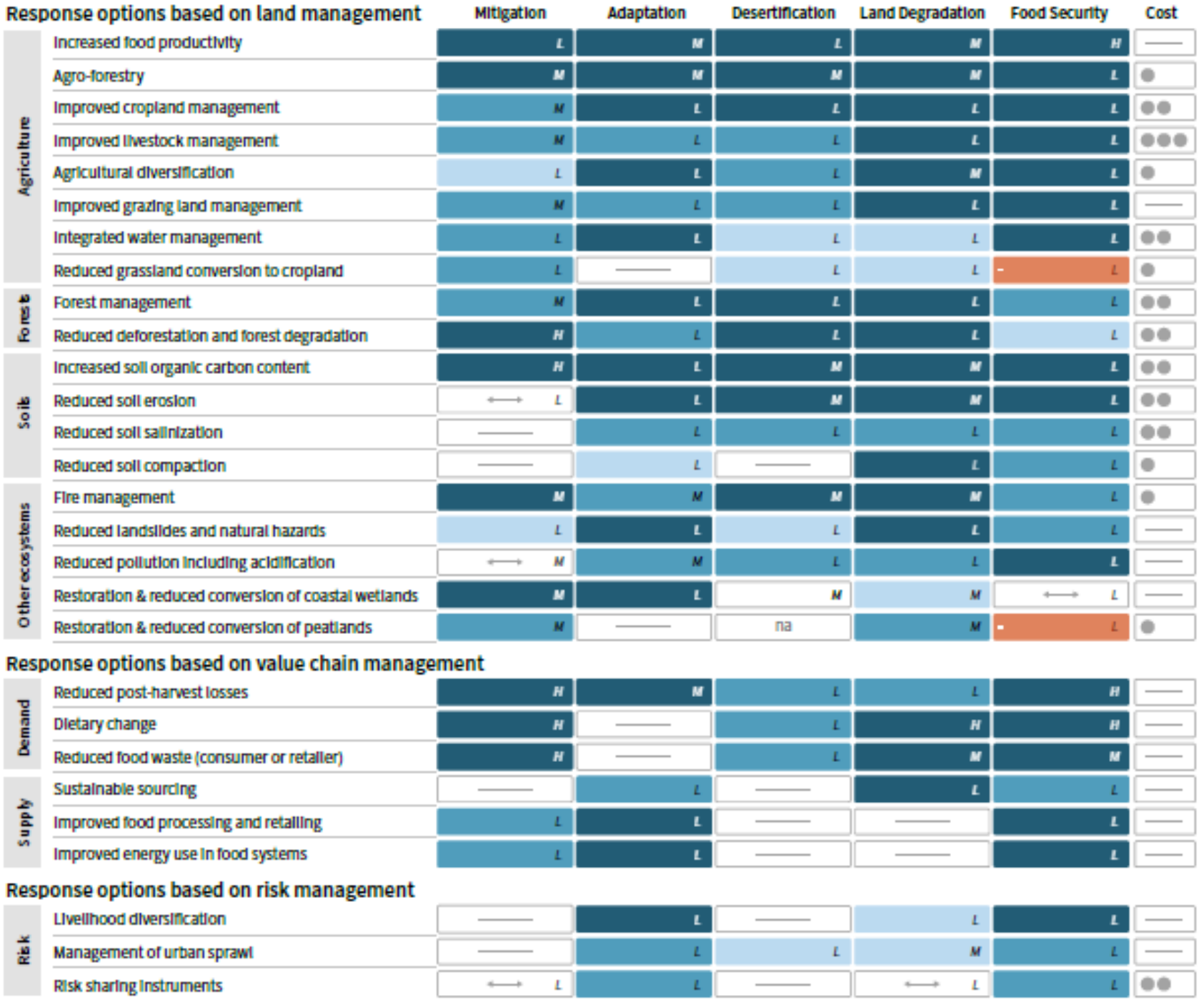
United Nations
Convention to Combat Desertification
United for land

Are there specific measures or actions to respond to and address slow onset events for which funding is particularly difficult to secure?


Integrated solutions are key, but funding tends to be siloed

Solutions need to include different options for different contexts.

https://www.ipcc.ch/srccl/

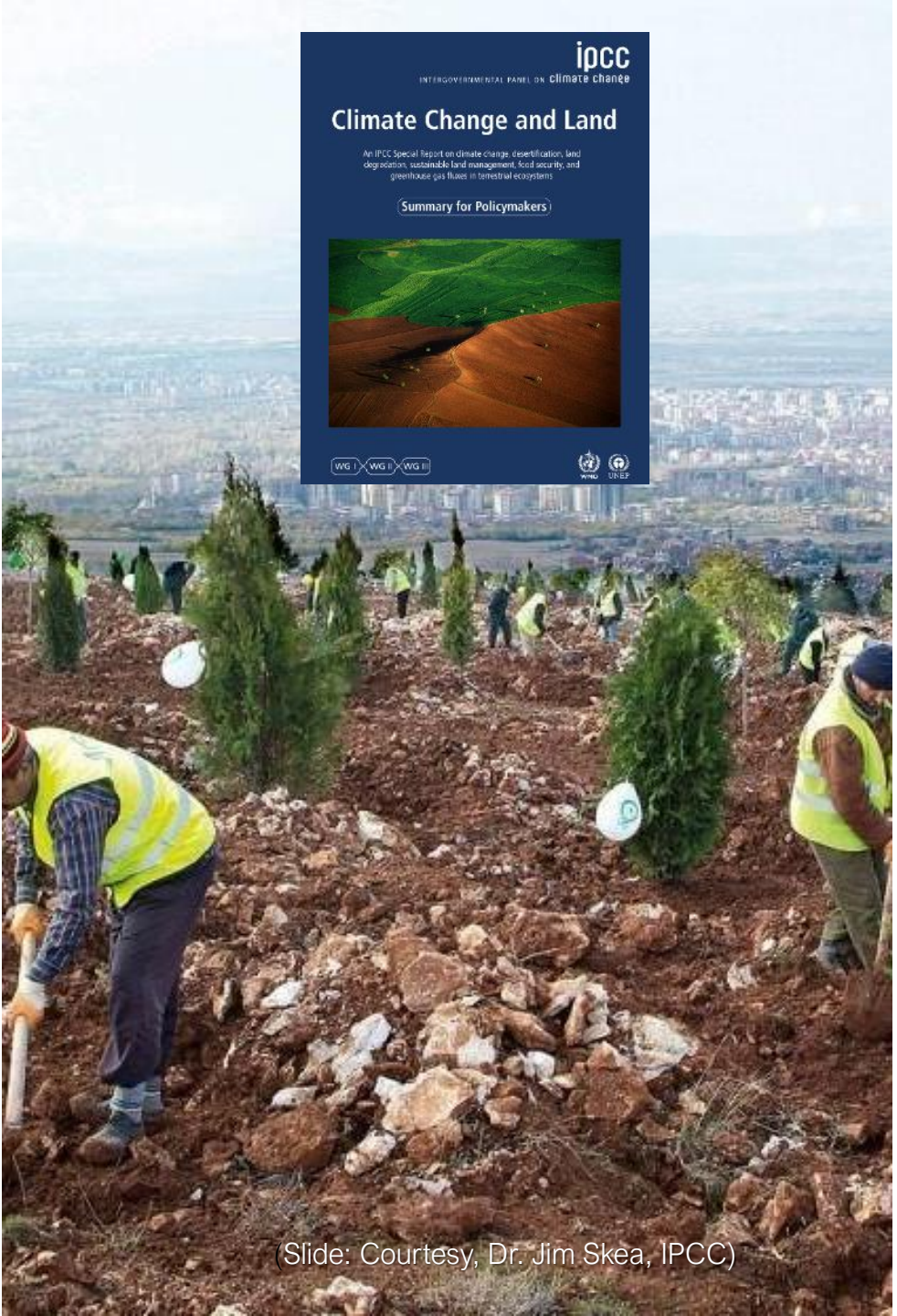


Response options based on land management		Mitigation	Adaptation	Desertification	Land Degradation	Food Security	Cost
Agriculture	Increased food productivity	L	M	L	M	H	—
	Agro-forestry	M	M	M	M	L	●
	Improved cropland management	M	L	L	L	L	●●
	Improved livestock management	M	L	L	L	L	●●●
	Agricultural diversification	L	L	L	M	L	●
	Improved grazing land management	M	L	L	L	L	—
	Integrated water management	L	L	L	L	L	●●
	Reduced grassland conversion to cropland	L	—	L	L	- L	●
Forests	Forest management	M	L	L	L	L	●●
	Reduced deforestation and forest degradation	H	L	L	L	L	●●
Soils	Increased soil organic carbon content	H	L	M	M	L	●●
	Reduced soil erosion	⟷ L	L	M	M	L	●●
	Reduced soil salinization	—	L	L	L	L	●●
	Reduced soil compaction	—	L	—	L	L	●
Other ecosystems	Fire management	M	M	M	M	L	●
	Reduced landslides and natural hazards	L	L	L	L	L	—
	Reduced pollution including acidification	⟷ M	M	L	L	L	—
	Restoration & reduced conversion of coastal wetlands	M	L	M	M	⟷ L	—
	Restoration & reduced conversion of peatlands	M	—	na	M	- L	●

Response options based on value chain management							
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	—

Response options based on risk management							
Risk	Livelihood diversification	—	L	—	L	L	—
	Management of urban sprawl	—	L	L	M	L	—
	Risk sharing instruments	⟷ L	L	—	⟷ L	L	●●

Because one size does not fit all…



(Slide: Courtesy, Dr. Jim Skea, IPCC)

Integrated response options are needed to achieve multiple benefits

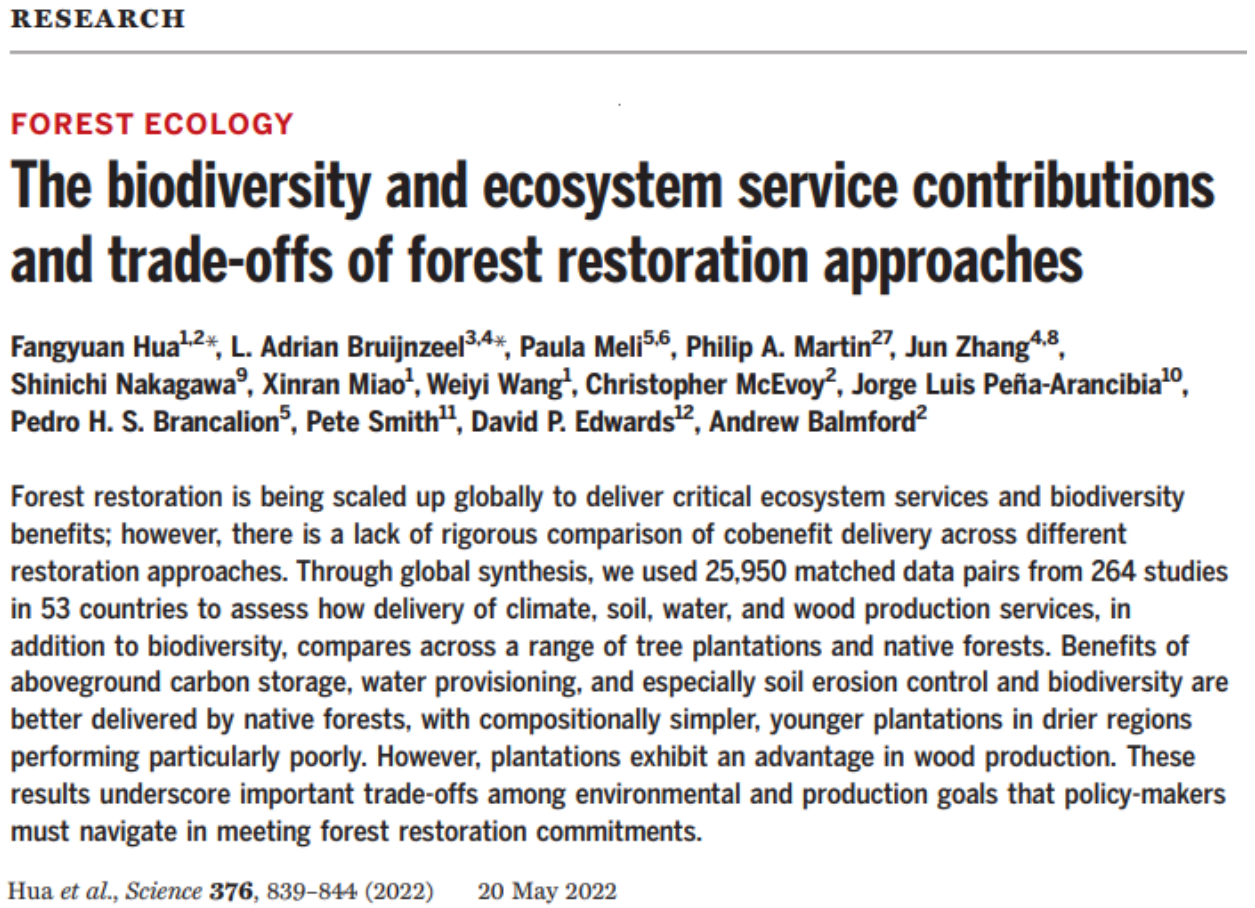
- **Several response options deliver for multiple challenges**, including climate change and sustainable development goals.
  - **Enhanced biodiversity and conserved habitats** (supporting the 2020 Biodiversity Framework)
  - **Reduce impacts of drought and flood** (disaster risk reduction)
  - **Close, at least in part, the agricultural yield gap** leading to additional agricultural production (food security);
  - **Minimize the adverse drivers of irregular migration and conflict over access to land and water resources in degradation "hot-spots"** by scaling up job creation and improving community livelihoods (peace and security, rural development and decent jobs for youth;

Its more than planting trees

United Nations
Convention to Combat Desertification
United for land

- While planting trees would seem to have clear, unmitigated benefits, the reality is not so simple.

- A recent global synthesis found that **native forests consistently delivered better performance than plantations** in the provision of ecosystem services, with additional benefits for biodiversity.



RESEARCH

FOREST ECOLOGY

The biodiversity and ecosystem service contributions and trade-offs of forest restoration approaches

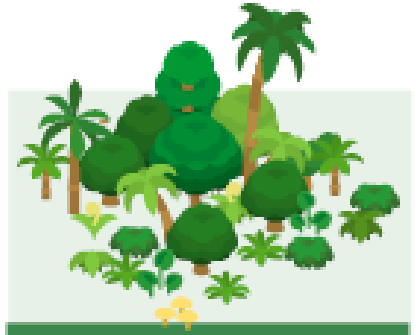
Fangyuan Hua[1,2]*, L. Adrian Bruijnzeel[3,4]*, Paula Meli[5,6], Philip A. Martin[27], Jun Zhang[4,8], Shinichi Nakagawa[9], Xinran Miao[1], Weiyi Wang[1], Christopher McEvoy[2], Jorge Luis Peña-Arancibia[10], Pedro H. S. Brancalion[5], Pete Smith[11], David P. Edwards[12], Andrew Balmford[2]

Forest restoration is being scaled up globally to deliver critical ecosystem services and biodiversity benefits; however, there is a lack of rigorous comparison of cobenefit delivery across different restoration approaches. Through global synthesis, we used 25,950 matched data pairs from 264 studies in 53 countries to assess how delivery of climate, soil, water, and wood production services, in addition to biodiversity, compares across a range of tree plantations and native forests. Benefits of aboveground carbon storage, water provisioning, and especially soil erosion control and biodiversity are better delivered by native forests, with compositionally simpler, younger plantations in drier regions performing particularly poorly. However, plantations exhibit an advantage in wood production. These results underscore important trade-offs among environmental and production goals that policy-makers must navigate in meeting forest restoration commitments.

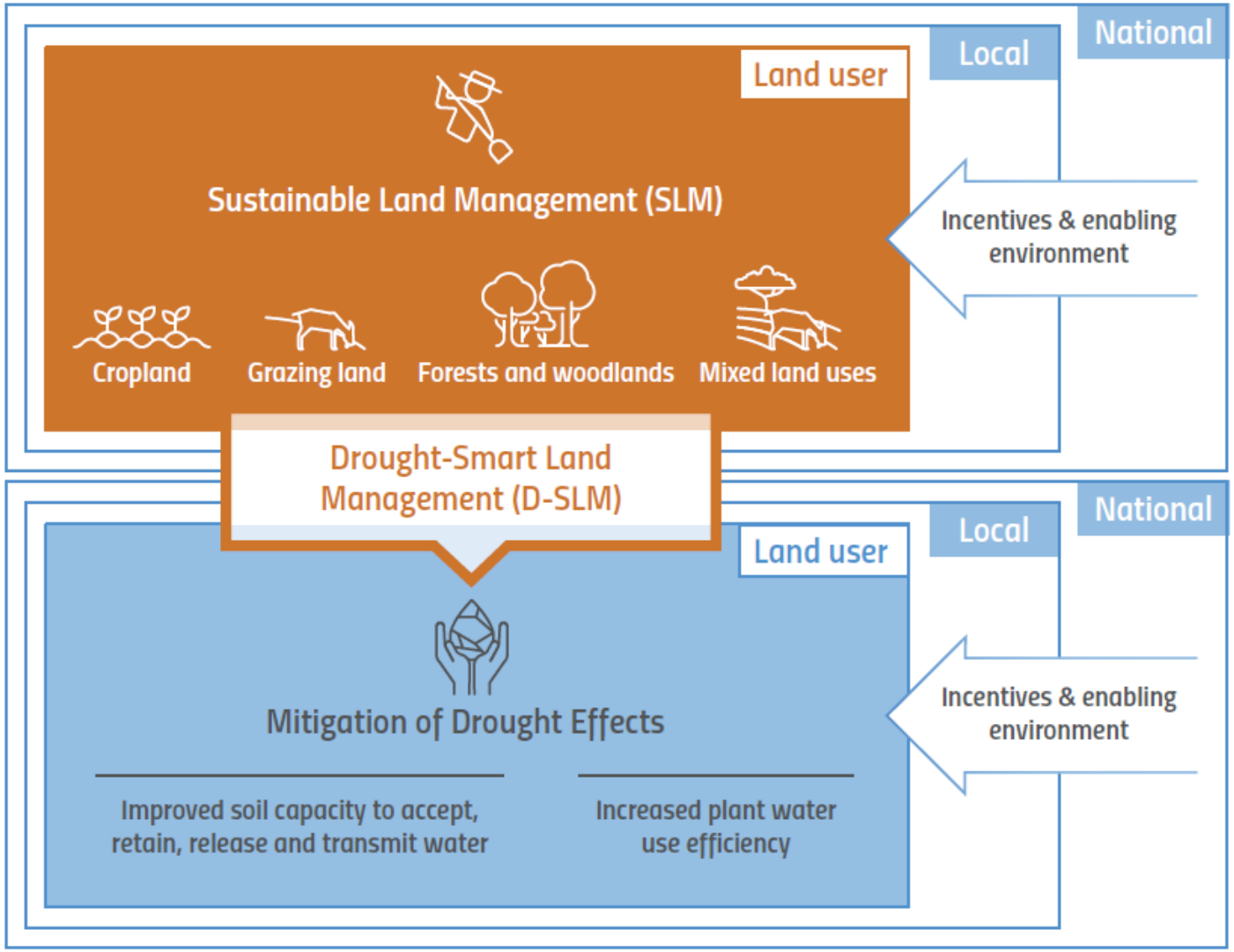
Hua *et al.*, *Science* **376**, 839–844 (2022) 20 May 2022

Hua et al. 2022 *Science*

Integration needs to occur across the urban-rural continuum

	 Cities/urban areas	 Urban–rural interface	 Rural/agricultural landscapes	 Natural ecosystems/ protected areas
PLACE				
APPROACHES	Green spaces and water management	Sustainable territorial development	Regenerative food and commodity production	Conservation and restoration of nature
ENABLERS	**Rights** (tenure security) / **Rewards** (incentives/investments) / **Responsibilities** (long term planning)			
ACTIONS	» Community gardens and urban farming » Tree planting and wetland restoration » Green belts and buildings (roofs/walls)	» Land use planning Protect watersheds and fertile farmland » Manage urbanization » Sectoral coordination for green infrastructure and supply chains	» Integrated farming (crops/trees/livestock) » Rangeland management » Sustainable intensification and agroecological practices	» Ecological restoration » Wildlife corridors and buffer zones » Indigenous/ community management » Sustainable harvesting in protected areas
BENEFITS	» Human health (quality of life) » Clean air and water » Flood control and wastewater management » Parks and recreation Cooler temperatures	» Water availability for urban residents » Local and regional food security » Biodiversity conservation Reduced urban sprawl	» Food security and rural livelihoods » Healthy soils and ecosystem functions » Reduced emissions » Water storage/recharge » Biodiversity conservation	» Nature's contribution to people » Global public goods (climate stability/ biodiversity) » Ecotourism and cultural landscapes

Drought-smart land management



Reichhuber et al. 2018

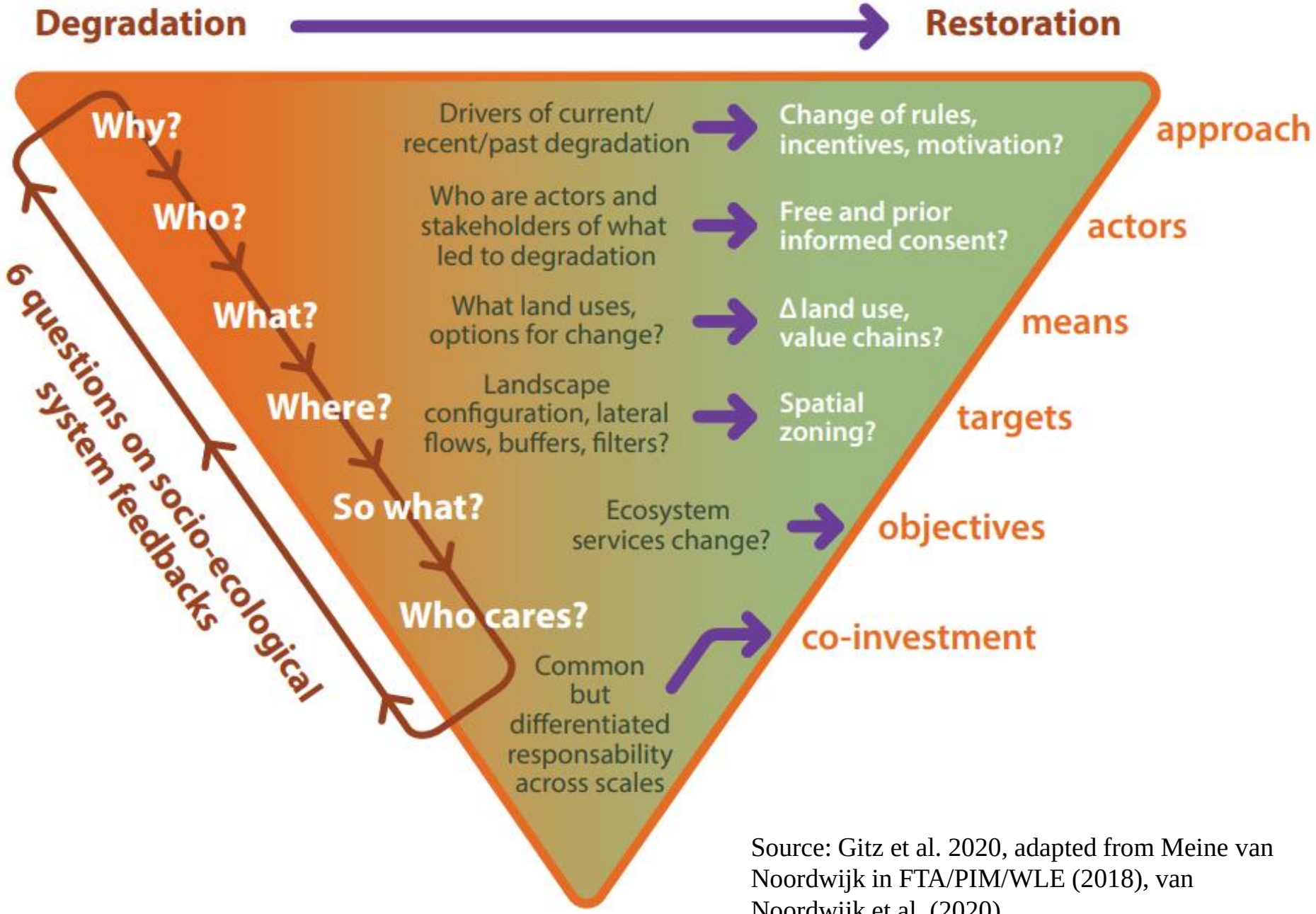
Drought-smart land management measures: impacts, costs and benefits, synergies, trade-offs and constraints

Reichhuber et al. 2018

Avoid
Reduce
Reverse

Land Use	D-SLM Category	LDN Category	Upfront Costs	Net Economic Returns	Food Security and Poverty Reduction	Trade-Offs and Constraints
Croplands	Controlling soil erosion			Neutral and negative in the short term*, positive in the long-term	o	Labor availability could be a constraint
	Minimizing soil disturbance			Often, but not always, positive already in the short-term	+	Competition between uses of plant residues for mulching or for livestock feeding
	Integrated soil fertility management			Usually already positive in the short-term	++	Competition between uses of livestock manure as soil amendment and energy source.
	Improved water management		to	Usually already positive in the short-term, especially in arid environments or where water is priced.	+	Lack of water markets and pricing can limit incentives for their adoption
	Improved vegetation management		to	Usually already positive in the short-term	+	May require technical capacities for their adoption by farmers
Grazing lands	Grazing pressure management			Usually already positive in the short-term	+	In some areas competes with expanding crop production
	Water management		to	Limited evidence	o	Limited evidence
	Vegetation management		to	Usually already positive in the short-term	+	Limited evidence
Forests/ Woodlands	Sustainable forest management, afforestation, reforestation, and of reducing deforestation			Neutral and negative in the short term, positive in the long-term	+	Limited evidence
Mixed land uses	Adopting agro-forestry and agro-pastoralism		to	Neutral and negative in the short term, positive in the long-term	+	Takes relatively long time for implementation
	Water management		to	Usually already positive in the short-term	o	Lack of water markets and pricing can limit incentives for their adoption
	Integrated watershed management			Positive in the long-term	o	Takes relatively long time for implementation
	Urban green infrastructure		to	Positive	o	Requires considerable technical capacities for planning and implementation

Solutions need to encompass all dimensions of the restoration process



Source: Gitz et al. 2020, adapted from Meine van Noordwijk in FTA/PIM/WLE (2018), van Noordwijk et al. (2020)

United Nations
Convention to Combat Desertification

United for land

Thank you!