GEF-6 REQUEST FOR ONE-STEP MEDIUM-SIZED PROJECT APPROVAL

TYPE OF TRUST FUND: GEF Trust Fund

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PART I: PROJECT IDENTIFICATION

Project Title:	Enabling the use of global data sources to assess and monitor land degradation at multiple scales		
Country(ies):	Global including Kenya, Uganda, Senegal and Tanzania	GEF Project ID:[1]	9163
GEF Agency(ies):	CI (select) (select)	GEF Agency Project ID:	
Other Executing Partner(s):	Vital Signs (VS) National Aeronautics and Space Administration (NASA) Lund University	Submission Date:	
GEF Focal Area(s):	Land Degradation	Project Duration (Months)	24
Integrated Approach Pilot	IAP-Cities ☐ IAP-Commodities ☐ IAP-Food Security ☐		
Name of Parent Program:	[if applicable]	Agency Fee ($)	164,540

A. FOCAL AREA STRATEGY FRAMEWORK AND PROGRAM[2]:

Focal Area Objectives/programs	Focal Area Outcomes	Trust Fund	(in $)	
			GEF Project Financing	Co-financing
LD-4 Program 5 (select) (select)	Outcome 4.1: SLM mainstreamed in development investments and value chains across multiple scales Outcome 4.2: Innovative mechanisms for multi-stakeholder planning and investments in SLM at scale	GEFTF	1,828,217	10,002,000
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
(select) (select) (select)		(select)		
	Total project costs		1,828,217	10,002,000

B. PROJECT FRAMEWORK

Project Objective: To provide guidance, methods and a toolbox for assessing and monitoring status and trends in land degradation using remote sensing technology which can be employed to inform land management and investment decisions as well as to improve reporting to the UNCCD and the GEF

Project Components/ Programs	Financing Type[3]	Project Outcomes	Project Outputs	Trust Fund	(in $)	
					GEF Project Financing	Confirmed Co-financing
1. Methods for assessing and monitoring status and trends in land degradation	TA	**1.1.** Improved understanding of the accuracy, suitability and trade-offs (e.g. resolution,	**1.1.1.** Comparison of different datasets and methods for assessing status and trends in land	GEFTF	584,768	3,405,600

[1] Project ID number will be assigned by GEFSEC and to be entered by Agency in subsequent document submissions.
[2] When completing Table A, refer to the excerpts on *GEF 6 Results Frameworks for GETF, LDCF and SCCF*.
[3] Financing type can be either investment or technical assistance.

		accessibility, repeatability, sustainability/automation, cost, etc.) of different global datasets for estimating status and trends in land degradation **1.2.** Agreed-upon method(s) for assessing status and trends in land degradation for identified end-users	degradation completed **1.1.2.** Evaluation of approaches for incorporating higher-resolution data for disaggregation or targeted analysis completed **1.2.1.** Standard methods, including analytical steps and recommended datasets, agreed on and presented to major stakeholders, including countries, the GEF, the UNCCD and their scientific and technical bodies **1.2.2.** Improvement of the Global Benefits Index (GBI) algorithm for the Land Degradation focal area for GEF-7 based on agreed-upon methods			
2. Demonstration of recommended methods and platforms to enable widespread adoption	TA	**2.1.** Completed baseline assessment of status and trends in land degradation in 4 pilot countries (Kenya, Senegal, Tanzania, Uganda)	**2.1.1.** Land degradation baseline produced for in-country evaluation for 4 pilot countries **2.1.2.** Draft guidance documents on methods and toolbox created based on application in 4 pilot countries (Kenya, Senegal,	GEFTF	518,753	6,345,000

			Tanzania, Uganda)			
		2.2. Established platforms to enable widespread adoption of the methods for assessment at regional- and global-scales	**2.2.1.** Data processing platforms, with data collection protocols, established in at least one regional center and at the global level			
3. Gender appropriate capacity development in the application of toolbox and recommended approaches for estimating status and trends in land degradation using remote sensing	TA	**3.1.** Strengthened capacity of the 4 pilot countries and regional center, with equitable participation by women and men, in accessing and processing data related to NDVI and other vegetation indices for estimating status and trends in land degradation **3.2.** Enhanced exchange of knowledge among countries and at least one regional center, with equitable participation by women and men, on remote sensing applications for assessing status and trends in land degradation	**3.1.1.** Draft gender appropriate guidance documents and manuals completed, incorporating the GEF, the UNCCD and country feedback, and made available online **3.2.1.** Training and capacity building of 4 national and at least one regional center in Africa, with equitable participation by women and men, on remote sensing applications for assessing status and trends in land degradation	GEFTF	563,871	251,400
	(select)			(select)		
	(select)			(select)		
	(select)			(select)		
	(select)			(select)		
	(select)			(select)		
			Subtotal		1,667,392	10,002,000
			Project Management Cost (PMC)[4]	(select)	160,825	
			Total GEF Project Financing		1,828,217	10,002,000

[4] For GEF Project Financing up to $2 million, PMC could be up to10% of the subtotal; above $2 million, PMC could be up to 5% of the subtotal. PMC should be charged proportionately to focal areas based on focal area project financing amount in Table D below.

For multi-trust fund projects, provide the total amount of PMC in Table B, and indicate the split of PMC among the different trust funds here: ( )

C. SOURCES OF CO-FINANCING FOR THE PROJECT BY NAME AND BY TYPE

Please include confirmed co-financing letters for the project with this form.

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Amount ($)
Others	National Aeronautics and Space Administration (NASA) – provision of commercial satellite data	cash	9,300,000
CSO	Vital Signs	cash	600,000
Others	Lund University	cash	102,000
(select)		(select)	
(select)		(select)	
(select)		(select)	
(select)		(select)	
(select)		(select)	
Total Co-financing			10,002,000

D. GEF/LDCF/SCCF RESOURCES REQUESTED BY AGENCY(IES), TRUST FUND, COUNTRY(IES), FOCAL AREA AND PROGRAMMING OF FUNDS

GEF Agency	Trust Fund	Country/ Regional/Global	Focal Area	Programming of Funds	(in $)		
					GEF Project Financing (a)	Agency Fee a) (b)	Total (c)=a+b
CI	GEF TF	Global	Land Degradation	(select as applicable)	1,828,217	164,540	1,992,757
(select)	(select)		(select)	(select as applicable)			0
(select)	(select)		(select)	(select as applicable)			0
(select)	(select)		(select)	(select as applicable)			0
(select)	(select)		(select)	(select as applicable)			0
(select)	(select)		(select)	(select as applicable)			0
(select)	(select)		(select)	(select as applicable)			0
(select)	(select)		(select)	(select as applicable)			0
(select)	(select)		(select)	(select as applicable)			0
(select)	(select)		(select)	(select as applicable)			0
Total Grant Resources					1,828,217	164,540	1,992,757

a) Refer to the Fee Policy for GEF Partner Agencies.

E. PROJECT'S TARGET CONTRIBUTIONS TO GLOBAL ENVIRONMENTAL BENEFITS[5]

Provide the expected project targets as appropriate.

Corporate Results	Replenishment Targets	Project Targets
1. Maintain globally significant biodiversity and the ecosystem goods and services that it provides to society	Improved management of landscapes and seascapes covering 300 million hectares	*hectares*
2. Sustainable land management in production systems (agriculture, rangelands, and forest landscapes)	120 million hectares under sustainable land management	*hectares*

[5] Provide those indicator values in this table to the extent applicable to your proposed project. Progress in programming against these targets for the projects per the *Corporate Results Framework* in the *GEF-6 Programming Directions*, will be aggregated and reported during mid-term and at the conclusion of the replenishment period. There is no need to complete this table for climate adaptation projects financed solely through LDCF and/or SCCF.

3. Promotion of collective management of transboundary water systems and implementation of the full range of policy, legal, and institutional reforms and investments contributing to sustainable use and maintenance of ecosystem services	Water-food-ecosystems security and conjunctive management of surface and groundwater in at least 10 freshwater basins;	*Number of freshwater basins*
	20% of globally over-exploited fisheries (by volume) moved to more sustainable levels	*Percent of fisheries, by volume*
4. Support to transformational shifts towards a low-emission and resilient development path	750 million tons of CO_{2e} mitigated (include both direct and indirect)	*metric tons*
5. Increase in phase-out, disposal and reduction of releases of POPs, ODS, mercury and other chemicals of global concern	Disposal of 80,000 tons of POPs (PCB, obsolete pesticides)	*metric tons*
	Reduction of 1000 tons of Mercury	*metric tons*
	Phase-out of 303.44 tons of ODP (HCFC)	*ODP tons*
6. Enhance capacity of countries to implement MEAs (multilateral environmental agreements) and mainstream into national and sub-national policy, planning financial and legal frameworks	Development and sectoral planning frameworks integrate measurable targets drawn from the MEAs in at least 10 countries	*Number of Countries: 4*
	Functional environmental information systems are established to support decision-making in at least 10 countries	*Number of Countries:4*

F. DOES THE PROJECT INCLUDE A "NON-GRANT" INSTRUMENT? No

(If non-grant instruments are used, provide an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF Trust Fund) in Annex B.

N/A

G. PROJECT PREPARATION GRANT (PPG)[6]

Is Project Preparation Grant requested? Yes ☐ No ☐ If no, skip item G.

PPG AMOUNT REQUESTED BY AGENCY(IES), TRUST FUND, COUNTRY(IES) AND THE PROGRAMMING OF FUNDS*

GEF Agency	Trust Fund	Country/ Regional/Global	Focal Area	Programming of Funds	(in $)		
					PPG (a)	Agency Fee[7] (b)	Total c = a + b
CI	GEF TF	Regional: Kenya, Uganda, Senegal and Tanzania	Land Degradation	(select as applicable)	2,445	220	2,665
(select)	(select)		(select)	(select as applicable)			0
Total PPG Amount					**2,445**	**220**	**2,665**

PART II: PROJECT JUSTIFICATION

1. *Project Description.* Briefly describe: a) the global environmental and/or adaptation problems, root causes and barriers that need to be addressed; b) the baseline scenario or any associated baseline projects, c) the proposed alternative scenario, GEF focal area[8] strategies, with a brief description of expected outcomes and components of the project, d) incremental/ additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF/SCCF and co-financing; e) global

[6] PPG of up to $50,000 is reimbursable to the country upon approval of the MSP.
[7] PPG fee percentage follows the percentage of the Agency fee over the GEF Project Financing amount requested.
[8] For biodiversity projects, in addition to explaining the project's consistency with the biodiversity focal area strategy, objectives and programs, please also describe which Aichi Target(s) the project will directly contribute to achieving.

environmental benefits (GEFTF), and adaptation benefits (LDCF/SCCF); and 6) innovation, sustainability and potential for scaling up.

1. This proposal addresses methods to estimate status and trends in land degradation, including improvements or other results of Sustainable Land Management (SLM), as well as lack of discernable changes, which we refer to in the Results Framework table as "status and trends in land degradation." Here, we define land degradation as a negative trend in primary production that is independent of climate variability (Ibrahim et al. 2015). In the main body of the proposal, for simplicity we use the term "land degradation" throughout to refer to all of these possible changes or lack thereof."

2. Our goal is to derive an approach that can yield one or two simple metrics in the form of continuous images that, when tracked over years, correlate well with trends of degradation. With such products, methods and a toolbox can be created to enable the GEF to understand regional patterns for prioritization, and enable countries to produce estimates of trends for reporting to the UNCCD and the GEF.

A. The global environmental problems, root causes and barriers that need to be addressed:

3. The global demand for food is expected to rise steeply as a result of burgeoning population, shifting dietary preferences, and food wastage, while increasing demands for renewable energy are competing with food production. In 2009, the Food and Agriculture Organization of the United Nations (FAO) estimated that we must increase global food production by 70% to meet demands in 2050 (FAO 2009). Further, accelerating climate change is projected to have severe impacts on crop productivity over large parts of the globe (Lobell and Gourdji 2012). The combination of increasing water scarcity, as a result of climate warming, and increasing competition across sectors, is likely to cause dramatic situations in terms of food and water security in many regions. As a consequence, *business as usual* is not an option. The threat to food security represents a planetary emergency that demands a variety of creative solutions and policies at global, regional, national and local levels. One of the most urgent responses to mitigate this situation is development of measures to halt and reverse land degradation. Such solutions are currently hampered by a lack of reliable data, as well as by a lack of cost effective methods for collecting and analyzing such data.

4. Land degradation has been highlighted as a key development challenge by numerous international processes, including by the United Nations Convention to Combat Desertification (UNCCD), the Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC), and the Sustainable Development Goals (SDGs). The Global Environment Facility (GEF) was designated as a financial mechanism for the UNCCD in 2003, through establishment of its Land Degradation focal area. The GEF aims to arrest land degradation, especially desertification and deforestation, by providing support to sustainable land management (SLM). SLM implements agricultural practices that maintain vegetative cover, build soil organic matter, make efficient use of inputs, such as water, nutrients and pesticides, and that minimize off-site impacts (Bierbaum et al. 2014).

5. Both the UNCCD and the GEF use land cover to monitor land degradation and implementation of SLM. In this context, land cover includes (a) distinct types of land cover, as typically represented in a land cover class map, and (b) varying characteristics within each type, such as amounts of biomass or productivity. Trend in land cover is also a key indicator of progress towards meeting the UNCCD's Strategic Objective 2: *to improve the condition of affected ecosystems* (UNCCD decision 22/COP.11). For the GEF, achievement of the overall goal of the Land Degradation focal area is measured through "change in land productivity" using, as a proxy, gross primary productivity (GPP), which is estimated through the remotely sensed Normalized Difference Vegetation Index (NDVI) which, in turn, is a proxy for photosynthetic capacity, screened for drought effects using rain-use efficiency (RUE).

6. The GEF uses information on trends in land cover and gross primary production (GPP) to allocate resources from the land degradation focal area of the GEF; other things being equal, countries suffering from serious land degradation, as measured by change in NDVI, are allocated more funds than those with less measurable evidence of land degradation. Further, to measure the impact of interventions, GEF-funded SLM projects should report on the same measures (GEF 2014). However, the term "land cover" is static with respect to land degradation in that it denotes only the type of vegetation in a given area. By coupling "land cover" with gross primary productivity, this results in a dynamic measure of "land cover." Thus, if land cover does not change, but the area in question is being degraded, this can be identified by analysis of NDVI through its coupling to gross primary production. If the land cover of an area does change, this resulting change can also be expressed in terms of gross primary productivity, enabling quantitative analyses.

7. The primer for the sixth GEF replenishment phase (GEF-6) lists the combination of indices used to calculate the GEF benefits index (GBI), which is combined with the GEF performance index (GPI), and the Gross Domestic Product index (GDPI) to prioritize countries (GEF, 2015). The primer states that "the GBI for the Land Degradation Focal Area is based on three indicators: the area affected by land degradation; the total dryland area; and the vulnerable population in the area affected. This ensures that the allocation is in accordance with GEF mandates based on:

    a) the need for controlling and preventing land degradation in the context of land-based production systems;

    b) the challenge of combating desertification in the drylands, including the need for adaption to drought risks; and

    c) the need to address livelihoods of vulnerable populations.

8. Yengoh et al. (2014) note that "proxy indicators were derived for each of these factors based on available data. With regard to factor a), a quantitative estimate of land area affected by land degradation 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."

9. The reviews conducted by Yengoh et al. (2014) and Higginbottom and Symeonakis (2014) recommend using NDVI for monitoring land degradation. However, much relevant research has been conducted since the Bai et al. (2008) work was done, and our proposed work incorporates several improvements in mapping land degradation. In particular, new data options and approaches warrant a reassessment in the context of estimation of land degradation for GEF's GBI and for relevant national applications and reporting interests.

10. Potential for the use of NDVI as a proxy for determining land productivity (one of the indicators of the state of land degradation) is based on numerous and rigorous studies that have identified a strong relationship between NDVI and GPP (Field et al. 1995, Prince et al. 1995, Vlek et al. 2010, Higginbottom and Symeonakis 2014) (Figure 1).

11. Remotely sensed data products derived from satellite measurements come in several bands of the electromagnetic spectrum. NDVI and related indices use bands in the visible and near-infrared wavelengths. When using satellite-derived products, it is important to consider sensor and image characteristics such as: image size, region of the earth from which images are acquired, spatial resolution, number of bands and wavelengths detected, spectral characteristics of the bands concerned, frequency of image acquisition, date of origin of the sensor (Strand et al. 2007).

12. In general, high spatial resolution data are helpful for fine-scale assessments and analysis at local levels, while medium spatial resolution data are useful at a regional or project scale. At a continental or global scale, coarse spatial resolution data support archives of long time series that include both inter-annual and detailed seasonal information and are preferred for many NDVI-based assessments and analyses. Long time series simplify the use of remote sensing to assess land degradation and monitor changes (Shalaby and Tateishi 2007, Bai et al. 2008b, de Jong et al. 2011, Anyamba and Tucker 2012, Townshend et al. 2012, Albalawi and Kumar 2013, Cook and Pau 2013, Symeonakis and Drake 2014).

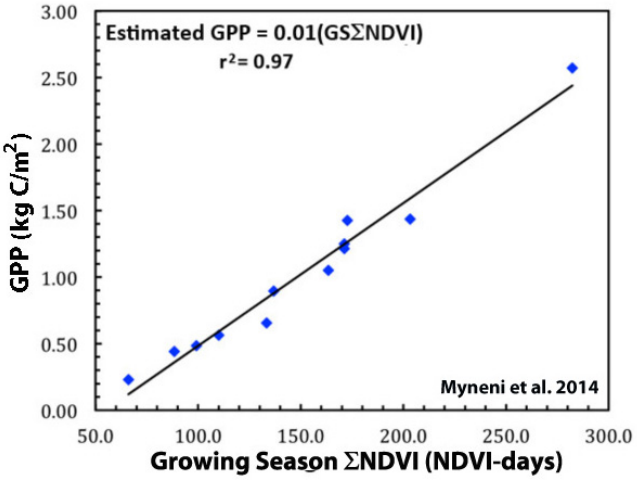


Figure 1. Coincident comparison between integrated gross primary production (GPP) from 12 flux towers, and integrated NDVI data from MODIS Terra for the respective growing seasons where the flux towers were situated. This demonstrates the strong relationship between NDVI and GPP, which is directly related to chlorophyll abundance and energy absorption (Meyfroidt et al. 2015). Note there is no saturation of NDVI with respect to photosynthetic capacity (i.e., the relationship between GPP and NDVI is linear).

13. NDVI has been used extensively in research on primary production, land use and land cover change, drought, desertification, soil erosion, vegetation burned areas, biodiversity monitoring and conservation, and soil organic carbon (Higgenbottom and Symeonakis 2014, Yengoh et al. 2014). Recent improvements and the longer time series of fundamental NDVI datasets call for development and testing of new and improved methods and tools for using NDVI or other spectral indices as a proxy for land degradation and for measuring the implementation of the UNCCD and the GEF's allocation of resources to combat land degradation, as well as for measuring the impacts of its SLM projects. However, some fundamental barriers have to be overcome before the use of NDVI or other spectral indices can be further rolled out and be taken up by all signatories to the UNCCD and by the GEF-eligible countries.

Barrier 1: Lack of standardized and harmonized datasets, methods and tools for assessing status and trends in land degradation at a scale that is appropriate for use at national and sub-national scales

14. There is a large body of evidence in the literature on the usefulness of NDVI data for detecting and monitoring areas of land degradation. While this is encouraging regarding the potential for regular use of NDVI-based data for national reporting on land degradation trends to the GEF and UNCCD, this evidence comes from studies that have used a wide range of data sources. Yengoh et al. (2014), commissioned by the Scientific and Technical Advisory Panel of the Global Environment Facility (STAP), thoroughly reviews this body of work, as does a recent paper by Higginbottom and Symeonakis (2014). These papers conclude that this body of evidence is significant; however, it has not yielded simple guidance on data, methods or tools for countries to use to set baselines and for reporting to the UNCCD or the GEF, or for the latter to use in priority setting.

15. This barrier is related to three critical factors: lack of standardized and harmonized datasets, lack of methods for using datasets, and lack of tools and specific guidance on how to use both the datasets and the tools. For data, there are several major considerations: (a) satellite-data sources and pre-processing; (b) NDVI and other spectral indices; and (c) temporal units for time periods and trends of these through time at several scales.

Barrier 2: Lack of systematic and documented testing of spectral indices for assessing baselines at national scale in different agro-ecosystems.

16. As described above, once a data source and spectral index is selected, there are multiple ways to benefit from the temporal domain of information provided. Assessments of different approaches should be made in countries where land degradation is occurring to determine which approaches best reveal trends. The seasonal data have resolutions of 250 m or coarser, and thus are appropriate for regional to national detection of trends. Finer-resolution data can be used to examine more precisely what has occurred in particular places that show particular trend signals. They can also be used to compare approaches and to calibrate and validate relationships between the coarser data and the occurrence of degradation or improvement.

Barrier 3: Remote sensing capacity constraints in countries affected by land degradation and desertification and lack of access to relevant satellite imagery and data.

17. Capacity in many countries for use of such data is very limited. Capacity needs can be summarized into three categories: knowledge capacity, financial capacity and logistical capacity. Improvements in knowledge capacity are needed for agency staff in countries to have a fundamental understanding of the data they will work with in order to use a particular method. This includes understanding the photosynthetic potential or vegetation indices, how they differ and how they relate to land cover, degradation and other changes. Knowledge capacity can be improved by producing materials that explain the relevant science, with examples. These materials should be targeted for an audience that is scientifically literate, yet non-expert in remote sensing.

18. Improvements in financial and logistical capacity are inter-related. Rather than increasing financial support, which may not be realistic, the costs for national estimation of degradation and other changes can be reduced. This can be done by providing a toolbox that is based on free Geographic Information System (GIS) software and by using freely available data. Both financial and logistical capacity can be addressed by providing a method that uses derived products with demonstrated relationships to degradation and other changes, yet are relatively simple and not large in data volume. This reduces the need to access seasonal data, which require greater internet bandwidth and specialized programs to produce the derived products in each country. Providing derived products over large regions or over a requested set of countries would also reduce potential for inconsistent application of methods among countries.

B. The baseline scenario and any associated baseline project

Previous Land Degradation Assessment Efforts

19. Early assessments of land degradation, such as the Global Assessment of Soil Degradation (GLASOD), were based on compilations of expert opinion. They are unrepeatable and systematic data show them to be unreliable (Bai et al. 2008a). Under the FAO/UNEP (United Nations Environment Program) program, Land Degradation in Drylands (LADA), Bai et al. (2008a) undertook a Global Assessment of Land Degradation and Improvement (GLADA) by analyszing linear trends of climate-adjusted Global Inventory Modeling and Mapping Studies (GIMMS) NDVI data.

20. GLADA, the first quantitative assessment of global land degradation aimed to identify and delineate "hot spots of land degradation, and their counterpoint - bright spots of land improvement." The study revealed that about 24% of the global land area was affected by land degradation between 1981 and 2003. Humid areas accounted for 78% of the global degraded land area, while arid and semiarid areas accounted for only 13%. Cropland and rangelands accounted for 18% and 43%, respectively, of the 16% of global land area where the NDVI increased. The authors observed that decreases in NDVI were both positively and negatively correlated with changes in population density, as well as

with both increases and decreases in poverty. They emphasized that NDVI can only be used as a proxy for land degradation and that it reveals nothing about the type of degradation or its drivers. Potential false alarms caused by drought cycles and rising global temperatures were removed by screening the data using rain use efficiency (RUE) and energy-use efficiency (EUE). However, since GLADA was conducted, new and improved datasets have emerged, together with opportunities to combine low resolution, medium resolution and high resolution satellite datasets to understand land degradation.

21. The relevant European Space Agency (ESA) baseline projects (totaling to over 3 mlllion euros in ESA investments) developed and refined a suite of algorithms that can be applied to ENVISAT MERIS and later to the Sentinel-3 OLCI satellite sensors. ESA also developed several indicators that can be derived from moderate and coarse spatial resolution Earth Observation data, for showing the status and trends of land degradation and biodiversity in inland waters and in drylands. The methods were developed with a user-driven approach. Close consultation with the UNCCD institutions and reporting countries were established and helped to refine the requirements to best fit the information needs of the end-users (with reporting obligations), while at the same time demonstrating the global applicability and scalability of the proposed indicators. The final user guides and handbooks were released in May 2015 (http://www.diversity2.info/products/documents/DEL8/DIV2_Products_User_Handbook_Drylands_v1.2.pdf).

22. Moreover, ESA has 8 years of experience in direct scientific collaboration with UNCCD concerning the use of Earth Observation data to assess regional-scale land degradation. Through projects such as DesertWatch and Diversity, methods were developed and tested in over 22 dryland areas, covering 10 million km² and more than 300 large perennial inland waters distributed around the world. The primary data sources for these activities are from the ESA ENVISAT satellite, specifically from the MERIS, AATSR, RA-2 and ASAR instruments. The projects also paved the way for sustainable provision of information into the future using future satellites, such as the Sentinel-3 and Proba-V.

23. In addition, there are several recent assessments that we can learn from and build upon (e.g., Higginbottom and Symeonakis 2014, Ibrahim et al. 2015, Mbow et al. 2015).

Satellite-data sources and pre-processing

24. The NASA MODIS program is committed to continued operation and delivery of MODIS data from the Aqua and Terra satellites through 2015. Since early 2014 we have overlapping data from VIIRS, with similar characteristics to MODIS, for generation of photosynthetic potential or GPP indices, and VIIRS data are planned through 2030. NASA plans continuation of compatible data with MODIS by undertaking the processing and distribution of VIIRS NDVI data. These will continue to provide daily or near-daily coverage of reflectance and greenness data for the globe at a 300-m resolution. The NASA GIMMS program is committed to continuing its research to harmonize surface reflectance and greenness data provided by these sources through 2015 and beyond.

25. NDVI and EVI are currently standard products from the MODIS program and NASA processing of VIIRS data will produce NDVI and the 2-channel EVI products. The 3-channel EVI product from MODIS is being discontinued for the NASA-processed VIIRS because it is more difficult to inter-calibrate than the 2-channel EVI or NDVI products.

26. National Oceanic and Atmospheric Administration (NOAA) AVHRR data have the longest temporal record, extending from July 1981 into 2015. These data include reflectance bands in the red and near-infrared and three thermal bands. The former allow calculation of NDVI and other two-band spectral indices; the latter allow estimation of and corrections for cloud contamination and atmospheric effects. AVHRR data have a 4 km resolution and are mapped to 8 km grid cells. While originally intended for atmospheric and oceanic study, AVHRR data have formed the basis for global-change and bio-climatology research from the 1980s to the present. They revealed spatially-

continuous, seasonal and inter-annual patterns of vegetation dynamics and land temperature for the first time; quantified land gross primary productivity; and identified how phenomena such as the El Nino Southern Oscillation affect climate (Pinzon and Tucker 2014). AVHRR NDVI data provide a longer time series; however their overall usefulness is limited because of their coarse (8 km) resolution, in comparison with 250 m NDVI data from the MODIS instruments, and thus are useful at the global to regional scale for a 34-year period, from 1982 to 2015.

27. The Vegetation-1 and -2 sensors on board SPOT-4 and SPOT-5 satellites provide data from 1998 to 2014. VEGETATION provides reflectance data for the red, NIR and middle-infrared at a resolution of 1.2 km. The SPOT program has produced several time series data sets, including surface reflectance and global NDVI. VEGETATION data do not include any thermal bands, and thus have less potential for correcting for atmospheric effects and clouds. The follow-on to Vegetation is the PROBA-V sensor, launched in early 2014. PROBA-V measures in the same bands as Vegetation, although with improved spatial resolution to 300 m in the visible and near infrared, and 600 m in the middle-infrared bands. PROBA-V is planned to fill a short-term gap before the completion of launches of the series of Sentinel satellites later this decade. The Sentinel series will provide a larger array of sensors over different spectral regions, and better coverage and frequency of updates than Landsat, that will allow for better corrections of atmospheric effects, and a larger set of derived products is planned than was the case with Vegetation and PROBA-V data. The ESA plans to continue PROBA-V through 2018 and then provide relevant data mainly via the Sentinel series, committed through 2035 and beyond.

28. MODIS data are produced by NASA and are well-documented. VIIRS data are now being processed by NASA using the same approaches that were used for MODIS data. These methods are being well-documented for the VIIRS data.

29. In summary, there are three data options for a global assessment of historic trends in photosynthetic capacity that can be used for land degradation studies: (1) AVHRR data that started in 1981; (2) European series of SPOT VEGETATION, PROBA-V and, later this decade, Sentinel data that started in 1998; and (3) MODIS and VIIRS data that started in 2000. MODIS and VIIRS data are the better satellite time series data because of their inter-calibration, atmospheric processing, and spatial resolutions. In collaboration with the ESA, we will explore the use of AVHRR NDVI data and freely available European data from SPOT, PROBA-V and Sentinel for their longer time record of 1981 to 2015, and complement these data with more detailed MODIS data from 2000 to 2015. Any and all 1981-2015 trends in AVHRR and SPOT/VEGETATION/PROBA-V NDVI will be confirmed by coincident MODIS NDVI data for their common observation period of 2000-2015.

30. This will enable our study of land degradation to use a 34-year history of consistent and inter-calibrated satellite data; confirm the quantitative utility of the AVHRR NDVI record; and disaggregate to the 250 m scale with MODIS NDVI data. AVHRR data are planned to continue to 2020, and possibly beyond, through MetOps-2 and the scheduled launch of MetOps-3 in 2016. MODIS will continue operations at least to 2017. VIIRS is already providing a back up to MODIS data now, and VIIRS will continue operations through 2030. AVHRR and VIIRS are the imagers on polar-orbiting meteorological satellites, and these missions are continuous because their data are used in numerical weather prediction. That is why VIIRS will continue to 2030, and probably beyond, and why the AVHRR record continues through MetOps-2 and MetOps-3.

Vegetation Indices

31. We discuss here only those vegetation indices for which current and freely available global data exist. These datasets are the NDVI, the MODIS 3-channel Enhanced Vegetation Index (EVI) (Huete et al. 2002) and the 2-channel EVI (Jiang et al. 2008). The MODIS 3-channel EVI will be discontinued for VIIRS because of problems with the calibration of the blue band, making inter-calibration of 3-channel EVIs difficult among different instruments (i.e., blue surface reflectance from dense green vegetation is ~2-3% ±1-2%); problems with sub-pixel clouds, aerosols, and snow;

the fact that MODIS data are atmospherically corrected; and the realization that the blue band is very highly correlated to the red band for vegetation in most vegetation settings. The 3-channel EVI will be replaced for VIIRS by a two-channel EVI (Jiang et al. 2008). Another problem with the MODIS 3-channel EVI is that when problems with the MODIS blue band occur, a backup algorithm produces the 2-channel EVI. Users cannot determine which method was used for the particular data they acquire, complicating attempts for consistent application. Furthermore, the 3-channel EVI cannot be calculated from AVHRR data.

32. In addition to decisions on the choice of data sources and spectral indices, there are additional considerations of how to use them. Daily to bi-weekly data provide the additional value of using information that is seasonal and can be summed or integrated over a year. While many options for how to make use of seasonal information are demonstrated in the studies reviewed by Yengoh et al. (2014), it is our opinion that a tremendous amount of information is present in NDVI or 2-channel EVI data through time. This has been substantiated by the vast number of peer-reviewed publications using AVHRR and MODIS time series data to study land vegetation (>7,300 as of March 22, 2015 from the Web of Science). A common approach using time series NDVI or EVI data is to integrate these data over the growing season.

33. MODIS time series NDVI data can also be analyzed for changes in frequency and amplitude, to identify changes in GPP which are directly linked to changes in cultivation practices. By analyzing frequency changes in NDVI time series, Tucker et al. (in prep) have been able to identify land abandonment, agricultural intensification, and "land grabs" where wealthy groups exclude local people from areas where they have lived for generations.

34. What is lacking is a targeted investigation in the context of the needs of the UNCCD and the GEF. Such a study can identify, perform and evaluate the optimal approach. The creation of datasets, methods and a toolbox is dependent on testing different options for estimating land degradation. As this has not yet been done, it represents a second major barrier that we propose to overcome with the simultaneous use of 40 and 50 cm commercial satellite data to identify where specifically land degradation exists, what caused the land degradation, and what can be done at the local-level to remediate this. This level of detail has been lacking in the past due to financial constraints.

Commercial satellite data

35. The National Aeronautics and Space Administration (NASA) has an agreement with the National Geospatial Intelligence Agency (NGA) to access NGA-purchased commercial satellite data at no cost for use in conjunction with NASA research projects. For this proposal, through the involvement of Tucker and his team at the NASA Goddard Space Flight Center (GSFC), we will be able to access thousands of commercial satellite images with <20% cloud cover from Kenya, Senegal, Tanzania, and Uganda for the time period of 2007-2015. Our land degradation study is exactly the type of NASA research project for which NGA hopes NASA will use these data.

36. While NASA cannot provide copies of the commercial satellite data to others, it can distribute derived products from them if they cannot be used to re-create the original data. NASA GSFC has already acquired commercial satellite data over much of sub-Saharan Africa and other parts of the world. The data are of sufficiently high resolution to reveal individual trees and bushes. The GSFC team is currently researching automated approaches to detect crowns, and thus characterize varying tree and shrub density over large areas. In some areas, high-resolution data are available over a multiple-year period, revealing patterns of agricultural abandonment, vegetation recovery, and other patterns of land-use change in fine detail. However, the archive for these data is not as comprehensive as the Landsat arhcive, and it mostly extends back only to 2006. Thus, these commercial satellite data, when used together with Landsat, MODIS, and AVHRR data, represent an excellent combined resource for evaluating land degradation and for guiding remediation efforts to reverse land degradation.

37. Through close collaboration between Vital Signs (VS), NASA, ESA and Lund University, and coordination with the GEF and with the pilot partner countries, this project will identify case study areas for methodological testing and evaluation. The coverage of Landsat and commercial data, in all but the most cloudy areas, is sufficient to enable stratified-random sampling for method validation. A targeted study thus (a) could select priority regions with known types of degradation, e.g., as determined by Vital Signs field-based data on land management and condition; (b) use the higher-resolution data to confirm land-cover status and trends; (c) relate these to the coarser data with longer records; (d) use the coarser data and appropriate methods to extrapolate areas of degradation and improvement; and again (e) sample using the higher-resolution data in consultation with national experts to evaluate the results.

38. The use of the commercial satellite, Landsat, PROBA-V and Sentinel data will mesh perfectly with field programs the countries have in place, e.g., Vital Signs, because the former data are fine-scale and appropriate for field verification.

39. The commercial satellite data will enable greater local understanding of what phenomena are responsible for land degradation at larger scales. These data will be revolutionary for land degradation studies. Like any very detailed undertaking, maximum value of the commercial satellite data will be possible only from selective and directed use of these very high spatial resolution data. The use of the commercial satellite data by knowledgeable local people, when combined with and directed by AVHRR, MODIS, PROBA-V and Landsat NDVI data, will be a powerful tool for identifying and remediating land degradation.

Field-based activities

40. While this project will not undertake any new field activities, it will leverage the field activities of Vital Signs (VS). VS has developed and implemented an integrated set of protocols for field-based monitoring of degradation and vegetation productivity at national and sub-national scales, based on a statistical sampling frame (http://vitalsigns.org/files/Vital-Signs-Sampling-Frame-2013.pdf) that incorporates both biophysical and socioeconomic measurements to understand the relationships between land cover, land degradation and human well-being.

41. VS uses satellite-data inputs (MODIS and Landsat) to stratify land cover and approximately 500 1-hectare plots are distributed in a stratified random design, with approximately 5000 pseudo-randomly placed rapid plots per country, for calibration of remotely sensed measurements.

42. The VS biophysical measurements, are combined with freely available, coarse-resolution satellite data to provide the continuous national coverage appropriate for the GEF and for the UNCCD for monitoring degradation. At the the landscape-scale (100 km^2), the VS biophysical and socioeconomic protocols are combined with commercial satellite imagery at to provide a detailed understanding of the relationship between land degradation and improvement and human well-being (e.g., poverty and nutrition), including gender disaggregated measures of well-being. However, presently this can only be done in a limited number of sites (~6) per country because the cost of commercial satellite imagery is prohibitive.

43. The combined analysis of the commercial satellite data from this project, with the VS biophysical and socioeconomic protocols, will enable novel multi-scale analyses of the relationship between land degradation and human well-being, from the scale of a household, to a community and to national scales. These analyses will yield integrated, multi-scale biohysical and socioeconomic products to support countries in meeting their national reporting obligations to the UNCCD, the GEF and the Sustainable Development Goals.

44. VS sampling has been implemented through governments and civil society organizations in five countries (Ghana, Kenya, Rwanda, Tanzania and Uganda. There also now is an opportunity to implement Vital Signs field sampling in Senegal through the GEF Resilient Food Security in sub-Saharan Africa Integrated Approach Pilot (IAP), thus providing integrated biophysical and

socioeconomic data products for all four pilot countries. Although Vital Signs data are not available for all developing countries, fine-scale satellite imagery is available from NASA for all developing countries and these data can be made available through cooperation with NASA.

C. Alternative Scenario

Project Objective

45. As stated in the Results Framework, the objective of this project is to provide guidance, methods and toolbox for assessing and monitoring status and trends in land degradation using remote sensing technology which can be employed to inform land management and investment decisions as well as to improve reporting to the UNCCD and the GEF.

46. Gaps identified in the baseline initiatives described above need to be addressed to enable countries to produce estimates of land degradation trends for reporting to the UNCCD and GEF, and to enable identification of regional patterns of land degradation trends for GEF prioritization. The creation of data sets, methods, and a toolbox is dependent on testing and verifying different methods for estimating land degradation at the country level. Moreover, there is also a need to develop country-capacity in the application of tools and recommended approaches for land degradation assessment using remote sensing.

47. We propose to evaluate several potential improvements over GLADA and previous work by the ESA. GLADA was based only on 8 km data and the ESA's focus was on regional-scale land degradation. In this project we will use multiple satellite spatial resolutions including Advanced Very High Resolution Radiometer (AVHRR) 8 km, Moderate Resolution Imaging Spectroradiometer (MODIS) 250 m, Landsat 30m, and commercial satellite 40 and 50 cm. By using multiple spatial resolutions, we will be able to (1) confirm observations and measurements of land degradation made using the coarse resolution time series; and (2) better understand how different types and severity of land degradation can be represented by the coarse resolution data, so these can be employed for global monitoring of land degradation at 8 km and 250 m. The commercial satellite data at 40 and 50 cm spatial resolution, together with field-based plot data from Vital Signs and other sources (e.g., World Agroforestry Center Land Degradation Surveillance Framework), will corroborate the remotely sensed land degradation data with ground observations at the local level.

48. Accordingly, our proposal has thus been designed around three components:

1) Methods for assessing and monitoring land degradation at multiple scales;
2) Demonstration of recommended methods and platforms to enable widespread adoption across scales, from the regional to national and local levels; and
3) In-country capacity development.

49. We propose a specific project design that begins with discussion of the proposed design with stakeholders, incorporates feedback, and makes modifications where necessary. Stakeholders include those in the international community, the GEF, UNCCD, STAP, and ESA and those at the national level in Kenya, Senegal, Tanzania, and Uganda, the four pilot countries where we will focus our proposed work. This also includes relevant national agencies in these countries, Vital Signs, and GEF Food Security Integrated Approach Pilot (IAP) project partners.

50. This will ensure that our work will result in methods, a toolbox, and capacity building for assessing land degradation that are aligned with the specific needs of the GEF's GBI and with the UNCCD. We will also use the early phase of our proposed work to set up regular coordination with the stakeholders above. This will include continued collaboration with all four countries as the work progresses, as methods are developed, and results elaborated. The involvement of in-country experts to work directly with us will result in the building of in-country capacity in Kenya, Senegal, Tanzania, and Uganda as the project progresses.

COMPONENT 1: Methods for assessing and monitoring status and trends in land degradation

51. This project requires the development of agreed-upon methods for using satellite data for assessing trends in land degradation. This will entail the following:

a) Comparison of different options for data sources and spectral indices derived from them (Outcome 1.1. Output 1.1.1);

b) Testing the potential for disaggregation using freely-available, finer-resolution data (Outcome 1.1. Output 1.1.2);

c) Development of methods agreed-upon by stakeholders (Outcome 1.2. Output 1.2.1); and

d) Improvement of the GBI algorithm for the land degradation focal area (Outcome 1.2. Output 1.2.2).

52. In doing these we must address the accuracy, suitability, and trade-offs (e.g. resolution, accessibility, repeatability, sustainability/automation, cost, etc.) of different global datasets and approaches as well as producing methods that are agreed upon by stakeholders for in-country use.

53. We have two expected outcomes and four outputs within this component.

Outcome 1.1. Improved understanding of the accuracy, suitability and trade-offs (e.g. resolution, accessibility, repeatability, sustainability/automation, cost, etc.). of different global datasets for estimating status and trends in land degradation

54. We propose to identify land degradation using vegetation indices, such as NDVI primary productivity or the enhanced vegetation index EVI, with satellite data sets that meet the following criteria:

- they are freely available;
- they are well described in the scientific literature;
- they are current into 2015 and will be continued beyond this time;
- they are produced in a consistent and calibrated non-stationary fashion;
- they have global coverage;
- they have a frequency of observation that is sufficiently dense to characterize seasonal and inter-annual dynamics; and
- they have spatial and spectral properties that enable estimation of land degradation at national and sub-national levels.

55. To achieve this we propose to build on the guidance of Yengoh et al. (2014), a study commissioned by STAP. In consultation with ESA, we will evaluate a range of vegetation indices, e.g., NDVI, EVI, S10 and EM10. We will use satellite data sources at 8-km resolution with coincident 250 m and 30 m data; and further disaggregate down to the 40 and 50 cm scale using commercial satellite data to understand the drivers of land degradation. In order to measure trends we will need data sources that are current and will continue into the future, and that ideally have a minimum of 30 year time series to the present.

56. This outcome will be based on detailed analysis of various data sets and methods in four African countries – Kenya, Senegal, Tanzania and Uganda – resulting in the outputs described below.

Output 1.1.1. Comparison of different datasets and methods for estimating status and trends in land degradation completed

57. This Output will be a report with sub-sections, each of which contains a comparison of particular dimensions of land degradation, with options for selecting data sources and methods, and guidance for using them to estimate land degradation. These sections include summaries of satellite data sources, spectral indices and approaches to using the temporal aspect of the data. The comparisons will benefit from the availability of medium-resolution Landsat and Sentinel-2 30 m data and commercial 40 and 50 cm data. The comparison and resulting report sections will include:

- Summarize the use of spectral indices for indicating photosynthetic capacity as a means to identify land degradation in Kenya, Senegal, Tanzania, and Uganda;
- Distinguishing climate trends from inter-annual variation such as drought;
- Evaluation of data sources relevant for identifying land degradation: AVHRR, MODIS, Landsat and Senintel-2, and commercial satellite data; and
- Evaluation whether primary productivity can be used to identify land degradation and the subsequent use of commercial satellite data to identify the drivers of land degradation.

Methods

58. The photosynthetic-capacity index product NDVI is seen as most appropriate by Yengoh et al. (2014) and by Higginbottom and Symeanakis (2014) for a unified approach, however we will evaluate a range of spectral indices for detecting land degradation. Data must exist at multiple scales and for different time spans. For example, the AVHRR NDVI 8-km bimonthly record from 1981 to 2015 will enable the separation of land degradation from short-term variations caused by inter-annual variations such as drought.

59. MODIS 250 m data from 2000 to 2015 will be used to confirm the AVHRR 8-km results for an overlapping period. We will also use Landsat and Sentinel-2 data to provide more detail at 30 m spatial resolution and then use 40 and 50 cm commercial satellite data to identify the drivers of land degradation. Commercial satellite data can distinguish among a range of processes, including those operating at a fine scale, e.g., de-intensification of agriculture, selective thinning of forest or woodland, or bush encroachment. They are thus an excellent data source for understanding land degradation at the local level.

60. This assessment will benefit from our extensive experience in studying land degradation, desertification, and distinguishing climatological from land-use effects, as well as our current work on automation of tree-cover density estimation with Landsat and commercial satellite data. It will also benefit from the local understanding of land dynamics of our in-country counterparts in Kenya, Senegal, Tanzania, and Uganda.

61. The following sources of satellite data, their nested uses, and analytical approaches are presented in the following Table.

Data Source	Use	Analytical Approaches and Expected Outcomes
NOAA AVHRR	Estimation of 8-km regional land degradation trend for 1981-2015 and beyond for identification of anomalies & droughts	34 year trends vs. regional climate anomalies such as drought
MODIS	Calculation of NDVI for 2000 to 2015 and beyond at 250 m for estimation of land degradation	AVHRR trend disaggregation and comparison with medium & high-resolution data
Landsat	Sub-national 30 m scale confirmation of land degradation from 2000 to 2015 and beyond	30 m disaggregation of AVHRR and MODIS data to sub-national scales
Sentinel-2	Sub-national 30 m scale confirmation of land degradation from 2016 and 2017	Comparisons with Landsat data for 2016-2017 (data will start in 2016)
Commercial satellites	Local-scale confirmation of land degradation from 2010-2015 and beyond	Land degradation disaggregation to 40 & 50 cm to understand drivers & processes at local level

Institutional Lead

62. This Output will be led by NASA with contributions from Lund University and Vital Signs.

Output 1.1.2. Evaluation of approaches for incorporating higher-resolution data for disaggregation or targeted analysis completed

63. This Output will be delivered as a second report, with specific sections that include:

- Summary of freely-available, higher-resolution data sources, their suitability and trade-offs (e.g. resolution, accessibility, repeatability, sustainability, potential for automated analysis and cost of use);
- Review and evaluation of approaches to disaggregate indicators for degradation and other change from coarse data to medium and fine resolutions; and
- Proposed algorithm to conduct the aggregation and disaggregation via data merging for use in a toolbox.

Methods

64. Medium-resolution 30 m data are freely available from Landsat and will be from Sentinel-2 and will be continued into the future. They are thus a valuable source, not only for evaluating coarser data, but also for possible disaggregation of temporal indices from 250 m to 30 m. Because of the less-frequent data acquisitions, these data have the disadvantage of less consistent timing of observations and relatively greater impacts of cloud interference. Nonetheless, for all but the most extremely cloudy areas, multiple images can be acquired for a given year, allowing alignment with coarser data from different seasons. Their 30 m spatial resolution is sufficient to detect land-cover changes to the one-hectare scale.

65. We will evaluate approaches that combine the more complete and consistent temporal information provided by coarser resolution MODIS data and the finer spatial resolution 30 m data of Landsat and Sentinel-2 to improve our mapping of land degradation at the sub-national scale. This will include statistical algorithms to "merge" the data of different resolutions that can be automated in a toolbox for end-user application. The result will be the ability to generate indicators and identify areas with different types of land degradation, other changes, or stability, similar to those for Output 1.1.1, at the 30 m spatial resolution.

66. To evaluate the results of incorporating higher-resolution data for disaggregation or targeted analysis, we will select pilot sites for analysis. To select these sites, we will first stratify countries

into approximately ten major vegetation types. Then within each vegetation class, we will first identify at least three separate areas of land degradation based on the coarse resolution data. We will then divide each of these areas, or pilot sites, into grids from which randomly selected pixels for validation will be derived. Spatial comparison at high resolution of disaggregated NDVI or estimates from other vegetation indices with on-site measurements will be performed to analyze spatio-temporal correlations of disaggregated maps.

67. As was the case for Output 1.1.1, we benefit from NASA's access to commercial satellite data. For this output, these 40 and 50 cm spatial resolution data will be merged into high-resolution mosaics for the entire extent of the four pilot countries. This will enable the high-resolution 40 and 50 cm mosaics to provide a detailed interpretation of land degradation processes and drivers where these have been identified with MODIS and Landsatsentinel-2. The commercial satellite data mosaics will also be invaluable to guide efforts to reverse land degradation at local levels.

Institutional Lead

68. This Output will be led by NASA with contributions from Lund University and Vital Signs.

Outcome 1.2. Agreed-upon methods for assessing land degradation/ improvement suitable for identified end-users

69. The evaluations conducted in Outcome 1.1 will have identified the most appropriate data sources, indices and options for disaggregation for this purpose. Additional steps for agreed-upon methods are to review them with stakeholders and then finalize them, based on the input received from the stakeholders.

70. These activities will produce two outputs.

Output 1.2.1. Standard methods, including analytical steps and recommended datasets, agreed upon and presented to major stakeholders, including countries, GEF, UNCCD and their scientific and technical bodies

71. This Output will be delivered as a third report, with specific sections that include:

- Reproduction of the presentation to stakeholders and list of whom presented to;
- Feedback provided by stakeholders and how this was incorporated into the projects analytical steps, evaluation of data sets, and final methods; and
- Description of the final methods for assessing land degradation suitable for identified end-users.

Methods

72. Our overall approach will be presented to stakeholders in order to obtain feedback, which we can take into account in a modification of our approach, and to reach an agreement on methods we select for evaluation in the four case-study countries. Presentations will be made to the GEF and STAP in Washington, D.C., and web-based presentations will be made to the UNCCD and OFPs and to national counterparts identified during the start-up phase. Presentations will include:

- Review of the logic for the proposed methods;
- Detailed description of methods for national demonstration;
- Feedback session and stakeholders ranking of proposed methods for national demonstration; and
- Adjustment of approach based on feedback and selection of agreed methods for pilot demonstrations and toolbox development.

Institutional Lead

73. This Output will be led by NASA with contributions from Lund University and Vital Signs.

Output 1.2.2. Improvement of the GBI algorithm for the Land Degradation focal area for GEF-7 based on agreed-upon methods

74. This Output will be delivered as a fourth report, with specific sections that include:

- Summary of the GBI, how it is used, and how it has been calculated to date;
- Summary description of agreed-upon methods for assessing land degradation suitable for identified end-users; and
- Description of how the agreed-upon methods can be applied to the GBI and what improvements this represents.

Methods

75. The methods for this output are a thorough documentation of the work performed rather than analytical testing or method development.

76. We will review relevant documents on the GBI and past methods for land degradation indicators. We will summarize the description of agreed-upon methods for assessing land degradation suitable for identified end-users, how the agreed-upon methods can be applied to the GBI, and the improvements this represents. A draft will be provided to the GEF, STAP, UNCCD and others for comments. These will be discussed via teleconference and a final report will then be written

Institutional Lead

77. This Output will be led by Lund University with contributions from NASA and Vital Signs.

***COMPONENT 2*: Demonstration of recommended methods and platforms to enable widespread adoption**

78. The objectives of this component are to:

- demonstrate the use of the agreed-upon methods to baselines for the four pilot countries;
- incorporate the methods into a GIS toolbox; and
- make the toolbox available through the project website and through other regional and global websites, including through Vital Signs.

79. The GIS toolbox will include links for accessing the source data through the internet, applications for mapping and calculating the indices, comparison of analytical outputs derived from coarse- and medium-resolution datasets with those derived from high-resolution data and ancillary GIS data, estimation of degradation, insights into drivers of degradation, and production of output tables and maps of results. The toolbox will be accompanied with guidance documents and other training materials. This will include a detailed assessment of the resources required for a country to adopt the approach for national and sub-national reporting, including, but not restricted to, any costs of data acquisition, skills required to interpret data, training needs, and other capacity building requirements To enable widespread adoption, we will create a project website where users can access the toolbox and the capacity-building materials. These materials also will be placed on the Vital Signs website and the World Overview of Conservation Approaches and Technologies (WOCAT) portal for global access.

80. To ensure long-term access to the datasets and the toolbox, at the outset of the project we will develop partnerships with the UNCCD and WOCAT, with the aim of also hosting the tools and the capacity-building materials on the UNCCD Knowledge Brokering Portal (SKBP) (http://www.unccd.int/en/programmes/Science/Knowledge-Management/Pages/Scientific-Knowledge-Brokering.aspx) and the WOCAT portal (https://www.wocat.net/). We will include a representative from WOCAT in the Project Inception Workshop. The aim of the SKBP is to provide a global knowledge resource and guidance on best practices related to SLM and land degradation. GEF-financed projects contribute to the development of national and local decision support in combating Desertification, Land Degradation, and Drought (DLDD). The goal of the WOCAT Network is to integrate knowledge management efforts for enabling widespread use of SLM among national, regional and international governmental and non-governmental organizations.

81. The toolbox will provide valuable support for enhancing cross-sector collaboration in integrated landscape management and for building the knowledgebase required to promote mainstreaming and scaling up of SLM best practices. As noted earlier, the area affected by land degradation is one of three indicators used to calculate the GEF benefits index (GBI) for its Land Degradation Focal Area. This indicator previously has been based on NDVI, and an improvement to the use of NDVI for this indicator is a major motivation of this project. Our proposed improvements involve using NDVI at multiple scales, from kilometers to meters to centimeters.

82. This component includes the following:

a) Baseline assessment of land degradation for four pilot countries (Outcome 2.1, Output 2.1.1)

b) Draft guidance documents for the application of the methods and toolbox (Outcome 2.1, Output 2.1.2)

c) Platform for data processing, method application and expansion to other countries (Outcome 2.2, Output 2.2.1)

Selection of pilot countries

83. We used the primary criteria below to select the pilot countries. In aggregate, the countries represent a range of:

- Types of degradation (e.g., loss of species, change in vegetation structure, soil structure, loss of organic matter);
- Land cover features (e.g., vegetation, topography, soil type);
- Climatic zones;
- Land use and management regimes (e.g., rangeland, cereal crops, plantation forest);
- Social contexts;
- Scales and extent of degradation;
- Drivers of degradation (e.g., erosion, pollution, deforestation, nutrient depletion);

84. In addition, we used the following secondary criteria, related to project feasibility, for selecting pilot countries:

- Vital Signs or other project partners have an established presence on the ground and/or existing partnerships at national (e.g., governments) and sub-national or local scales to facilitate implementation and capacity building within the project timeframe; and
- The selected countries maximize opportunities for synergies of this project with other GEF programs and projects under the land degradation focal area, especially the IAP-Food Security Sub-Saharan Africa.

85. Based on the considerations above, we identified Kenya, Senegal,Tanzania and Uganda as the four pilot countries. These countries span a range of land cover types and climatic zones, from humid tropical forest, to mixed and perennial farming systems and Guinea-Savanna with cereal-root crops and agro-pastoral systems.

86. Vital Signs has formal partnerships with both government and civil society organizations in Kenya, Tanzania and Uganda.

87. In Kenya, Vital Signs has a formal partnership agreement with the Ministry of Environment and Natural Resources.

88. In Tanzania, Vital Signs has formal partnership agreements with the National Bureau of Statistics and the Ministry of Agriculture, Food Security and Cooperatives, as well as with the Southern Agricultural Growth Corridor of Tanzania Center to provide data, indicators, knowledge and decision support tools to support: a) national reporting requirements, b) more environmentally sustainable decision making about agricultural development and c) implementation of the National Climate Resilient Agriculture Plan. Vital Signs has an office in Morogoro, Tanzania, with a team of nine Tanzanians engaged in data collection and integration, working through our local implementing partner, the Tanzania Forest Conservation Group, a civil society organization. These arrangements enable Vital Signs to work at scales ranging from individual farm households, to landscapes, districts or regions and the national scale.

89. In Uganda, Vital Signs has a formal partnership with the Ministry of Agriculture and the Ministry of Environment to provide data, indicators, knowledge and decision support tools to support an evidence-based approach to agricultural and environmental decision making, including natural capital accounting. Vital Signs Uganda has a team of nine Ugandans engaged in data collection and integration, working through our local implementing partner, the African Innovations Institute. These arrangements enable Vital Signs to work at scales ranging from individual farm households, to landscapes, districts or regions and the national scale.

90. In Senegal, Lund University Center for Sustainability Studies (LUCSUS) through its partners, the Department of Physical Geography and Ecosystem Sciences in Lund, as well as the Department of Geography at Copenhagen University, have been collaborating with Center de Suivi Ecologique. Center de Suivi Ecologique is a Senegalese institution specialized in the field of natural resources management and environmental research. It operates under the tutelage of the Ministère de l'Envioronnement de la Protection de la Nature, des Bassins de Rétention, et Lacs Artificiels. Center de Suivi Ecologique has developed a scientific and technical partnership with numerous national and international institutions in different sectors. It participates actively in environmental data collection as well as the development of national and regional expertise in the field of natural resources management.

91. The development of methods and tools for land degradation assessments is vital for a host of strategic development objectives of Senegal. Coordinating mechanisms established and strengthened through this project would support harmonization and management of various planned and/ongoing SLM initiatives in the Senegal (such as FAO/UNEP's LADA, Global Mechanism's support, etc.). Land degradation has been repeatedly recognized by the Senegalese government as a key constraint to development at local and national levels. This project is therefore expected to generate local, national and global environmental benefits which would contribute to meeting a key sustainable development goal for Senegal. This is to help prevent and reduce the impact of land degradation on the health and integrity of the ecosystems (particularly the forest and agrosylvo ecosystems) in the Groundnut Basin, the most seriously degraded area in Sengal. Administratively, the Groundnut Basin covers the regions of Kaolack, Fatick and Diourbel. This priority challenge is reflected in the PRSP-II (DSRP-II), where combating land degradation and promoting sustainable agriculture and forestry is defined as priority objective to reduce poverty. Addressing land degradation through water and soil conservation and a number of restoration activities, including agroforestry

development, is central in the sustainable management of natural resources for agricultural development and food security.

Outcome 2.1. Baseline assessment of land degradation in 4 pilot countries (Kenya, Senegal, Tanzania, Uganda)

92. This outcome includes the application of the agreed upon methods for the estimation of a land degradation baseline for the four pilot countries. These will be complimented by the production of draft guidance documents on the methods and toolbox, which will eventually serve as core examples for capacity building materials created in Component 3. This Outcome has two Outputs.

Output 2.1.1. Land degradation baseline produced for in-country evaluation for 4 pilot countries

93. This Output will be delivered as a fifth report which will contain a series of country-specific documents, each with an associated GIS of data inputs, ancillary data and results. These will include:

- Documentation of the application of methods in each country;
- Tabular and graphical presentations of the results, including the most relevant satellite image examples, indices, and maps of resulting estimates of land degradation
- All satellite data used, including national coverage of AVHRR, MODIS, Landsat and SENTINEL-2, as well as wall-to-wall commercial satellite-data mosaics
- Derived data and final results in GIS format that are organized so they can be viewed through an open-source GIS.

Methods

94. In our initial start-up meetings with representatives from each country, and in subsequent internet-based meetings, we will discuss the range of land uses and expected types of degradation and associated locations across the countries. We will also request relevant maps and other data from the countries to create a base GIS of ancillary data. The Vital Signs atlases for Tanzania and Uganda will provide some of this ancillary data. The specific application of the methods will be informed by these discussions and ancillary data, by evaluation of high-resolution imagery for each country and by existing field-based plot measurements from Vital Signs and other sources.

95. We will use the same baseline – 1981 - for all countries. Global AVHRR 8 km NDVI data are available for all countries from 1985-2015 and beyond. MODIS NDVI data at 250 m are available from 2000 to 2015 and beyond. We have complete coverage of high-resolution imagery for each country already at NASA from 2010 to 2015. We will create wall-to-wall mosaics of these data for interpretation of current land degradation status. We will also create Landsat mosaics for 2015, 2010, and 2000 for further interpretation of changes over time, and where applicable, for disaggregation to identify drivers of land degradation.

96. This combination of data will allow us to calibrate the application of the method, whether based on the coarse- or fine-resolution data. Using our definition of land degradation, i.e., a negative trend in primary production that is independent of climate variability (Ibrahim et al. 2015), for each data type, we will identify thresholds for identifying land degradation by land cover class at both national and regional scales, estimate the extent of land degradation and measure trends over time. Within each stratum, the 40 and 50 cm resolution data will be used to determine the drivers of the changes estimated with the other satellite data.

Institutional Lead

97. This Output will be led by NASA with contributions from Lund University and Vital Signs.

Output 2.1.2. Draft guidance documents on methods and toolbox created based on application in 3 pilot countries (Kenya, Senegal, Tanzania, Uganda)

98. This Output will be delivered as a sixth report, drawing on the methodological applications in Output 2.1.1 to create draft guidance. Sub-sections will include:

- Guidance on data inputs and access;
- Guidance on the overall process of disaggregation from the national to local scale, and the role of data of different spatial resolutions;
- Guidance on data transformations and calculation of indices;
- Guidance on methodological details of estimating land degradation, including interfacing with ancillary data sources; and
- Guidance on production of quantitative and mapped estimates.

Methods

99. As we conduct the pilot projects in Kenya, Senegal, Tanzania, and Uganda, draft guidance will be created so that end-users can repeat the entire process. This will include data access, all processing steps, comparisons with ancillary data, and the generation of the final estimates. As we obtain feedback and evaluation of the baselines estimated for the four countries from our respective national counterparts, we will incorporate this into the guidance documents.

100. The cost or logistics of using the methods with a tailored, user-friendly open-source GIS toolbox would not be prohibitive. For example, countries will be able to easily test different thresholds applied to the coarse data at the national level in the form of continuous indices to define areas of probable land degradation. The toolbox will also enable exploration of medium-resolution data, from Landsat and Sentinel-2, within areas of probable change to further disaggregate estimates of land degradation. This will include a standard GIS interface for comparing these data with high-resolution imagery, as well as with field data.

Institutional Lead

101. This Output will be led by Lund University with contributions from NASA and Vital Signs.

Outcome 2.2. Platforms for capacity building and for expanding the use of the data, methods and toolox to other countries and regions

102. We will create a platform to enable use of the data, methods and tools by other countries and regions. This will be a component of the project website where the tool for applying the methods, links to agreed-upon datasets for regional- and global-scale analysis will be available for download. The website will also be mirrored on the Vital Signs website and on the website of the regional center. This will enable other countries in Africa and worldwide to access the tools and the methods.

Output 2.2.1. Data processing platforms, with data collection protocols, established in regional centers and at global level

103. This Output will be delivered as a portal within the project website and replicated in the Vital Signs main web site and in a regional center, that will serve as the platform for accessing guidance, protocols and the tool to implement the agreed upon methods. This will include:

- Description of the project and its goals in the context of the GEF GBI and national capacity building;

- Access to the GIS toolbox to implement the agreed upon methods;
- Access to the data for the four countries serving as pilots for implementation of the methods and toolbox
- Access to guidance documents and protocols

104. We will develop a portal on the project website for the regional- and global-scale toolbox and guidance documents. From this portal, stakeholders will be able to access the downloadable toolbox, a link for accessing for accessing regional-scale datasets, together with all guidance documents for applying the methods. This will include all relevant instructions needed, the toolbox, and all lessons learned from the demonstrations of the approach in the four pilot countries.

105. This website will be mirrored in regional centers through appropriate information and communication technology and will be linked to existing platforms, such as those provided by Vital Signs, CILSS, IGAD and the Center de Suivi Ecologique in Senegal, the UNCCD SKBP and WOCAT.

Methods

106. We will produce a website to access all guidance documents and a downloadable toolbox for accessing data and applying the methods. This will include all relevant instructions needed, the toolbox, and all lessons learned from the demonstrations of the approach in the four countries.

107. This website will be mirrored in regional centers through appropriate information and communication technology and be linked to existing platforms, such as those provided by Vital Signs, CILSS, IGAD and the Centre de Suivi Ecologique in Senegal, the UNCCD SKBP and WOCAT.

108. By having a project website with separate portals for the toolbox and access to data for local-, national-, regional- and global-scale assessment of land degradation, together with guidance documents, we will be creating a systematic approach for consistent, repeatable, multi-scale assessment of land degradation, thereby enabling consistent comparisons across different scales and by different institutions and stakeholders.

Institutional Lead

109. This Output will be led by Vital Signs with contributions from NASA and Lund University.

COMPONENT 3. Gender appropriate capacity development in the application of the toolbox and recommended approaches for estimating status and trends in land degradation using remote sensing

110. Based on stakeholder engagement and feedback, we will develop a gender appropriate e-learning toolbox – essentially an online sourcebook for assessing land degradation - including tutorials and manuals for each assessment scale. The aim is to mainstream the use of the methods, the toolbox and data into decision making, for a range of users, from scientists who are not remote sensing specialists, to senior managers or policy analysts. The tutorials and manuals will learn how to apply the toolbox and datasets appropriately at all of the different scales (i.e., local-, national-, regional- and global-scales). All of the project partners have demonstrated experience with successfully developing manuals and web-based tutorials (e.g., you-tube videos) for teaching non-specialists to apply complex scientific methods and to interpret the resulting products.

111. In addition, we will provide access to a wiki-type area where users in different countries can interact, trouble shoot for one another, provide advice, exchange and compare user experiences and assessment results.

112. We will follow established e-learning best practices and throughout the development process we will solicit and incorporate user feedback. We also will take advantage of convenings where multiple stakeholders will participate to conduct in person workshops as a means of testing and refining the learning tools.

Outcome 3.1. Strengthened capacity of the 4 pilot countries and regional center, with equitable participation by women and men, in accessing and processing data related to NDVI and other vegetation indices for estimating degradation/improvement

Output 3.1.1. Draft gender appropriate guidance documents and manuals design completed, incorporating GEF, UNCCD and country feedback, and made available online

113. Online gender appropriate guidance documents and manuals, that reflect input and feedback from the GEF, the UNCCD and from the four pilot countries, will be made available through the project website, the Vital Signs website and through a regional center.

Methods

114. Online gender appropriate guidance documents and manuals, that reflect input and feedback from the GEF, the UNCCD and from the four pilot countries, will be made available through the project website, the Vital Signs website and through a regional center.

115. All project partners have substantial experience with developing gender appropriate guidance documents for application of complex scientific methods for users with a range of levels of expertise and experience.

Institutional Lead

116. This Output will be led by Vital Signs with contributions from the Lund University.

Outcome 3.2. Enhanced exchange of knowledge among countries and at least one regional center, with equitable participation by women and men, on remote sensing methods for estimating status and trends in land degradation

Output 3.2.1. Training and capacity building of 4 national and of regional centers in Africa, with equitable participation by women and men, on remote sensing methods and manuals developed in the previous stages for estimating status and trends in land degradation

Enhanced capacity of stakeholders in Kenya, Senegal, Tanzania and Uganda, with equitable participation by women and men, to use consistent approaches to conducting land degradation assessments based on remotely sensed data.

Methods

117. We will conduct training workshops in country, with equitable participation by women and men, and use this experience to develop gender appropriate online tutorials (e.g., you-tube videos) to provide regional capacity building.

118. We also will take advantage of a scalable training model that has been used successfully by Vital Signs, whereby, in addition to training stakeholders in the four pilot countries on the use of the methods, datasets and the toolbox, we also will train them to train others.

119. We will track the number of users and percent of women trained and will integrate user feedback into a process of improving the online training materials.

Institutional Lead

120. This Output will be led by Lund University with contributions from Vital Signs and NASA

D. Incremental or additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF/SCCF and co-financing:

121. There is growing interest in using remote sensing for monitoring trends in land cover, because changes in land cover are being used as a proxy indicator for land degradation by the UNCCD. In the assessment of land degradation or changes in land productivity, two complementary approaches may be distinguished:

122. An assessment of historic trends in land degradation or changes in land productivity, in which past changes are examined; and

123. An assessment of future trends, in which scenario building and projections are made of expected changes in land degradation or land productivity based on defined scenarios.

124. During the last fifty years, NDVI has been widely used for vegetation mapping and monitoring, as well as for the assessment of land cover and associated changes. This is because remotely-sensed, satellite-derived datasets provide spatially continuous data and yield time-series signatures from which temporal patterns, trends, variations and relationships can be derived. This has not prevented people from misusing NDVI, and care should be exercised in the use of any scientific method. Misuse of NDVI is often related to lack of capacity, knowledge and scientific expertise among national, regional and global users of land cover information, as well as to a lack of standardized and harmonized datasets.

125. Under the baseline scenario, without incremental GEF financing, the full potential for the use of NDVI for harmonized and standardized global land degradation monitoring will not be realized and different users will continue to use different tools, methods and data. As a result, information in different countries and regions will not be comparable. Moreover, not all countries affected by land degradation and desertification have the basic capacity and skills to undertake land cover monitoring, interpret results and report to the UNCCD on one of the core indicators of trends in land cover that were adopted at COP 11, linked to its Strategic Objective-2 to improve conditions of affected ecosystems (decision 22/COP.11).

126. With GEF incremental support from the Land Degradation Focal Area, this project, will assist the GEF in aligning the focal area portfolio monitoring needs of global environmental benefits linked to improvements in land cover and reduced land degradation with the activities of the STAP and the UNCCD Secretariat on indicator-based reporting in response to COP decision 22/COP.11. The proposed project will thus contribute to the use of better data for monitoring of land cover and will equip the GEF, the UNCCD and country parties with better methods and a toolbox for monitoring and reporting on trends in land cover (LD-EA Outcome 5.1). This will contribute to enhanced implementation of the Convention in the longer term.

127. By making better data on trends in land cover accessible, and by providing more user friendly methods and a toolbox, the GEF, UNCCD and country parties will also gain access to better assessments of changes in land cover and will be able to more accurately identify areas suffering from land degradation. This will improve the basis for making decisions at global-, regional- and national-levels regarding where to invest resources to mitigate land degradation and promote sustainable land management. Incremental GEF support will therefore be directed to mainstreaming SLM in development investments and value chains, across multiple scales, in collaboration with the IAP-Food Security in Sub-Saharan Africa. Baseline co-financing to the Project amounting to US$ 10,002,640 will be provided from NASA, Vital Signs and Lund University.

E. Global Environmental Benefits (GEBs):

128. This project will identify the most appropriate global data and will develop standardized methods for estimating the status and trends in land degradation and. Improved data and methods, together with the regional and global platforms for amplification of the approach and capacity building of key users of the data and methods at regional and national levels, the project is expected to lead to more accurate assessments of trends in land cover and land degradation, which will in turn inform the UNCCD process and the allocation of funding to the GEF land degradation focal area.

129. More indirect and long-term benefits of improved targeting of UNCCD and GEF interventions will lead to enhanced land cover in areas with most potential for restoration, larger area covered by SLM due to a more cost-effective approach to the implementation of the Convention and GEF projects, and enhancement of other ecosystem services generated by SLM such as increased carbon stocks in soils and vegetation, enhanced agro-biodiversity, improved connectivity of critical habitats in the production landscape, as well as improved management of water resources for irrigation, etc. in dry areas.

130. The GEF-supported alternative scenario will generate the following GEBs:

Baseline	Alternative	GEBs
Lack of standardized and harmonized data, methods and tools for assessing trends land in degradation	Identification of the most appropriate global datasets for estimating status and trends in land degradation Standard methods available for assessing land degradation and improvement of the GBI algorithm for the Land Degradation focal area for GEF-7	More accurate assessment of trends in land cover and land degradation enables better targeting of SLM interventions at global-, regional- and national- levels, which will maximize the impact of GEF funding and improve the effectiveness of implementation of the UNCCD. Better targeting of SLM interventions will lead to: (i) Improved land cover in areas with the greatest potential for restoration (ii) An increase in the area covered by SLM (iii) Enhancement of other benefits generated by SLM, such as increased soil carbon, improved water use efficiency, enhanced agro-biodoversity and improved habitat connectivity
Lack of systematic and documented testing of NDVI for assessing national-scale baselines across a range of agro-ecosystems	Baseline assessment of land degradation and draft guidance documents and potential toolbox and methods applied in pilot countries Platforms for amplification of assessments at global and regional levels, including data collection protocols	
Capacity constraints in countries affected by land degradation and desertification related to application of remote-sensing tools and methods for land degradation assessment	Strengthened capacity of selected pilot countries and regional centers in accessing and processing NDVI and other vegetation indices for land degradation monitoring and assessment Enhanced exchange of knowledge about applications of NDVI and other vegetation indices for monitoring land degradation and for amplifying the use of the remote-sensing toolbox and methods	

F. Innovation, sustainability and potential for scaling up:

131. This project is designed to develop, test and improve upon the tools, methods, learning and systems required to scale up remote-sensing applications for land cover and land degradation assessment and monitoring. The project is intended to have a global reach.

a) Innovation

132. One innovative component of this project is its use of new data to enable multi-scale monitoring of trends in land cover and land degradation. Our approach combines low-resolution AVHRR and MODIS data with high-resolution data from commercial satellites that has not previously been available. Another innovative aspect of the project is development of new, user-friendly methods and a toolbox, including new analytical methods, for assessing status and trends in land degradation. These methods and the toolbox will be developed in collaboration with major stakeholders from affected countries, the GEF, the UNCCD and their scientific and technical bodies, and will be made available through the Vital Signs and the project websites, the UNCCD SKBP and WOCAT.

133. Another form of innovation stems from the development of an interactive product that will link to updated data, e.g., the fine-scale satellite imagery available through NASA, so that users can easily access and tailor data for their own location and conditions.

b) Sustainability

134. NASA will ensure the sustained provision of data for land cover analysis through the AVHRR NDVI and the MODIS NDVI through NASA's MODIS team, and then through the VIIRS team, which, in the next few years, will replace MODIS. VIIRs will continue operation to 2030. In addition, the methods and tools that we will develop for analysis of land cover and land degradation trends in countries affected by desertification and drought will be maintained by Vital Signs and will be made available to an increasing number of partners. Lund University, together with other academic partners, will continue work on improving the toolbox through applied research projects in Africa and other regions of the world.

c) Potential for scaling up and replication

135. Throughout the project, Vital Signs and partners will publish reports, guidance documents and case studies that highlight learning and emerging best practices, to make the tools we develop available for global replication beyond the selected pilot countries and regional centers in this proposal. A global communications package will be designed based on the results of this project to highlight the tools and support that are available for assessments of land cover using remote sensing and NDVI analysis. In addition, the Project will also scale up the use of identified datasets, methods and the toolbox through the Vital Signs monitoring platform and the GEF-funded IAP-Food Security program in Sub-Saharan Africa.

2. *Child Project?* If this is a child project under a program, describe how the components contribute to the overall program impact.
N/A

3 *Stakeholders.* Will project design include the participation of relevant stakeholders from civil society and indigenous people? (yes ☒ /no☐) If yes, identify key stakeholders and briefly describe how they will be engaged in project design/preparation:

136. This targeted research project will work with global, regional and national stakeholders to improve access and capacity to use new land cover datasets and to apply new methods and a toolbox for monitoring and assessment of trends in land cover and land degradation.

137. The proposal idea evolved from a STAP workshop on resilience convened in November, 2014. The proposed project results were discussed with the STAP and the STAP provided input through several iterations of proposal development. Most recently, the STAP provided written comments on the last draft, which we have responded to in this final proposal. In addition, the STAP convened a side event at the 2015 UNCCD Science Conference, in which Vital Signs, NASA and ESA participated and discussed the proposal and methods with stakeholders from the UNCCD Secretariat and Operational Focal Points from a range of countries, including Tanzania. Following the side event we convened a project planning meeting with Vital Signs, NASA and ESA and ESA provided input to the proposal development process.

138. Key stakeholders, and their expected engagement during the implementation phase, are described in the table below:

Stakeholder	Interests in the Project	Project Effect(s) on Stakeholder	Engagement During Project Implementation
GEF and STAP	Key users of the improved datasets and the assessments of status and trends of land cover and land degradation using remote-sensing/NDVI in their work	The results of the project will help GEF to identify areas most at risk of land degradation and priorities for interventions, and for allocation of GEF STAR resources	STAP will be invited to sit on the Project Steering Committee, therefore be able to provide direct input to the project work plan, review and approve annual work plans and budgets, and review and approve any key project outputs
UNCCD Secretariat/Committee on Science and Technology (CST)	Needs improved baseline data on land cover and land degradation for global reporting	The Project will provide better global data for reporting on land cover and land degradation under the UNCCD	CST will be invited to review project outputs, such as the toolbox and methods.
UNCCD focal points	Key users of land cover data for reporting on the core indicator under SO-2 of the 10YSP on land cover	Will be provided with better data and with a toolbox for monitoring and reporting on the UNCCD core indicator of land cover	UNCCD focal points will be consulted and trained in the application of the toolbox in project workshops
National technical experts	Need access to improved data and tools for land cover and land degradation monitoring and assessment	Will benefit from capacity development and enhancement of their technical skills	They will be consulted and trained on the use of new data and on the application of the toolbox and methods
Regional remote-sensing centers	Need access to improved data and better tools for land cover monitoring and assessment	Will be assisted in establishing platforms for knowledge sharing, learning and replication of the approach within the remits of their regions	They will be consulted and trained on the use of new data and on the application of the toolbox and methods
The European Commission Joint Research Center (JRC) and the European Space	Sharing of data and experiences throughout the project with the UNCCD and the GEF	Will be able to apply research results in practice and share data and experiences with UNCCD focal points	Will serve on the project Steering Committee and will share data and information on land cover and other land degradation indicators and

Stakeholder	Interests in the Project	Project Effect(s) on Stakeholder	Engagement During Project Implementation
Agency (ESA)			assessment tools

139. To ensure that the project meets CI-GEF Project Agency's "***Stakeholders Engagement Best Practice ,***" a Stakeholders Engagement Plan (SEP) has been prepared and is attached as Annex H. The purpose of the SEP is to:

140. Identify and prioritize key stakeholder groups that might not be listed and described in this project document;

141. Describe the consultation process and methods, especially regarding the activities to be implemented under Components 2 and 3 of the project;

142. Provide a strategy and timetable for sharing information and consulting with each of these groups; and

143. Describe the process by which people affected by the project can bring their grievances to the Executing Entity for consideration and redress.

144. This Project will work in partnership with other GEF projects and programs, especially the IAP-Food Security in Sub-Saharan Africa, to reach out to countries and to UNCCD focal points with its capacity development and training activities on the application of a toolbox and recommended approaches for land degradation assessment using remote sensing.

4. *Gender Consideration.* Are gender considerations taken into account? (yes ☒ /no☐). If yes, briefly describe how gender considerations will be mainstreamed into project preparation and implementation, taken into account the differences, needs, roles and priorities of men and women.

145. The MSP is consistent with the GEF Policy on Gender Mainstreaming (PL/SD/02. May 1, 2012) and is fully aligned with the focus of Vital Signs' gender policy to address gender holistically throughout the project cycle, and knowledge sharing that ensures women's full access to data and information. Component 3, the capacity building component of the MSP, will have special focus on developing gender appropriate training materials, will ensure that at least 40% of the people trained are women and will employ indicators for gender disaggregated monitoring of workshop participants and individuals trained.

146. In addition, using Vital Signs socioeconomic data in Kenya, Tanzania and Uganda, we will conduct analyses at sub-national scales, to evaluate the extent to which women are impacted by land degradation and to provide insights that will help enable countries to target land improvement activities that will benefit women.

147. To ensure that the project meets CI-GEF Project Agency's "Gender Mainstreaming Policy #8", the Executing Agency will prepare and submit for approval, along with the Year 2 Workplan, a document detailing:

148. How gender issues will be effectively incorporated into capacity building guidelines and manuals (Outputs 3.1.1.); and

149. The measures that will be put in place to ensure the equitable participation of women and men in in national and regional training workshops (Output 3.1.2.).

5. *Benefits.* Describe the socioeconomic benefits to be delivered by the project at the national and local levels. Do any of these benefits support the achievement of global environment benefits (GEF Trust Fund) and/or adaptation to climate change?

150. The project will generate economic benefits for governments obliged to report to the UNCCD on its core indicator on land cover, as the methods and toolbox developed to assess land cover using freely available datasets will provide governments with a cost effective way of meeting convention obligations. This could in future also be extended to reporting to other conventions that use land cover as a proxy for other indicators, e.g., Land Use, Land Use Change, and Forestry (LULUCF), Reducing Emissions from Deforestation and Forest Degradation (REDD) and habitat connectivity.

151. In addition, the use of improved information on changes in land cover and areas at risk of land degradation and desertification will enable governments to improve the targeting of interventions that address these problems through sustainable land management (SLM). SLM interventions are designed to generate multiple environmental and socio-economic benefits and poor communities in affected arid, semi-arid and sub-humid areas that are the focus on the UNCCD will thus benefit from improved land productivity, incomes and livelihoods.

6. *Risks.* Indicate risks, including climate change, potential social and environmental future risks that might prevent the project objectives from being achieved, and if possible, propose measures that address these risks:

152. Key project risks and mitigation measures are summarized below:

Risk description	**Risk level** High, Medium, Low	**Mitigation action(s)**
Insufficient human and financial resources	Low	The project includes training and capacity building activities that will build human capacity in the use of remote sensing for spectral indices for land cover assessment. NASA will make global data sets available for free, which will minimize the need for new financial resources at country level.
Low interest from national stakeholders due to lack of incentives to participate	Low	UNCCD focal points at national level have incentives to improve their reporting to the UNCCD on land cover, and are expected to find the toolbox and methods offered by the project useful, and find the index we develop to be a cost-effective way of reporting trends in land degradation.
Potential for the spectral index to fail as a proxy for land degradation	Low	A negative trend in primary production, that is not indicative of land degradation could be due to the following circumstances: climate trends towards drier conditions, like were observed in the Sahelian Zone from 1970 to 1984; the presence of surface water that is injurious to plant growth; and de-intensification of agriculture where fertilizers and/or irrigation is reduced over time. The proposal will address these conditions or other possible confounding circumstances by using 50 cm commercial satellite data for Kenya, Senegal, Tanzania, and Uganda. These data will identify what is happening at the local scale and identify how this is related to what ever is observed in the spectral analyses conducted. This is a novel and fundamental aspect of our proposal.
Project partners are not sufficiently willing to share scientific information, data, methods	Low	The experiences of the previous GEF funded projects, such as LADA and GEF-Soil Organic Carbon Stocks and Changes (GEF-SOC), have demonstrated that countries and other development partners are willing to share information and data and see a large added value in sharing experiences related to assessment. Countries have demonstrated a commitment to open access to

Risk description	Risk level High, Medium, Low	Mitigation action(s)
		scientific information and data through their MOU agreements with VS. VS has a global access policy, committing to open access to data, methods and models.
It is not possible to reach agreement on standardized/harmonized approaches, methods and toolbox to assess land degradation trends	Low	The experiences of the previous GEF funded LADA project has shown that it is indeed possible to reach agreement on standardized and harmonized approaches to assessment of Land Degradation. As the proposed project further develops these tools and methods, a consultative and participatory process will be followed to ensure that agreement is also reached on the updated methods and toolbox.
Weak institutional framework and project coordination hampers Project Monitoring and Evaluation (M&E) and achievement of results	Low	M&E processes will be facilitated by existing structures and strong coordination between national and global levels

7. *Cost Effectiveness*. Explain how cost-effectiveness is reflected in the project design:

153. The proposed alternative approach, using remote sensing and trends in NDVI or other vegetation indices for assessment of land degradation is the only feasible and cost effective way of assessing land degradation over large areas and over long time spans. Business as Usual approaches, based on field assessment and/or expert opinion, such as GLASOD, have been shown to be impossible to harmonize or are unreliable and biased. In the absence of the proposed Project, opportunities for rolling out the use of NDVI or other vegetation indices are limited, because of (a) limited awareness and capacity barriers at the country level, (b) lack of access to the new datasets that will be made available by NASA, and (c) lack of knowledge about data processing and interpretation.

154. The proposed project approach is deemed to be the most cost-effective and the most likely to lead to sustainable results in terms of methods and approaches for land degradation assessment at global, regional and national levels, because the funds from the GEF will leverage global expertise on land cover/land degradation assessment and the use of NDVI or other vegetation indices as a proxy, from both NASA, VS and leading academic institutions. With a baseline and co-financing of US$10,002,640 million, the GEF costs are less than 20% of the entire Project cost. The Project partners are also committing to continue to make data and expertise available to the GEF, UNCCD and country parties for land degradation assessment using remote sensing and to train and build capacity of users in affected countries.

Summary of Incremental Cost Reasoning and Expected Contributions to the Baseline

155. The GEF funding from this project will help to enhance capacity of countries to implement Multilateral Environmental Agreements (MEAs) and mainstream understanding of land degradation into national and sub-national policy, planning financial and legal frameworks. Further, it will enable the GEF to improve the GBI algorithm for the land degradation focal area. The investments made by the GEF, as well as investments made by countries to meet their national reporting requirements under MEAS will serve as the baseline for this GEF project.

156. This project will take advantage of and build on current GEF investments, such as (a) the Integrated Pilot on Fostering Resilient Food Security in Sub-Saharan Africa, (b) Decision Support

for Mainstreaming and Scaling up of Sustainable Land Management Project, (c) SLM and Climate Change Mitigation Co-benefits Project and (d) Participatory Assessment of Land Degradation and SLM in Grasslands and Pastoral Systems Project, (e) the GEF Strategic Investment Program for SLM in Sub-Saharan Africa (SIP), as well as (f) the investment of Conservation International and the Bill & Melinda Gates Foundation, the MacArthur Foundation and the Barr Foundation to implement a multi-scale monitoring and assessment system for agricultural productivity, ecosystem services and human well-being in fie countries in Sub-Saharan Africa.

157. The GEF funding from this project will provide the incremental costs to advance land degradation monitoring beyond what national, UNCCD and other GEF investments would have achieved on their own. For example, the GEF STAP commissioned a thorough review by Yengoh et al. (2014) of land degradation indices and monitoring tools. The review concludes that while there is a significant body of evidence to support the use of NDVI or other remotely sensed vegetation indices to monitor land degradation, these methods and evidence have not yet yielded suitable tools, methods or improved capacity of countries to set baselines or improve their reporting to the UNCCD, or for the GEF to use in priority setting.

158. The review by Yengoh et al. (2014), as well as a recent review by Higginbottom and Symeonakis (2014) suggest that without projects such as the one we propose here, three crucial barriers to effective land degradation monitoring, reporting and priority setting will not be overcome, namely: the lack of standardized and harmonized datasets, lack of methods for using datasets, and lack of tools and specific guidance on how to use both the datasets and the tools.

159. Access to a toolbox and methods for land degradation assessments would support the GEF Strategic Investment Program for SLM in Sub-Saharan Africa (SIP) and would contribute to the SIP's Program Goal (i.e. improving natural resource-based livelihoods in Sub-Saharan Africa by reducing land degradation) by specifically contributing to reduce land degradation in Senegal. In doing so, this project contributes to the NEPAD/CAADP's goal of reaching the country's 6% per annum agricultural growth target, and to the NEPAD/EAP's objectives of program area 1 (degradation).

160. The development of knowledge and a toolbox for land degradation assessments is consistent with and would support the implementation of TerrAfrica Business Planning Framework (particularly Activity Line 3, Objectives 6 and 7), as it would contribute to SLM mainstreaming at different levels through institutional capacity building and support to establishment of cross-sectoral coordination mechanisms, and would help to develop targeted investments that would advance SLM scale-up.

161. Incremental GEF funding is needed to enable several needed improvements in mapping, monitoring and reporting land degradation. In particular, countries and the GEF need a toolbox and knowledge to take advantage of new data options and approaches for relevant national applications and reporting interests and for improving the GEF's GBI.

162. This project will also generate co-benefits, such as improved rural livelihoods, by significantly advancing understanding of the relationships between land degradation, food security and human well-being.

8. Coordination. Outline the coordination with other relevant GEF-financed projects and other initiatives [not mentioned in 1]:

163. This MSP will be coordinated with a number of GEF-funded projects where synergies and opportunities for collaboration exist, in particular:

Initiative	Coordination
Fostering Sustainability and Resilience for Food Security in Sub-Saharan Africa – An Integrated Approach Pilot (IAP)	The GEF IAP-Food Security that is led by the International Fund for Agricultural Development (IFAD) has identified improvement in land cover as a program level indicator for monitoring of GEBs. NDVI has been identified as a possible indicator for monitoring trends in land cover and productivity of the land. Close collaboration will therefore be forged with the Program and the proposed pilot countries in Africa are all participating in the IAP-Food Security.
Decision Support for Mainstreaming and Scaling up of Sustainable Land Management Project (DS – SLM) project.	This global GEF/FAO project is a follow up to LADA and will provide harmonized data and a tool for land degradation assessment, land-use systems diagnostics and SLM best practices assessments to support programmatic processes for scaling up SLM. This new phase of LADA does not using remote sensing data for assessment of land degradation trends. Collaboration will therefore be sought on linking satellite-based data from this project with the GEF/FAO project field assessments.
SLM and Climate Change Mitigation Co-benefits (GEF/United Nations Environmental Programme (UNEP)/ World Bank (WB)).	The global project will build the technical capacity of countries to apply the carbon benefit tool previously supported by GEF to ensure that carbon benefits from GEF projects are adequately monitored and reported. The MSP will explore opportunities to link monitoring of carbon benefits at national level to monitoring of land degradation using NDVI or other vegetation indices.
Participatory assessment of land degradation and SLM in grassland and pastoral systems (GEF/FAO).	The global project will improve assessment capability and decision-making processes with respect to pastoral, agro-sylvo-pastoral and grasslands system stakeholders to reveres land degradation and enhance food security and resilience to climate change. Collaboration with this project could provide a link to decision-making processes related to land degradation assessment and remediation.

9. *Institutional Arrangement.* Describe the institutional arrangement for project implementation:

164. Vital Signs[9] will establish a Project Management Unit (PMU) that will be hosted by VS, the executing agency for the project. The PMU will be responsible for overall project management, supervising sub-grantees, ensuring project success, and for liaison with and reporting to the GEF Project Agency. CI/VS will convene monthly conference calls with all project partners, supplemented by more frequent calls as needed. VS is hosted in the CI Moore Center for Science and Oceans Division (MCSO) managed and supervised independently from the CI-GEF Project Agency. No funds from this grant will be used to pay staff salaries or expenses of the CI GEF Project Agency.

165. VS staff will include the Chief Scientist, Sandy Andelman, who will provide overall project leadership. Andelman has over 17 years of experience leading large trans-disciplinary collaborative research projects and has expertise in the design and implementation of global-scale monitoring and assessment systems. In addition, other VS staff includes Director of Data Science, Alex Zvoleff, who has expertise in remote sensing, multi-scale modeling and analysis of satellite imagery and gridded data sets; and a Senior Remote Sensing Analyst, with expertise in supervised and unsupervised classification and time series analysis of Landsat imagery. VS also will provide a

[9] Vital Signs (VS) is a separate and distinct division within Conservation International. It is a multi-donor, multi-stakeholder initiative with an inclusive governance structure enabling joint, efficient decision-making. Vital Signs is a partnership including Earth Institute, Columbia University, and Council for Scientific and Industrial Research. It is guided by an Oversight Council which receives strategic support and guidance from a Technical Council. These bodies guide the key decisions and strategic direction of Vital Signs and operate with the support of CI as the Administrator of Vital Signs.

project coordinator and administrative/finance assistant. In addition, the Vital Signs Country Directors in Kenya, Tanzania and Uganda, respectively, will serve as the project liaisons to the GEF and UNCCD Operational Focal Points (OFPs) in these three pilot countries. The Vital Signs Africa Field Director will serve as the liaison to the Senegal OFP. The Vital Signs Country Directors will also be responsible for ensuring that in country capacity building takes place.

166. NASA and Lund University, the other two executing partners in the project, will be supported through sub-grants. For each Project Output, one institution has lead responsibility, but all partners will work collaboratively on all Outputs.

167. NASA is responsible for development and testing of methods. The NASA team is led by Compton Tucker, who specializes in studying the earth with satellite data. He was among the first researchers to employ coarse-resolution satellite data to exploit the time domain for studying global photosynthesis on land, determining land cover, monitoring droughts, providing famine early warning, and predicting ecologically-coupled disease outbreaks. He has also used large quantities of Landsat data to study forest condition, deforestation, and forest fragmentation in temperate, subtropical, and tropical forests.

168. NASA will lead the generation of Outputs 1.1.1, 1.1.2, 1.2.1 and 2.1.1. NASA will provide commercial satellite-derived data, develop new or modify existing analytical methods and technical services for evaluation of different data and methods. Both CI-VS and Lund will collaborate with NASA on design and testing of methods, evaluation of results and linkages to the other Outputs related to building capacity and creating the platform for capacity building and expansion of use. All three institutions will work closely with ESA on evaluation and comparison of methods and products.

169. Methods and products will be evaluated using: a) high-resolution satellite imagery provided by NASA; b) field information provided by CI-VS for Kenya, Tanzania and Uganda; c) field information provided by Senegalese counterparts, mostly through the Centre de Suivi Ecologique, coordinated through Lund; and d) expert opinion from all countries, coordinated through CI-VS and Lund, and through the GEF IAP Food Security project. These sources of information will be used for validation of remotely sensed products, in lieu of collecting new field data, which is beyond the scope of this project.

170. The Lund University Centre for Sustainability Studies (LUCSUS), will lead the development of guidelines, a toolbox and underlying methods, and training and capacity building of countries and regional centers and is responsible for Outputs 1.2.2, 2.1.2 and 3.2.1. This Center is a platform for education, research and cooperation inside and outside academia on questions related to sustainable development (http://www.lucsus.lu.se/). The Lund University Centre for Sustainability Studies (LUCSUS), Lund University, Sweden is a platform for education, research and cooperation inside and outside academia on questions related to sustainable development (http://www.lucsus.lu.se). LUCSUS has long and extensive experience from field based research on land degradation and related issues (such as food security, agricultural technology adoption, agro-forestry, social organization of agriculture and land use). In terms of geographical expertise, the center has extensive experience from relevant research the Sahel region, East Africa and Central Africa. This is evident from a range of peer-reviewed articles. Lund will contribute to methodological testing and evaluation of results lead by NASA as well as to revisions of guidelines and other materials led by CI-VS.

171. The staff from Lund on this project are Anna Tengberg, Yengoh Genesis and Lennart Olsson. They have expertise in multiple aspects of research on land degradation, as well as experience with capacity building, and linking both in the contexts of international targets and reporting.

172. Tengberg is an Adjunct Professor at Lund. She has held consultancies in the FAO GEF office to lead the development of projects ranging from inland fisheries to sustainable land management to climate change adaptation. She designed the follow-up strategy for LADA that builds on its partnership with the World Overview of Conservation Approaches and Technologies (WOCAT).

She is currently the lead consultant to develop the Programme Framework Document (PFD) for GEF Integrated Approach Pilot (IAP) on Sustainability and Resilience for Food Security in Sub-Saharan Africa. She was consulted to review the Report on GEF STAR GBI for Land Degradation for the GEF Evaluation Office. In 2008 though 2010 she worked on the UNDP/GEF's Global Sustainable Land Management Portfolio and was responsible for global oversight, quality control and reporting to UNDP HQ, GEF and UNCCD.

173. Yengoh is from Cameroon, completed his PhD at Lund in 2013, and is now a postdoctoral researcher there with expertise on the consequences of large-scale land use change for access to, and use of land resources in sub-Saharan Africa. Early in his career, Genesis is well-published, leading articles on topics such as food insecurity, land acquisitions, gender aspects of land tenure and use, crop yields and farmer perspectives of yields, to name a few. Most relevant is his lead-authorship of the report to GEF "Review of the Use of Normalized Difference Vegetation Index for Global Assessment of Land degradation, Status and Trend. Report prepared by LUCSUS for STAP/GEF" (Yengoh, et al 2014), which was a main basis for the STAP's request that this team be formed to submit this proposal.

174. Olsson is full professor in Physical Geography at Lund University and a founding Director of LUCSUS since 2000. He has conducted research since his PhD and has overseen dissertations on African desertification, related remote sensing applications and sustainability of land production.

175. Thus, the expertise of Lund is key as they provide in-region experience including local perceptions and studies of degradation and yield, experience in GEF and UN needs for national-level reporting, targets and indicators, as well as a strong understanding of satellite observations specifically in these contexts.

176. The European Space Agency (ESA) will be invited to collaborate on the comparison and evaluations of methods and results and will provide data products for such purposes. ESA staff will not be funded through this project, since they have related activities that should allow them to partner through other funding. We have included funds in the project budget to cover the cost of travel for coordination and working sessions, which will be supplemented with remote coordination in the intervening times.

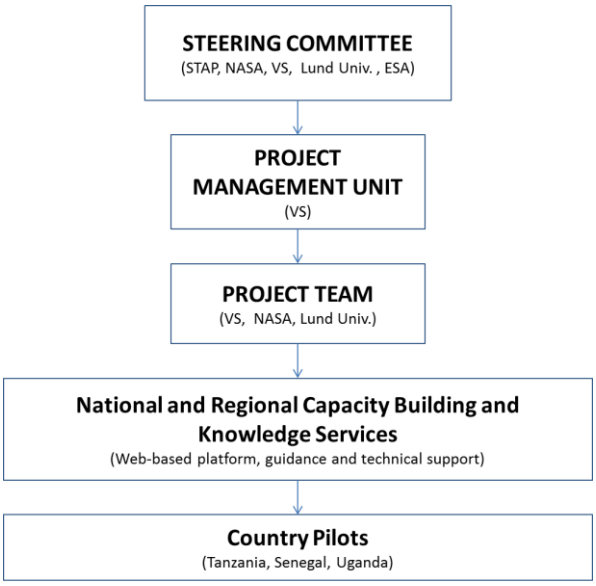
177. In addition to the project management responsibilities outlined above, Vital Signs is responsible for Outputs 2.2.1 and 3.1.1. This includes the finalization of capacity-building materials and the web-based platform for capacity building and expansion of use. This will be done in collaboration with NASA and Lund.

178. We will engage the GEF OFPs for Kenya, Senegal, Tanzania and Uganda in the inception workshop, to ensure country ownership of and engagement with the project.

179. The Project Steering Committee (PSC) will comprise five representatives, one each from CI-VS, NASA, Lund University, STAP and ESA. The PSC will meet semi-annually (once per year in person and once by video conference) and will be responsible for providing input to the project work plan, reviewing and approving annual work plans and budgets, reviewing and approving all key project outputs.

180. The CI-GEF Project Agency will provide project assurance, including supporting project implementation by maintaining oversight of all technical and financial management, and providing other assistance upon request of the Executing Agency. The CI-GEF Project Agency will also monitor the project's implementation and achievement of the project outputs, ensure the proper use of GEF funds, and review and approve any changes in budgets or work plans. The CI- GEF Project Agency will arbitrate and ensure resolution of any execution conflicts.

181. Project organizational chart:



10. Knowledge Management. Outline the knowledge management approach for the project, including, if any, plans for the project to learn from other relevant projects and initiatives, to assess and document in a user-friendly form, and share these experiences and expertise with relevant stakeholders.

182. The proposed project will learn from the LADA project discussed earlier and will explore opportunities to link up with the knowledge management and decision-support system to support evidence-based strategy formulation at national level for promoting SLM and contributing to global processes to address land degradation that is currently under development by FAO/LADA/ World Overview of Conservation Approaches and Technologies (WOCAT).

183. Moreover, the project will use the knowledge management platforms established by CI-VS at global and country levels. A key aim of VS is to provide freely accessible and transparent information and decision support system (with appropriate protection of privacy of households and locational Information on endangered species).

184. VS is committed to providing a framework of open access to all VS data, tools and technology without embargoes (i.e., in as close to real time as is technically feasible) to promote data sharing, collaboration, capacity building and analysis and integration of VS data with other related data sets, which will be a great asset to the Project.

11. Consistency with National Priorities. Is the project consistent with the National strategies and plans or reports and assessements under relevant conventions? (yes ☒ /no☐). If yes, which ones and how: NAPAs, NAPs, NBSAPs, ASGM NAPs, MIAs, NCs, TNAs, NCSA, NIPs, PRSPs, NPFE, BURs, etc.

185. The MSP will contribute to improving the monitoring of the implementation of the UNCCD and its 10-year strategic plan (10YSP) 2008-2018. The 10YSP is the focus of GEF-6 support to the Land Degradation focal area and improved data and information on its core indicator of land cover is therefore crucial. The UNCCD progress indicators (formerly known as impact indicators) shows 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.

186. At its eleventh session the COP adopted a refined set of six progress indicators (decision 22/COP.11) that will be used for the first time during the second leg of the fifth reporting process in 2016. Strategic Objective 2 (SO-2) of the 10YSP to improve conditions of affected ecosystems uses trends in land cover as one of its two progress indicators, which will also be monitored by country parties reporting on the implementation of NAPs under the UNCCD. The MSP is thus fully aligned with UNCCD objectives and requirements and linkages to NAP reporting will be further explored in pilot countries.

187. The selected pilot countries have all completed UNCCD NAPs – Kenya (2002), Senegal (1998), Tanzania (1999) and Uganda (1999) - and the NAPs all have components dealing with capacity development and monitoring and evaluation of land degradation/desertification and implementation of remedial actions, such as SLM. The Project is therefore fully aligned with the national priorities of the pilot countries and their obligations to the UNCCD and will also benefit other country parties to the UNCCD through wide dissemination of methods, the toolbox and datasets.

12. M & E Plan. Describe the budgeted monitoring and evaluation plan.

188. The project monitoring and evaluation will be conducted in accordance with established Conservation International (CI) and GEF procedures by the project team and the CI-GEF Project Agency. The project's M&E plan will be presented and finalized at the project inception workshop, including a review of indicators, means of verification, and the full definition of project staff M&E responsibilities.

A. *Monitoring and Evaluation Roles and Responsibilities*

189. The PMU will be responsible for initiating and organizing key monitoring and evaluation tasks. This includes the project inception workshop and report, quarterly progress reporting, annual progress and implementation reporting, documentation of lessons learned, and support for and cooperation with the independent external evaluation exercises.

190. Vital Signs, the project Executing Agency is responsible for ensuring the monitoring and evaluation activities are carried out in a timely and comprehensive manner, and for initiating key monitoring and evaluation activities, such as the independent evaluation exercises.

191. NASA and Lund University, the key project executing partners are responsible for providing any and all required information and data necessary for timely and comprehensive project reporting, including results and financial data, as necessary and appropriate.

192. The Project Steering Committee will play a key oversight role for the project, with semi-annual meetings to receive updates on project implementation progress and approve annual workplans. The Project Steering Committee also provides continuous ad-hoc oversight and feedback on project activities, responding to inquiries or requests for approval from the PMU or Executing Agency.

193. The CI-GEF Project Agency will play an overall assurance, backstopping, and oversight role with respect to monitoring and evaluation activities.

194. The CI Internal Audit function is responsible for contracting and oversight of the planned independent external evaluation exercises at the mid-point and end of the project.

B. *Monitoring and Evaluation Components and Activities*

195. The Project M&E Plan includes the following components:

a. **Inception workshop**
The project inception workshop will be held within the first three months of project start and will include the project stakeholders. An overarching objective of the inception workshop is to

assist the project team in understanding and taking ownership of the project's objectives and outcomes. The inception workshop will be used to detail the roles, support services and complementary responsibilities of the CI-GEF Project Agency and the Executing Agency.

b. **Inception workshop report**
The Executing Agency will produce an inception report documenting all changes and decisions made during the inception workshop to the project planned activities, budget, results framework, and any other key aspects of the project. The inception report will be produced within one month of the inception workshop, as it will serve as a key input to the timely planning and execution of project start-up and activities.

c. **Project Results Monitoring Plan** (Objective, Outcomes, and Outputs)
A Project Results Monitoring Plan will be developed by the Executing Agency, which will include objective, outcome and output indicators, metrics to be collected for each indicator, methodology for data collection and analysis, baseline information, location of data gathering, frequency of data collection, responsible parties, and indicative resources needed to complete the plan. The Project Results Monitoring Plan is presented in Annex D of this document.

All indicators identified in the Safeguard Plan will be monitored throughout the life of the project to assess whether the project has successfully achieved its expected results.

d. **GEF Focal Area Tracking Tools**
The relevant GEF Focal Area Tracking Tools will also be completed i) prior to project start-up, and ii) at the time of the terminal evaluation.

e. **Project Steering Committee Meetings**
PSC meetings will be held semi-annually. Meetings shall be held to review and approve project annual budget and work plans, discuss implementation issues and identify solutions, and to increase coordination and communication between key project partners. The meetings held by the PSC will be monitored and results adequately reported.

f. CI-GEF Project Agency Field Supervision Missions

The CI-GEF PA will conduct annual visits to the project and potentially to project field sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Oversight visits will most likely be conducted to coincide with the timing of PSC meetings. Other members of the PSC may also join field visits. A Field Visit Report will be prepared by the CI-GEF PA staff participating in the oversight mission, and will be circulated to the project team and PSC members within one month of the visit.

g. **Quarterly Progress Reporting**
The Executing Agency will submit quarterly progress reports to the CI-GEF Project Agency, including a budget follow-up and requests for disbursement to cover expected quarterly expenditures.

h. **Annual Project Implementation Report** (PIR)
The Executing Agency will prepare an annual PIR to monitor progress made since project start and in particular for the reporting period (July 1st to June 30th). The PIR will summarize the annual project result and progress. A summary of the report will be shared with the Project Steering Committee.

i. **Final Project Report**
The Executing Agency will draft a final report at the end of the project.

j. **Independent Terminal Evaluation**
An independent Terminal Evaluation will take place within six months after project completion and will be undertaken in accordance with CI and GEF guidance. The terminal evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The Executing

Agency in collaboration with the PSC will provide a formal management answer to the findings and recommendations of the terminal evaluation.

k. **Lessons Learned and Knowledge Generation**
Results from the project will be disseminated within and beyond the four pilot countries through existing information sharing networks and fora. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. There will be a two-way flow of information between this project and other projects of a similar focus.

l. **Financial Statements Audit**
Annual Financial reports submitted by the executing Agency will be audited annually by external auditors appointed by the Executing Agency.

196. The Terms of Reference for the evaluations will be drafted by the CI-GEF PA in accordance with GEF requirements. The procurement and contracting for the independent evaluations will handled by CI's General Counsel's Office. The funding for the evaluations will come from the project budget, as indicated at project approval.

Project M&E Plan Summary

Type of M&E	Reporting Frequency	Responsible Parties	Indicative Budget from GEF (USD)
a. Inception workshop and Report	Within three months of project start-up	PMU, supported by VS, NASA and LUCSUS	26,000
b. Inception workshop Report *197.*	No later than one month post IW.	PMU, VS, NASA and LUCSUS	Completed by PMU
c. Project Results Monitoring Plan (Objective, Outcomes and Outputs)	Annually (data on indicators will be gathered according to monitoring plan schedule shown on Annex D)	PMU, VS, NASA and LUCSUS	Completed by PMU
d. GEF Focal Area Tracking Tools	i) At the submission of the Request for Medium-Sized Project Approval; and; iii) at project completion	PMU, VS, NASA and LUCSUS	Completed by PMU
e. Project Steering Committee Meetings	Semi-annual	PMU, VS, NASA and LUCSUS	USD 7,800
f. CI-GEF Project Agency Field Supervision Missions	Annual or as required	VS and CI-GEF PA	Covered by the CI-GEF Agency budget
g. Quarterly Progress Reporting	Quarterly	PMU, with inputs from Vital Signs and other partners	Completed by PMU
h. Annual Project Implementation Report (PIR)	Annually for year ending June 30	PMU supported by Vital Signs and cleared and submitted by CI to the GEF Secretariat	Completed by PMU

Type of M&E	Reporting Frequency	Responsible Parties	Indicative Budget from GEF (USD)
i. Project Completion Report	Upon project operational closure	PMU, VS	completed by PMU
j. Independent Terminal Evaluation	Evaluation field mission within three months prior to project completion.	CI Evaluation Office, PMU, VS and CI-GEF PA	USD 25,000
k. Lessons Learned and Knowledge Generation	At least annually	PMU, VS and CI-GEF PA	completed by PMU
l. Financial Statements Audit	Annually	VS and CI-GEF PA	USD 16,000.

Project Budget and Financing

A. Overall Project Budget

198. The project will be financed by a medium size GEF grant of USD 1,828,217, with a total co-financing of $10,002,000

199. A summary of the project costs and the co-financing contributions is given in the two tables below. The project budget may be subject to revision during implementation. The detailed project budget is provided in Appendix E.

200. The planned project GEF budget by component is:

Budget Item		Project budget by component (in USD)			
	Component 1	Component 2	Component 3	PMC	Total budget
Personnel salaries and benefits*	$166,914	$134,754	$136,442	$72,150	**$510,261**
Professional services	$0	$9,300	$40,000	$41,000	**$90,300**
Travels and accommodations	$43,058	$0	$93,101	$31,912	**$168,071**
Meetings and workshops	$0	$0	$18,900	$7,100	**$26,000**
Grants & Agreements	$340,772	$361,323	$252,400	$0	**$954,496**
Equipment	$4,500	$0	$0	$0	**$4,500**
Other direct costs	$29,524	$13,375	$23,028	$8,663	**$74,590**
TOTAL GEF FUNDED ROJECT	**$584,768**	**$518,753**	**$563,871**	**$160,825**	**$1,828,217**

*This budget line contains only salaries and benefits related to Vital Signs staff and Vital Signs hosting division Moore Center for Science and Oceans (MCSO) staff. The MSCO division is independent from the CI-GEF Project Agency division.

201. The planned project GEF budget by year is:

Budget Item	Project budget by year (in USD)		
	Year 1	Year 2	Total budget
Personnel salaries and benefits*	$259,562	$250,699	**$510,261**
Professional services	$16000	$74,300	**$90,300**
Travels and accommodations	$74,970	$93,101	**$168,071**
Meetings and workshops	$7,100	$18,900	**$26,000**
Grants & Agreements	$471,529	$482,967	**$954,496**
Equipment	$4,500	$0	**$4,500**
Other direct costs	$38,456	$36,134	**$74,590**
TOTAL GEF FUNDED PROJECT	**$872,117**	**$956,100**	**$1,828,217**

*This budget line contains only salaries and benefits related to Vital Signs staff and Vital Signs hosting division Moore Center for Science and Oceans (MCSO) staff. The MSCO division is independent from the CI-GEF Project Agency division.

B. Overall Project Co-financing

202. USD 1,828,217 is requested from GEF funding, and a total of USD 10,002,000 is expected in co-financing for the project from the following partners :

- NASA $9,300,000. This is for the cost of high resolution, commercial satellite imagery, based on approximately 9700 images at a cost of $6/km2,
- Lund University $102,000 for salaries and benefits for Lund University staff on the project (Tengberg, Yengoh, Olsson),
- Vital Signs for $600,000 which will cover costs of knowledge platform development and maintenance plus contributions for salaries related to demonstration of methods and

platforms for upscaling and gender appropriate capacity development in application of tools and approaches for estimating land degradation trends.

C. Status of implementation of project preparation activities and the use of funds

PPG GRANT APPROVED AT PIF: ONE-STEP MSP			
Project Preparation Activities Implemented	***GEF/LDCF/SCCF/NPIF Amount ($)***		
	Budgeted Amount	***Amount Spent To date***	***Amount Committed***
Travel expenses for the STAP side event at the UNCCD (United Nations Convention to Combat Desertification) Conference in Cancun – Vital signs project lead		$2,445	$2,445
Total		$2,445	$2,445

PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. Record of Endorsement[10] of GEF Operational Focal Point (S) on Behalf of the Government(S): (Please attach the *Operational Focal Point endorsement letter(s)* with this template. For SGP, use this SGP OFP endorsement letter).

NAME	POSITION	MINISTRY	DATE *(MM/dd/yyyy)*

B. GEF Agency(ies) Certification

This request has been prepared in accordance with GEF policies[10] and procedures and meets the GEF criteria for a medium-sized project approval under GEF-6.					
Agency Coordinator, Agency name	Signature	DATE *(MM/dd/yyyy)*	Project Contact Person	Telephone	Email Address
Lilian Spijkerman		09/04/2015	Miguel A. Morales	+1 (703) 341-2637	mamorales@conservation.org

C. ADDITIONAL GEF PROJECT AGENCY CERTIFICATION *(Applicable only to newly accredited GEF Project Agencies)*

For newly accredited GEF Project Agencies, please download and fill up the required **GEF Project Agency Certification of Ceiling Information Template** to be attached as an annex to this project template.

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[10] For regional and/or global projects in which participating countries are identified, OFP endorsement letters from these countries are required even though there may not be a STAR allocation associated with the project.

ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found)

Objective:	To provide guidance, methods and a toolbox for assessing and monitoring status and trends of land degradation using remote sensing technology which can be employed to inform land management and investment decisions as well as to improve reporting to the UNCCD and the GEF
Indicators:	a. Number of methods and availability of a toolbox to estimate national-level areas status and trends of land degradation developed and available b. Number of baselines of degradation in target countries completed c. Number of effective methods tested and toolbox demonstrated d. Number of guidance documentation and capacity-building materials completed and available

Expected Outcomes and Indicators	Project Baseline	End of Project Target	Expected Outputs and Indicators
Component 1: Methods for assessing and monitoring status and trends in land degradation			
Outcome 1.1.: Improved understanding of the accuracy, suitability and trade-offs (e.g. resolution, accessibility, repeatability, sustainability/automation, cost, etc.) of different global datasets for estimating status and trends in land degradation ***Indicator 1.1.:*** *# of reports that improves the understanding of implications for estimating status and trends in degradation completed and readily available for key stakeholders*	Current methods do not enable estimation of areas of land degradation or drivers	Improved understanding sufficient to identify data sources and methods that enable estimation of areas of land degradation or drivers	**Output 1.1.1**.: Comparison of different datasets and methods for land degradation completed ***Indicator 1.1.1.:*** *# of global satellite data sources, indices related to productive capacity, and methods for analysis of the temporal component of satellite-derived indices compared* **Output 1.1.2.:** Evaluation of approaches for incorporating higher-resolution data for disaggregation or targeted analysis completed

Expected Outcomes and Indicators	Project Baseline	End of Project Target	Expected Outputs and Indicators
			Indicator 1.1.2.: *# of approaches for incorporating higher-resolution data evaluated*
Outcome 1.2.: Agreed-upon method(s) for assessing land degradation suitable for identified end-users **Indicator 1.2:** # of agreed-upon methods	Lack of agreement on method(s) for assessing land degradation suitable for end-users	Methods for assessing land degradation have been developed that are suitable for end users and agreed upon among key stakeholders	**Output 1.2.1.:** Standard methods, including analytical steps and recommended datasets, agreed and presented to major stakeholders, including countries, GEF, UNCCD and their scientific and technical bodies ***Indicator 1.2.1***# of stakeholders who have received presentations of methods to for discussions of agreement **Output 1.2.2.:** Improvement of the Global Benefits Index (GBI) algorithm for the Land degradation focal area for GEF-7 based on agreed-upon methods ***Indicator 1.2.2****.: Report of how results from an agreed method can improve the GBI algorithm completed and shared with key stakeholders*
Component 2: Demonstration of recommended methods and platforms to enable widespread adoption			
Outcome 2.1.: Baseline assessment of status and trends of land degradation in 4 pilot countries	Lack of baselines of degradation based on internationally-applicable method(s)	Baselines have been completed for 3 pilot countries and guidance documents have been completed and	**Output 2.1.1**.: Land degradation baseline produced for in-country evaluation for 3 pilot countries

Expected Outcomes and Indicators	Project Baseline	End of Project Target	Expected Outputs and Indicators
(Kenya, Senegal, Tanzania, Uganda) ***Indicator 2.1****.: # of national baseline reports and guidance documents completed and readily available for key stakeholders*		are available for key stakeholders	***Indicator 2.1.1****.: # of national baselines completed* **Output 2.1.2**.: Guidance documents on methods and toolbox created based on application in 3 pilot countries (Senegal, Tanzania, Uganda) ***Indicator 2.1.2****.: # of guidance documents completed and shared with key stakeholders*
Outcome 2.2.: Platforms for capacity building and for expanding the use of the data, methods and toolbox to other countries and regions established and fully functional ***Indicator 2.2****.: # of platforms created and functional*	Lack of platforms to distribute methods and knowledge for estimating degradation	Improved distribution of methods and knowledge through one regional and one global web platform that provide methodological guidance, demonstrations and toolbox.	**Output 2.2.1**: Data processing platforms, with data collection protocols, established in at least one regional center and at global level ***Indicator 2.2.1****.: # of protocols and related documents present on regional and global platforms*
Component 3: Gender appropriate capacity development in the application of toolbox and recommended approaches for estimating land degradation using remote sensing			
Outcome 3.1.: Strengthened capacity of the 4 pilot countries and regional center in accessing and processing spectral index-related data for estimating status and trends in land degradation	Lack of national capacity to access and process data to estimate degradation	National capacity to access and process data to estimate degradation improved	**Output 3.1.1**. Draft gender-sensitive guidance documents and manuals completed, incorporating the GEF, the UNCCD and country feedback, and made available online

Expected Outcomes and Indicators	Project Baseline	End of Project Target	Expected Outputs and Indicators
Indicator 3.1*.: # of nationals, disaggregated by gender, who have provided feedback or used online materials*			***Indicator 3.1.1****.: # of gender appropriate online guidance documents, manuals and related materials completed and made available*
Outcome 3.2.: Enhanced exchange of knowledge among countries and at least one regional center, with equitable participation by women and men, on remote sensing applications for land degradation monitoring ***Indicator 3.2****.: Four countries or regional centers, and percent of women, that have received capacity building*	Scarce exchange of knowledge on remote sensing applications for land degradation monitoring	Professional exchanges of key stakeholders from at least four countries completed	**Output 3.2.1.:** Training and capacity building of 4 national and at least one regional center in Africa, with equitable participation by women and men, on remote sensing methods and manuals developed in the previous stages for land degradation monitoring ***Indicator 3.2.1****.: # of countries, including number of women with increased capacity to conduct technical aspects of degradation-estimation methods developed in the previous stages (remote sensing concepts, ability to access data, ability to produce indices from data and ability to use indices)*

ANNEX B: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used**)**

Provide a calendar of expected reflows to the GEF/LDCF/SCCF Trust Funds or to your Agency (and/or revolving fund that will be set up)

N/A

ANNEX C: PROJECT TIMELINE

OUTCOMES/OUTPUTS	Timeline							
	Year 1				Year 2			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 1.1.								
Output 1.1.1: Comparison of different datasets and methods for land degradation completed								
Output 1.1.2.: Evaluation of approaches for incorporating higher-resolution data for disaggregation or targeted analysis completed								
Outcome 1.2.								
Output 1.2.1.: Standard methods, including analytical steps and recommended datasets, agreed and presented to major stakeholders, including countries, GEF, UNCCD and their scientific and technical bodies								
Output 1.2.2.: Improvement of the GBI algorithm for the Land degradation focal area for GEF-7 based on better remote sensing/Land Degradation data								
Outcome 2.1.								
Output 2.1.1.: Draft guidance documents and potential toolbox and methodologies applied in 4 pilot countries (Kenya, Senegal, Tanzania, Uganda)								
Output 2.1.2.: Land degradation baseline produced for in-country evaluation for 4 pilot countries								
Outcome 2.2.								
Output 2.2.1.: Data processing platforms, with data collection protocols, established in at least one regional center and at global level								
Outcome 3.1.								
Output 3.1.1.: Draft gender appropriate guidance documents and manuals completed, incorporating the GEF, the UNCCD and country feedback, and made available online								
Output 3.2.								
Output 3.2.1.: Training and capacity building of 4 national and at least one regional center in Africa on remote sensing methods and manuals developed in the previous stages for land degradation monitoring								

ANNEX D: PROJECT RESULTS MONITORING PLAN

Indicators	Metrics	Methodology	Baseline	Location	Frequency	Responsible Parties	Indicative Resources
Objective:							
Objective Indicator a: Assessment of availability of methods and tools to estimate national-level areas of land degradation developed and available	Assessment of availability of methods tools completed and available	Use reports from Outputs 1.1.1, 1.1.2, 1.2.1 and 1.2.2 to determine methods developed and web platforms to determine availability	No comparisons of methods developed or available at project inception date	Washington, DC	Y2 Q1	Executing Agency	$2,500
Objective Indicator b: Number of baselines of degradation in target countries completed	# of national baselines completed	Use national baseline reports and review materials on web platforms	No baseline or platforms at project inception date	Washington, DC	Y2 Q4	Executing Agency	$2,500
Objective Indicator c: Number of effective methods tested demonstration of toolbox	# of methods tested and demonstration of toolbox	Use reports from Outputs 1.1.1, 1.1.2, 1.2.1 and 1.2.2 to determine methods and toolbox design demonstrated and tested	No guidance methods and tools demonstrated and tested at project inception date	Washington, DC	Y2 Q4	Executing Agency	$2,500
Objective Indicator d: Number of guidance documents and capacity-building materials completed and available	# of guidance documents and capacity-building materials completed and available	Use web platforms to determine guidance documents and capacity-building materials completed and available	No guidance documentation and capacity-building materials completed and available at project inception date	Washington, DC	Y2 Q4	Executing Agency	$2,500
Component 1: Methods for assessing and monitoring status and trends in land degradation							
Indicator 1.1. # of reports that improves the understanding of implications for estimating status and trends in degradation completed and readily	# of reports	Use reports from Outputs 1.1.1 and 1.1.2 to determine #s included	None at project inception date	Washington, DC	Y2 Q1	Executing Agency	$1,000

available for key stakeholders							
Indicator 1.1.1.: # of global satellite data sources, indices related to productive capacity, and methods for analysis of the temporal component of satellite-derived indices compared	# of each parameter listed	Use report from Output 1.1.1 to determine #s compared	None at project inception date	Washington, DC	Y2 Q1	Executing Agency	$3,000
Indicator 1.1.2.: # of approaches for incorporating higher-resolution data evaluated	# of approaches	Use report from Output 1.1.2 to determine # evaluated	None at project inception date	Washington, DC	Y2 Q1	Executing Agency	$3,000
Indicator 1.2.: # of agreed-upon method(s) for assessing land degradation suitable for identified end-users	# of agreed-upon methods	Use reports from 1.2.1 and 1.2.2. to determine # of agreed-upon methods	None at project inception date	Washington, DC	Y2 Q1	Executing Agency	$1,000
Indicator 1.2.1.: # of stakeholders who have received presentations of methods to for discussions of agreement	# of stakeholders who have received presentations	Use attendance reports from national and remote presentation sessions	None at project inception date	Washington, DC	Y2 Q1	Executing Agency	$1,000
Indicator 1.2.2.: Explanation of how results from an agreed method can improve the GBI algorithm completed	Completeness and strength of explanation	Use report from Output 1.2.2.	None at project inception date	Washington, DC	Y2 Q1	Executing Agency	$1,000
Component 2: Demonstration of recommended methods for aggregation and platforms to enable widespread adoption							
Indicator 2.1.: # of platforms created and functional	#s of platforms	Review and test functionality of web platforms	None at project inception date	Washington, DC	Y2 Q4	Executing Agency	$2,000
Indicator 2.1.1.: # of national baselines completed	# of baselines	Obtain reports from web or project and verify baseline data archived	None at project inception date	Washington, DC	Y2 Q4	Executing Agency	$5,000
Indicator 2.1.2.: # of guidance documents completed and shared with key	# of guidance documents	Review guidance documents on web platforms and	None at project inception date	Washington, DC	Y2 Q4	Executing Agency	$5,000

stakeholders		distribution lists of stakeholders					
Indicator 2.2.: # of platforms created	# of platforms	Use report from Output 2.1.2 to determine # created	None at project inception date	Washington, DC	Y2 Q4	Executing Agency	$4,000
Indicator 2.2.1.: # of protocols and related documents present on regional and global platforms	# of protocols and documents	Use report from Output 2.2.1 to determine #s present	None at project inception date	Washington, DC	Y2 Q4	Executing Agency	$1,500
Component 3: Gender appropriate capacity development in the application of toolbox and recommended approaches for estimating status and trends in land degradation using remote sensing							
Indicator 3.1.: # of nationals, disaggregated by gender, who have provided feedback or used online materials	# of nationals disaggregated by gender	Review records from feedback sessions	None at project inception date	Washington, DC	Y2 Q4	Executing Agency	$2,000
Indicator 3.1.1.: # of gender appropriate online guidance documents, manuals and related materials completed and made available	#s of gender appropriate, online guidance documents, manuals and related materials completed and available	Review materials added to web platforms	None at project inception date	Washington, DC	Y2 Q4	Executing Agency	$5,000
Indicator 3.2.: Four countries or regional centers, and percent of women, that have received capacity building	# of countries or regional centers and percentage of women	Review attendance lists of capacity-building events	None at project inception date	Washington, DC	Y2 Q4	Executing Agency	$1,500
Indicator 3.2.1.: # of countries, and percentage of women, with increased capacity to conduct technical aspects of degradation-estimation methods developed in the previous stages (remote sensing concepts, ability to access data, ability to produce indices from data and ability to use indices)	# of countries, and percent of women, with increased capacity	Gender disaggregated review questionnaires on knowledge of remote sensing concepts, ability to access data, ability to produce indices from data and ability to use indices prior to and after capacity-building sessions	None at project inception date	Washington, DC	Y2 Q4	Executing Agency	$4,000

ANNEX E: DETAILED PROJECT BUDGET

Detailed GEF Project budget

Project Title: Enabling the use of global data sources to assess and monitor land degradation at multiple scales

Executing Agencie: Vital Signs

Project Amount GEF-funded (USD) : 1,828,217

Project Amount co-financing (USD) : 10,002,000

Total Project Amount (USD) : 11,830,217

Indicative Project starting date : Jul-15

Indicative Project end date : Jun-17

Duration (in years): 2

GEF FUNDED BUDGET			Project budget by component (in USD)					Project budget per year (in USD)		
EXPENSES TYPE	*DESCRIPTION*		Component 1	Component 2	Component 3	Project Management Costs	Total	YR1	YR2	TOTAL
Salaries and benefits	Project lead 10%		14,200	13,127	19,648	-	**46,976**	24,668	22,308	**46,976**
Salaries and benefits	Technical lead - 50%		78,720	50,363	52,120	-	**181,203**	97,860	83,343	**181,203**
Salaries and benefits	Project Assistant 100%		33,908	34,194	29,858	22,903	**120,864**	53,196	67,668	**120,864**
Salaries and benefits	Analyst and programmer 50%		33,579	28,974	26,298	-	**88,851**	47,792	41,059	**88,851**
Salaries and benefits	Analyst 10%		6,507	8,095	8,518	-	**23,120**	11,787	11,333	**23,120**
Salaries and benefits	Operations and Finance Support		-	-	-	46,449	**46,449**	22,888	23,561	**46,449**
Salaries and benefits	Operation and finance support		-	-	-	2,798	**2,798**	1,372	1,427	**2,798**
Total Personnel Salaries and benefits			**166,914**	**134,754**	**136,442**	**72,150**	**510,261**	**259,562**	**250,699**	**510,261**
Consultant Fees - International	Cloud Storage (to develop a more affordable storage option)		-	9,300	-	-	**9,300**	3,000	6,300	**9,300**
Consultant Fees - International	Building and maintenance of the web-based capacity-building global platform		-	-	5,000	-	**5,000**	5,000	-	**5,000**
Consultant Fees - International	Web maps : Addition of spatial-data viewing interface to the platform		-	-	30,000	-	**30,000**	-	30,000	**30,000**
Other fees / professional services	Creation of Regional platform version of the capacity-building website		-	-	5,000	-	**5,000**	-	5,000	**5,000**
Consultant Fees - International	Final Independent Evaluation		-	-	-	25,000	**25,000**	-	25,000	**25,000**
Auditing Fees	Annual financial project audit		-	-	-	16,000	**16,000**	8,000	8,000	**16,000**
Total Professional Services			**-**	**9,300**	**40,000**	**41,000**	**90,300**	**16,000**	**74,300**	**90,300**
International Transportation	3 Coordination travels w/European Space Agency (ESA) and Joint Research Committee (JRC)		3,000	-	1,560	-	**4,560**	3,000	1,560	**4,560**
Lodging / meals / perdiem			2,880	-	1,674	-	**4,554**	2,880	1,674	**4,554**
Local transportation			512	-	146	-	**658**	512	146	**658**
International Transportation	University of Lund coordination meetings		3,000	-	3,120	-	**6,120**	3,000	3,120	**6,120**
Lodging / meals / perdiem			2,880	-	2,974	-	**5,854**	2,880	2,974	**5,854**
Local transportation			330	-	343	-	**673**	330	343	**673**
International Transportation	Travels to Uganda, tanzania and Senagal for Input on design in yr 1, demo of approach / tools in y2		18,000	-	17,368	-	**35,368**	18,000	17,368	**35,368**
Lodging / meals / perdiem			11,616	-	12,788	-	**24,404**	11,616	12,788	**24,404**
Local transportation			840	-	832	-	**1,672**	840	832	**1,672**
Local Transportation	Project Lead travel to project coordination meetiing and steering committee		-	-	1,664	1,800	**3,464**	1,800	1,664	**3,464**
Lodging / meals / perdiem			-	-	957	1,150	**2,107**	1,150	957	**2,107**
Local transportation			-	-	104	100	**204**	100	104	**204**
International Transportation	Project Inception Workshop in Tanzania					19,400	**19,400**	19,400		**19,400**
Lodging / meals / perdiem						8,162	**8,162**	8,162		**8,162**
Local transportation						1,300	**1,300**	1,300		**1,300**
International Transportation	Regional workshop				13,936		**13,936**		13,936	**13,936**
Lodging / meals / perdiem					4,424		**4,424**		4,424	**4,424**
Local transportation					1,726		**1,726**		1,726	**1,726**
Local transportation	3 national workshops				7,020	-	**7,020**	-	7,020	**7,020**
Lodging / meals / perdiem					22,464	-	**22,464**	-	22,464	**22,464**
Total Travel and Accommodations			**43,058**	**-**	**93,101**	**31,912**	**168,071**	**74,970**	**93,101**	**168,071**

GEF FUNDED BUDGET			Project budget by component (in USD)					Project budget per year (in USD)		
EXPENSES TYPE	*DESCRIPTION*		Component 1	Component 2	Component 3	Project Management Costs	Total	YR1	YR2	TOTAL
Space rental and material for workshops	Steering Committee in DC					1,100	**1,100**	1,100	-	**1,100**
Space rental and material for workshops	Project Inception Workshop in Tanzania					6,000	**6,000**	6,000		**6,000**
Space rental and material for workshops	3 national workshops		-	-	18,900	-	**18,900**	-	18,900	**18,900**
Total Meetings and workshops			**-**	**-**	**18,900**	**7,100**	**26,000**	**7,100**	**18,900**	**26,000**
Grants & Agreements	NASA : Modis and Digital Globe data processing, analysis		253,998	290,739	96,913	-	**641,650**	314,171	327,479	**641,650**
Grants & Agreements	Lund University : Degradation analysis, coord w/LADA project		70,585	70,585	141,170	-	**282,339**	141,170	141,170	**282,339**
Grants & Agreements	TFCG : Vital Signs partner in Tanzania		4,859	-	5,102	-	**9,960**	4,859	5,102	**9,960**
Grants & Agreements	AfrII : Vital Signs partner in Uganda		7,330		5,216		**12,546**	7,330	5,216	**12,546**
Grants & Agreements	Senegal : vital signs potential partner		4,000		4,000		**8,000**	4,000	4,000	**8,000**
Total Grants & Agreements			**340,772**	**361,323**	**252,400**	**-**	**954,496**	**471,529**	**482,967**	**954,496**
Furniture and equipment > 5000 USD	Contribution to IT equipment renewal		4,500	-	-	-	**4,500**	4,500	-	**4,500**
Total Equipment			**4,500**	**-**	**-**	**-**	**4,500**	**4,500**	**-**	**4,500**
Communication printing	Publications		6,000	-	5,250	-	**11,250**	6,000	5,250	**11,250**
Furniture and equipment maintenance	Software for Image processing / statistic		8,000	-	8,400	-	**16,400**	8,000	8,400	**16,400**
Office operating costs	Rent / communication costs		15,524	13,375	9,378	8,663	**46,940**	24,456	22,484	**46,940**
Total Other Direct Costs			**29,524**	**13,375**	**23,028**	**8,663**	**74,590**	**38,456**	**36,134**	**74,590**
Total GEF funded project costs			**584,768**	**518,753**	**563,871**	**160,825**	**1,828,217**	**872,117**	**956,100**	**1,828,217**
CO-FINANCING			**Co-financing by component (in USD)**					**Co-financing per year (in USD)**		
SOURCES OF CO-FINANCING	*NAME OF CO-FINANCIER*	*TYPE OF CO-FINANCING*	Component 1	Component 2	Component 3	PMC	Total	YR1	YR2	TOTAL
Other	NASA	*cash*	3,255,000	6,045,000			**9,300,000**	5,580,000	3,720,000	**9,300,000**
Other	Lund University	*Cash*	30,600	-	71,400		**102,000**	51,000	51,000	**102,000**
CSO	Vital Signs	*Cash*	120,000	300,000	180,000		**600,000**	240,000	360,000	**600,000**
Sub Total Co-financing IN-KIND			**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Sub Total Co-financingIN CASH			**3,405,600**	**6,345,000**	**251,400**	**-**	**10,002,000**	**5,871,000**	**4,131,000**	**10,002,000**
Total Co-financing			**3,405,600**	**6,345,000**	**251,400**	**-**	**10,002,000**	**5,871,000**	**4,131,000**	**10,002,000**
TOTAL PROJECT BUDGET			3,990,368	6,863,753	815,271	160,825	**11,830,217**	6,743,117	5,087,100	**11,830,217**

ANNEX F: CO-FINANCING LETTERS

National Aeronautics and Space
Administration
Goddard Space Flight Center
Greenbelt, MD
20771

April 14, 2015

Ms. Lilian Spijkerman
Vice President and Managing Director, CI-GEF Project Agency
2011 Crystal Drive, Suite 500
Arlington, Virginia 22202
USA

RE: Subject: Co-Financing support for "Enabling the Use of Global Data Sources to Assess and Monitor Land Degradation at Multiple Scales"

Dear Ms. Spijkerman:

On behalf of NASA/Goddard Space Flight Center, I am pleased to commit $9,300,000 in co-financing to Conservation International in support of the GEF Funded Project, "Enabling the Use of Global Data Sources to Assess and Monitor Land Degradation at Multiple Scales". This amount of co-financing was estimated as the value of 9,700 commercial satellite images at the cost of $6/km^2 of coverage.

This co-financing will support the Methodology for Monitoring and Assessing Trends in Land Degradation during the period of August 1, 2015 to July 31, 2017.

This contribution, as described above, is intended to qualify as co-financing should the project proposal be successful.

Sincerely,

Compton Tucker

Compton J. Tucker, Senior Biospheric Scientist
Earth Science Division, Code 610.9
301 614-6644 (office)
email: compton.j.tucker@nasa.gov

Lund 16 April 2015

LUND UNIVERSITY

LUCSUS –
Lund University Centre for Sustainability Studies
Professor Lennart Olsson, Director

Ms. Lilian Spijkerman
Vice President and Managing Director
CI-GEF Project Agency
2011 Crystal Drive, Suite 500
Arlington, Virginia 22202
USA

Subject: Co-Financing support for the project "Enabling the use of global data sources to assess and monitor land degradation at multiple scales"

Dear Ms. Spijkerman,

On behalf of Lund University Centre for Sustainability Studies (LUCSUS), I am pleased to commit $102,000 in co financing to Conservation International in support of the GEF Funded Project, "Enabling the use of global data sources to assess and monitor land degradation at multiple scales".

This co financing will support Component 2: Demonstration of recommended methods and platforms for up-scaling during the duration of the project.

This contribution as described above is intended to quality as co-financing should the project proposal be successful.

Sincerely,

Lennart Olsson, Professor and Director
Lund University Centre for Sustainability Studies

Postal address: Box 170, S 22100 Lund, Sweden. *Visiting address:* Biskopsgatan 5 'Josephson'. Lund
Phone: Int. +46 46 222 0511 *E-mail:* lennart.olsson@ucsus.lu.se

VITAL SIGNS

21 May, 2015

Ms. Lilian Spijkerman
Vice President and Managing Director, CI-GEF Project Agency
2011 Crystal Drive
Suite 500
Arlington, Virginia 22202
USA

Subject: Co-Financing support for the GEF MSP entitled "Enabling the use of global data sources to assess and monitor land degradation at multiple scales."

Dear Ms. Spijkerman,

On behalf of Vital Signs, I am pleased to commit $ 600,000 in co-financing to Conservation International in support of the GEF Funded Project, "Enabling the use of global data sources to assess and monitor land degradation at multiple scales."

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This co-financing will provide partial support of project components 1-3: (1) methods for monitoring and assessing trends in land degradation and improvement; (2) demonstration of recommended methods and platforms for up-scaling; and (3) gender appropriate capacity development in the application of tools and recommended approaches for estimating land degradation and improvement using remote sensing during the period 1 August, 2015 to 31 July, 2017.

This contribution as described above is intended to qualify as co-financing should the project proposal be successful .

Sincerely,

Sandy J. Andelman, Ph.D.
Executive Director

ANNEX G: GEF TRACKING TOOL FOR THE LAND DEGRADATION FOCAL AREA

ANNEX H. Stakeholder Engagement Plan

A. Introduction

203. The global demand for food is expected to rise steeply as a result of burgeoning population, shifting dietary preferences, and food wastage, while increasing demands for renewable energy are competing with food production. In 2009, the Food and Agriculture Organization of the United Nations (FAO) estimated that we must increase global food production by 70% to meet demands in 2050 (FAO 2009). Further, accelerating climate change is projected to have severe impacts on crop productivity over large parts of the globe (Lobell and Gourdji 2012). The combination of increasing water scarcity, as a result of climate warming, and increasing competition across sectors, is likely to cause dramatic situations in terms of food and water security in many regions. As a consequence, *business as usual* is not an option. The threat to food security represents a planetary emergency that demands a variety of creative solutions and policies at global, regional, national and local levels. One of the most urgent responses to mitigate this situation is development of measures to halt and reverse land degradation. Such solutions are currently hampered by a lack of reliable data, as well as by a lack of cost effective methods for collecting and analyzing such data.

204. Land degradation has been highlighted as a key development challenge by numerous international processes, including by the United Nations Convention to Combat Desertification (UNCCD), the Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC), and the Sustainable Development Goals (SDGs). The Global Environment Facility (GEF) was designated as a financial mechanism for the UNCCD in 2003, through establishment of its Land Degradation focal area. The GEF aims to arrest land degradation, especially desertification and deforestation, by providing support to sustainable land management (SLM). SLM implements agricultural practices that maintain vegetative cover, build soil organic matter, make efficient use of inputs, such as water, nutrients and pesticides, and that minimize off-site impacts (Bierbaum et al. 2014).

205. This proposal addresses methods to estimate status and trends in land degradation, including improvements or other results of Sustainable Land Management (SLM), as well as lack of discernable changes, which we refer to in the Results Framework table as "status and trends in land degradation." Here, we define land degradation as a negative trend in primary production that is independent of climate variability (Ibrahim et al. 2015). In the main body of the proposal, for simplicity we use the term "land degradation" throughout to refer to all of these possible changes or lack thereof."

206. Our goal is to derive an approach that can yield one or two simple metrics in the form of continuous images that, when tracked over years, correlate well with trends of degradation. With such products, methods and a toolbox can be created to enable the GEF to understand regional patterns for prioritization, and enable countries to produce estimates of trends for reporting to the UNCCD and the GEF. Further, by integerating these products, with the Vital Signs socioeconomic data, countries, the GEF and the UNCCD will gain insights into the relationship between land degradation and human well-being, e.g., food security and poverty.

B. Policies and Requirements

207. This plan aims to fulfill the CI-GEF agency policies on the process to inform and engage the different partners and stakeholders involved in the project. The CI-GEF Project Agency oversees the Executing Entity involving all stakeholders, including project-affected groups, indigenous peoples, and local CSOs, as early as possible in the preparation process and ensures that their views and concerns are made known and taken into account. The CI-GEF Project Agency Team will also ensure that the Executing Entity will continue to hold consultations throughout project

implementation as deemed necessary to address environmental and social impact assessment-related issues that affect them. To address this requirement and given the nature of the project, the stakeholder engagement plan is organized following the three components of the project.

C. Summary of Stakeholder Engagement Activities During Project Development

208. We have engaged in a series of information sharing and consultation activities with a range of project stakeholders. These activities and the stakeholders involved are summarized below.

209. The current project follows from and builds upon the STAP-commissioned study on a "Review of normalized difference vegetation index for global assessment of land degradation status and trend" by Genesis T. Yengoh, David Dent, Lennart Olsson, Anna Tengberg and Compton Tucker. The Yengoh et al. study was presented and discussed at the STAP Agro-Ecosystem Resilience Workshop 19-21 November, 2014 in Sydney, Australia. The meeting and discussion included representatives from the UNCCD, CBD, UNFCCC and GEF Secretariats; the STAP; the Commonwealth Scientific and Industrial Research Organization (CSIRO) and representatives from (Australia, Cameroon, Canada, Denmark, France, Germany, Italy, Netherlands, Sweden, United Kingdom, United States, Zimbabwe). Our project addresses recommendations made by stakeholders during this STAP workshop.

210. Following the STAP Agro-Ecosystem Resilience Workshop, and in addition to the STAP Side event described below, throughout the proposal preparation process, we have engaged with the STAP by email, through a conference call 28 January, 2015; in person meetings 14 April, 28 May, and 31 May, 2015. We also received detailed written comments from the STAP on drafts of this proposal on 11 March and 31 May, 2015 and responded to those comments in writing and incorporated them into the proposal.

211. The UNCCD Science Conference is the mechanism established by the UNCCD "to strengthen the capacity of the Committee on Science and Technology to process scientific, technical and socio-economic information." At the UNCCD Science Conference in Cancun, Mexico, on 10 March, 2015, we presented and discussed key elements of our proposed project approach during the STAP Side Event on "The use of satellite data to measure and monitor land degradation over time at multiple scales." The participants and discussants included representatives from the GEF Secretariat, the STAP, NASA, UNCCD Secretariat, European Space Agency (ESA) and Joint Research Centre of the European Commission (JRC), as well as representatives from a range of countries.

212. Vital Signs, NASA, ESA and JRC met informally on 11 March, 2015, at the UNCCD Science Conference to discuss and agree upon the general approach, including methods and data sources for the current project.

213. Representatives from Vital Signs convened a stakeholder workshop in Dar es Salaam, Tanzania, 28 April, 2015, with representatives from the Office of the President; Office of the Vice President, including Ministry of Environment; Office of the Prime Minister; Ministry of Agriculture Food Security and Cooperatives; National Bureau of Statistics, plus civil society organizations and universities to discuss and get feedback on metrics and indicators and data sources for monitoring and assessment of food security, ecosystem services, land degradation and human well-being. The Tanzania GEF Operational Focal was invited to this meeting and he sent his representative, as he was out of the country at the time. The workshop report is available on request.

214. Representatives from Vital Signs convened a stakeholder workshop in Uganda, 22-23 June, 2015 to discuss and get feedback on metrics and indicators and data sources for monitoring and assessment of food security, ecosystem services, land degradation and human well-being. Participants included representatives from the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF); Ministry of Water and Environment (MWE); Ministry of Finance, Planning and Economic Development, African Research Innovations Institute, Makere University and the Uganda

Bureau of Statistics. The workshop report is available on request. Following the Uganda stakeholder workshop, informal consultations were held with the Uganda GEF Focal Point, Mr. Patrick Ocailap and with the Ministers of MAAIF and MWE, who have requested assistance from Vital Signs to assist with developing indicators to track land degradation, food security, ecosystem services and human well-being in Uganda.

215. Informal consultations were held with the Kenya Ministry of Environment and Natural Resources in February, 2015 and again in June, 2015. As a result of the June, 2015 consultation, we agreed to add Kenya as one of the pilot countries for this project.

216. Informal consultations with the International Fund for Agricultural Development (IFAD), the lead agency for the GEF Food Security IAP, have been conducted throughout the development of the project proposal (February, March and June 2015) to maximize synergies between the two projects.

217. Vital Signs participated in a workshop and exercise on land degradation measurement and reporting in Windhoek, Namibia 27 June – 2 July, 2015, organized by the U.S. UNCCD Science and Technology Correspondent. Participants included representatives of government, academic and civil organizations from Kenya, Namibia, Netherlands, U.S. and U.K. In addition, informal consultations were held with the U.S. UNCCD Science and Technology Correspondent in November, 2014, March 2015 and June 2015.

D. Project Stakeholders and E. Stakeholder Engagement Program

218. The goal of this Stakeholder Engagement Plan is to involve all project stakeholders, including the GEF and STAP, UNCCD Secretariat/CST, UNCCD, regional remote sensing centers and the European Commission JRC and the ESA and the international scientific community, as early as possible in the implementation process and throughout the project, and to ensure that their views and concerns are made known and taken into consideration. The plan will also help the project in ensuring effective communication channels and working relationships. The PMU and PSC will hold consultations with stakeholders throughout project implementation, through formal workshops, and informally as necessary.

219. We will engage the international scientific community with relevant expertise in providing peer review of the toolbox and project reports. We will solicit names of experts from the PSC, but have already identified several candidates, e.g., Dr. Michael Stocking, University of East Anglia; Dr. Zanguo Bai, ISRIC; Dr. Fergus Sinclair, ICRAF; Dr. Bilal Butt, University of Michigan. The table below provides a summary of the engagement of the major stakeholders.

220. The Stakeholder Engagement Plan will be implemented in conjunction with the Gender Mainstreaming Strategy and Action Plan that provides more detailed guidance on helping to ensure gender equity in the project.

221. Key stakeholders are listed below. They have been consulted and their input has been incorporated into this proposal and their expected engagement during the project implementation phase is described in the table below.

Stakeholder	Interests in the Project	Project Effect(s) on Stakeholder	Engagement During Project Implementation
GEF and STAP	Key users of the improved data and the assessments of status and trends of land cover and land degradation using remote-sensing in their work	The results of the project will help GEF to identify areas most at risk of land degradation and priorities for interventions, and for allocation of GEF STAR	In addition to consultations with the STAP throughout proposal development (see response to STAP proposal comments in Annex G), STAP will be invited to sit in

Stakeholder	Interests in the Project	Project Effect(s) on Stakeholder	Engagement During Project Implementation
		resources	on the Project Steering Committee, and therefore will be able to provide direct input to the project work plan, review and approve annual work plans and budgets, and review and approve any key project outputs
UNCCD Secretariat/Committee on Science and Technology (CST) and WOCAT	Needs improved baseline data on land cover and land degradation for global reporting	The Project will provide better global data for reporting on land cover and land degradation under the UNCCD	CST was consulted during proposal development, will be consulted throughout the project, and will be invited to review project outputs, such as toolbox and underlying methods. We will include a representative from WOCAT Network to ensure their input and to provide an important mechanism for dissemination of toolbox and data.
UNCCD national focal points	Key users of land cover data for reporting on the core indicator under SO-2 of the 10YSP on land cover	Will be provided with better data and with a toolbox for monitoring and reporting on the UNCCD core indicator of land cover	UNCCD focal points for Kenya, Tanzania and Uganda have been consulted during proposal development and will be consulted and trained in the application of the toolbox in project workshops. In addition, informal consultations were conducted with focal points from Burkina Faso, Burundi, Ethiopia, Ghana, Kenya, Malawi, Niger, Nigeria, Senegal, Swaziland, Tanzania and Uganda during two GEF Food Security IAP workshops in October 2014 and February 2015. The UNCCD focal points from Kenya, Senegal, Tanzania, Uganda will participate in the project inception workshop
National technical experts	Need access to improved data and tools for land cover and land degradation monitoring and assessment	Will benefit from capacity development and enhancement of their technical skills	The Kenya, Senegal, Tanzania and Uganda focal points have been consulted during proposal development and will be consulted and trained on the use of new data and on the application of the toolbox and methods

Stakeholder	Interests in the Project	Project Effect(s) on Stakeholder	Engagement During Project Implementation
Regional remote-sensing centers	Need access to improved data and better tools for land cover monitoring and assessment	Will be assisted in establishing platforms for knowledge sharing, learning and replication of the approach within the remits of their regions	The focal points for Kenya, Senegal, Tanzania and Uganda will be consulted and trained on the use of new data and on the application of toolbox and methods
The European Commission Joint Research Center (JRC) and the European Space Agency (ESA)	Sharing of data and experiences throughout the project with the UNCCD and the GEF	Will be able to apply research results in practice and share data and experiences with UNCCD focal points	ESA and JRC were consulted during the proposal development and provided comments on two drafts of the proposal. A representative of ESA will serve on the project Steering Committee; will share data and information and participate in assessment on land cover and other land degradation indicators and assessment tools
International Scientific Community	Ensure credibility of toolbox and data	Will share and exchange research methods and knowledge	We will engage representatives of the international scientific community in formal peer review of the toolbox and all reports (see par 219) and in informal review through presentations at international scientific meetings.

F. Methods Used for Consultation

222. To ensure wide dissemination, all project data, the toolbox and capacity building materials and project reports will be made available through the project website, the

223.

224. website and through the WOCAT portal. In addition, we will provide links to the project through national websites.

225. The socioeconomic data that will be used in this project have been collected by Vital Signs, in partnership with national statistical agencies. Vital Signs operates currently in Ghana, Rwanda, Tanzania and Uganda, through MOUs with the National Statistical Agencies in those countries. Collection of all socioeconomic data complies with national and international policies, and also the procedures are consistent with CI's Free Prior and Informed Consent Policy, no all Personally Identifiable Information strictly protected and the methods and standards used have been reviewed and approved by CI's Institutional Review Committee. No new household surveys or socioeconomic data will be collected as part of this project.

226. We will engage UNCCD national focal points from Kenya, Senegal, Tanzania and Uganda, as well as STAP and ESA representatives in the project inception workshop. During that workshop we

will agree with these stakeholders on the most effective means for consultation with them. Further, we will engage representatives from the STAP and ESA on the PSC.

227. We will engage national UNCCD focal points and national technical experts from the four pilot countries in capacity building workshops, using participatory methods, and will solicit input from the in advance and following the workshops through surveys and interviews.

228. We will engage the international scientific community through participation and presentations at scientific conferences and we will engage them in formal peer review of the toolbox and reports.

G. Timetable

	Timeline							
	Year 1 (Aug 2015 - July 2016)				Year 2 (Aug 2016 - July 2017)			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Stakeholders and Key Engagement Methods								
GEF and STAP:								
Participation of STAP Rep on Steering Committee								
Information Sharing, consultation								
Consultation on improvement of GBI algorithm								
UNCCD Sec/Committee on Science and Technology								
Knowledge products and tool input and dissemination								
Consultation and information sharing								
UNCCD National Focal Points								
Formal advice on project progress								
Information sharing and capacity building								
National Technical Experts								
Information sharing and capacity building								
Regional Remote Sensing Centers								
Knowledge products and tool input and dissemination								
European Commission Joint Research Center (JRC) and European Space Agency (ESA)								
Comparison of datasets, methods								
Agree on standard methods								

H. Resources and Responsibilities

229. Vital Signs is responsible for project execution and Sandy Andelman from is responsible for ensuring implementation of the project's stakeholder engagement plan at the whole-project level. For NASA, Dr. Compton Tucker will be responsible for ensuring implementation of the stakeholder engagement plan, and the comparable liaison at Lund University will be Dr. Anna Tengberg. The PSC, in its review of the project workplan and budget will ensure that resources for stakeholder engagement are allocated appropriately during project implementation.

I. Grievance Mechanism

230. Given the nature of the project, which focuses on global research and toolbox development, it is unlikely that local communities or indigenous groups would have any grievances, since the project will not directly impact such stakeholders.

231. The PSC will set up a process for monitoring, addressing and resolving any and all grievances and will assign a primary point of contact. We will post instructions on the project web site with the contact information and information regarding the grievance mechanism. This will include contact information for the PSC members and CI-GEF Project Agency staff. As part of this mechanism any interested stakeholders may raise a grievance at all times to the SC members, or to the CI-GEF Project Agency.

232. The primary point of contact for handling grievances will respond to grievances in writing within 15 calendar days of receipt. Claims will be filed and will be included in project monitoring and

reporting. If the claimant is not satisfied with the response, the grievance may be submitted directly to the CI-GEF Project Agency.

ANNEX I. Vital Signs, NASA, and Lund University Response to STAP and ESA comments on proposal

1. We have inserted the supporting reference.
2. We define land degradation to be a negative trend in primary production that is independent of climate variability (Ibrahim et al. 2015). This is now included in the text.
3. We have added the following clarifying text: A negative trend in NDVI and hence primary production that is not indicative of land degradation could be due to the following circumstances: climate trends towards drier conditions, like were observed in the Sahelian Zone from 1970 to 1984; the presence of surface water that is injurious to plant growth; and the intensification of agriculture where fertilizers and/or irrigation is reduced over time. The proposal will address these conditions or other possible confounding circumstances by using 50 cm commercial satellite data for all of Senegal, Tanzania, and Uganda. These data will identify what is happening at the local scale and identify how this is related to whatever is observed in the NDVI analyses. This is a novel and fundamental aspect of our proposal.
4. We have clarified and broadened the comparisons we will make and have included ESA as a potential implementing partner.
5. We have added the following: Fine scale satellite imagery are available from NASA for all developing countries and these data can be made available through cooperation with NASA. The lack of Vital Signs--type data is a good point that the GEF must address, because these data are very important for addressing land degradation.
6. We agree and have eliminated the use of the terms “up--- scaling” and “down--scaling.” Where referring to analysis of data at different resolutions we now use the terms “aggregation” and “disaggregation.” Where we are talking about enabling widespread use of the datasets, methods and tools, we have revised the language accordingly.

STAP Specific Comments

1. We have fixed the typo related to GBI.
2. We agree with the comment and have revised the text accordingly.
3. We agree with the comment and have revised the text accordingly.
4. We agree with the comment and have revised the text accordingly.
5. We have added the reference.
6. We agree with the comment and have revised the text accordingly.
7. We agree with the comment and have revised the text accordingly.
8. We agree with the comment and have revised the text accordingly.
9. We have added the citation.
10. We have added text to address work by ESA and also several recent papers that address this topic. We will learn from and build upon all of these:
    Ibrahim et al. 2015; Mbow et al. 2015; Higginbottom and Symeonakis 2014.
11. We agree with the comment and have moved that paragraph to the Alternative Scenario section.
12. We agree with the comment and have revised the text accordingly.

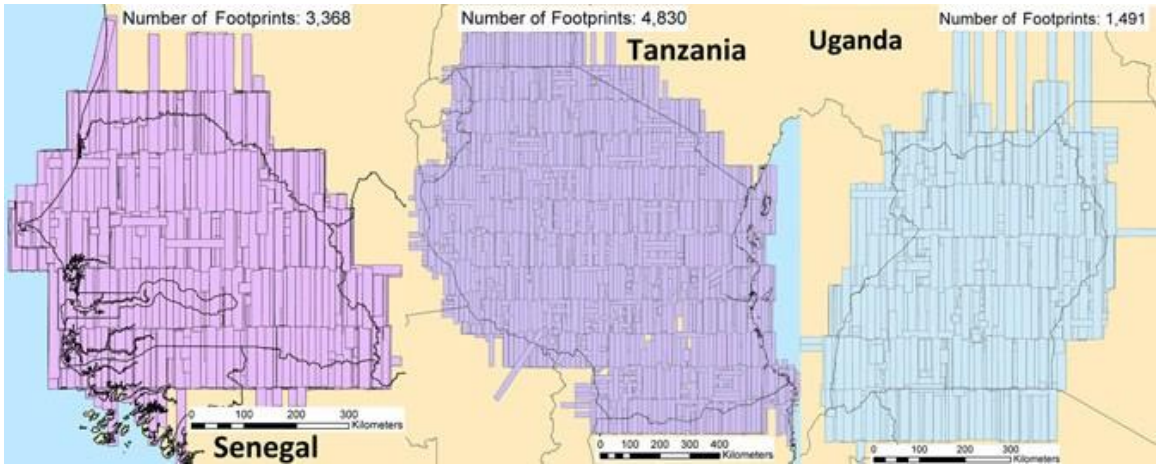
13. We have added additional, clarifying text: MODIS data are produced by NASA and are well--- documented. VIIRS data are now being processed by NASA using the same approaches that were used for MODIS data and these are being well--- documented for the VIIRS data.
14. We agree with the comment and have revised the text accordingly.
15. This is true. The archive of commercial satellite data is somewhat sparse before 2006 but there is a high density of these data for 2008 to 2015.
16. We agree with the comment and have revised the text accordingly.
17. We agree with the comment and have revised the text accordingly.
18. We agree with the comment and have revised the text accordingly.
19. We agree with the comment and have revised the text accordingly.
20. Commercial satellite data can determine if a de--- intensification of agriculture has happened, can determine if a forest or woodland is being selectively thinned, can determine if bush encroachment is occurring, and can identify a host of other fine--- spatial detail circumstances are present. We define land degradation as "a negative trend in primary production that is independent of climate variability (Ibrahim et al. 2015)". We have revised the text accordingly.
21. We have added text to clarify how the pilot sites will be selected.
22. We agree with the comment and have revised the text accordingly.
23. We agree with the comment and have revised the text accordingly.
24. We agree and have changed the text accordingly.
25. We agree with the comment and have revised the text accordingly.
26. Yes, the same baseline will be used for all countries. We will start with AVHRR 8-km NDVI data for each country in 1981 and continue this through 2015. We will use MODIS NDVI data from 2000 through 2015. The text has been revised.
27. We agree with the comment and have revised the text accordingly.
28. We agree with the comment and have revised the text accordingly.
29. We agree with the comment and have revised the text accordingly.
30. We have added text to address the issue of sustainability of access to the data, methods and tools after the end of the project.
31. We have added text: "Another form of innovation will stem from the development of an interactive product that can be automatically updated so that users can easily access and tailor data based on their own location and conditions." This is an excellent statement from the reviewers.
32. The commercial satellite data are available from NASA for research projects that involve NASA. These data are available from all countries. The solution here is for the GEF to involve NASA in the use of these data to address land degradation. There is no restriction on distributing derived products from the commercial satellite data.
33. We agree - ESA is on the steering committee. We have added that.
34. We disagree.

ESA Comments

1. We are including ESA on the Project Steering Committee and as a key project stakeholder, ensuring we will work closely together. However, keep in mind that ENVISAT data only exist from 2002 to 2012 and the launch of Sentinel--- 2 has now been postponed due to concerns over the Vega launch vehicle.
2. We agree, and we have selected suggested option 1.

General comments

1. The 40 and 50 cm commercial satellite data add another dimension to the proposed work, the dimension that satellite data can be disaggregated to a landscape component scale. Furthermore, there is a large number of images available for each of the three countries we propose to study.



2. We agree with this statement, but we only have capacity within an MSP to cover 3 pilot countries.

Specific comments collected from the ESA Diversity Project

1. While ESA has many excellent capabilities and many excellent researchers, it is our intention to use existing data to address land degradation. In the future, Sentinel--- 2 data may also play a large role but they do not exist at this time.
2. We agree with most of the statements here. However, we feel the recent Ibrahim et al. 2015 paper offers a superior approach in using soil moisture rather than rainfall and potential evapotranspiration.
3. We agree and look forward to new ESA satellite products being available for addressing land degradation.

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Acronyms

ASGM NAP	Artisanal and Small Scale Gold Mining National Action Plan
AVHRR	Advanced Very High Resolution Radiometer
AZE	Alliance for Zero Extinction
BAU	Business-As-Usual
CBD	Convention on Biodiversity
CI	Conservation International
CILSS	Permanent Interstate Committee for drought control in the Sahel
CST	Committee on Science and Technology
ESA	European Space Agency
ESMF	Environmental & Social Management Framework
EUE	Energy-Use efficiency
EVI	Enhanced Vegetation Index
FAO	Food and Agriculture Organization of the United Nations
GBI	Generalized Benefits Index
GEB	Global Environmental Benefits
GEF	Global Environment Facility
GEF-SOC	Soil Organic Carbon Stocks and Changes
GIMMS	Global Inventory Modeling and Mapping Studies
GIS	Geographic Information System
GLADA	Global Assessment of Land Degradation and Improvement
GLASOD	Global Assessment of Soil Degradation
GPP	Gross Primary Production
GSFC	Goddard Space Flight Center
IAP	Integrated Approach Pilot
IFAD	International Fund for Agricultural Development
IGAD	Intergovernmental Authority on Development
INRM	Integrated Natural Resource Management
IW	Inception Workshop
JRC	European Commission Joint Research Center
KBA	Key Biodiversity Areas
LADA	Land Degradation in Drylands
LDCF	Least Developed Countries Fund
LULUCF	Land Use, Land Use Change, and Forestry
M&E	Monitoring and Evaluation
MEA	Multilateral Environmental Agreements
NAP	National Action Program
NASA	National Aeronautics and Space Administration
NBSAP	National Biodiversity Strategies and Action Plans
NCSA	National Center for Supercomputing Applications
NDVI	Normalized Difference Vegetation Index
NGA	National Geospatial Intelligence Agency
NGSFC	NASA Goddard Space Flight Center
NOAA	National Oceanic and Atmospheric Administration
ODS	Ozone Depleting Substances
OFP	Operational Focal Point
PA	Project Agency
PMU	Project Management Unit
POPs	Persistent Organic Pollutants
PRSP	Poverty Reduction Strategy Papers
PSC	Project Steering Committee
REDD	Reducing Emissions from Deforestation and forest Degradation

RUE	Rain-Use Efficiency
SCCF	Special Climate Change Fund
SFM	Sustainable Forest Management
SKBP	Scientific Knowledge Brokering Portal
SLM	Sustainable Land Management
STAP	Scientific and Technical Advisory Council
STAR	System for Transparent Allocation of Resources
TNA	Technology Needs Assessment
TOR	Terms of Reference
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VS	Vital Signs
WB	World Bank
WOCAT	World Overview of Conservation Approaches and Technologies