Chapter 11
Recommendations for Future Application of NDVI

11.1 In the Convention National Reporting

As discussed in the Introduction, both the UNCCD and the GEF use land cover to monitor land degradation. The UNCCD progress indicators (formerly known as impact indicators) should show progress made in achieving long-term benefits for people living in areas affected by desertification, land degradation, and drought, for affected ecosystems, and for the global environment. At its eleventh session, the COP adopted a refined set of six progress indicators (*Decision 22/COP.11; see Annex 6*) which will be used for the first time during the second leg of the fifth reporting process in 2016. Recommendations were made to the latest Conference of the Parties of the UNCCD (ICCD/COP(11)/CST/2) for refinements to the provisionally adopted set of impact indicators (Annex 6).

The findings of this report have implications for all three strategic objectives (SOs) of the UNCCD: SO-1 *to improve the living conditions of affected populations*, SO-2 *to improve the conditions of affected ecosystems*, and SO-3 *to generate global benefits through effective implementation of the UNCCD* (Table 11.1). Monitoring of drought using NDVI and NDWI could have implications for trends in access to safe drinking water (SO-1). It has been clearly shown that NDVI is a reliable measure of photosynthetic capacity and thus for monitoring trends in land cover and productivity of the land (SO-2). NDVI can also support reporting on global benefits related to trends in carbon stocks and biodiversity (SO-3), as shown in other sections of this report (also see Annex 2). Ideally, reporting on these indicators should be harmonized with reporting to the UNFCCC on carbon stocks and to the CBD on biodiversity indicators.

G.T. Yengoh et al., *Use of the Normalized Difference Vegetation Index (NDVI) to Assess Land Degradation at Multiple Scales*, SpringerBriefs in Environmental Science, DOI 10.1007/978-3-319-24112-8_11

Table 11.1 UNCCD core indicators for national reporting

Indicator	Potential use of NDVI
Strategic objective 1: to improve the living conditions of affected populations	
SO-1. (1): Trends in population living below the relative poverty line and/or income inequality in affected areas	*Not applicable*
SO-1. (2): Trends in access to safe drinking water in affected areas	NDVI could be combined with the normalized difference water index (NDWI) to monitor drought and be linked to water use of land-use systems (see Annex 1)
Strategic objective 2: to improve the condition of affected ecosystems	
SO-2. (1): Trends in land cover	NDVI is the best tested vegetation index with the longest time series for monitoring of land-cover trends (33 years), which compensates for the low resolution. However, care needs to be exercised in interpretation of the results and the drivers of change (Annex 2)
SO-2. (2): Trends in land productivity or functioning of the land	The relationship between NDVI and biomass productivity has been well established in the literature. NDVI can be used to estimate land productivity and monitor such productivity over time (Annex 2)
Strategic objective 3: to generate global benefits through effective implementation of the UNCCD	
SO-3. (1): Trends in carbon stocks above- and belowground	NDVI can be used together with higher-resolution data to estimate trends in carbon stocks, e.g., REDD and SOC assessments (Annex 1)
SO-3. (2): Trends in abundance and distribution of selected species	NDVI can be used to monitor habitat fragmentation and connectivity which crucially affect the abundance and distribution of species (Annex 1)

11.2 In a Revised GEF Resource Allocation Methodology

Land cover is used as an indicator for all three GEF focal areas affected by the System for Transparent Allocation of Resources (STAR) that calculates country-specific allocations from each focal area[1]:

Land Degradation—the latest Global Benefit Index (GBI) for the land degradation (LD) focal area was designed to take into account three key factors in accordance with GEF mandate for financing: (1) the need to control and prevent land degradation in land-based production systems; (2) the challenge of combating desertification in the drylands, including the need for adaptation to drought risks; and (3) the need to address livelihoods of vulnerable populations. Proxy indicators were derived for each of these factors based on available data.

[1] GEF/POLICY: PL/RA/01, March 14 2013: System for Transparent Allocation of Resources (STAR).

With regard to factor (1), a quantitative estimate of land area (in km^2 or as percent of territory) affected by LD was used as a proxy indicator for *loss of ecosystem function and productivity*. The indicator was derived by Bai et al. (2008) using NDVI. Each country's share of the global total area affected was calculated for use in the GBI. The three indices were assigned weights as follows: 60 % to dryland area, 20 % to rural population, and 20 % to land area affected.

GBILD = (0.2 × global share of land area affected) + (0.6 × proportion of dryland area) + (0.2 × proportion of rural population)

Climate Change: For its land-use, land-use change, and forestry (LULUCF) component, it uses forest cover in hectares and absolute change in forest cover, as reported by countries to FAO. NDVI could potentially be used to strengthen this index as NDVI is strongly correlated with vegetation dynamics in humid areas.

Biodiversity: This index uses distribution of terrestrial eco-regions, including threatened eco-regions as monitored by WWF. Also here, the use of NDVI could improve data quality if it is used consistently.

Trends in NDVI could thus become an important part of a land-cover indicator cutting across three GEF focal areas and used as a proxy for productivity, carbon stocks, and biodiversity. With regard to the land degradation focal area, a revised GEF STAR should be based on all the six core indicators identified for the UNCCD Strategic Objectives (see Table 11.1 and Annex 6). However, with a more robust application of NDVI based on recent advances, this index might be given a greater weight in a revised STAR, as it can contribute to monitoring of five of the UNCCD indicators if applied consistently and using the most reliable datasets.