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EJP SOIL
European Joint Programme

Land Degradation Neutrality (LDN)

What is it and how is it monitored?

Barron Joseph Orr

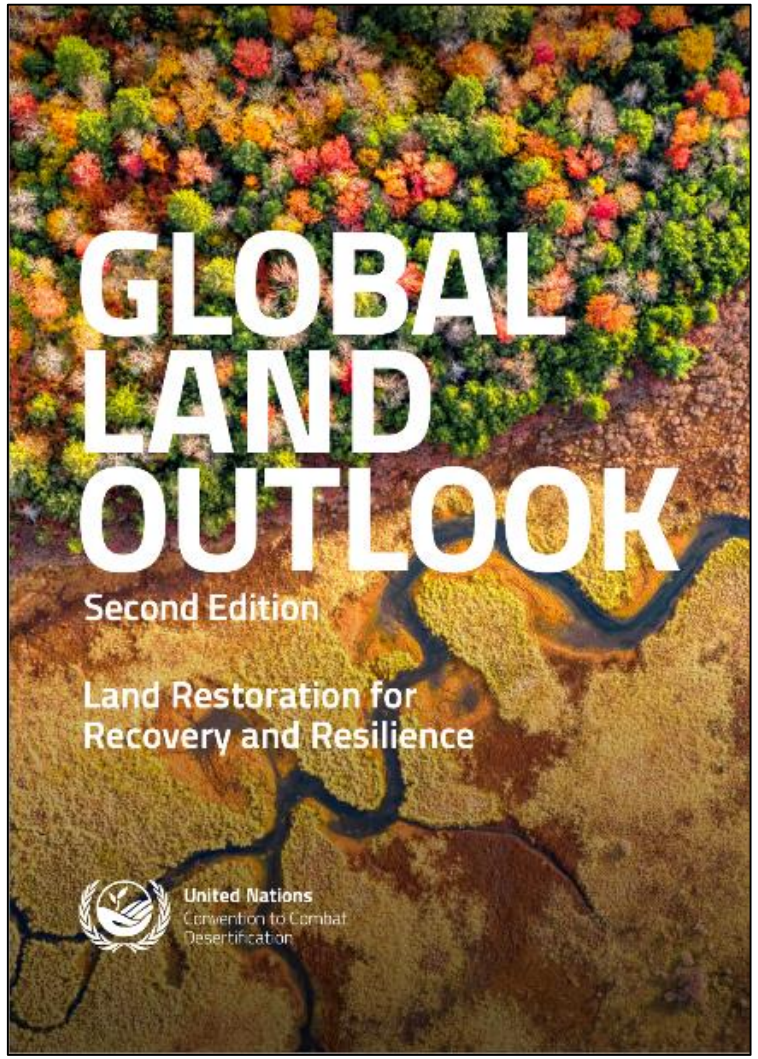
Second session: proposals and needs

Land Degradation and Healthy Soils: Towards a Glossary and Monitoring System

18 April 2023

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**
- If business as usual continues through 2050, GLO2 **projects the further degradation of 16 million square km** – an area the size of South America.
- **Land is limited**, and will be needed for many necessary, but competing demands: food, water, energy, climate, biodiversity and much more



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

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

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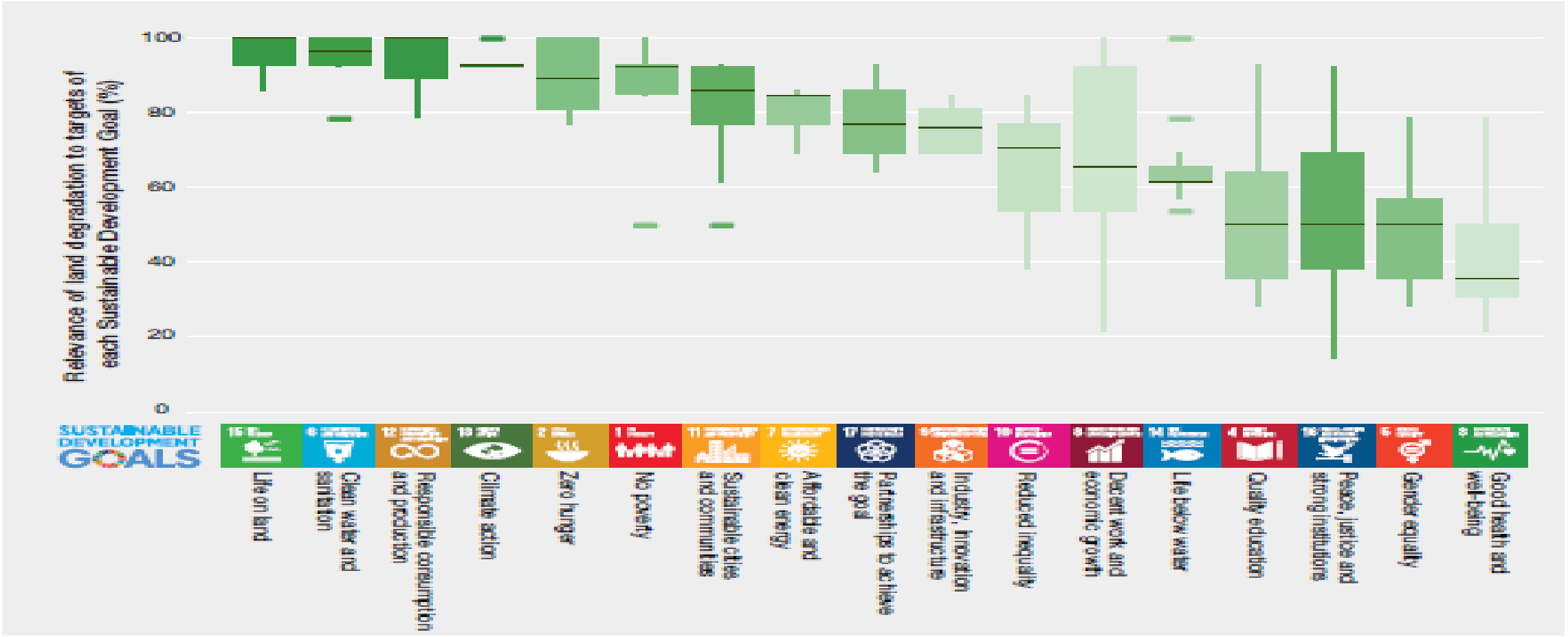
https://www.unccd.int/resources/global-land-outlook/glo2

What can we do?

Successfully addressing the Sustainable Development Goals requires simultaneously halting and reversing land degradation.



How can we keep land in balance AND navigate the inevitable SDG trade-offs?

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A balanced approach is needed.

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- One that **anticipates new degradation** even as we plan to reverse past degradation
- One that **considers tradeoffs** among competing interests across the landscape
- One that demands we do the **right things** in the **right places** at the **right scale**

LDN provides the framework for this.

Land Degradation Neutrality (LDN)

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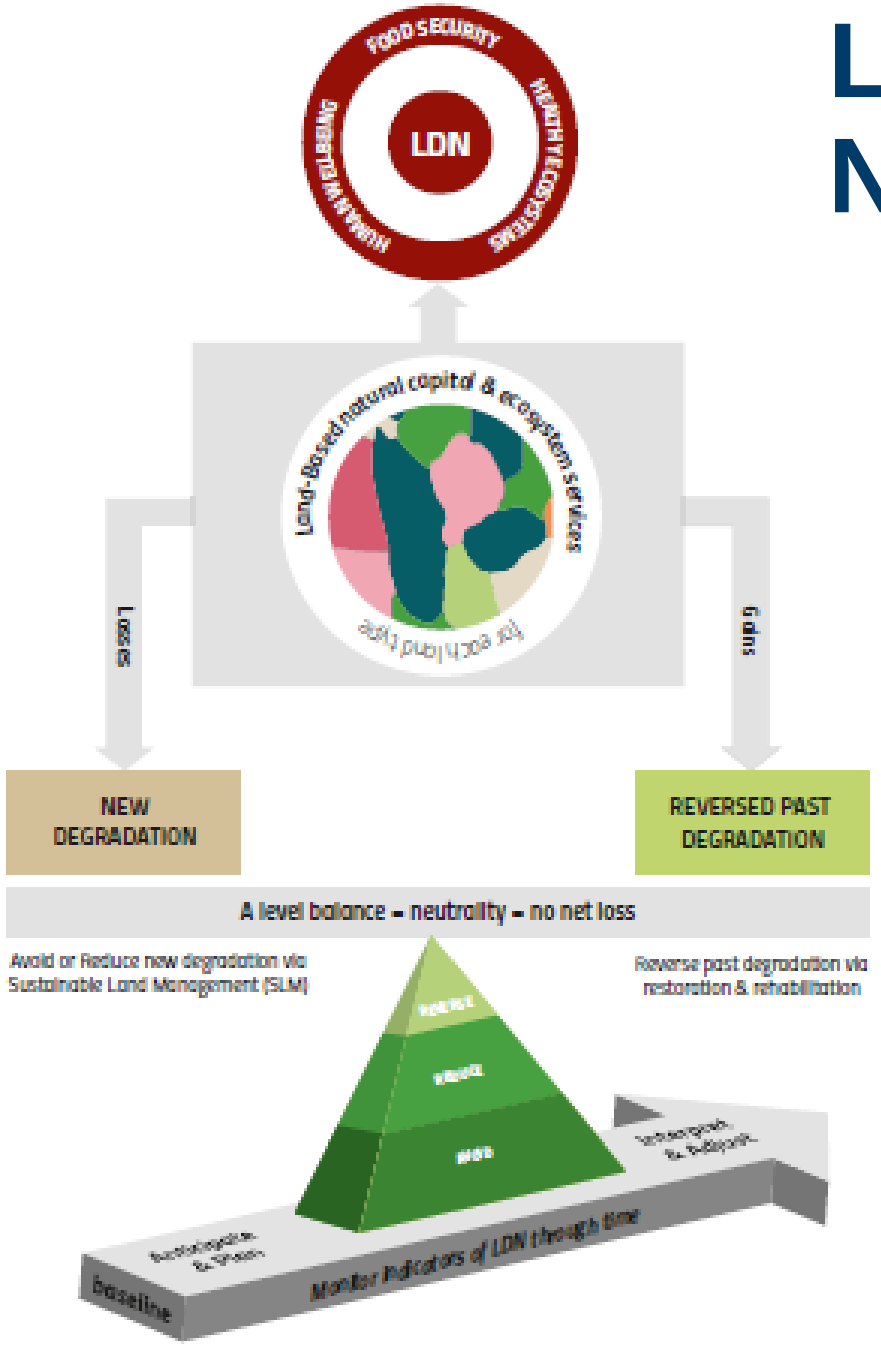
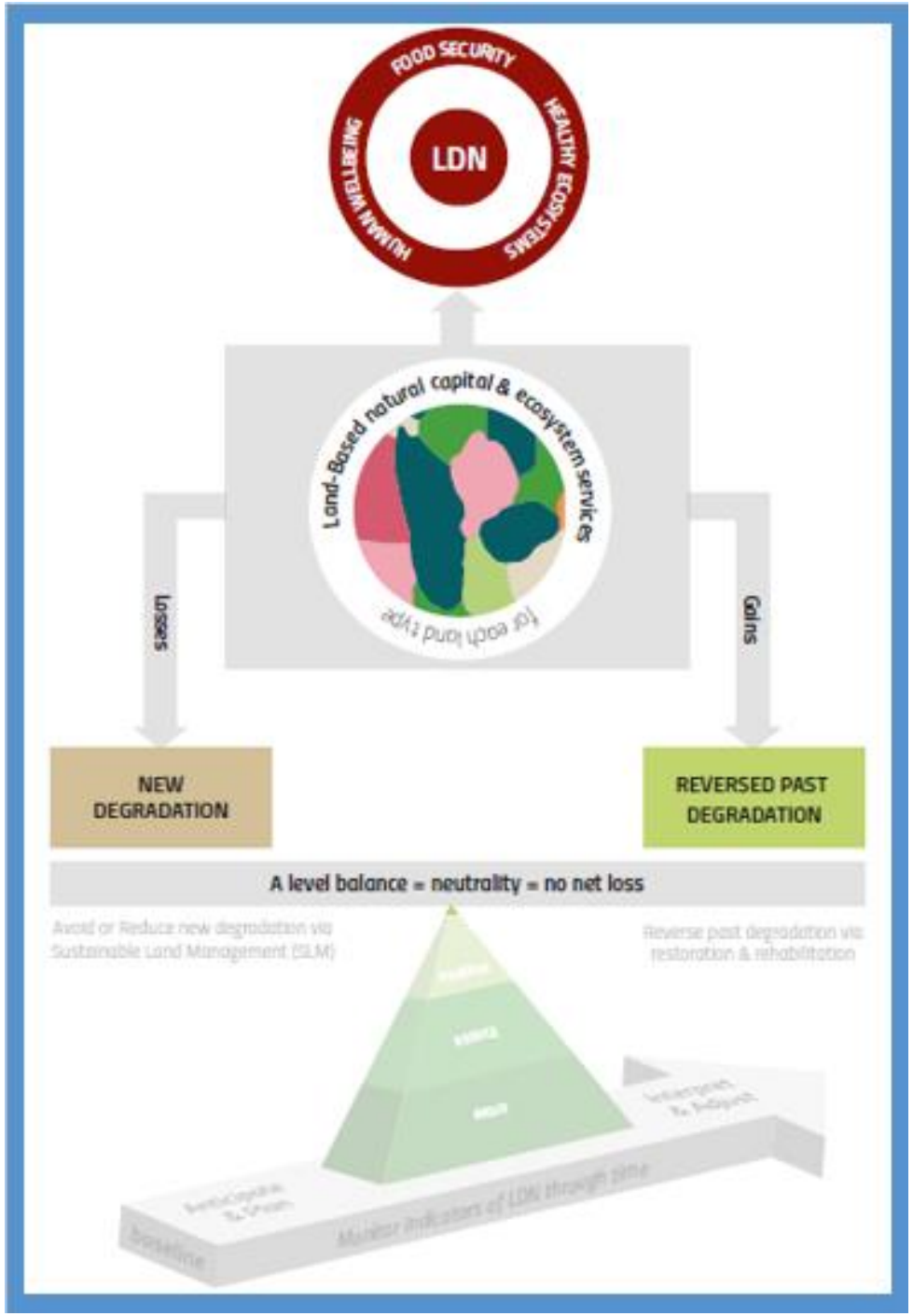


"A state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems"

LDN seeks to maintain natural capital and the ecosystem services that flow from it



Mechanism for achieving neutrality

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Neutrality = ***no net loss*** compared to the reference state (baseline)

Baseline is NOW (current condition)

Counterbalancing future land degradation (anticipated **losses**) through planned measures to achieve equivalent **gains** elsewhere within the same **land type**

“like for like”

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It is about having the right information…

…to do the right things in the right places at the right scale

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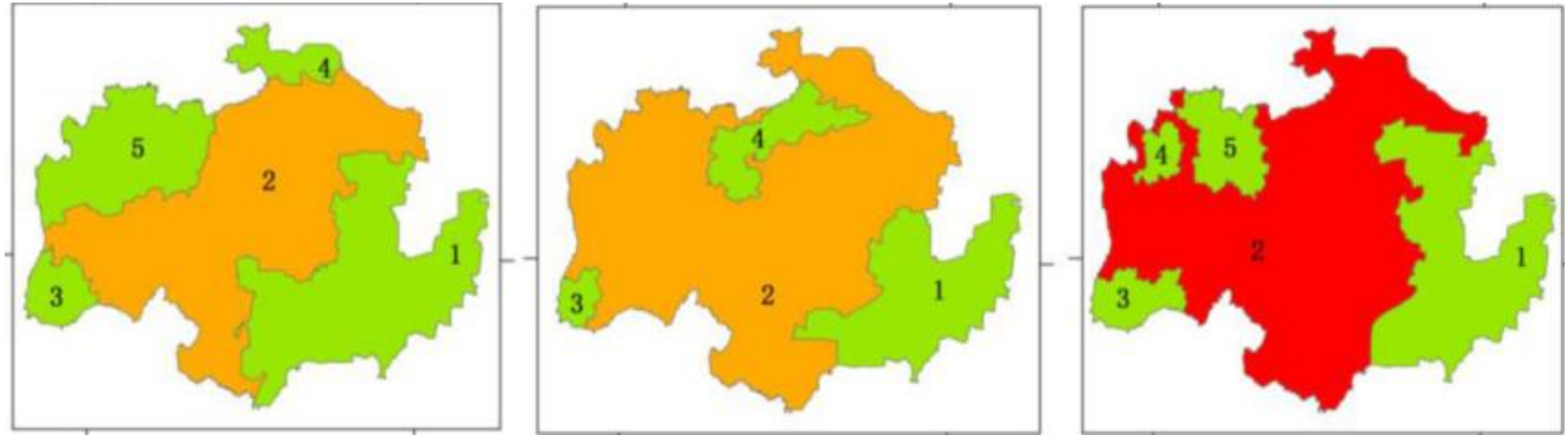
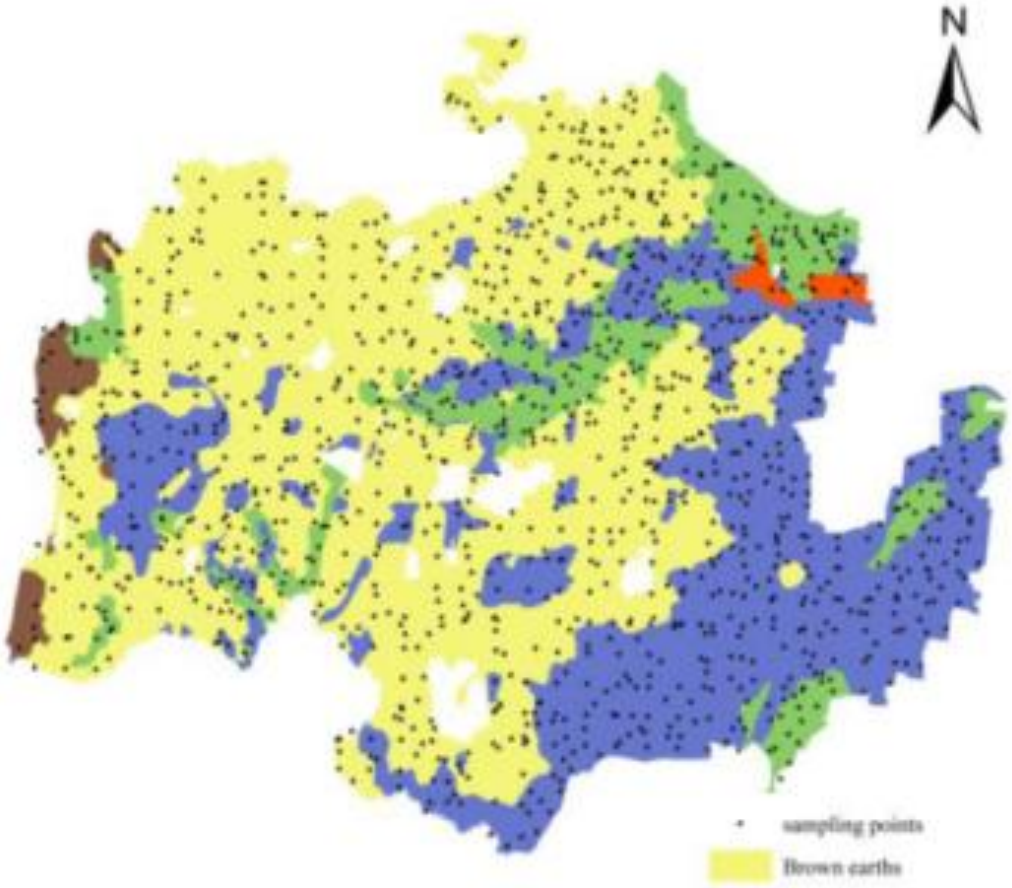


Integrated land use planning is the key to achieving LDN



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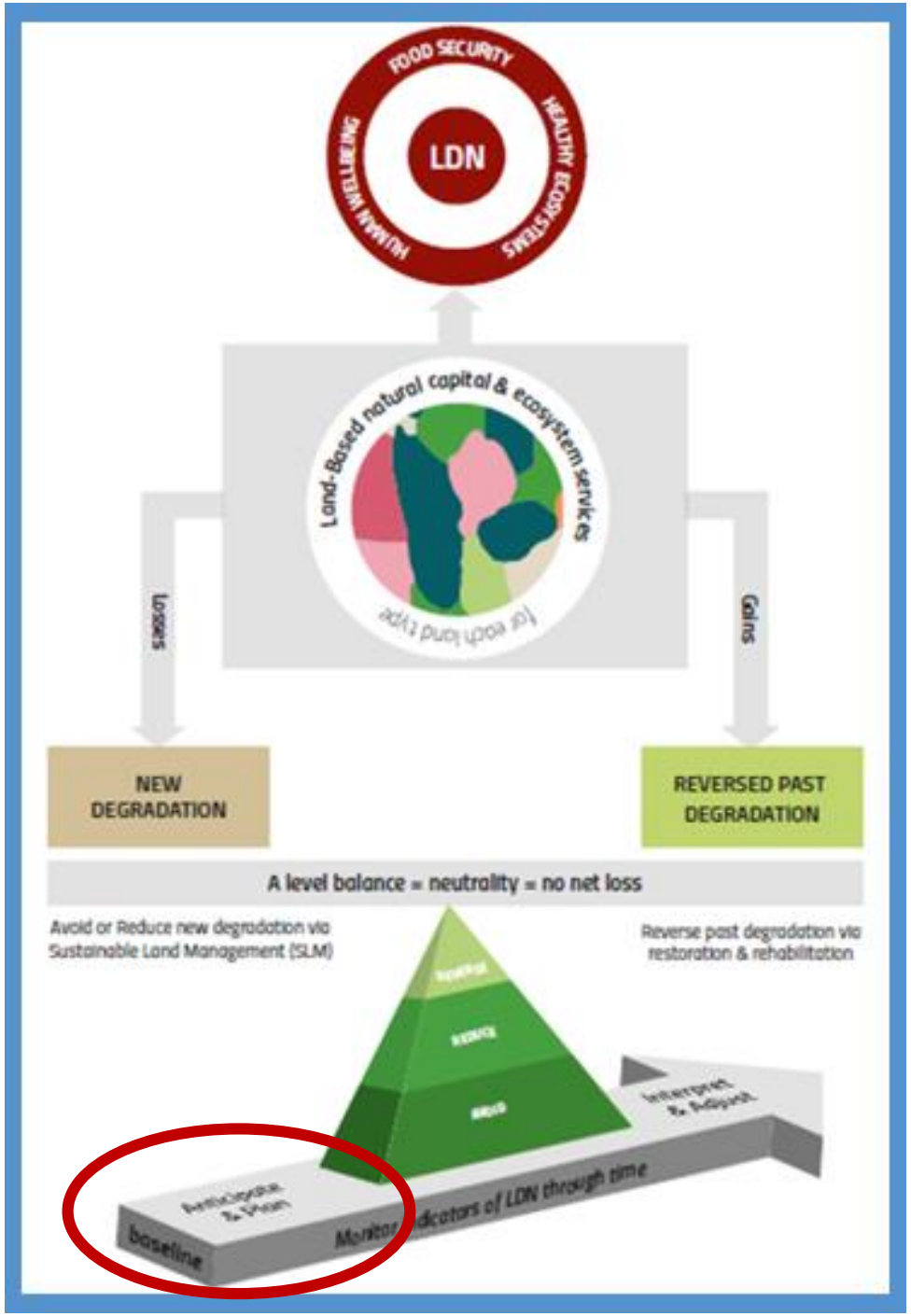
Using the best information available

- Land degradation status
- Land potential
- Resilience
- Socio-economic data
- Gender considerations

In order to

- Optimize the spatial mix of possible interventions
- Navigate trade-offs



What is does *integrated* land use planning involve?

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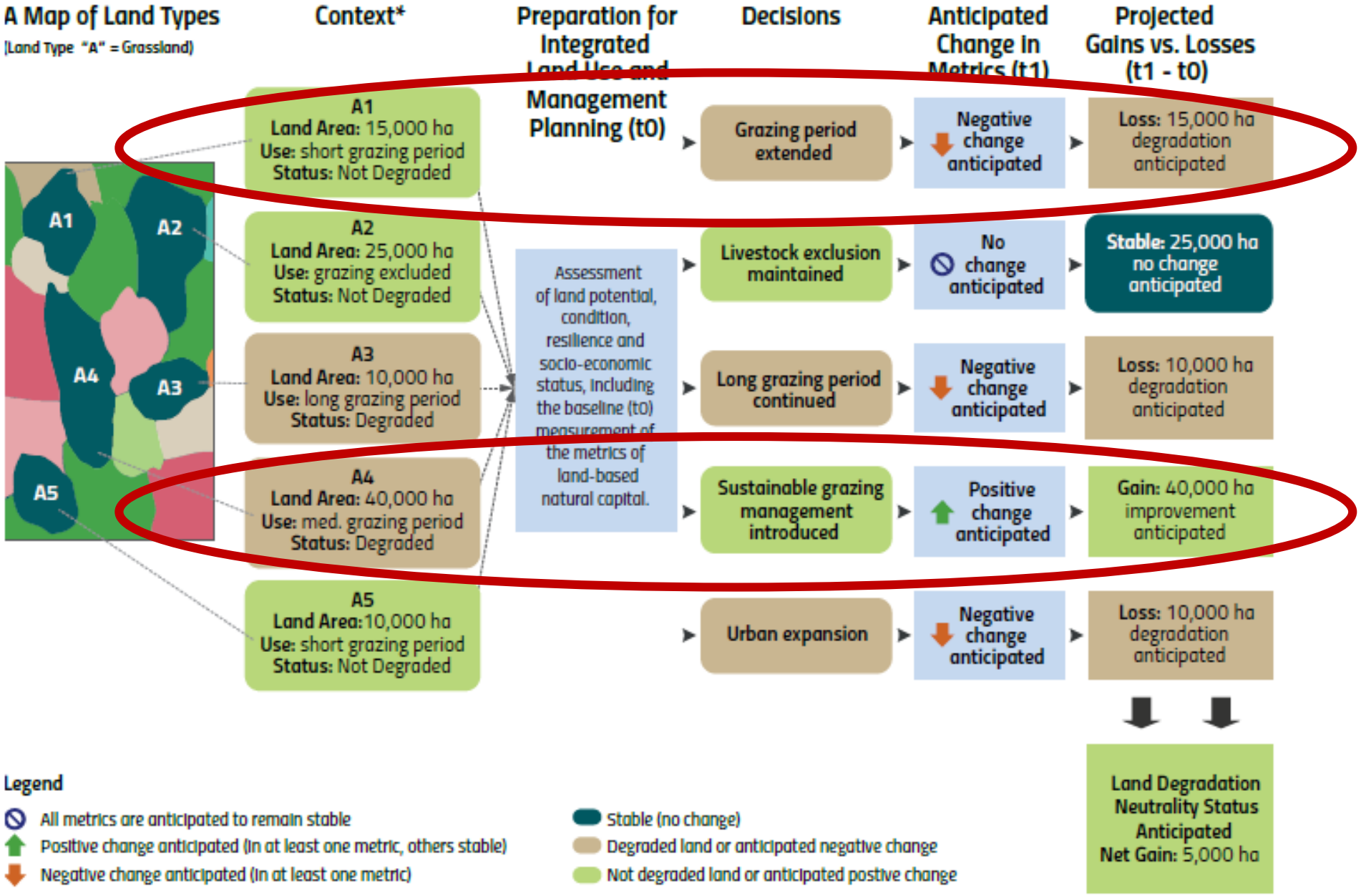
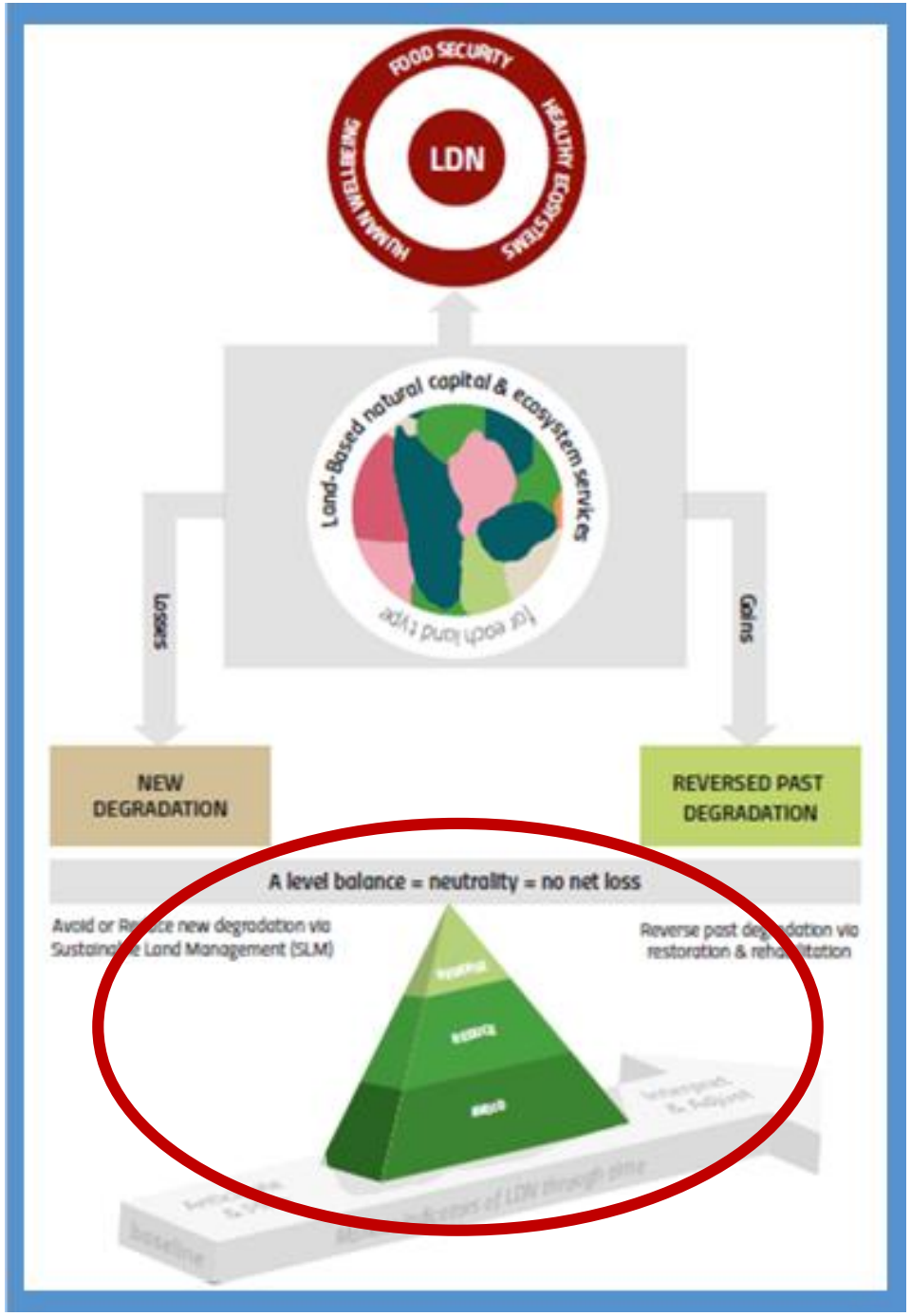
- Integrated across competing **social, economic** and **environmental** demands for land
- This involves:
  - **Anticipating** where degradation is likely to occur
  - **Modelling the inevitable tradeoffs** among competing demands on land resources, location by location
  - Identifying the **optimal mix of interventions** across the landscape
  - In order to **achieve or exceed land degradation neutrality**
- Essential to **leverage** existing land use planning processes

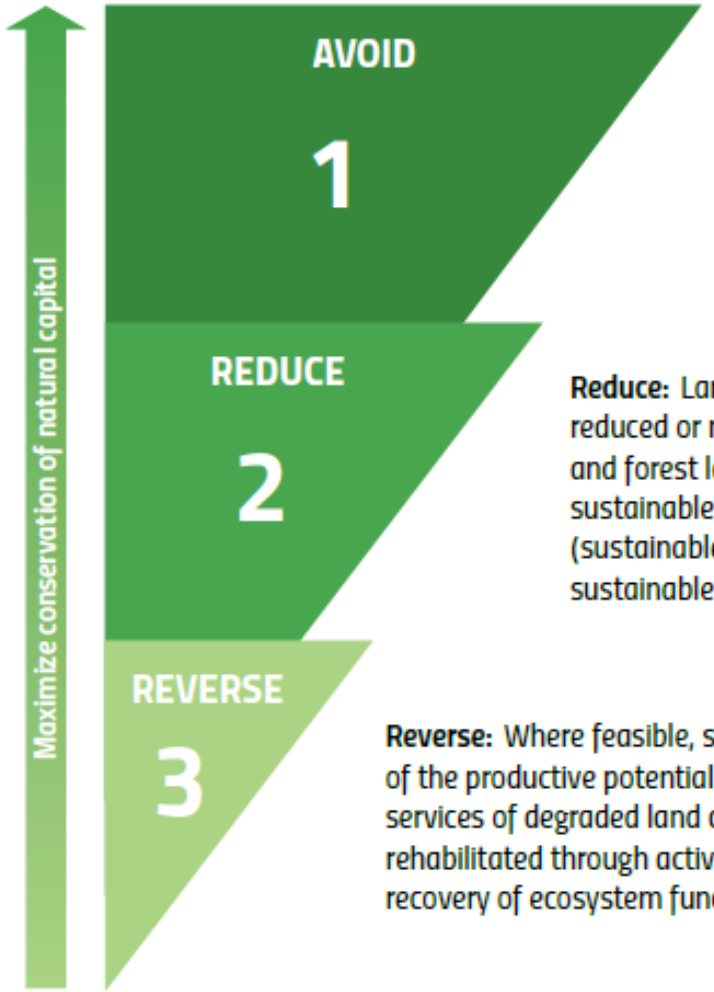
When planned gains counterbalance all projected losses, no net loss is achieved





LDN Response Hierarchy

Prevention is better than cure



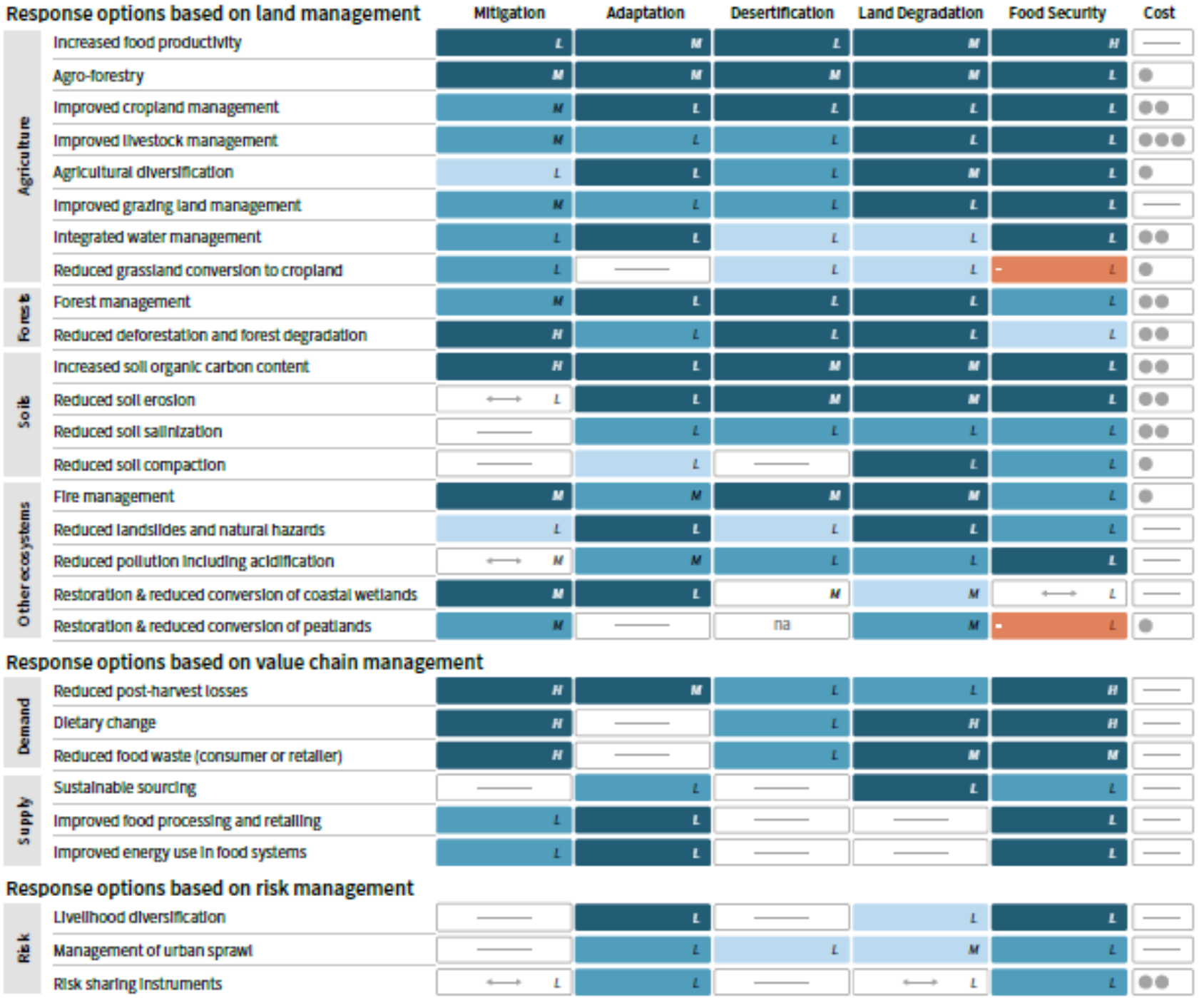
Avoid: Land degradation can be avoided by addressing drivers of degradation and through proactive measures to prevent adverse change in land quality of non-degraded land and confer resilience, via appropriate regulation, planning and management practices.

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.

Because one size does not fit all…

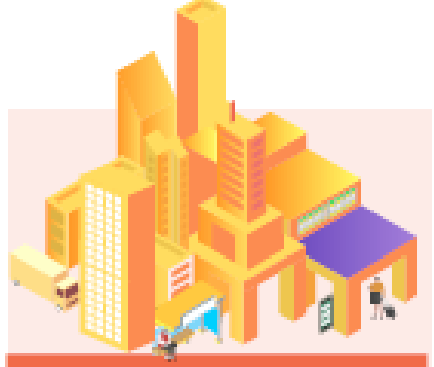
Solutions need to include different options for different contexts



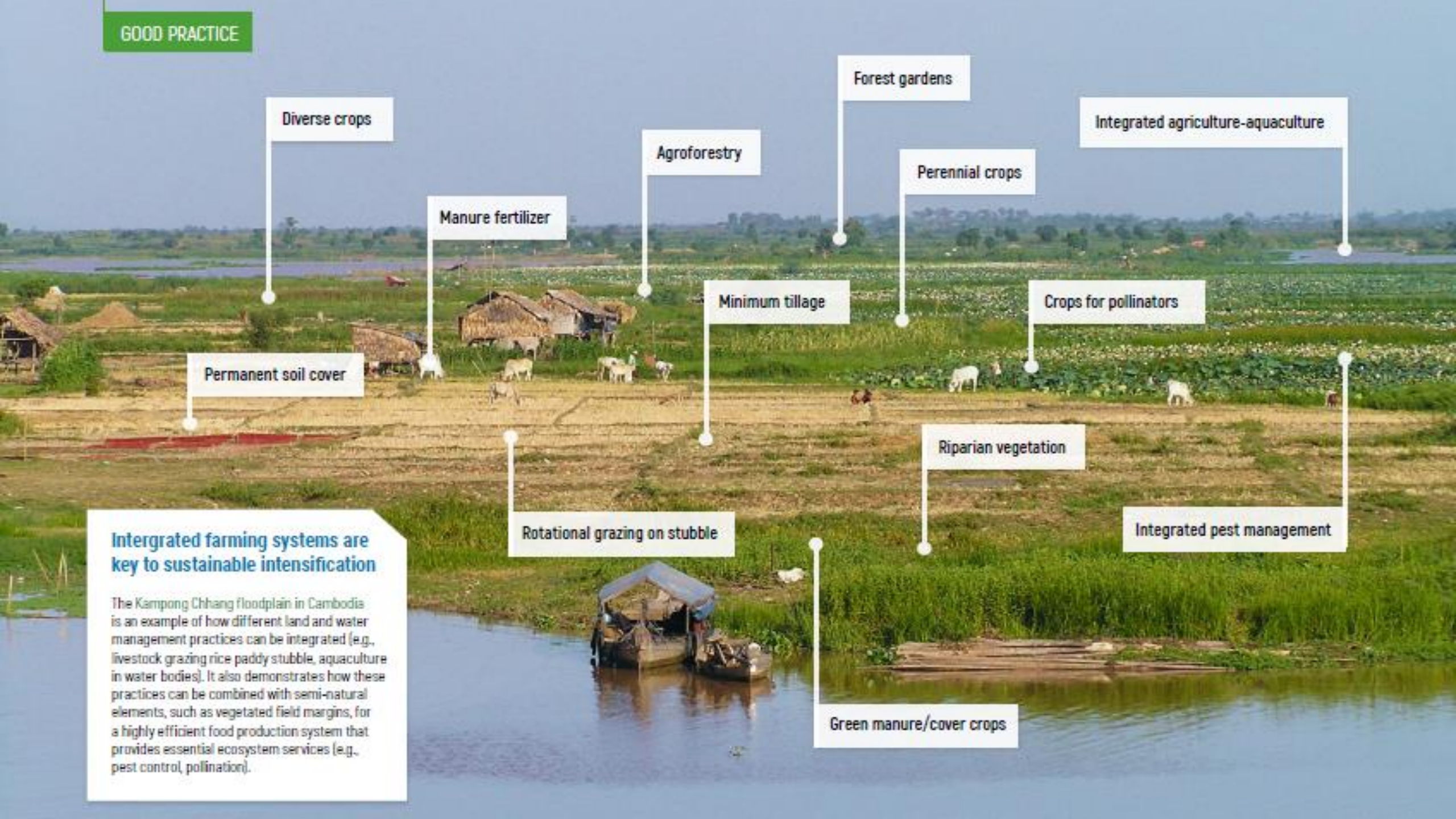
	Response options based on land management	Mitigation	Adaptation	Desertification	Land Degradation	Food Security	Cost
Agriculture	Increased food productivity	L	M	L	M	H	—
	Agro-forestry	M	M	M	M	L	●
	Improved cropland management	M	L	L	L	L	●●
	Improved livestock management	M	L	L	L	L	●●●
	Agricultural diversification	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	●●

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

Place-based approach

PLACE	 Cities/urban areas	 Urban–rural interface	 Rural/agricultural landscapes	 Natural ecosystems/ protected areas
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

GOOD PRACTICE



Intergrated farming systems are key to sustainable intensification

The Kampong Chhang floodplain in Cambodia is an example of how different land and water management practices can be integrated (e.g., livestock grazing rice paddy stubble, aquaculture in water bodies). It also demonstrates how these practices can be combined with semi-natural elements, such as vegetated field margins, for a highly efficient food production system that provides essential ecosystem services (e.g., pest control, pollination).

Effective land governance is critical

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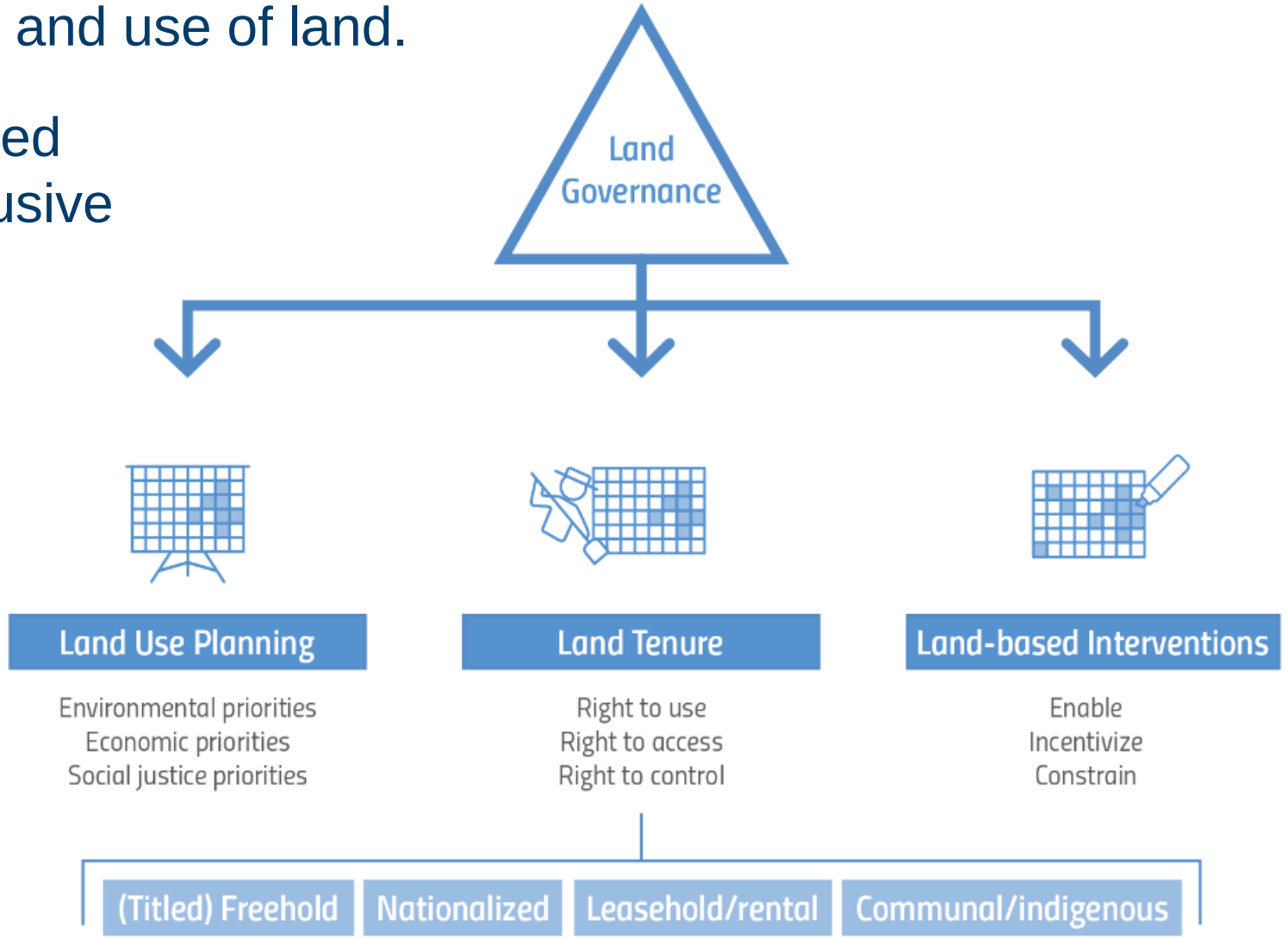
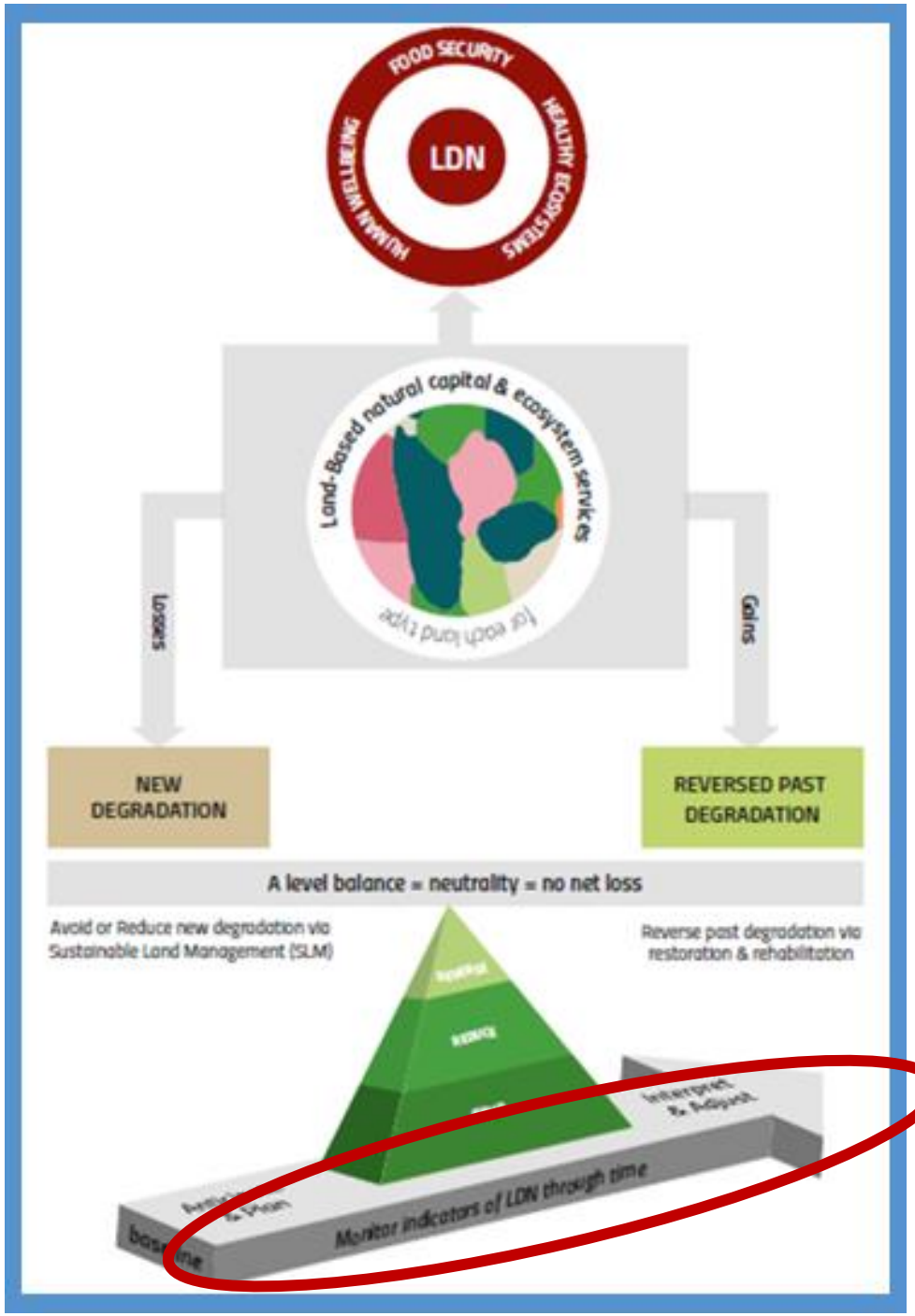
Land governance is the process by which decisions are made regarding the access to and use of land.

Decision makers need to be steered towards sustainability though inclusive and responsive land governance through:

- Effective laws and regulations
- Maximizing land tenure security
- Enhance co-benefits of improved livelihood and well-being





Monitoring and learning

LAND DEGRADATION NEUTRALITY

- Global indicators: Land cover, land productivity and soil organic carbon
- “One out, all out”, area basis
- Complemented by:
  -Locally-relevant indicators
  -Process indicators
  -Outcome indicators
- Verified using local knowledge (multi-stakeholder platforms nested across scales)

Global monitoring

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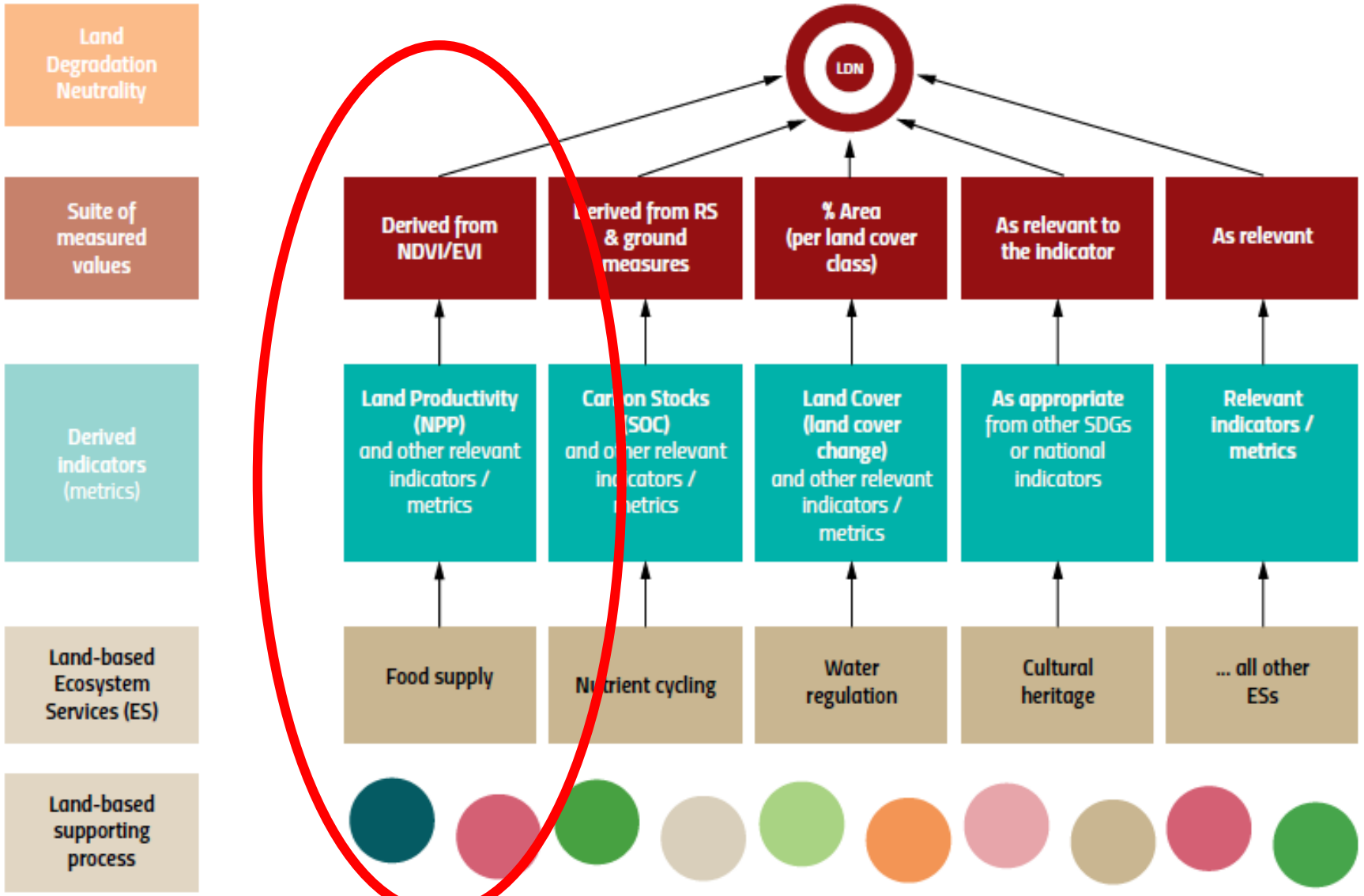
SDG Target 15.3: "By 2030, combat desertification, **restore degraded land and soil**, including land affected by desertification, drought and floods, and strive to **achieve a land-degradation neutral world**"

SDG Indicator 15.3.1: **Proportion of land that is degraded over total land area.**

Selection of indicators based on ecosystem functions that provide ecosystem services



The LDN framework does not prescribe how to measure the indicators.

It recommends effort to achieve consensus on **common criteria** and **standards** to harmonize application.

Monitor indicators relative to the baseline

What is measured & monitored?

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Three essential **land degradation** variables are measured in all countries.

Transformational variable:

Trends in land cover change

Fast ecological variable:

Land productivity dynamics

Slow ecological variable:

Trends in soil organic carbon (SOC)

Countries may also measured any other relevant indicators

Slow ecological variable: Carbon stored as soil organic matter builds healthy soil and sustains humanity

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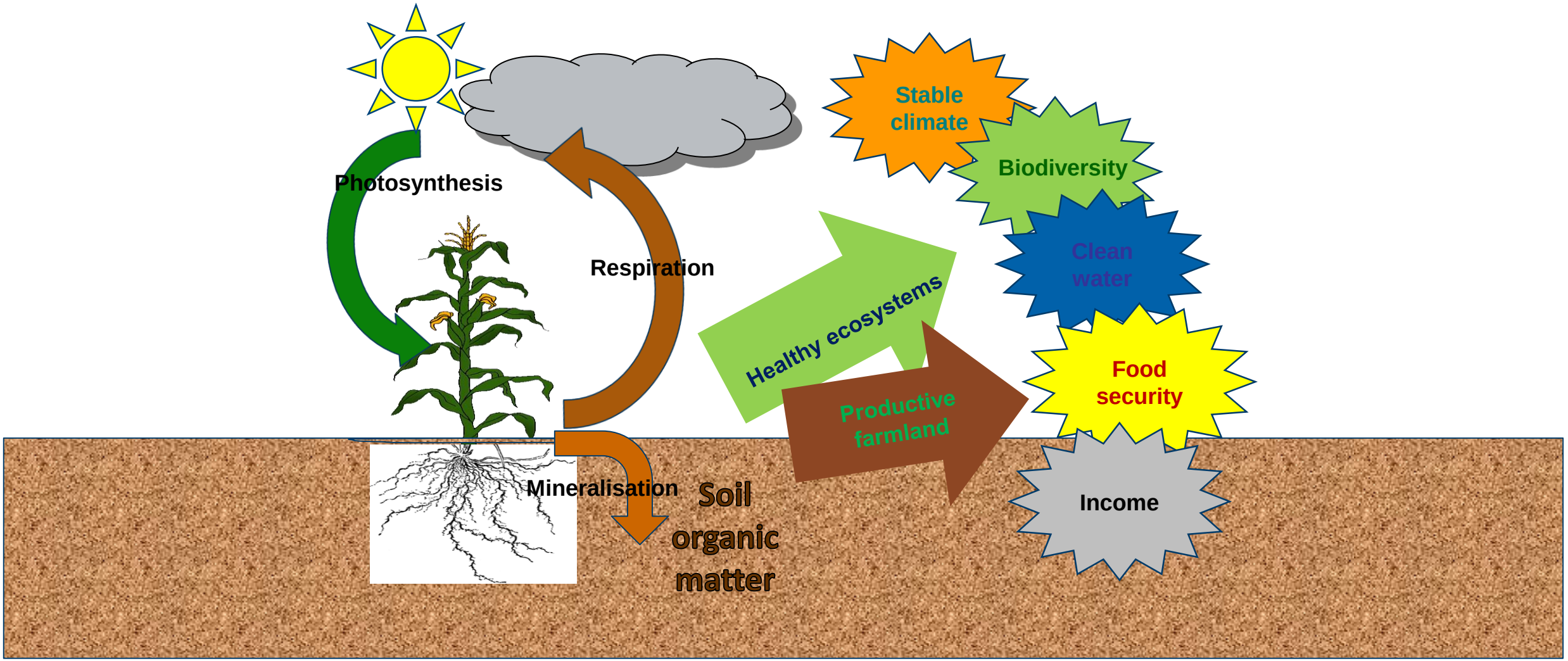

Soil organic carbon (SOC) stocks

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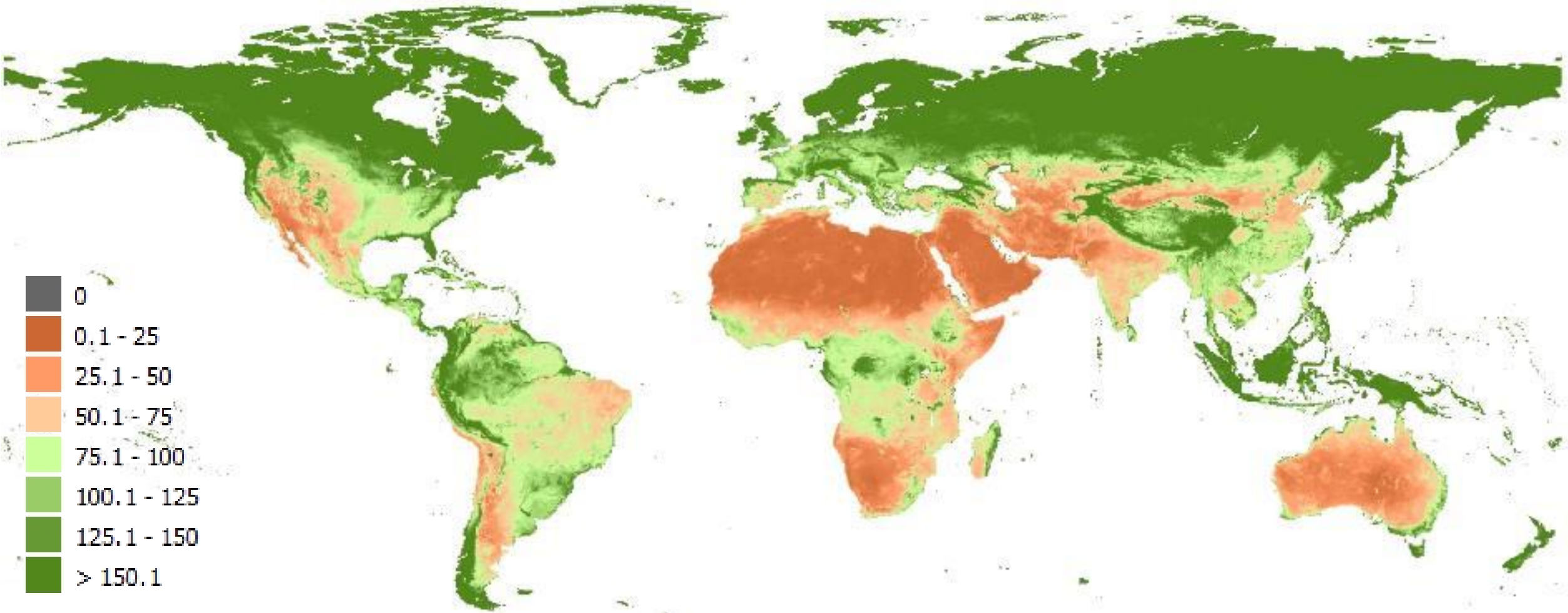

Source: International Soil Reference and Information Centre (ISRIC) SoilGrids250m dataset

Tiered approach to SOC stock estimation

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Tier 1 – General method with default values

- Default data
- Information on land cover change
- Default stock change factors

Tier 2 – Additional use of country-specific data

- Change factors
- Reference SOC stocks
- Soil types and/or land management classification systems

Tier 3 – More complex method involving ground measurements and modelling

- Recommended for countries with adequate technical capacity and data

- Countries may use one of the 3 methods documented in the IPCC guidelines to determine baseline SOC stocks and changes in SOC stocks
- Consistent with IPCC guidelines, supplements & refinements (IPCC 2006; 2013; 2019)
- It is good practice to use higher tiers for significant sources/sinks.

SDG Indicator 15.3.1
Proportion of land degraded over total land area

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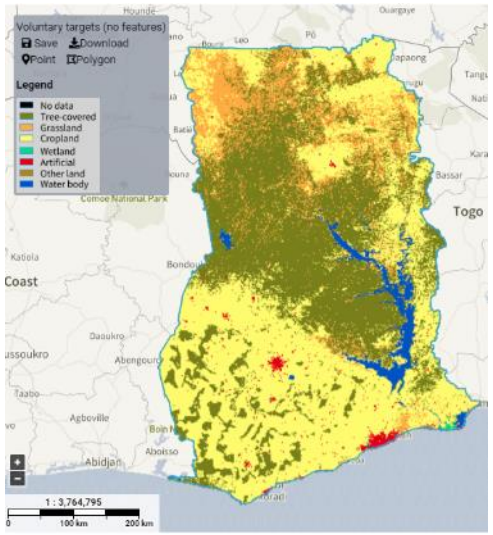
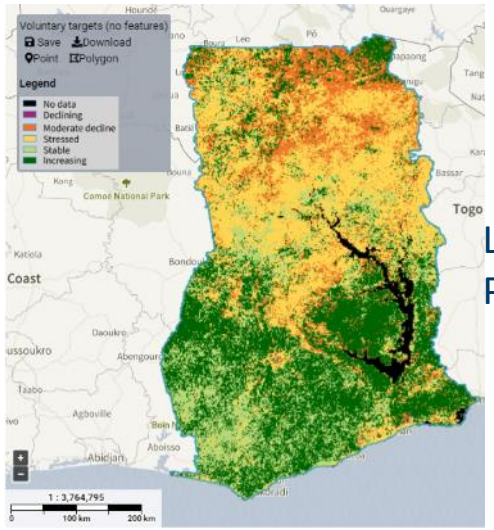
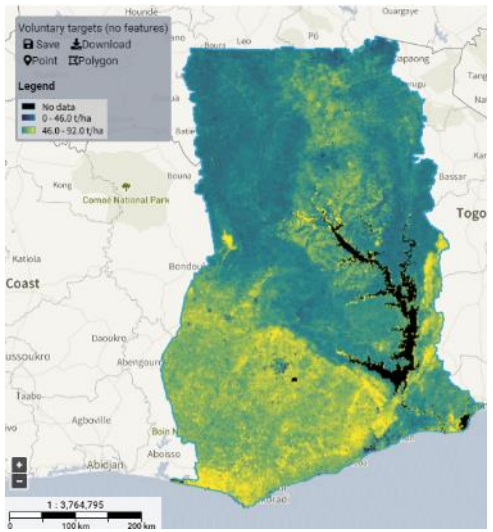
Tier 1



LAND COVER



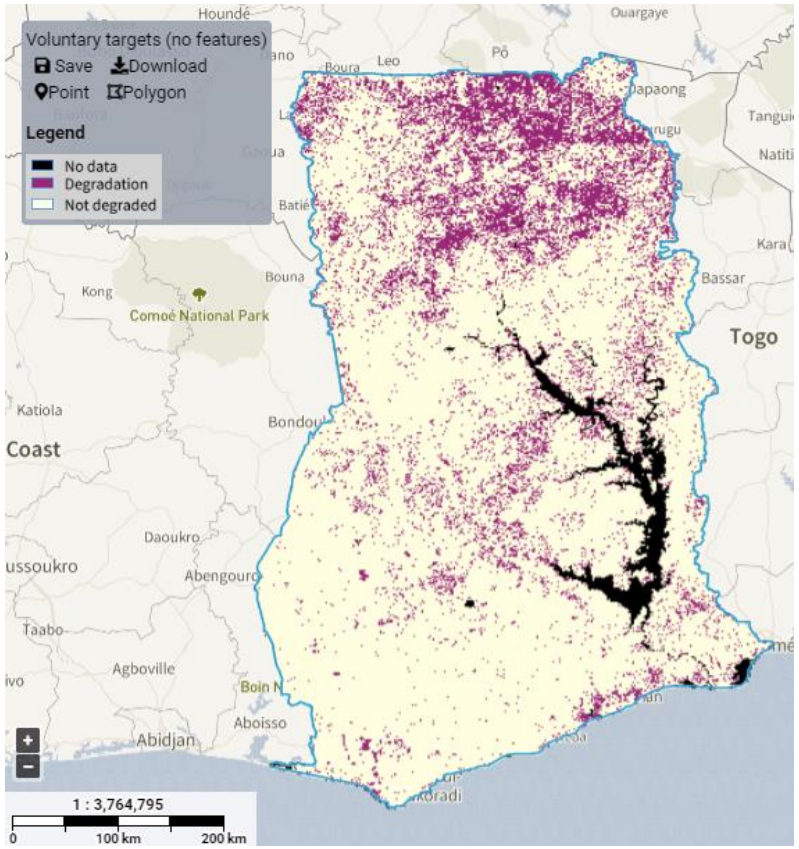
LAND PRODUCTIVITY



SOIL ORGANIC CARBON

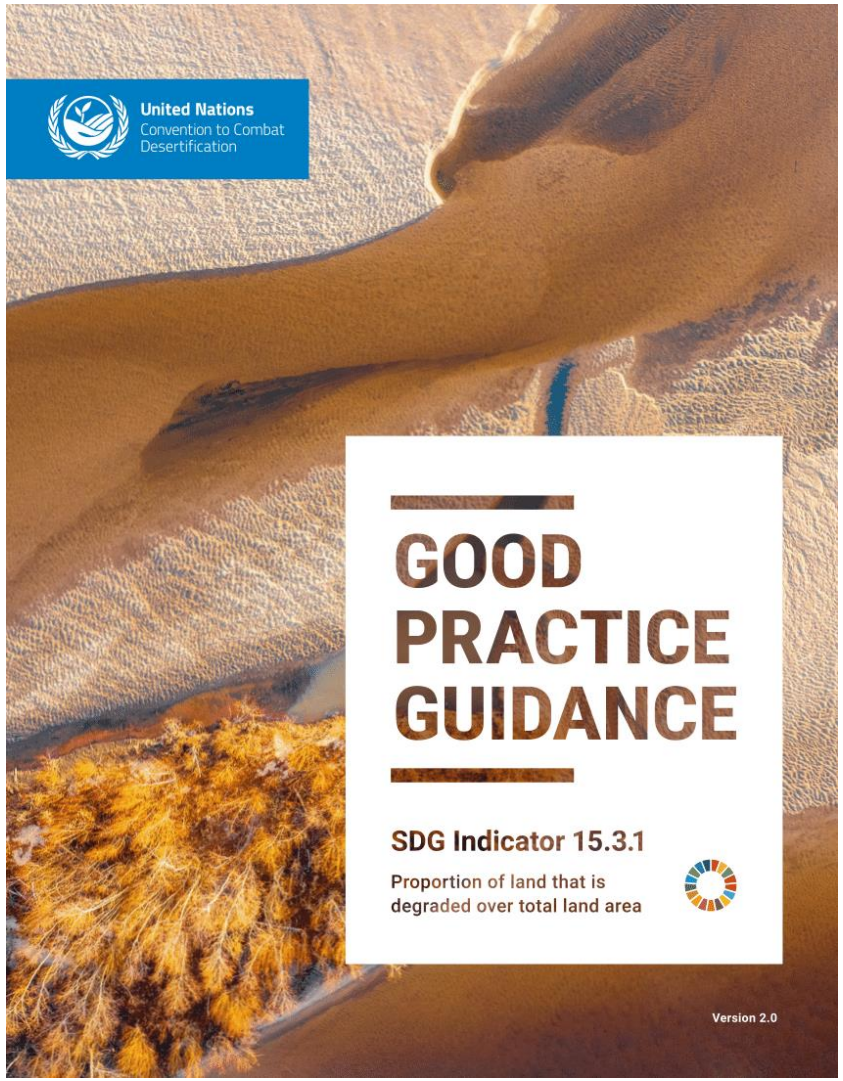
"ONE OUT ALL OUT"

→ **SDG 15.3.1**



Default data from PRAIS 4 - not validated by the country

Using globally harmonized analytical methods



- The Good Practice Guidance (GPG) provides the analytical methods for calculating SDG Indicator 15.3.1 using Earth observation data
- Includes guidance the three sub-indicators, which are trends in land cover, land productivity and soil organic carbon stocks.
- Reflects current best practice, data and knowledge
- This guidance supports implementation of the Tier I methods for Indicator 15.3.1 adopted by the UN Statistical Commission

https://www.unccd.int/resources/manuals-and-guides/good-practice-guidance-sdg-indicator-1531-proportion-land-degraded

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Data, tools and guidance for monitoring and reporting

LAND DEGRADATION NEUTRALITY

LAND DEGRADATION NEUTRALITY

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…is a unique **stakeholder-driven initiative** with a clear policy mandate from UNCCD

…helps national and local actors in all countries **use Earth observations to achieve LDN**

…promotes/supports **collaborative development, provision** & **use** of EO datasets, quality standards, analytical tools, capacity building

…**harmonizes methodologies & tools** and arrive at broad consensus to **accelerate** the achievement of **multiple benefits** from **healthy land**

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A portfolio of partners & tools are needed to support the achievement of LDN

- **Data analysis needs vary** depending on the decision context
- For example, in integrated land use planning:
  - Different phases have different requirements
  - Varying needs depending on top-down vs bottom-up, stakeholder involvement, etc.
- A **"federated" approach** allows all the opportunity to contribute

LAND DEGRADATION NEUTRALITY

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Thank you!

Some extra slides if needed…

Land cover and land cover change

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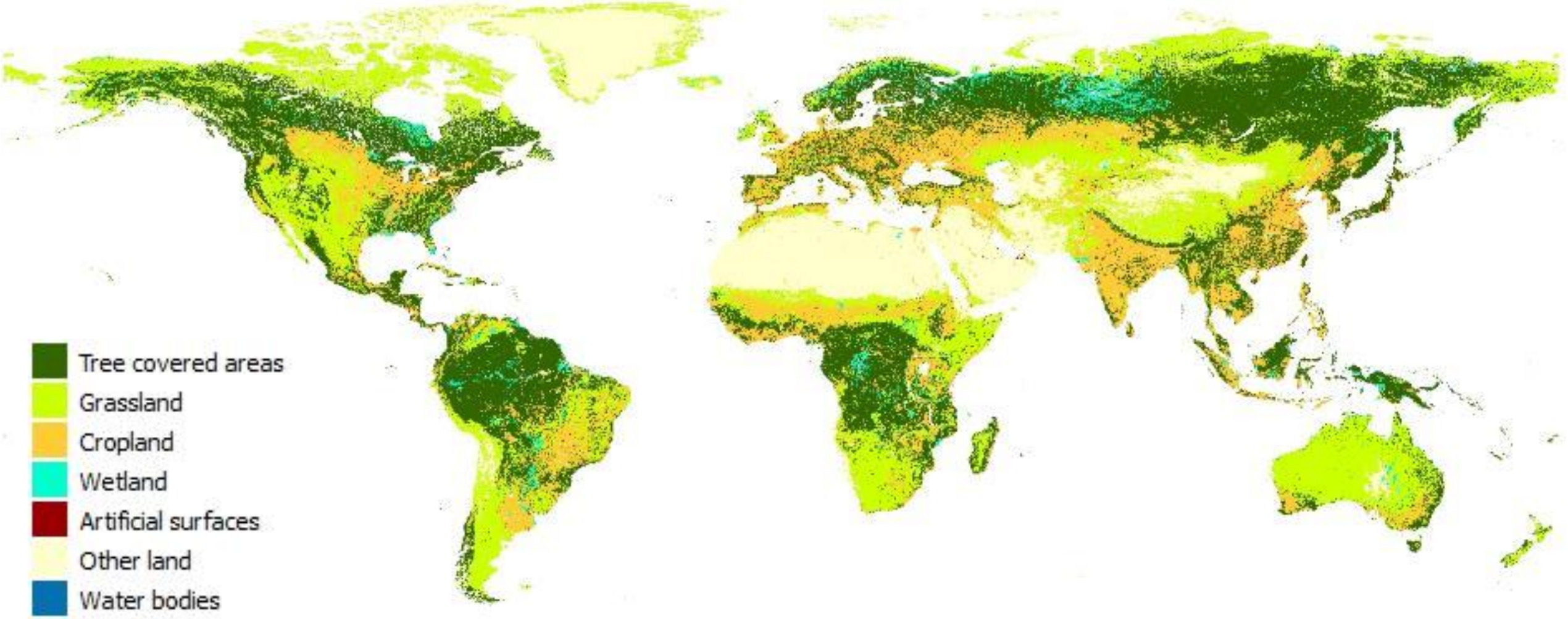

Land cover and land cover change

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The intention of the land cover sub-indicator is to identify where degradation has occurred specifically as a result of land cover change (e.g. deforestation, urban expansion, etc.)

Good practice principles to compute the land cover sub-indicator:

- **Identify key degradation processes** that should be included in the country's assessment of land degradation
- **Select a land cover legend** competent for capturing the degradation transitions identified as significant
- **Generate a transition matrix** that specifies land cover changes as being either degradation, improvement or neutral transitions

Transition matrix

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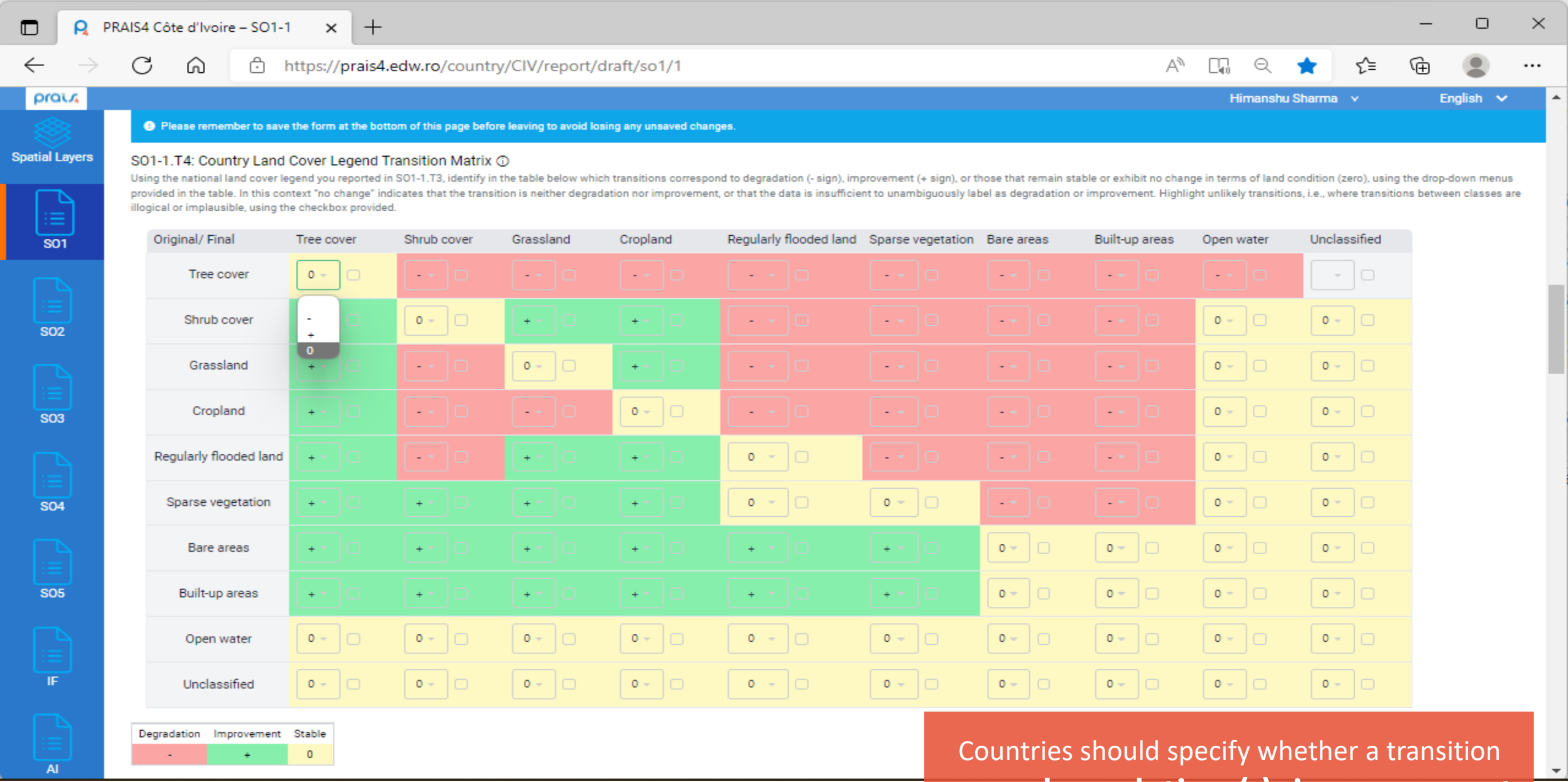
FINAL CLASS

ORIGINAL CLASS: IPCC Class	Forest Land	Grassland	Cropland	Wetlands	Settlements	Other Land
Forest Land	Stable	Vegetation loss	Deforestation	Inundation	Deforestation	Vegetation loss
Grassland	Afforestation	Stable	Agricultural expansion	Inundation	Urban expansion	Vegetation loss
Cropland	Afforestation	Withdrawal of Agriculture	Stable	Inundation	Urban expansion	Vegetation loss
Wetlands	Woody Encroachment	Wetland drainage	Wetland drainage	Stable	Wetland drainage	Wetland drainage
Settlements	Afforestation	Vegetation establishment	Agricultural expansion	Wetland establishment	Stable	Withdrawal of Settlements
Other Land	Afforestation	Vegetation establishment	Agricultural expansion	Wetland establishment	Urban expansion	Stable

Example of a land cover matrix using the IPCC classes

Improvement (green), stable (yellow) or degradation (red). Unlikely transitions are written in red

…an example only!


PRAIS4 Côte d'Ivoire – SO1-1
https://prais4.edw.ro/country/CIV/report/draft/so1/1
Himanshu Sharma
English
Spatial Layers
SO1
SO2
SO3
SO4
SO5
IF
AI
Please remember to save the form at the bottom of this page before leaving to avoid losing any unsaved changes.
SO1-1.T4: Country Land Cover Legend Transition Matrix
Using the national land cover legend you reported in SO1-1.T3, identify in the table below which transitions correspond to degradation (- sign), improvement (+ sign), or those that remain stable or exhibit no change in terms of land condition (zero), using the drop-down menus provided in the table. In this context "no change" indicates that the transition is neither degradation nor improvement, or that the data is insufficient to unambiguously label as degradation or improvement. Highlight unlikely transitions, i.e., where transitions between classes are illogical or implausible, using the checkbox provided.
Original/ Final
Tree cover
Shrub cover
Grassland
Cropland
Regularly flooded land
Sparse vegetation
Bare areas
Built-up areas
Open water
Unclassified
Degradation
Improvement
Stable
Countries should specify whether a transition causes degradation (-), improvement (+) or no change

Land productivity

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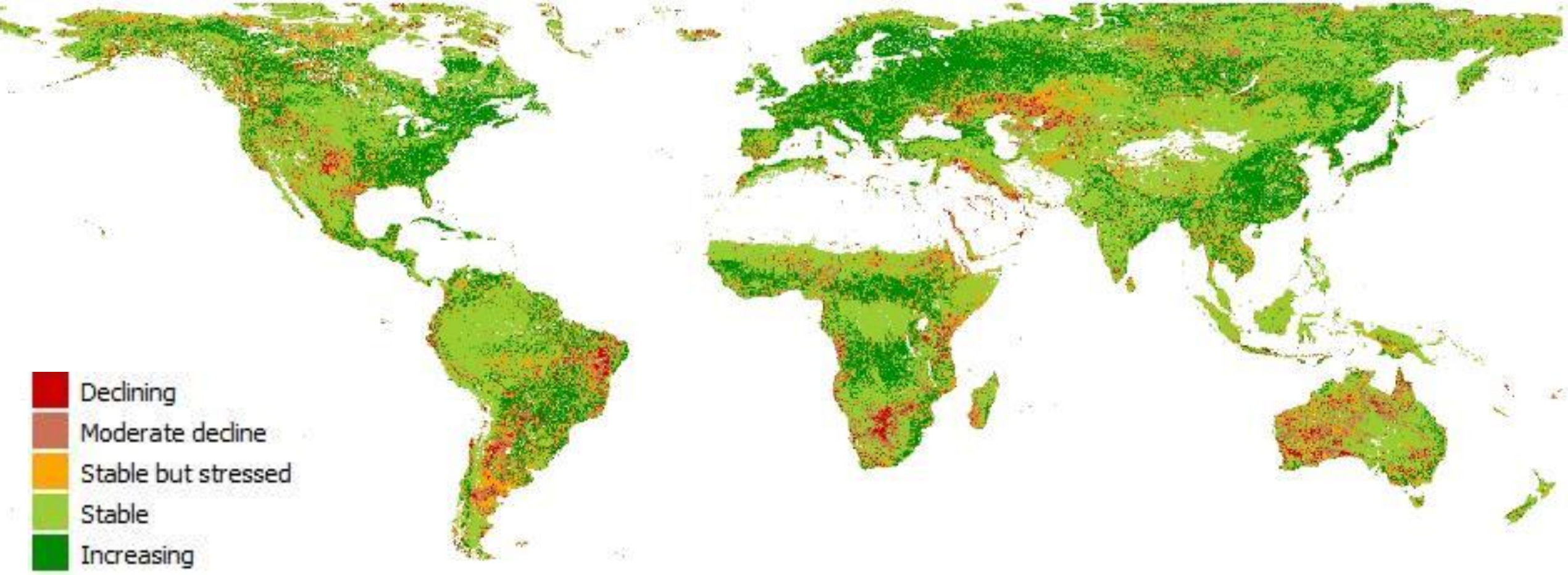

Source: Land Productivity Dynamics (LPD) dataset produced by the Joint Research Centre (JRC) of the European Commission

Land productivity

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Land productivity is the biological productive capacity of the land

It reflects long-term variations in the ecosystem functioning on plant and biomass growth

It is calculated from the Normalized Difference Vegetation Index (NDVI), considered as a proxy for net primary productivity

Land Productivity degradation dynamics

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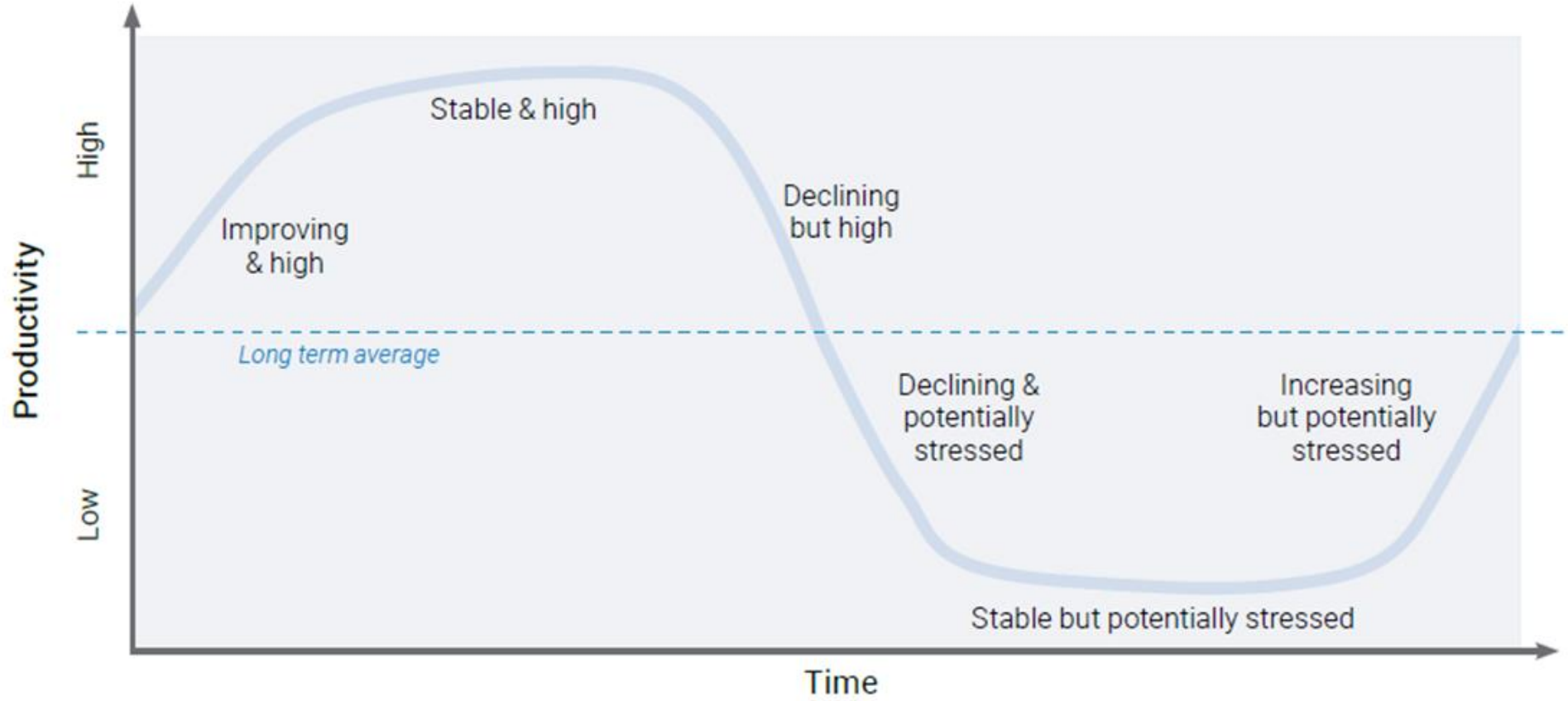
Figure 4-2
Stylised phases in the long-term average trend of land productivity. A declining trend of productivity, or productivity levels that remain below the long-term average, may indicate productivity degradation.



Trajectory and level

Land productivity metrics

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Trend

Measures the trajectory of change in annual productivity over the long term per pixel

State

Compares the current to historical annual productivity per pixel

Performance

Compares the local annual productivity with other areas having similar land productivity potential

Three productivity metrics from the **annual NDVI integral**

Land productivity dynamics

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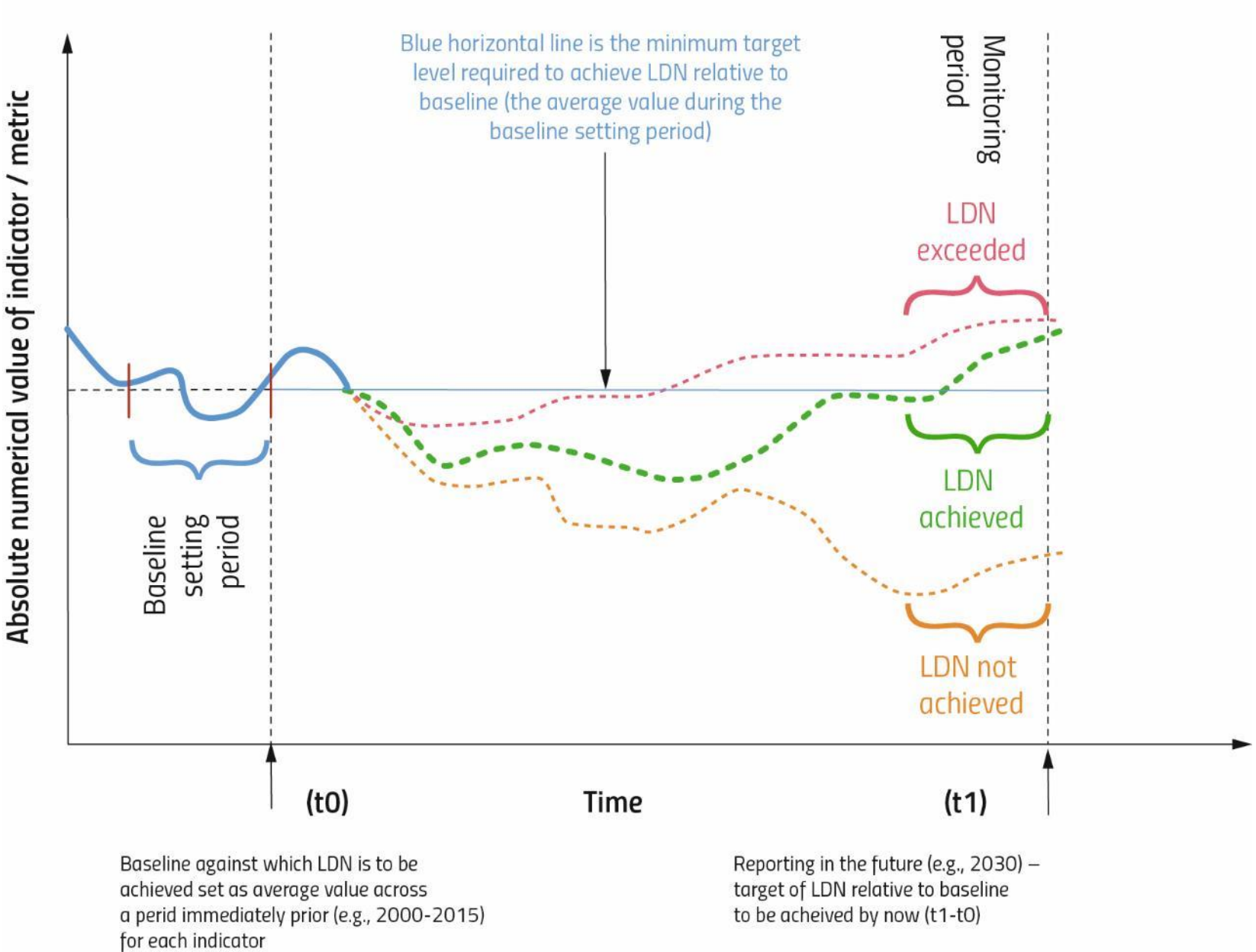
	Changes observed in the three input productivity metrics			Land productivity dynamics and land productivity degradation status derived from the combination of the three productivity metrics	
Class combination	Trend	State	Performance	Land productivity dynamics (5 classes)	Land productivity degradation status (3 classes)
1	Improving	Improving	Stable	Improving	Improving
2	Improving	Improving	Degraded	Improving	Improving
3	Improving	Stable	Stable	Improving	Improving
4	Improving	Stable	Degraded	Improving	Improving
5	Improving	Degrading	Stable	Improving	Improving
6	Improving	Degrading	Degraded	Moderate decline	Degrading
7	Stable	Improving	Stable	Stable	Stable
8	Stable	Improving	Degraded	Stable	Stable
9	Stable	Stable	Stable	Stable	Stable
10	Stable	Stable	Degraded	Stressed	Stable
11	Stable	Degrading	Stable	Moderate decline	Degrading
12	Stable	Degrading	Degraded	Degrading	Degrading
13	Degrading	Improving	Stable	Degrading	Degrading
14	Degrading	Improving	Degraded	Degrading	Degrading
15	Degrading	Stable	Stable	Degrading	Degrading
16	Degrading	Stable	Degraded	Degrading	Degrading
17	Degrading	Degrading	Stable	Degrading	Degrading
18	Degrading	Degrading	Degraded	Degrading	Degrading

Productivity metrics can be combined to determine five classes of land productivity dynamics and three classes of land productivity degradation

LDN target = baseline



In order to maintain neutrality, the baseline becomes the target to be achieved

Baseline: the land-based natural capital as measured by a set of globally agreed LDN indicators at t0

Neutrality is usually the minimum objective

One out all out rule

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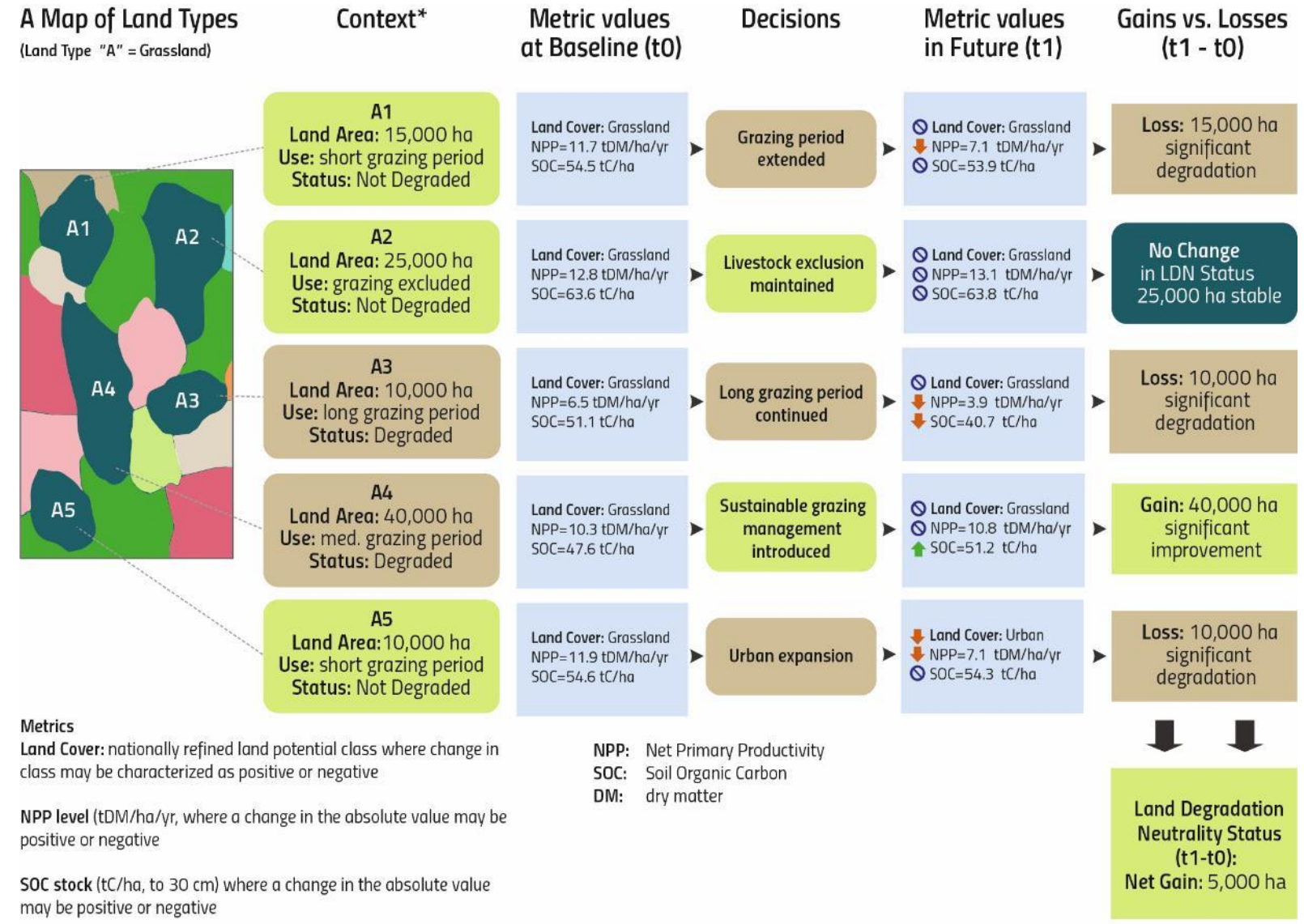
If one of the sub-indicators shows significant reduction or negative change (or is stable when degraded in the baseline or previous reporting period) for a particular land unit, then it would be considered as degraded subject to validation by national authorities

Sub indicator			Indicator
Land cover	Productivity	SOC	Degraded
Y	Y	Y	Y
Y	Y	N	Y
Y	N	Y	Y
Y	N	N	Y
N	Y	Y	Y
N	Y	N	Y
N	N	Y	Y
N	N	N	N

$$A(Degraded)_{i,n} = A(persistent)_{i,n} + A(recent)_{i,n} - A(improved)_{i,n}$$

A(persistent)i,n = Areas of land that have persisted in a degraded state since the baseline period,
A(recent)i,n = Areas that have degraded since the baseline period
A(improved)i,n = Areas that have improved from a degraded state to a non-degraded state since the baseline period.

How do we link SDG Indicator 15.3.1 to the achievement of LDN?



Compare the proportion of degraded land to improved land (losses vs. gains)

Remember counterbalancing, i.e. a gain in one land type cannot counterbalance a loss in a different land type