

**Table S1.** Criteria for ecosystem health indicator selection (in bold are the criteria that are covered by using remote sensing data)

Criterion	Details	Source
Assesses integrative ecosystem health	Vigor, organization, resilience	[65]
Describes the status of an ecosystem	Decline of nutrient pools, primary productivity, species diversity	[25,65,66]
Reflects function and structure of an ecosystem	Species composition, distribution, abundance, tolerance, adaptability, efficiency across different scales	[11,65–68]
Represents sustainability of human-coupled ecosystems	Biophysical and social-economic ecosystem services	[11,25,65,68]
Representative of the ecosystem and interpretable	Sensitive to stresses, strong scientific basis, <b>quantifiable</b> , expected responses to stress, corresponds to <b>broad geographic extends</b> , historical record available	[11,12,16,25,26,65–68]
Related to management goals	<b>Easy to apply, cost-effective, integrative</b> (summarizing many indicators), <b>nondestructive to the ecosystem</b> , potential for <b>measurement continuity</b> , not redundant, <b>timely, retrospective</b> , used by other monitoring programs, comprehensible, applicable to policy and management goals	[16,25,26,66–68]

**Table S2.** Percentage contributions of examined studies per ecosystem type by remote sensing (RS) type, top ten RS sensors, top five resolutions, and top five vegetation indices (VIs).

Ecosystem type	Forest		Grassland	
<i>RS type</i>				
	Multispectral	45.3%	Multispectral	52.8%
	LiDAR	17.3%	Hyperspectral	22.2%
	Hyperspectral	13.3%	UAV/Aerial	12.5%
	UAV/Aerial	13.3%	Radar	6.9%
	Radar	10.7%	LiDAR	5.6%
<i>Top 10 RS sensors</i>				
	Landsat	20.9%	Landsat	23.1%
	MODIS	10.1%	MODIS	17.9%
	LiDAR	10.1%	Hyperspectral	12.6%
	Aerial	6.2%	Aerial	5.3%
	AVHRR	5.4%	AVHRR	5.3%
	SPOT	4.7%	Sentinel	5.3%
	SAR	3.9%	AVIRIS	4.2%
	AVIRIS	3.1%	LiDAR	4.2%

Hyperspectral	3.1%	Digital Multispectral Imagery	2.1%
EnMAP	2.30%	Hyperion	2.1%
<i>Top 5 resolutions (m)</i>			
30	21.7%	30	30.0%
1000	17.4%	250	12.0%
10	3.6%	10	10.0%
20	3.6%	1000	3.6%
1	3.6%	25	3.6%
<i>Top 10 VIs</i>			
NDVI	28.3%	NDVI	31.0%
NBR	12.1%	NBR	6.9%
Tasseled Cap	9.1%	SAVI	6.9%
EVI	4.0%	Tasseled Cap	6.9%
SAVI	4.0%	EVI	5.2%

**Table S3.** Satellite sensors and derived indices to estimate ecological indicators of the “Soil Chemistry and Structure” attribute in grassland and forest ecosystems

Satellite sensors	Independent variable	Derived ecosystem health indicator	Ecosystem used	Field measurements	Modeling method	Example study
TerraSAR-X COSMO-SkyMed SPOT Landsat	NDVI, LAI, FAPAR, FCOVER	Soil moisture content	Grassland	Soil moisture, soil roughness, LAI, FAPAR, FCOVER, biomass, vegetation water content, vegetation height,	Multi-layer perceptron neural networks	El Hajj et al. [88]
LiDAR	DTW		Forest	Soil bulk density and chemicals, gravimetric water content, soil pH	Linear mixed-effect model	Sewell et al. [89]
AirSAR AVIRIS Landsat	LTCG, Radar C <sub>vv</sub> , L <sub>hv</sub> , NDVI, EVI, PRI	Bare ground cover	Grassland	Canopy percentages	Break points and linear interpolation	Huang et al. [75]
RADAR ERS-1 JERS Landsat			Forest	Training sites’ GPS location for vegetation classification	Maximum likelihood classification	Ranson et al. [90]
ASTER	SAVI	Variation of erosion	Grassland	Vegetation height, vegetation cover, surface roughness length	Supervised maximum-likelihood classification	Reiche et al. [91]

NDVI: Normalized Difference Vegetation Index, LAI: Leaf Area Index, FAPAR: Fraction of Absorbed Photosynthetically Active Radiation, FCOVER: Fraction Vegetation Cover, DTW: Depth-to-water Index, LTCG: Landsat Tasseled Cap Greenness, PRI: Photochemical Reflectance Index, SAVI: Soil Adjusted Vegetation Index.

**Table S4.** Satellite sensors and derived indices to estimate ecological indicators of the “Disturbance” attribute in grassland and forest ecosystems

Satellite sensors	Independent variable	Derived ecosystem health indicator	Ecosystem used	Field measurements	Modeling method	Example study
Sentinel-2	SR, NDVI, EVI, RCI, NDVI <sub>n</sub> , PVI <sub>n</sub> , GSAVI <sub>n</sub> , MSAVI <sub>n</sub> , NDVI <sub>ngreen</sub> , EVI <sub>n</sub> , EVI <sub>2n</sub> , MTVI <sub>1n</sub> , NDII <sub>7n</sub> , NDVI <sub>re2n</sub> , NDVI <sub>re3n</sub>	Grazing capacity and stocking rate	Grassland	Dried aboveground biomass	Resource Selection Functions and Multiple linear regression	Doan [69]
Sentinel-2 Landsat RADAR	NBR, NDVI, LST	Seasonal timing of disturbance	Grassland	Species identification, species abundance, soil samples	Vegetation species response capacity model	Adagbasa et al. [92]
Landsat MODIS	NBR		Forest		Decision tree analysis	Loboda et al. [93]
Landsat	NDVI, NPV, MASD, FVC	Disturbance intensity	Grassland	Aboveground biomass	Artificial neural networks and ANOVA	Li et al. [82]
MODIS Landsat	NBR, dNBR, RdNBR		Forest		Distributional statistics, Linear and Non-linear regression algorithms	Heward et al. [94]
Landsat MODIS	Band 7/Band 5, NDVI, NBR, dNBR, RdNBR, Kauth Thomas brightness – greenness - wetness	Disturbance extent	Forest	Residual organic layer depth	Random forest algorithm	Barrett et al. [95]
HyMAP Landsat	MSI, CRI1, GNDVI, ARI2, NDVI, NWI2, NSMI, GOSAVI, NPCI, TCARI, DI1	Defoliation and tree mortality rate	Forest		Classification algorithms Naïve Bayes, Support Vector Machine, Decision tree analysis	Lausch et al. [21]

SR: Simple Ratio, NDVI: Normalized Difference Vegetation Index, EVI: Enhanced Vegetation Index, RCI: Ratio Cover Index, NDVI<sub>n</sub>: Narrow Normalized Difference Vegetation Index, PVI<sub>n</sub>: Narrow Perpendicular Vegetation Index, GSAVI<sub>n</sub>: Narrow Green Normalized Difference Vegetation Index, MSAVI<sub>n</sub>: Narrow Modified Soil-adjusted Vegetation Index, NDVI<sub>ngreen</sub>: Narrow Green Normalized Difference Vegetation Index, EVI<sub>n</sub>: Narrow Enhanced Vegetation Index, EVI<sub>2n</sub>: Narrow Enhanced Vegetation Index 2, MTVI<sub>1n</sub>: Narrow Modified Triangular Vegetation Index 1, NDII<sub>7n</sub>: Narrow Normalized Difference Infrared Index 7, NDVI<sub>re2n</sub>: Narrow Normalized Difference Vegetation Index red-edge 2, NDVI<sub>re3n</sub>: Narrow Normalized Difference Vegetation Index red-edge 3, NBR:

Normalized Burn Ratio, LST: Land Surface Temperature, NPV: Non-photosynthetic Vegetation, MASD: Mean Absolute Spectral Dynamic, FVC: Fractional Vegetation Cover, dNBR: Difference NBR, RdNBR: Relativized dNBR, MSI: Moisture Stress Index, CRI1: Carotenoid Reflectance Index 1, GNDVI: Green NDVI, ARI2: Anthocyanin Reflectance Index 2, NWI2: Normalized Water Index 2, NSMI: Normalized Difference Soil Moisture Index, GOSAVI: Green Optimized SAVI, NPCI: Normalized Pigment Chlorophyll Ratio Index, TCARI: Transformed Chlorophyll Absorption Reflectance Index, DII: Derivative Index.

**Table S5.** Satellite sensors and derived indices to estimate ecological indicators of “Fragmentation” and “Hydrology” attributes in grassland and forest ecosystems

Satellite sensors	Independent variable	Derived ecosystem health indicator	Ecosystem used	Field measurements	Modeling method	Example study
MODIS	NDVI		Grassland		Improved Costanza model	Suo et al. [96]
	Digital Number values	Landscape diversity index	Forest	Shannon Index, Simpson Index, Pielou evenness, Renyl Indices	Open-Source Program GRASS-GIS	Rocchini et al. [46]
		Number of patches				
		Mean patch size				
		Linear forest clearings density				
		Edge density	Forest		Patch analysis	Pattison et al. [68]
		Percent of land occupied/unoccupied by linear forest clearings (LFCs)				
AVHRR	NDVI	Winter snow coverage	Grassland		Least-squares method	Wang & Qiao [86]

NDVI: Normalized Difference Vegetation Index