Land Degradation Neutrality (LDN)

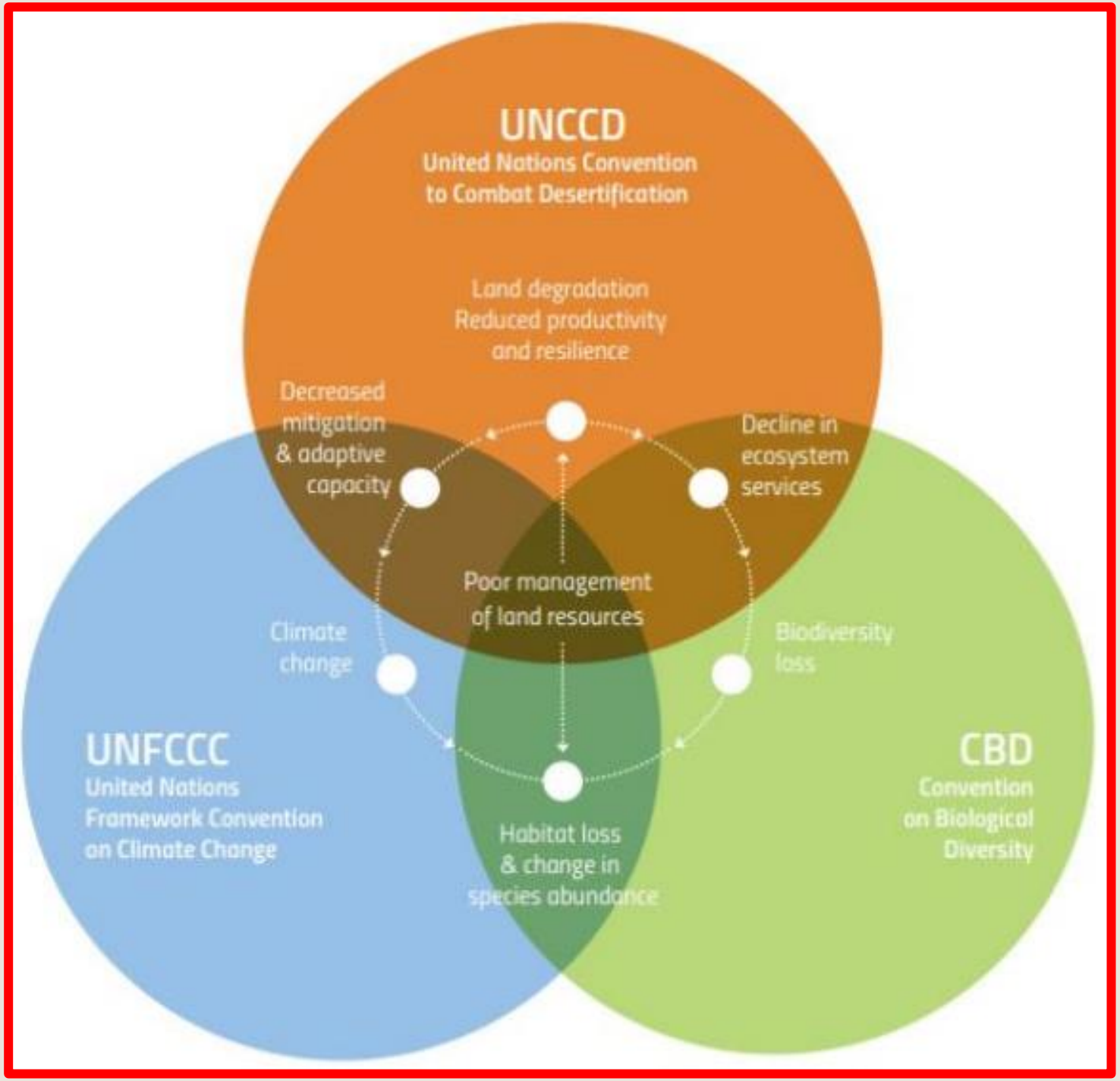
Prof. Dr. Günay Erpul
Ankara University

The LDN Concept

Following the 1992 Rio Earth Summit, the international community established three conventions to enable sustainable development: The United Nations Framework Convention on Climate Change **(UNFCCC)**; the Convention on Biological Diversity **(CBD)**; and the United Nations Convention to Combat Desertification **(UNCCD)**.

The LDN concept was first brought to international attention in 2012 through the document 'Zero Net Land Degradation: A New Sustainable Development Goal (SDG) for Rio+20' (Lal, Safriel, and Boer 2012).

The UNCCD used this document to advocate the inclusion of a reference to the LDN in the Rio+20 outcome document 'The Future We Want' (Chasek et al. 2015; UN 2012).



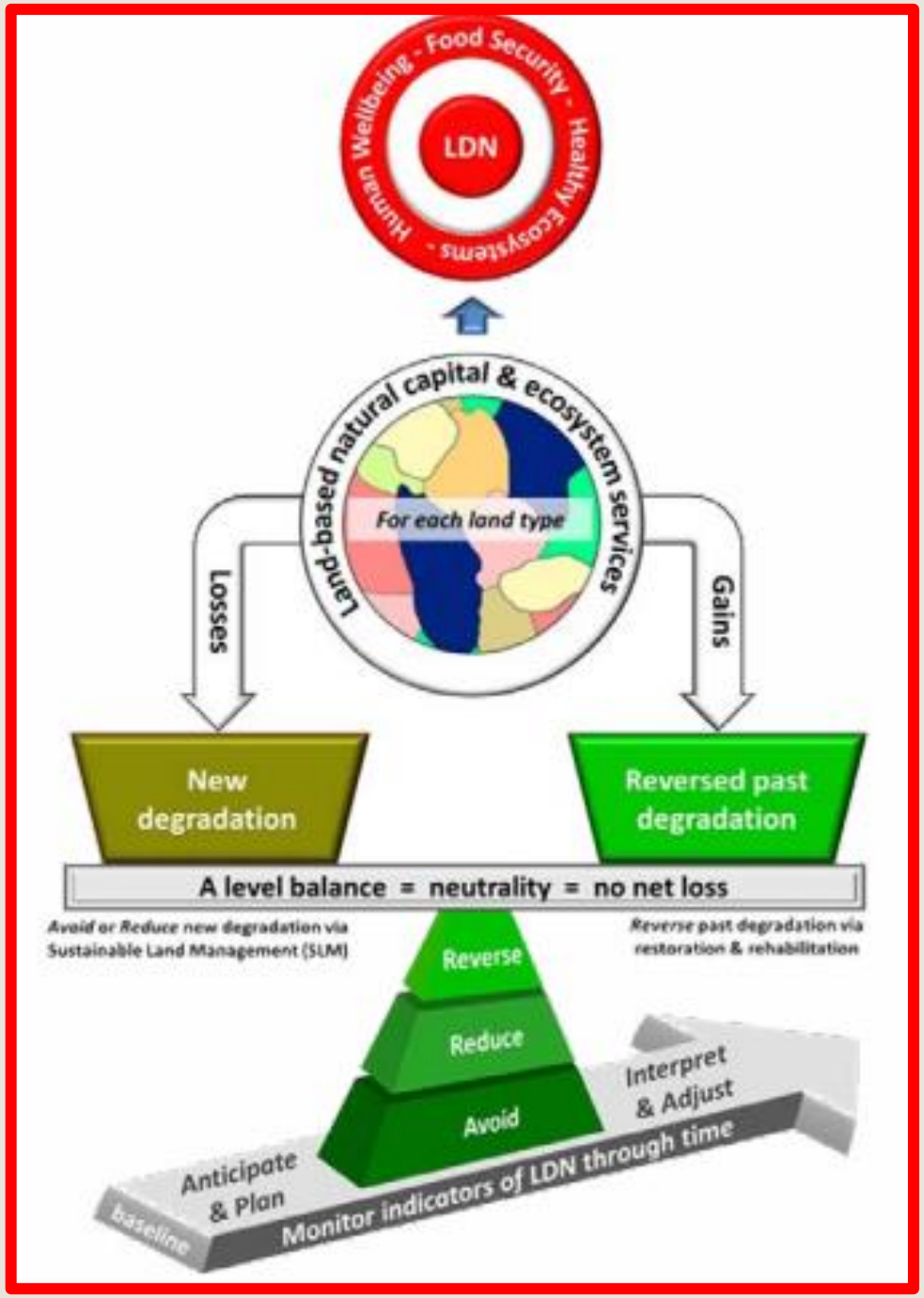
Intertwined threats and the objectives of the Rio conventions

The three Rio Conventions are the result of concerns over similar environmental and development issues and have sustainable development at their hearts.

UNCCD (2017)

Definition of LDN

The United Nations Convention to Combat Desertification (UNCCD) defines land degradation neutrality as "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"



The overarching concept of LDN, the key elements of the conceptual framework, and their interrelationships

The LDN

This paved the way for LDN to be adopted as SDG Target 15.3 which states ‘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’ (UN 2015).

The 12th Conference of the Parties to the UNCCD (COP 12) subsequently integrated LDN into the UNCCD process in October 2015.

The UNCCD secretariat has since become the custodian agency for SDG indicator 15.3.1 on LDN, meaning that national LDN reports for the UNCCD are also used to report to the High-level Political Forum on Sustainable Development (UNCCD 2017).

5 Strategic Objectives of the UNCCD 2018 – 2030 Strategic Framework

Strategic objective 1: To improve the condition of affected ecosystems, combat desertification/land degradation, promote sustainable land management and contribute to land degradation neutrality,

Strategic objective 2: To improve the living conditions of affected populations,

Strategic objective 3: To mitigate, adapt to, and manage the effects of drought in order to enhance resilience of vulnerable populations and ecosystems,

Strategic objective 4: To generate global environmental benefits through effective implementation of the UNCCD,

Strategic objective 5: To mobilize substantial and additional financial and non-financial resources to support the implementation of the Convention by building effective partnerships at the global and national level.

Four Building Blocks for LDN Target Setting

Leveraging LDN: facilitating the engagement of decision makers and stakeholders involved in land management and the LDN target-setting process,

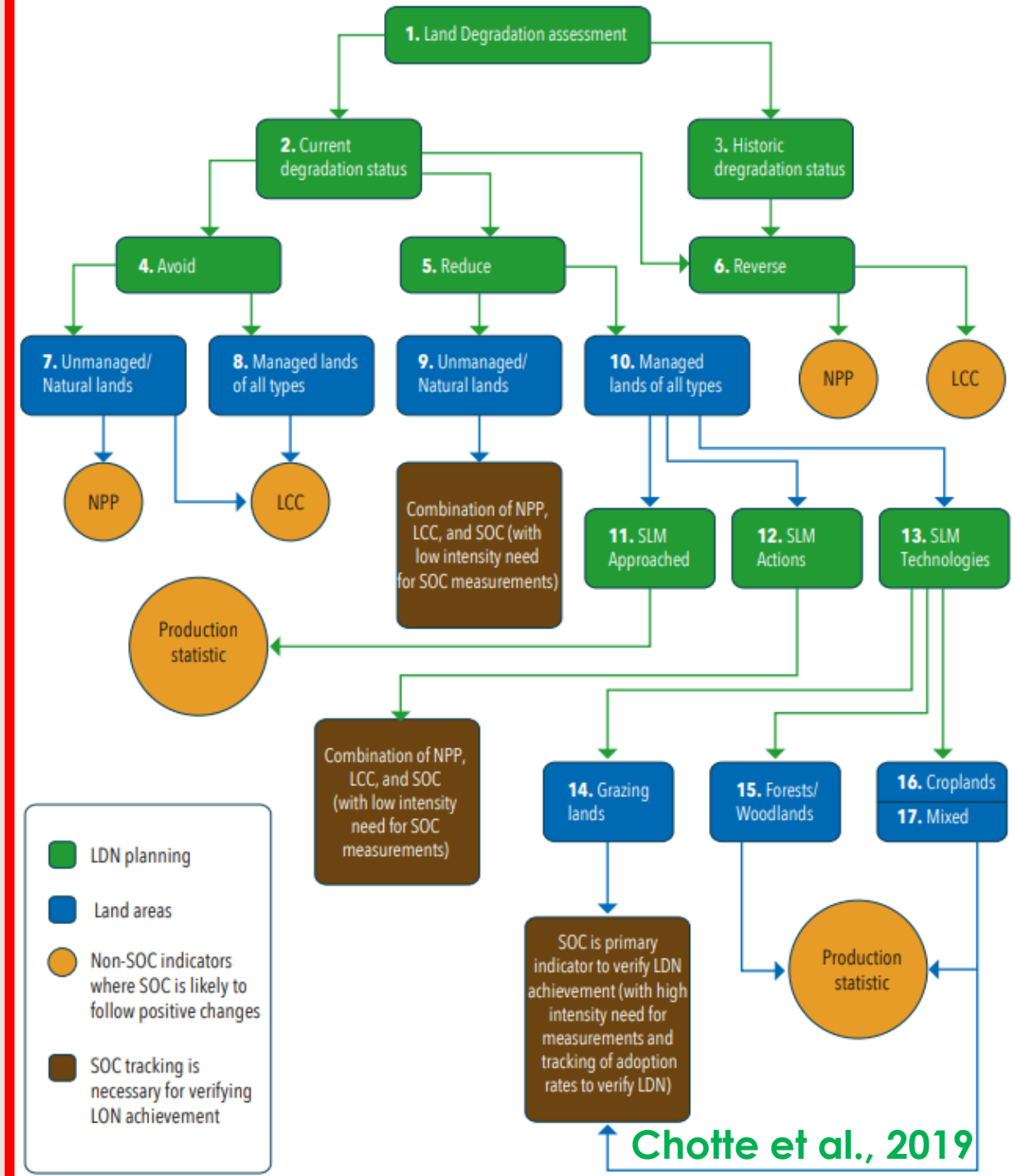
Assessing LDN: strengthening countries' capacities for making informed decisions on what action to take by assessing the current state of land and the drivers of land degradation, using the best available data,

Setting LDN targets and associated measures: supporting countries to define the country's ambitions in combating land degradation by defining LDN targets and measures,

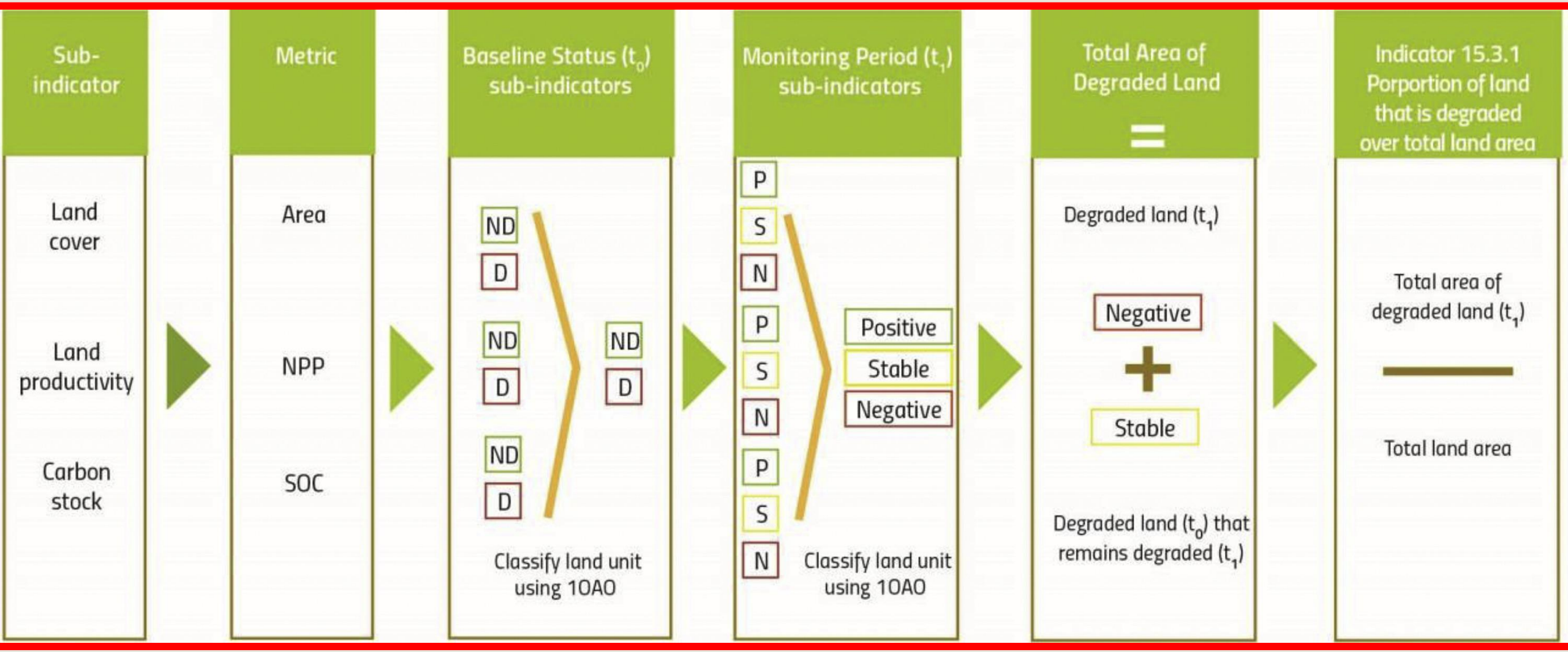
Achieving LDN: helping countries to create an enabling environment by integrating LDN into national policies and identifying investment opportunities along with transformative LDN programs and projects.

Key sites for monitoring soil organic carbon (SOC; brown) in the context of other indices of tracking land degradation neutrality (LDN; orange), as distributed across degradation status following land degradation assessment and response actions (green) by land types (blue).

Intensive SOC monitoring is needed in lands that are more variable and where SOC is the key indicator for LDN (i.e. where land cover and net primary productivity [NPP] are not expected to change, or where soil carbon trading is undertaken). Production statistics are related to NPP and can be valuable as an indicator of LDN.



To calculate SDG indicator 15.3.1, the sub-indicators are combined to determine the degradation status at the indicator level, and the results are spatially aggregated to calculate the extent of degraded land over total land area



Steps to derive SDG indicator 15.3.1 from the sub-indicators. ND is not degraded and D is degraded. 1OAO is the 'one-out, all-out' principle for combining indicators

Sub Indicator 1. Land Cover and Change

The land cover and land cover change sub-indicator involves defining transitions from one land cover type to another as either improving, stable or degraded.

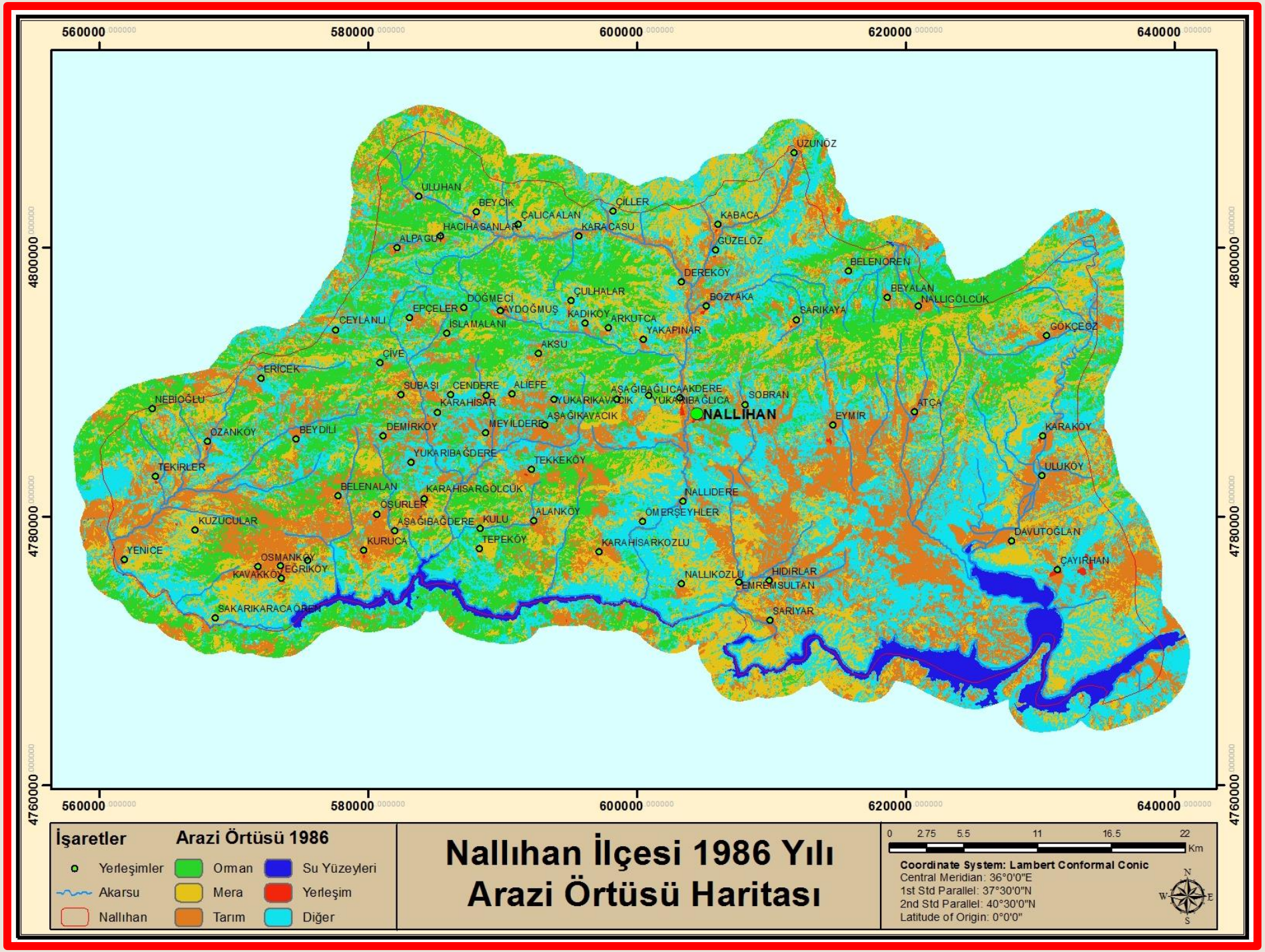
It points to changes in land cover where there is a loss in the provision of valued ecosystem services.

The spatial regions identified by this sub-indicator can be used to define boundaries for the assessment of the land productivity and SOC stock sub-indicators, and also for the aggregation or disaggregation of results across scales.

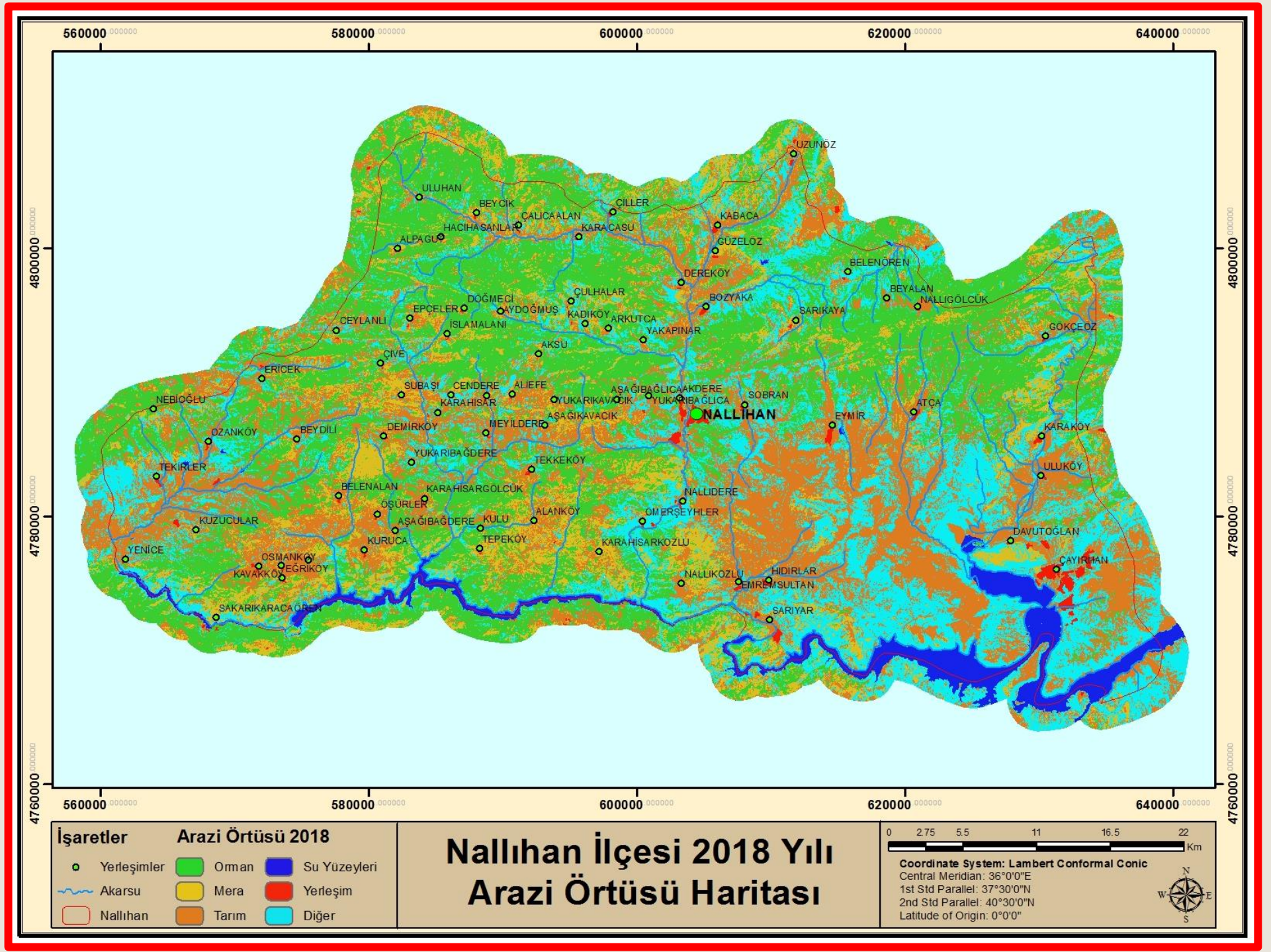
The six classes in the Intergovernmental Panel on Climate Change (IPCC) land use change legend (Penman et al., 2003) are deemed suitable as a minimum for reporting, however national agencies are encouraged to enhance their ability to identify and map important land degradation processes occurring in their country that may require disaggregation into more defined land cover types.

IPCC	GLC-Share	ESA CCI-LC
Forest Land	Tree Covered Areas	Tree broadleaved evergreen, Tree broadleaved deciduous, Tree needle leaved evergreen, Tree needle leaved deciduous, Tree mixed leaf type, Mosaic tree, shrub / herbaceous cover
Grassland	Grassland Shrub Covered Areas Sparse Vegetation	Mosaic natural vegetation / cropland, Mosaic herbaceous cover / tree, shrub, Scrublands, Grassland, Lichens and mosses, Sparse vegetation
Cropland	Cropland	Cropland rain fed, Cropland, irrigated or post-flooding, Mosaic cropland / natural vegetation
Wetlands	Herbaceous Vegetation, aquatic and regularly flooded Mangrove	Tree cover, flooded, saline water, Shrub or herbaceous cover, flooded Tree flooded, fresh water
Settlements	Artificial Surfaces	Urban areas
Other land	Bare soil Snow and Glacier	Bare areas, Permanent snow and ice
Empty Cell	Water Bodies	Water bodies

Land Cover Map of Nallihan District (1986)



Land Cover Map of Nallihan District (2018)



Original Class \ Final 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 graphical summary of the land cover/land use change matrix for the 6 IPCC classes (30 possible transitions). Unlikely transitions are highlighted in red text. Major land cover processes (flows) are identified and boxes are color coded as improvement (green), stable (blue) or degradation (red). This is a guide only, and the determination of whether changes from one land cover type to another are interpreted as degradation should be made by countries in the context of their land cover conditions

Sub Indicator 2. Land Productivity

For the purposes of SDG 15.3.1, changes in land productivity are determined from Earth observations of changes in Annual Net Primary Productivity (ANPP) between years.

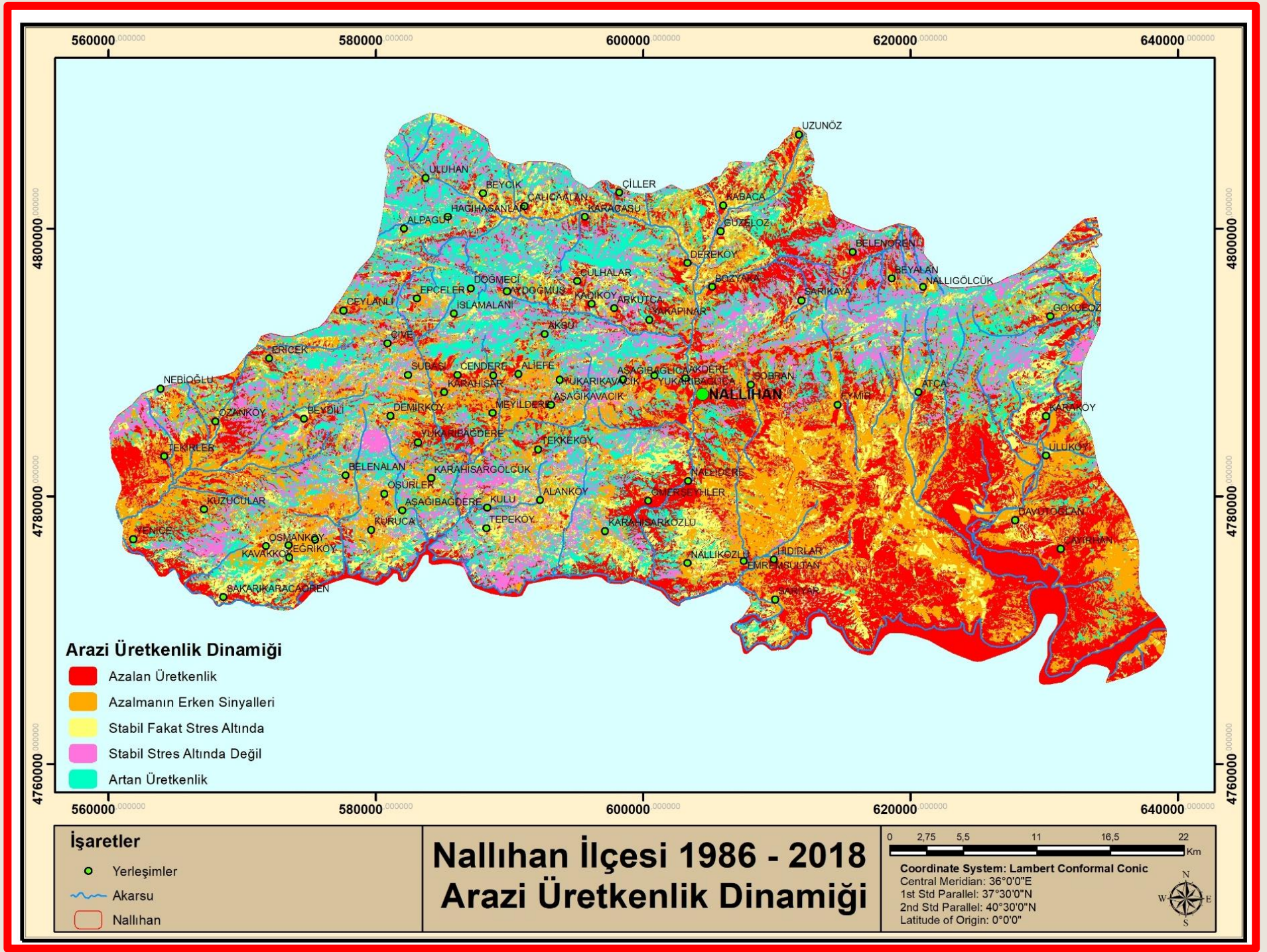
This sub-indicator reflects the net effects of ecosystem changes on plant biomass growth as an indicator of the health and productivity of the land.

Observations of plant productivity, such as from the Normalized Difference Vegetation Index (NDVI; Tucker, 1979) or other image transformations sensitive to vegetation growth, can be used to determine relative changes in plant growth between years.

Land Cover (2018)	Change Area		Trend	NDVI Class 2018	Land Productivity Dynamics	
	ha	%	- & +		Value	Explanation
Other Land	68,15	0,03	-	Weak	1	Declining Productivity
Other Land	1822,74	0,90	-	Weak	1	Declining Productivity
Other Land	3152,61	1,55	-	Weak	1	Declining Productivity
Other Land	22,34	0,01	+	Weak	1	Declining Productivity
Other Land	0,30	0,00	+	Weak	1	Declining Productivity
Other Land	12690,60	6,25	No Change	Weak	1	Declining Productivity
Other Land	23,73	0,01	-	Weak	1	Declining Productivity
Other Land	31,87	0,02	-	Intensive	1	Declining Productivity
Other Land	567,62	0,28	-	Intensive	1	Declining Productivity
Other Land	2,69	0,00	+	Intensive	1	Declining Productivity
Other Land	0,09	0,00	+	Intensive	1	Declining Productivity
Other Land	98,18	0,05	No Change	Intensive	1	Declining Productivity
Other Land	2097,76	1,03	-	Moderate	1	Declining Productivity
Other Land	4495,66	2,21	-	Moderate	1	Declining Productivity
Other Land	4313,05	2,12	-	Moderate	1	Declining Productivity
Other Land	37,05	0,02	+	Moderate	2	Early Sign of Declining
Other Land	4,70	0,00	+	Moderate	2	Early Sign of Declining
Other Land	17741,30	8,73	No Change	Moderate	1	Declining Productivity
Other Land	0,09	0,00	-	Very Weak	1	Declining Productivity
Grassland	7,56	0,00	-	Weak	2	Early Sign of Declining
Grassland	290,55	0,14	No Change	Weak	2	Early Sign of Declining

Nallhan Land Productivity Dynamics (Example)

Land Productivity Dynamics Map of Nallihan District (1986 - 2018)



Sub Indicator 3. Carbon Stocks

Carbon stocks reflect the integration of many processes affecting plant growth, as well as the gains and losses from terrestrial organic matter pools.

As outlined in UNCCD decision 22/COP.11 (UNCCD, 2013), SOC stock is the metric currently used to assess carbon stocks and will be replaced by total terrestrial system carbon stock once a standardized calculation method is operational.

Conceptual framework for quantifying changes in soil organic carbon (SOC) stocks

Level of detail	SOC stock baseline	SOC stock changes
Tier 1	Apply IPCC Tier 1 methods that relate SOC stock to environmental and management factors, with separate approaches and defaults for mineral and organic soils.	Apply IPCC Tier 1 methods to assess SOC stock change (0-30 cm) after default 20-year period[1]; methods differ for mineral and organic soils.
Tier 2	Two general approaches: a) Apply IPCC Tier 2 method, i.e. update of SOC reference stocks and associated stock change factors with nationally-determined values. SOC reference stocks can be determined from global or national high-resolution, digital soil maps or from measurements (e.g. national soil surveys); b) Where available and robust, apply methods that relate SOC stock to environmental and management factors, using statistical learning methods (e.g. used in state-of-the-art digital soil mapping studies) using best available baseline data for SOC stock and environmental covariates (e.g. land cover) for defined reference period. Where possible, refine established global relationship using national data.	a) Apply IPCC Tier 2 method using stock change factors with nationally-determined values; b) Apply methods derived from baseline data to changed environmental and management conditions observed during the reporting year, i.e. use relationships derived from global or national digital soil mapping products.
Tier 3	Two general approaches: a) As for Tier 2b above, but only using measured soil data for the baseline period; b) Derived from ecosystem (process-based) modelling.	a) As for Tier 2b above, but only using measured soil data for the reporting period; b) Derived from ecosystem modelling, calibrated at points using results from new field measurements/monitoring.

Combining Sub-Indicators

In the Good Practice Guidance, the principle used to combine results from the three sub-indicators to determine the extent of degradation in SDG indicator 15.3.1. is "one-out, all-out" (1OAO), which is applied taking into account changes in the sub-indicators which are depicted as

(i) positive or improving,
(ii) negative or declining, or
(iii) stable or unchanging.

If one of the sub-indicators is negative (or stable when degraded in the baseline or previous monitoring year) for a particular land unit, then that pixel or region would be considered as degraded, subject to validation by national authorities.

Within the spatial features that comprise the study region, degradation is considered to have occurred if degradation is reported in any one of the sub-indicators.

Thank you

Prof. Dr. Günay ERPUL
Ankara University