

## INDICES AND METRICS

### VITAL SIGNS DECISION SUPPORT INDICES

Index	Scale	Description
<b>Climate Change</b>	<ul style="list-style-type: none"> <li>• Plot</li> <li>• Landscape</li> <li>• Nation</li> </ul>	Human-induced changes in greenhouse gases
<b>Soil Health</b>	<ul style="list-style-type: none"> <li>• Plot</li> <li>• Landscape</li> <li>• Nation</li> </ul>	The ability of soil to deliver ecosystem services such as food production, water and nutrient provision and regulation and climate regulation.
<b>Water Security</b>	<ul style="list-style-type: none"> <li>• Landscape</li> <li>• Nation</li> </ul>	The availability of sufficient clean water for household use, agricultural production and healthy ecosystems.
<b>Agricultural Intensification</b>	<ul style="list-style-type: none"> <li>• Plot</li> <li>• Landscape</li> <li>• Nation</li> </ul>	Practices that increase agricultural productivity per unit of land area using a variety of technological and agricultural management changes.
<b>Wood Fuel Sustainability</b>	<ul style="list-style-type: none"> <li>• Landscape</li> <li>• Nation</li> </ul>	The amount of consumption of wood fuel relative to the growth rate of woody biomass.
<b>Rangeland Degradation</b>	<ul style="list-style-type: none"> <li>• Landscape</li> <li>• Nation</li> </ul>	The deterioration of land productivity, e.g., soil, vegetation and/or water resources
<b>Poverty</b>	<ul style="list-style-type: none"> <li>• Household</li> <li>• Landscape</li> <li>• Nation</li> </ul>	A measure of standard of living, indicating whether a person has enough money or resources to meet her needs.
<b>Food Security</b>	<ul style="list-style-type: none"> <li>• Household</li> <li>• Landscape</li> <li>• Nation</li> </ul>	The physical, social, and economic access to sufficient and nutritious food to meet dietary needs for a healthy and active life.
<b>Resilience</b>	<ul style="list-style-type: none"> <li>• Household</li> <li>• Landscape</li> <li>• Nation</li> <li>• Continent</li> </ul>	The ability of people, agriculture and ecosystems to remain healthy and productive in the face of climate variability, shocks and other stressors.



Metrics for agriculture, ecosystem services and livelihoods. Primary measurements are carried out at four scales: 1) household; 2) plot, i.e. < 1 hectare, 3) landscape, i.e. 100 km<sup>2</sup>, and 4) region or nation, ~350,000's km<sup>2</sup> (modified from Andelman et al. 2011). Note that, while there are many metrics, all of these metrics role up into a small number, ~6, of high-level decision support indicators.

## METRICS

METRICS	SCALE	TIERS				CATEGORIES			DESCRIPTION	DATA SOURCE	FREQUENCY
	Spatial resolution	Tier 1	Tier 2	Tier 3	Tier 4	Ecosystem Services	Agriculture	Livelihoods			
<b>LANDSCAPE STRUCTURE &amp; COMPOSITION</b>									Spatial structure & composition of land cover classes (not a service, per se, but play critical role in determining services produced)	Satellite remote sensing (MODIS, Landsat1, ASTER2, Quickbird); ground validation (field campaign) HHS	3 years
Area per land cover type	L, R	•			•	•	•			As above	3 years
Area in different types of agriculture (grain, fruit, vegetables, rangelands, trees)	P, L, R	•			•	•	•			As above	3 years
Number of households	L, R	•			•	•		•		As above	3 years
Road density (km/km <sup>2</sup> )		•			•	•	•	•		As above	3 years
<b>WATER AVAILABILITY</b>	H, P, L, R		•	•	•	•	•	•	Water availability for household use, food production and ecosystems	FEWS, TRMM, CMORH, MODIS, Landsat, WV2 or Quickbird, HHS, stream gauge	Daily monthly annual
Daily precipitation	L, R	•		•	•	•	•			Climate stations, CMORPH, TRMM	Daily
River/stream discharge	L			•	•	•	•			Stream gauges	Continuous
Water withdrawals for domestic, agricultural and urban uses	H, P, L		•		•	•	•	•		HHS	Annual



<b>WATER QUALITY</b>	H, L	•	•	•	•	•	Water pollution due to soil erosion and leaching	Field measurements	Annual	5 years
% bare ground	L, R	•			•			MODIS, Landsat, WV2 or Quickbird	Annual	
Mg/L of N, P and fecal coliform	L	•	•	•	•	•		Water samples	Annual	
pH	L	•	•	•	•	•		Water samples	5 years	
Water source type for domestic consumption	H	•	•	•	•	•		HHS	5 years	
<b>SOIL HEALTH</b>	P	•	•	•	•	•	Nutrients applied to agricultural soils minus nutrients extracted in crops and residues	HHS, agricultural surveys, field measurements		2 years
Balance of nutrients (kg/ha of cropland/y of elemental N, P, K and S)	P	•	•	•	•	•		HHS, field measurements		3-5 years
Soil carbon in topsoil	P, L	•	•	•	•	•		Field measurements		3-5 years
Soil exchangeable P, Ca, K, Al, S, pH	P, L	•	•	•	•	•		Field measurements and regional maps		5 years
Soil loss (t/ha/yr) (derived from rainfall rates, slope, land cover and management)	P, L, R		•	•	•	•		Digital elevation, ppt, land cover and management, modelling		Annual
<b>AGRICULTURE</b>	P, L, R	•	•	•	•	•	Crops and livestock for production of food and cash	HHS, field measurements, Remote sensing		Annual
Crop type	P, L, R	•	•	•	•	•		HHS, field measurements		Annual
Crop area planted	P, L, R	•	•	•	•	•		HHS, field measurements		Annual
Crop area harvested	P	•	•	•	•	•		HHS, field measurements		Annual
Crop yield	P	•	•	•	•	•		HHS, field measurements		Annual
Length of fallow season	P		•	•	•	•		HHS		Annual



Fertilizer type	P				•		•		HHS	Annual
Quantity of fertilizer by type	P				•		•		HHS	Annual
Crop fraction remaining after harvest	P				•	•	•		HHS	Annual
Type, quantity of crop byproduct produced in last year (kg or L)	P				•	•	•		HHS	3 years
<b>LIVESTOCK &amp; RANGELAND</b>										
Livestock type, number and density	L, R		•		•	•	•		National surveys	3-5 years
Pasture area (ha)	H, L		•		•	•	•		HHS	3 years
Type and number of livestock owned	H		•		•	•	•	•	HHS	3 years
Type and percent of livestock feed or forage from different sources	H, P		•		•	•	•		HHS	3 years
<b>FUELWOOD SUFFICIENCY</b>										
	P, L, R	•			•	•		•	Sustainability of fuelwood supply	5 years
Annual production of woody biomass (kg.y)	L, R	•			•	•		•	MODIS, Landsat, WV2 or Quickbird, biomass measurements, HHS	5 years
Annual harvest of woody biomass (kg.y)	H		•		•	•		•	HHS	5 years
Time spent collecting fuelwood	H		•		•	•		•	HHS	2 years
Primary fuel for cooking	H		•		•			•	HHS	3 years
Primary fuel for light	H		•		•			•	HHS	3 years
Types of fuel purchased in last year	H		•		•			•	HHS	3 years
Percent of income allocated to fuel	H		•		•			•	HHS	3 years
<b>CARBON STOCKS, ABOVE AND BELOW GROUND</b>										
	P, L, R	•	•		•	•			MODIS, Landsat, WV2 or Quickbird, biomass measurements,	Annual 5 years
Above-ground carbon in vegetation (tons carbon/km <sup>2</sup> )	P, L, R	•	•		•	•				5 years



Soil carbon to 1 m (ton C/ha)	P, L, R	•	•	•				soil samples	5 years	
<b>CLIMATE and CLIMATE FORCING</b>	P, L, R	•		•	•			Temperature, precipitation, humidity, solar insolation	Climate stations	Continuous
Temperature (degrees C)	P, L, R			•	•			Climate stations, ibutton sensors	Daily max and min	
Precipitation (mm)	P,L, R	•		•	•			Climate stations, CMORPH, TRMM	Daily	
kWh/m <sup>2</sup> day	L, R			•	•			Climate stations,	Daily	
N fertilizer applied (kg N/ha)	P, R		•	•	•	•		HHS	3 years	
Livestock density	P, L, R		•	•	•	•		HHS	3-5 years	
Area planted to grain	P, L, R		•	•	•	•		HHS, Landsat, WV2	3-5 years	
Area and type of legume	P, L, R		•	•	•	•		HHS, Landsat, WV2	3-5 years	
<b>BIODIVERSITY</b>	L, R	•	•	•	•			Diversity of genes, species, ecosystems and landscapes	MODIS, Landsat, WV2 or Quickbird, camera traps, surveys	Annual 3 years
Invasive species types / extent	L			•	•			WV2 or Quickbird, Field surveys	3 years	
Protected areas	L, R							WCMC,	2 years	

预览已结束，完整报告链接和二维码如下：

[https://www.yunbaogao.cn/report/index/report?reportId=5\\_16256](https://www.yunbaogao.cn/report/index/report?reportId=5_16256)



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