Land Degradation Neutrality Target Setting Programme
DATA DESCRIPTION
LAND PRODUCTIVITY DYNAMICS (LPD)

Simplified JRC Methodology

Source: LPD is derived from NDVI product of MODIS/Terra Vegetation Indices 16-Day L3 Global 250m SIN Grid V006

Methodology

LPD is a map of persistent decline/stress, stability and gain of land productivity, strictly during the observation period from 2001 to 2017 generated through the interaction of three NDVI-based indicators: Steadiness, Initial standing biomass, and Standing biomass at change . The processing chain are the following:

1st step: The annual aggregates of NDVI time series: result output of 15 bands with annual integral values.

2nd step: calculate trend over 15 annual values per pixel and assign negative slope values to 1 class and positive values to a second class: output binary file respectively 1 band with 2 classes one assigned to positive and one to negative slopes of trend (many zero values not expected, but maybe a zero flag could be considered if necessary)

3rd step: calculate multi-temporal image differencing (MTID) over 15 annual values and assign again positive and negative values to two classes (not many zero values expected, zero flag could be considered if necessary).

4th step: logical combination of above outputs 2 and 3, i.e. each pixel assigned to one of the 4 possible combinations (what we call 'steadiness' class, not to be confused with classes in the final map ('steadiness map'): steadiness 1: trend -/MTID -; steadiness 2: trend -/MTID +; steadiness 3: trend +/MTID -, steadiness 4: trend +/MTID +; (should there be any zero whether in trend or MTID, it is proposed to give it the sign of the available 'combination partner' value: i.e. trend 0/ MTID +, would be assigned to steadiness class/value 4 or trend -/MTID 0 would be assigned to steadiness class/value 1); (no double zero trend/MTID are expected).

5th step: the initial standing biomass file, i.e. output of step 5 calculated as mean NDVI (**(i.e.** not the annual means as used to generate step2) of each pixel over the first 3 years and assigned to 3 mean levels of NDVI as follows: $0 < NDVI < 0.3$ is assigned value 1 (low initial standing biomass), $NDVI >= 0.3$ to <0.6 is assigned value 2 (medium initial standing biomass), $NDVI >= 0.6$ is assigned value 3 (high initial standing biomass); (the limits are provisional: I would consider lowering slightly the limit between medium and high standing biomass once looking into a first test data set).

6th step: calculation of changes, i.e. % difference, in GPP proxy between first 3 years SUM_NDVI (i.e. SUM-NDVI of (2001+2002+2003)/3) and the mean of the last 3 years SUM_NDVI (i.e. SUM-NDVI of (2015+2016+2017)/3) of time series: i.e calculate mean of time integrated annual NDVI of first 3 years (mean-TNDVI-t0) of the time series and the mean of time integrated annual NDVI of the last 3 years (mean-TNDVI-t1). Then calculate (mean-TNDVI-t1/mean-TNDVI-t0) -1, this gives percent change of TNDVI, being closest GPP proxy, between beginning and end of time series. This should be grouped in a group of significant negative change, significant positive change and

insignificant or no change (i.e. within limits of natural oscillation of productivity). A cumulative histogram of the calculated GPP change pixels of step 6 and assign all pixels below the 15 percentile to negative change and all pixel above the 85 percentile to positive change and again the range in between (15 to 85 percentile) are assigned neutral.

7th and last step: logical tabulation/combination of 4 steadiness classes (output step 4), with 3 classes (low, medium, high) of initial standing biomass (output step 5) and 3 classes of change of GPP proxy between beginning and end of time series (output step 6) to 36 combinations and assignment to the final 5 LPD classes.

Steadiness (ST)	ST1 (T -/MTID -)			ST2 (T -/MTID +)			ST3 (T +/MTID -)			ST4 (T +/MTID +)		
Initial mean biomass low/medium/high	L	M	H	L	M	H	L	M	H	L	M	H
GPP change (negative -, neutral n, positive +	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+	-/n/+
Tabulation and labelling of above variables.	1 ST1/L/ -	2 ST1/M/ -	3 ST1/H/ -	10 ST2/L/ -	11 ST2/M/ -	12 ST2/H/ -	19 ST3/L/ -	20 ST3/M/ -	21 ST3/H/ -	28 ST4/L/ -	29 ST4/M/ -	30 ST4/H/ -
Assignment of 36 sub-classes to final 5 LPD classes	4 ST1/L/ n	5 ST1/M/ n	6 ST1/H/ n	13 ST2/L/ n	14 ST2/M/ n	15 ST2/H/ n	22 ST3/L/ n	23 ST3/M/ n	24 ST3/H/ n	31 ST4/L/ n	32 ST4/M/ n	33 ST4/H/ n
	7 ST1/L/ +	8 St1/M/ +	9 ST1/H/ +	16 ST2/L/ +	17 ST2/M/ +	18 ST2/H/ +	25 ST3/L/ +	26 ST3/M/ +	27 ST3/H/ +	34 ST4/L/ +	35 ST4/M/ +	36 ST4/H/ +

The resulting 36 combinations are assigned to the 5 final LPD classes as follows:

LPD Class	LPD 1 (declining)	LPD 2 (slightly declining)	LPD 3 (stable but stressed)	LPD 4 (stable)	LPD 5 (increasing)
Range of Labels included	1-8	9-14	15-22	23-32	33-36

The tabulation of the output raster files of above described steps 4, 5 and 6 is implemented by simple logical operators

VALUES: 1-5

VALUE	description
1	Declining productivity

2	Early signs of decline
3	Stable, but stressed
4	Stable, not stressed
5	Increasing productivity