

Annex to the Framework for assessing climate change and disaster-related losses of biodiversity and ecosystem services report

(FRAME-ECO)

Data sources collection

The framework was developed to advance the assessment of climate change and disaster-related losses of biodiversity and ecosystem services. As part of this research, we compiled a list of databases and resources to support countries in tracking key components of the framework: (1) Ecosystem extend, (2) Ecosystem condition, including biodiversity, (3) Diverse values of nature and ecosystem services, (4) Sudden onset events, and (5) Slow onset events.

Disclaimer:

This annex contains a data source collection which provides an overview of exemplary global, and some selected regional or even national datasets and platforms to inspire and support the assessment of climate change and disaster-related losses of biodiversity and ecosystem services. It is not exhaustive, and each dataset has limitations in coverage, resolution and applicability. Many analyses require additional processing, and higher-resolution or ground-truthed data may significantly improve accuracy. Regional and national datasets, where available, can be more relevant for local contexts and decision-making. Users are encouraged to complement these sources with local information and assessments to better capture post-disaster impacts on ecosystems and biodiversity.

List of Abbreviations

Abbreviation	Full Name
AEKOS	Australian Ecological Knowledge and Observation System
ALA	Atlas of Living Australia
ARBIMS	Albertine Rift Biodiversity Information Management System
Arise	National biodiversity monitoring platform (Netherlands)
ASEAN	Association of Southeast Asian Nations
BASIN	Biodiversity and Social-Institutional Network (Core Benefits Framework)
BIOCLIM	Bioclimatic Variables
BIOMIS	Biodiversity Information System (India State Boards)
BMD	Biodiversity Meets Data
BOLD	Barcode of Life Data System
CICES	Common International Classification of Ecosystem Services
CHL	Chlorophyll
CLC	Corine Land Cover
CMIP	Coupled Model Intercomparison Project Phase
CSV	Comma-Separated Values
CRU	Climatic Research Unit
DwC-A	Darwin Core Archive
EBVs	Essential Biodiversity Variables
EDID	European Drought Impact Database
EDR	European Drought Reference
EDII	European Drought Impact Inventory
EM-DAT	Emergency Events Database
EMPL-EBI	EMBL-EBI Global Biodiversity Portal / European Molecular Biology Laboratory (contextual)
ENVALUE	Environmental Valuation Database developed by New South Wales (NSW) and Environment Protection Authority (EPA)
ERA5	ECMWF Reanalysis v5
ES	Ecosystem Services
ESABII	East and Southeast Asian Biodiversity Information Initiative
ESVD	Ecosystem Services Valuation Database
EU	European Union
EVRI	Environmental Valuation Reference Inventory
FBIS	Freshwater Biodiversity Information System (South Africa)
GBF	Global Biodiversity Framework
GBIF	Global Biodiversity Information Facility
GCCSTAT	Gulf Cooperation Council Statistics Portal
GEE	Google Earth Engine
GEO BON	Group on Earth Observations Biodiversity Observation Network
GLAD	Global Land Analysis & Discovery
GMW	Global Mangrove Watch
GPCC	Global Precipitation Climatology Centre
HANZE	Historical Analysis of Natural Hazards in Europe

HRL	High-Resolution Layers
HYSMyeongJo	Hanyang System MyeongJo (Korean font)
IBGE	Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics)
IBIS	Indian Biodiversity Information System
IBP	India Biodiversity Portal
ICES	International Council for the Exploration of the Sea
IIASA	International Institute for Applied Systems Analysis
iNaturalist	International citizen-science biodiversity observation platform
INPN	Inventaire National du Patrimoine Naturel
INCA	Integrated Natural Capital Accounting
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
InVEST	Integrated Valuation of Ecosystem Services and Tradeoffs
JRC	Joint Research Centre (European Commission)
LPI	Living Planet Index
MAMBO	Monitoring of Automated Models for Biodiversity Observation (Europe)
MARCO-BOLO	Marine Coastal Biodiversity Long-term Observation (EU)
MODIS	Moderate Resolution Imaging Spectroradiometer
NALCMS (CEC)	North American Land Change Monitoring System coordinated by the Commission for Environmental Cooperation
NCP	Nature's Contributions to People
NetCDF	Network Common Data Form
NOAA	National Oceanic and Atmospheric Administration
NOEP	National Ocean Economics Program
NSW EPA	New South Wales Environment Protection Authority
OBIS	Ocean Biodiversity Information System
OBSGESSION	Observation of Ecosystem Changes for Action
RS	Remote Sensing
SANBI	South African National Biodiversity Institute
SEEA	System of Environmental-Economic Accounting
SEEA-EA	System of Environmental-Economic Accounting – Ecosystem Accounting
SGLI	Second-generation Global Imager
SMHI	Swedish Meteorological and Hydrological Institute
SMI	Soil Moisture Index
SPI	Standardized Precipitation Index
SPEI	Standardized Precipitation Evapotranspiration Index
TanBIF	Tanzania Biodiversity Information Facility
TERN	Terrestrial Ecosystem Research Network
UN	United Nations
UNEP	United Nations Environment Programme
UNEP-WCMC	United Nations Environment Programme – World Conservation Monitoring Centre
WSL	Swiss Federal Institute for Forest, Snow and Landscape Research
YOC	Yet Another Chlorophyll product

1. Ecosystem extent

Understanding the spatial distribution and size of ecosystems is fundamental for monitoring changes and assessing impacts from climate and disaster events. Data on ecosystem extent provides the reference for detecting ecosystem conversions, losses or restoration over time.

Name of data source	Short description	Spatial coverage	Spatial resolution	Temporal coverage	Temporal resolution	Data format	Access Link	Notes/Comments
GLOBAL (WORLDWIDE)								
WorldCover (ESA)	Global 10 m land cover (2020–2021, now annual composites)	Global	10 m	2020–2021 (plus annual composites)	Annual	GeoTIFF	https://esa-worldcover.org/en/data-access	Annual composites available since 2023 (sentinel-2). (esa-worldcover.org , CEOs)
Global Dynamic Land Cover (Copernicus CGLS-LC100)	Annual global 100 m land cover layers	Global	100 m	2015–2019	Annual	GeoTIFF	https://land.copernicus.eu/en/products/global-dynamic-land-cover?tab=datasets	Also on Google Earth Engine (Google for Developers , docs.digitalafrica.org)
World Terrestrial Ecosystems (WTE)	431 ecosystem types (climate × landform × land cover)	Global	250 m	2015, 2020; projections to 2050 (SSPs)	Snapshot; projections	Raster (GeoTIFF/MPK X), web explorer	https://rmgsc.cr.usgs.gov/wte/	2020 datalayer downloadable; 2050 scenario paper. (USGS , USGS Science)

								Data Catalog, ScienceDirect)
Global Mangrove Watch (GMW v3)	Mangrove extent & change epochs 1996–2020	Global coastlines	~25 m (JAXA ALOS PALSAR, Landsat)	1996–2020 (11 epochs)	Epochal (multi-year)	Vector & raster (Zenodo), JAXA rasters	https://www.globalmangrovewatch.org/	Version 3.0 dataset on Zenodo; epochs noted by CEOS GST. (Zenodo , CEOs)
Global Intertidal / Tidal Wetland Change (Murray et al.)	Loss/gain of tidal wetlands (mangrove, saltmarsh, tidal flat)	Global (≈60° N–60° S)	30 m	1999–2019	Annual change tagging (per-pixel year)	Raster (Google earth engine (GEE) assets), supporting code	https://www.globalintertidalchange.org/	Data viewer notes year/type per pixel. (globalintertidalchange.org , Nature)
Global Groundwater-Dependent Ecosystems (GDEs)	Global drylands GDE map from ML & EO	Global drylands	~30 m	2009–2020	Snapshot	Raster (GeoTIFF), code	https://zenodo.org/records/11062894	Nature 2024 study; 30 m res stated. (Zenodo , Nature)
Land Use Harmonization (LUH2)	Historical & projected land-use states/transitions	Global	Gridded (0.25° typical)	850–2100	Not real-time (CMIP phases)	NetCDF (.nc)	https://www.globallandusechange.org/luh2/	Harmonized with SSP/CMIP.

FAO Global Forest Resources Assessment (FRA)	Country reports + remote sensing on forest extent/change	Global (national)	30–100 m (RS layers)	1948–present	5-year	Vector, raster, reports	https://fra-data.fao.org	RS component + national reports.
Global Forest Watch (WRI)	Forest cover, loss, gain, degradation, alerts	Global	Variable (to 30 m)	2000–present	Daily–annual	Raster, vector, CSV, web/API	https://data.globalforestwatch.org	Multiple providers; frequent updates.
Critical Natural Assets (Chaplin-Kramer et al.)	Areas providing 90% of 14 NCPs; global optimization	Global land & waters	2 km	c. 2000–2020 (inputs)	Snapshot	Raster files	https://osf.io/r5xz7/	Nature Ecol. Evol. 2022; 2 km resolution. (OSF , PMC)
UNEP-WCMC WDPA/OECM	Protected & conserved areas repository	Global	Variable	1981–present	Monthly	Vector (SHP), CSV	https://www.protectedplanet.net/en/thematic-areas/wdpa?tab=download	Monthly updates documented. (resources.unep-wcmc.org)
HydroBASINS (HydroSHEDS)	Hierarchical global sub-basin polygons (Pfafstetter)	Global (ex-Antarctica detail varies)	Multi-scale (levels)	2013–present	Irregular	Vector (SHP), docs	https://www.hydrosheds.org/products/hydrobasins	Also refer following link for related core products: https://www.hydrosheds.org/products

IPBES Global Assessment Tools	Provides integrated biodiversity and ecosystem indicators to inform global assessments and support policy decisions on ecosystem extent and condition. They synthesize diverse datasets for comprehensive monitoring and reporting.	Global	Variable	2019–present	Irregular	Reports, indicators, datasets	https://ipbes.net	
IUCN Red List of Ecosystems (RLE)	Global framework & database of ecosystem risk/status	Global	Variable (national→global)	2014–present	Annual/irregular	Vector (SHP), API, docs	https://iucnrle.org/rle-database	Tools & spatial resources available. ()
IUCN Global Ecosystem Typology (GET)	Global ecosystem classification (multi-level)	Global	N/A (typology)	2020–present	Irregular	Typology, some GIS layers - The IUCN Global Ecosystem	https://iucn.org/resources/conservation-tool/iucn-global-	Level-3 layer on GEE exists. (IUCN, Google

						Typology (GET) provides spatial data layers including hierarchical ecosystem classification maps (Levels 1 to 3) as polygon or raster formats, available via platforms like Google Earth Engine.	ecosystem-typology	for Developers)
GEO Global Ecosystems Atlas	Open hub aggregating ecosystem maps	Global	Variable - raster grids at different resolutions (e.g., 10 m, 30 m, 250 m, or coarser) to vector polygon units that represent ecosystem patches or types.	2022–present	Biennial	Vector, raster, code	https://globalecosystemsatlas.org	About & methodology pages. (earthobservations.org , globalecosystemsatlas.org)

ARIES for SEEA	Automated accounts using global datasets	Global (country runs)	300 m–1 km	2000–present	Quarterly (platform)	Raster (NetCDF), API	https://aries.integratedmodeling.org/project/aries-for-seea/	For further details on the database: (SEE Accounting)
SEEA Ecosystem Accounting (UN)	International standard for ecosystem accounts	Global/national	Variable (spanning from fine-scale remote sensing grids (around 10–30 m) to coarser ecosystem or administrative reporting units (around 1 km or more))	2012–present	Annual/irregular	Guidelines; vector/raster	https://seea.un.org	
WWF Global 200 Ecoregions	Priority terrestrial/freshwater/marine ecoregions	Global	Ecoregion polygons (vector) - corresponding at broad ecological scales with ecosystem types classified according to the IUCN GET framework.	2002 (static)	One-time	Vector (SHP)	https://global.panda.org/maps/wwf-global-200-ecoregions/about	Download options via multiple hubs. (global.panda.org , ecoregions.appspot.com)

GLIMS (Global Land Ice Measurement s from Space)	Glacier outlines + metadata	Global (glaciated)	15–30 m typical (ASTER/Landsat)	1870–present	Irregular	Shapefiles, KML, GML, etc.	https://www.glims.org/	
World Glacier Monitoring Service (WGMS)	Glacier change (mass/length/area) + inventories	Global	Station/region variable - (both individual glaciers (point or polygon) and regional aggregates.)	1894–present	Irregular to annual	CSV (fluctuations), NetCDF (gridded mass change)	https://wgms.ch	
Land Use Harmonization (LUH2)	Historical & projected land-use states/transitions	Global	Gridded (0.25° typical)	850–2100	Not real-time (CMIP phases)	NetCDF (.nc)	https://www.globalchange.umd.edu/lulc-data/luh2/	Harmonized with SSP/CMIP.
Ramsar Sites Information Service	Wetlands of international importance	Global	Varies (spatial details of some sites having highly detailed polygons while others are represented more coarsely. Spatially explicit, consisting of vector polygons that depict the	2014–present	Continuous (6-yr country review)	Shapefiles, CSV	https://rsis.ramsar.org	

			precise geographic extent of each designated Ramsar wetland.)					
REGIONAL								
Africa Land Cover (ESA/AfDB)	10 m land cover for Africa (based on Sentinel-2)	Africa	10 m	2020–present	Annual	GeoTIFF	https://land.copernicus.eu/en/products/global-dynamic-land-cover?tab=datasets	Tied to ESA programs; AfDB collaboration noted (provider statement).
CSIRO National Ecosystems Data	AU terrestrial, marine & freshwater; scenarios	Australia	250 m	1990–2025	5-year	NetCDF, web services	https://research.csiro.au/national-ecosystems-and-services-data/	Includes futures.
MapBiomass	Annual LC/LU for multiple countries (SA focus)	South America (expanding)	30 m (vintage varies)	1985–2023	Annual	GeoTIFF, SHP	https://mapbiomas.org	Tracks change; supports monitoring.
North American Land Change Monitoring System NALCMS (CEC)	Harmonized land cover (FAO LCCS)	USA, Canada, Mexico	30 m	2005–present	5-year	GeoTIFF	https://www.cec.org/nalcms	CEC coordination.

EEA Ecosystem Extent Accounts viewer	Ecosystem extent statistics for EEA-38+UK	Europe	100 m (from CLC/HRL)	2000–2018	6-year (CLC epochs)	Raster/CSV	https://www.eea.europa.eu/en/analysis/maps-and-charts/ecosystem-extent-accounts-data-viewers	Based on CLC/LEAC. (European Environment Agency)
ASEAN Biodiversity Dashboard	Regional biodiversity & ecosystem indicators	SE Asia	100 m–1 km	2010–present	Quarterly	Vector, raster, CSV	https://aseanbiodiversity.org	
Asia-Pacific Regional Land Cover (SERVIR-Mekong)	Regional LC for policy & management	SE Asia (Mekong), wider APAC	30 m	2000–present	Annual	GeoTIFF, SHP, CSV	https://servir.dpc.net or https://servir.mekong.org	Stakeholder validation.
Ecosystem types of Europe (EEA)	Probabilistic EUNIS-based ecosystem layers	Europe (EEA-38+UK)	100 m	2006, 2012 (v3 r1 2019)	Snapshot	Raster (GeoTIFF)	https://www.eea.europa.eu/data-and-maps/data/ecosystem-types-of-europe-1	Product docs & metadata. (European Environment Agency, sdi.eea.europa.eu)
NatureServe Explorer	Species & ecosystem locations/statuses	U.S., Canada	30–100 m	2000–present	Weekly (platform)	Web, vector, API	https://www.natureserve.org/access-data	
Copernicus Land	Europe land cover/land use	Europe, global	10–100 m	2000–present	Annual/biennial	Raster (GeoTIFF), vector	https://land.copernicus.eu	Supports EEA accounts.

Monitoring Service	& global products							
Critical Natural Assets (Chaplin-Kramer et al.)	Areas providing 90% of 14 NCPs; global optimization	Global land & waters	2 km	c. 2000–2020 (inputs)	Snapshot	Raster files	https://osf.io/r5xz7/	Nature Ecol. Evol. 2022; 2 km resolution. (OSF, PMC)
NATIONAL								
Atlas of Living Australia (ALA)	National species & environment layers	Australia	10–250 m	2010–present	Daily (platform)	Web, vector, raster, API	https://www.ala.org.au	
Germany – Destatis ecosystem accounts	National ecosystem extent accounts	Germany	100 m–1 km	2015–present	Annual	Vector, CSV, PDF	https://www.destatis.de/.../ecosystem-account/_node.html	SEEA-aligned.
Queensland Regional Ecosystem Database	Regional ecosystems for planning & policy	Queensland, AU	1:100,000	1999–present	Annual	Shapefiles, PDF	https://www.nrme.qld.gov.au/.../regional-ecosystem-database	
USGS Gap Analysis Project (GAP)	U.S. habitat/land cover & biodiversity layers	U.S.	30 m	2001–present	Biennial	Raster, vector, web maps	https://gapanalysis.usgs.gov	
Colombia – SiB spatial data	National biodiversity &	Colombia	100 m–1 km	2000–present	Monthly	Shapefiles, CSV	https://catalogo.biodiversidad.co	GBIF-aligned.

	ecosystem datasets							
France – INPN ecosystem maps	National ecosystem/habitat classifications	France	100 m–1 km	2000–present	Regular updates	Vector, PDF, web maps	https://inpn.mnhn.fr	
Brazil – IBGE ecosystem accounts	National ecosystem accounts/biomes	Brazil	1 km	2000–present	Annual	Shapefiles, PDFs	https://www.ibge.gov.br	SEEA-aligned focus on Amazon/Cerrado.
Ireland – Ecosystem Extent Accounts	National trends across major ecosystems	Ireland	100 m–1 km	2000–2018	3–5 years	Vector, CSV, PDF	https://www.cso.ie/.../ecosystems2000-2018/	SEEA-aligned.
South Africa – SANBI BGIS	National ecosystems & threatened types	South Africa	10–100 m	1990–present	Annual	Shapefiles, web services	https://bgis.sanbi.org	South Africa – SANBI BGIS
New Zealand LCDB	National land cover & change	New Zealand	15 m	1996–present	~3-year	GeoTIFF, web maps	https://lris.scinfo.org.nz/lcdb	For national reporting.

Outlook:

To advance the application of ecosystem extent data in the FRAME-ECO framework, there is a critical need for improved integration of high-resolution, up-to-date global and regional datasets, alongside enhanced capacity development in countries for their effective use. Emphasis must be placed on harmonizing methodologies and fostering partnerships to ensure consistent, transparent reporting aligned with international ecosystem accounting standards such as UN SEEA EA.

2. Ecosystem condition, including biodiversity

Assessing ecosystem condition involves evaluating the health, integrity, and functioning of ecosystems. In the context of this framework, biodiversity is included under ecosystem conditions. Relevant indicators to set reference conditions and to track changes are, for example, species composition, structural attributes, and ecological processes.

Name of data source	Short description	Spatial coverage	Spatial resolution	Temporal coverage	Temporal resolution	Data format	Access Link	Notes/Comments
GLOBAL (WORLDWIDE)								
Living Planet Index (LPI)	Vertebrate population trends indicator	Global	Country/population level	1970–2020 (data from 2024 report)	Biennial	CSV time-series	https://www.livingplanetindex.org/data_portal	~31,800 populations across ~5,200 species
UN SEEA Ecosystem Accounting (EA)	Global/national condition accounting standard	Global	Varies: Units vary depending on the specific ecological or condition indicator used within the accounts. Area (e.g., hectares, square kilometers) for ecosystem extent or	2012–present	Annual / irregular	Guidelines, vector/raster	https://seea.un.org	Supports condition accounts worldwide

			<p>condition zones</p> <p>Biodiversity indices or metrics (e.g., species richness counts, abundance indices without fixed units)</p> <p>Condition scores or qualitative scales (dimensionless or index values)</p>					
Ecosystem Services Valuation Database (ESVD)	Monetary valuation of ecosystem services by biome	Global	<p>Varies (primarily monetary units measuring ecosystem service values:</p> <ul style="list-style-type: none"> - Currency per spatial or ecological unit (e.g., USD/hectare/year, euros /biome) 	1990–2020	Periodic	CSV, PDF	esvd.info / esvd.net	>4,000 monetary value records

			- Some non-monetary service metrics may be included, but the core focus is economic valuation.					
Global Data Cube	Annual ecosystem type mapping with condition & uncertainty	Global (land, freshwater, coastal, marine)	~10 km	1992–2018 (ongoing updates)	Annual/periodic	GeoTIFF / NetCDF	Open Data Cube Open Source	Tracks trends vs reference conditions
GEO BON Biodiversity Habitat Index	Habitat condition index from RS + models	Global	1 km	2000–present	Annual	GeoTIFF raster	GEO BON Report Map of Life - Indicators	Aligned with Aichi Target 5
Copernicus Biodiversity Indicators (ERA5/CMIP5)	Global bioclimatic variables (e.g., BIOCLIM)	Global (land & marine)	0.5°	ERA5: 1979–2018; CMIP5: 1950–2100	Monthly, annual, multidecadal	NetCDF-4 (CF)	ERA5: Global bioclimatic indicators from 1979 to 2018 CMIP5: Global bioclimatic indicators from 1950 to 2100	Climate-ecosystem linkage datasets
Global Biodiversity	Species occurrence	Global	Variable (point-level): point-level occurrences of	1700s–present	Daily updates	Darwin Core + API	GBIF Portal	>2 billion records

Information Facility (GBIF)	records (global)		species, meaning the database records species observations or specimen locations as geographic coordinates (latitude and longitude). This scale can range from very fine (exact GPS locations) to more generalized locations, depending on the accuracy and precision of data provided by contributors.					
Observation.org	Citizen-science biodiversity observations	Global	GPS point-level	2004–present	Continuous	CSV, API	Welcome - Observation.org	Community-validated species sightings

NatureMap Earth	Integrated global biodiversity, carbon, ecosystem services maps	Global	~10 km	2019–present	Periodic updates	GeoTIFF layers	Map Nature Map Explorer	UNEP-WCMC & IIASA product
Mountain Biodiversity Portal	Mountain ecosystem/habitat condition overview	Global (mountain ranges)	Based on ~2.5' ruggedness grid	Collected 2000–2011; released 2022	Static (one-time)	Shapefiles + raster	GMBA Mountain Biodiversity Portal	Framework for baseline condition
BioFresh	Freshwater biodiversity condition data	Global freshwater ecosystems (catchments)	Catchment-based	2000–present	Annual	Darwin Core + shapefiles	BioFresh Portal	Linked to HydroBASINS
Global Eutrophication Watch	Coastal eutrophication screening using satellite CHL	Global (coasts)	250 m	2003–2024	Monthly	Web app, remote access	global-eutrophication-watch	MODIS, SGLI, YOC blended products
Global Plastics Hub	Platform on plastic pollution impacts on ecosystems	Global (country-level)	Country-level	Varies by data source	Annual where available	Platform indicators (no raw data)	https://globalplasticshub.org/	Resource aggregator, not raw data
“From Pollution to Solution” (UNEP)	Global assessment of marine	Global	Varies (Does not have a uniform spatial resolution like pixel- or grid-	Latest assessment (2021)	One-off	Report	From Pollution to Solution	UNEP flagship assessment

	litter/ecosystem impacts		<p>based data. Instead, it includes:</p> <ul style="list-style-type: none"> -Broad-scale assessments that may cover large marine regions or global oceans. -More localized or site-specific data from various reporting and assessment efforts. -Aggregated data derived from different sources and methods with different spatial coverages.) 					
OBIS (Ocean Biodiversity Information System)	Marine species occurrence database	Global (marine)	Varies (contains species occurrence records that are	Irregular (2000–present); ongoing ingestion	Irregular	DwC-A ZIP	https://obis.org/	Tracks >45M observations of ~120k species

			georeferenced as point data (individual sampling sites, observation points, or specimen locations) with coordinates.)					
SeaLifeBase & FishBase	Aquatic species condition/ecology data	Global (marine & freshwater)	Varies from precise point locations (e.g., sampling sites) to broader geographic regions or habitat polygons depending on the source and nature of the compiled data.	Bi-monthly updates (FishBase); continuous (SeaLifeBase)	Continuous	Web API, CSV, spreadsheets	SeaLifeBase: SeaLifeBase - Home FishBase: FishBase : A Global Information System on Fishes	Covers finfish, invertebrates, plants
EnviDat (WSL)	Environmental monitoring datasets (Swiss portal with global content)	Global	25 m–1 km	1900–present	Periodic	GeoTIFF, CSV	EnviDat Portal	Long-term ecological data; DOI-assigned
REGIONAL								
ICES	Marine ecosystem data for Northern Hemisphere	Northern Hemisphere	Variable (Different types of marine ecosystem and	1970-present	Continuous	CSV, API	https://www.ices.dk	Fisheries/ecosystem data

			<p>fisheries data from varied geographic scales, including:</p> <p>Point data from sampling stations or surveys, Aggregated regional data at statistical reporting areas,</p> <p>Broader spatial scales such as subregions or ocean basins for assessments.</p>					
EuropaBON	EU ecosystem service & condition indicators	Europe	<p>Variable: Site-level measurements or local monitoring plots, Regional aggregations across administrative boundaries or ecological regions,</p>	2020-present	Annual	Dashboards, models	EuropaBON Project EuropaBON WP3.1	EBVs aligned with policy

			Larger-scale data aggregation that covers national or continental extents.)					
ARBIMS	Biodiversity & condition data, African mountains	East Africa	Variable : varies (between fine-scale site-level data and coarser-scale regional mapping outputs, tailored to the ecological variable and monitoring approach used.)	2000-present	Irregular	CSV, Shapefile	ARBIMS Portal	Focus on threatened species
ESABII	Biodiversity data hub, SE Asia	SE Asia	(varying from meters (high resolution) at site-level to kilometers or coarser scales for aggregated or modeled data)	2000-present	Annual	Web maps, reports	ESABII / East and Southeast Asian Biodiversity Information Initiative	Supports conservation

Pacific Mangroves	Mangrove density mapping	Pacific Islands	10 m	2016-2022	Annual	AWS	https://maps.digitalearthpacific.org/	Beta data, based on GMW
NATIONAL								
Uganda National Biodiversity Bank	Uganda biodiversity and condition data	Uganda	~1:50,000	2000-present	Annual	CSV, PDF	National Biodiversity Data Bank	National reporting hub
SANBI	South African biodiversity data	South Africa	10-100 m	1990-present	Annual	Shapefile, Web	Resources - SANBI	Includes threatened ecosystems
Atlas of Living Australia	Biodiversity, ecosystems data	Australia	10 – 250 m	2010-present	Daily	Web, API	ALA Portal	Global network integration

Outlook: The framework requires the promotion of standardized, harmonized biodiversity monitoring protocols leveraging both remote sensing and in situ data, complemented by citizen science and global biodiversity databases. Strengthening data interoperability and supporting policy-relevant biodiversity indicators, as recommended by IPBES and CBD, will be vital to integrate condition assessments into national and global decision-making processes.

3. Diverse values of nature and ecosystem services

Ecosystem services encompass the benefits that people derive from nature, including provisioning, regulating, cultural, and supporting services. Further recognizing diverse values of nature - instrumental, relational and intrinsic - is key for comprehensive assessments of what can be lost through accelerating climate change impacts and hazardous events.

Name of data source	Short description	Spatial coverage	Spatial resolution	Temporal coverage	Temporal resolution	Data format	Access Link	Notes/Comments
GLOBAL (WORLDWIDE)								
Ecosystem Services Valuation Database (ESVD)	Global monetary values for ES across biomes	Global	Not spatial	1990–2020 (ongoing)	Periodic updates	CSV, PDF, Web	esvd.info / esvd.net	>4 000 value records; uses CICES classification
Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST)	Open-source models to map & value ecosystem services	Global	User-defined	Model-run based (time step optional)	Scenario-dependent	Raster/vector via app or Python API	https://naturalcapitalproject.stanford.edu/software/invest	Suite of models (e.g., pollination, carbon)
Value Tool for Natural Hazards	Database of non-market value estimates for natural hazards	Australia-focused, still applicable elsewhere	Not spatial	Varies	One-off values	Web-based tool	https://tools.bnhcrc.com.au/wtp/home	Includes Value Selector and guidance for benefit transfer

IPBES Assessments & Values Framework	Provides comprehensive reviews of nature's contributions to people, including ecosystem services and diverse value types such as instrumental, relational, and intrinsic values. It is used to integrate qualitative and quantitative value assessments, supporting holistic evaluations of ecosystem services and diverse values of nature in decision-making and	Global (with regional reports)	Not spatial	Continuous	When new assessments are published	PDFs, conceptual maps, methodologies	https://ipbes.net	Key for qualitative & quantitative value frameworks
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	policy development.							
Ramsar Sites ES Catalogue	Database of ecosystem services per Ramsar wetland site	Global (170+ countries)	Varies by site	Continual updates	Field-level reporting (approx. every 6 yrs)	Web interface	Home Ramsar Sites Information Service	Covers provisioning/regulating/cultural services at site-level
Global Biodiversity Information Facility (GBIF)	Species occurrence data supporting ES mapping and research	Global	Variable (point to national)	1700s–present	Daily updates	Darwin Core, API, CSV, Web	gbif.org	Enables habitat-based ES proxies
Observation.org	Citizen-science biodiversity observations supporting ES assessment	Global	GPS-point level	2000s–present	Continuous	Web, API, CSV	observation.org	>71 million validated observations; integrated with GBIF
EVRI (Environmental Valuation Reference Inventory)	Summaries of environmental/health valuation studies	Global	Not spatial	Ongoing	Periodic	Online database	https://evri.ca/en	>5 000 valuation study summaries
Environmental Valuation Database (ENVALUE)	New South Wales (NSW) Environment Protection Authority	Global	Not spatial	Since ~1995	Updated via agency schedule	Online database	https://apps.environment.nsw.gov.au/enval	Early valuation repository for environmental

	(EPA)-developed environmental valuation study database						ueapp/default.asp	decision-making
BlueValue	Global inventory of ecosystem valuation studies (user-friendly interface)	Global	Not spatial	Ongoing	Periodic	Online database	https://www.bluevalue.org/	Updated successor to GecoServ
Biotfy	AI-powered real-time monitoring of ecosystem service indicators	Global (site-specific)	Site-level (landscape)	2020–present	Real-time	Web API, dashboards	biotfy.com	Employs sensors, bioacoustics, and remote sensing
DynamicEarth Net	Daily multispectral imagery and ES-proxy monthly labels across 75 sites	Global (selected)	High-res imagery	Daily imagery; monthly labels	Daily/monthly	Semantic segmentation rasters	https://arxiv.org/abs/2203.12560	Useful for habitat and biomass production monitoring
HydroBASINS (for services)	Catchment mapping enabling ecosystem service	Global	Catchment polygon	2013–present	Irregular	Shapefiles, manuals	HydroBASINS	Helps model services like flood control and water supply

	regulation analysis							
Cultural ES from Social Media & Literature	Non-quantitative analysis of cultural values using social media and literature	Global (wetlands focused)	Not spatial	1968–2022	Irregular	Scholarly metadata & networks	https://www.mdpi.com/2071-1050/14/4/2089 ...	Captures relational/spiritual values through hashtags, eudaimonic analysis
REGIONAL								
Integrated Natural Capital Accounting (INCA)	EU pilot system for ecosystem accounting including biophysical and monetary valuation	Europe	Variable	2000-2021	~6 years	GeoTIFF, maps	https://ecosystem-accounts.jrc.ec.europa.eu/inca-tool	Implements SEEA; covers 9 ecosystem services
Copernicus Ecosystem Registry	EU platform providing ecosystem service data	EU	10-100 m	2000-present	Continuous	GeoTIFF, API	https://ecosystem-accounts.jrc.ec.europa.eu/inca-tool	Supports policy and research projects
Nordic Environmental Valuation Database	Repository for valuation studies across Nordic countries	Nordic countries	Not spatial	Ongoing	Periodic	Spreadsheet	https://norden.diva-portal.org	Regional monetary valuation
NOEP Non-market database	Bibliography of non-market valuation	Arctic region	Not spatial	Ongoing	Irregular	Online database	https://www.oceaneconomics.org/NOEP/Ar	Bibliography for Arctic valuations

	studies for Arctic resources						ctic/nonMarket/nonMarket.aspx	
NatureServe Explorer	US and Canadian species and ecosystem condition & valuation data	US, Canada	30-100 m	2000-present	Weekly	Web, API, maps	natureserve.org/access-data	Used for conservation and ecosystem valuation
ASEAN Biodiversity Dashboard	Southeast Asia biodiversity and ecosystem service indicators	Southeast Asia	100 m-1 km	2010-present	Quarterly	Vector, raster, CSV	aseanbiodiversity.org	Supports regional biodiversity policies
NATIONAL								
Brazil IBGE	Ecosystem service accounts with spatial and monetary data	Brazil	~1 km	2000-present	Annual	Shapefiles, PDF	https://www.ibge.gov.br/en/	Covers carbon, water, recreation; SEEA-aligned
SANBI	South African biodiversity and ecosystem service metrics	South Africa	10-100 m	2000-present	Annual	Shapefiles, web, PDF	bgis.sanbi.org	Integrates various ecosystem data
TERN AEKOS	Australian ecosystem service and biodiversity data	Australia	Site-specific	1970-present	Annual	CSV	aekos.org	>100,000 survey sites and indicators
Atlas of Living Australia (ALA)	Australian biodiversity	Australia	10-250 m	2010-present	Daily	Web, API, maps	ala.org.au	Integrates with global networks

	and ecosystem service data							
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Outlook: The next steps involve advancing ecosystem service valuation frameworks that incorporate multiple value dimensions, consistent with IPBES values approaches and SEEA EA guidelines. To effectively champion these in FRAME-ECO, capacity development for ecosystem accounting, scenario modeling, and inclusive stakeholder engagement is essential to capture diverse socio-cultural contexts and support equitable nature-based solutions.

4. Sudden Onset Events

Sudden onset events include climate-induced hazards such as floods, droughts, storms, and wildfires that cause abrupt and localized ecosystem and biodiversity losses. Datasets include event databases, satellite alerts, and historical records that capture occurrence, intensity, and impact metrics.

Type of hazard	Name of data source	Short description	Spatial coverage	Spatial resolution	Temporal coverage	Temporal resolution	Data format	Access Link	Notes/Comments
GLOBAL (WORLDWIDE)									
General	The International Charter: Space and Major Disasters	Satellite data and expert-derived products for disaster relief and environment protection	Global	Variable	2000–present	Event	Various	https://disasterscharter.org/activations	
General	EM-DAT The international disaster database	Global database: 26,000+ disasters (since 1900), occurrence and impacts, from multiple sources	Global	Not specified	1990–present	Event	Database	https://www.emdat.be/	Open access for non-commercial use

General	DesInventar Disaster Information Management System	Institutional disaster loss database for prevention, mitigation, preparedness	Near global	Different, dependent on country/region	Not specified	Event	Database	https://www.desinventar.net/index.html	
Flood	Dartmouth Flood Observatory	Space-based flood measurement, mapping, modeling	Global	~250m (MODIS), ~10–30m (Sentinel-1/Landsat)	1985–present	Event	Various	https://floodobservatory.colorado.edu/	
Drought	Global Database of Drought Events	Meteorological drought events (SPEI & SPI from GPCC & CRU)	Global	0.5°, macro-regional, country scale	1951–2016	Event	dbf, NetCDF, CSV	https://data.jrc.ec.europa.eu/collection/id-00321	
REGIONAL									
Flood	HANZE database	Historical Analysis of Natural Hazards in Europe	Europe	Variable	1870–2020	Event	Various	https://naturalhazards.eu/	
Drought	European Drought Impact Database (EDID)	Georeferenced records of drought impacts (Europe, multiple sectors)	Europe	Variable	1970–present	Annual/event	Web-based visualizations	https://drought.emergency.copernicus.eu/tumbo/edid/overview	

Drought	European Drought Reference (EDR) / EDII	Historical drought events in Europe, publicly disseminated	Europe	Variable	1904–2014	Event	Online database	https://geo.uio.no/edc/droughtdb/	
Drought	European Drought Observatory	Drought indicators (SMI, SPI) in raster format	Europe	Variable	2010–present	Various	GeoTIFF, NetCDF	https://drought.emergency.copernicus.eu/	

Outlook: Key advancements needed include linking disaster risk reduction frameworks with biodiversity and ecosystem monitoring to quantify vulnerabilities and losses. Real-time data sharing platforms and improved impact attribution methods will enhance responsiveness. Policy integration requires leveraging disaster-loss databases and remote sensing to inform ecosystem-based adaptation and resilience-building.

5. Slow onset events

Slow onset events (SOEs)- sea level rise, increasing temperatures, ocean acidification, and glacial retreat ([UNFCCC 2012](#))- unfold gradually but can have profound long-term impacts on ecosystems and biodiversity. Understanding these events requires access to data that captures trends and changes over time, such as time series datasets on climate variables, hydrology, land cover, or ecosystem responses. The following tables provide potential datasources for climate / temperature ([5.1](#)), ocean acification ([5.2](#)), sea level rise ([5.3](#)) and glacial retreat ([5.4](#)).

5.1 Climate / Temperature

Name of data source	Short description	Spatial coverage	Spatial resolution	Temporal coverage	Temporal resolution	Data format	Access Link	Notes/Comments
GLOBAL (WORLDWIDE)								
NASA GISTEMP	Global surface temperature anomalies	Global	2° x 2°	1880-present	Monthly	NetCDF, CSV	data.giss.nasa.gov/gistemp	Integrates GHCN v4 & ERSSTv5
HadISD	Global synoptic temperature, pressure, moisture, wind	Global	3400 stations	1973-2011	Sub-daily (hourly)	NetCDF, ASCII	HadISD	Long term warming, extreme heat
NASA GISS Surface Temp Analysis	Global land-ocean temperature index	Global	~2° x 2° grid	1880-present	Annual	CSV, NetCDF, Graphs	NASA GISS	Regular updates
Climate Reanalyzer (ERA5)	Daily global surface temperature estimates	Global	0.25° x 0.25°	1940-present	Daily	Interactive, CSV, NetCDF	Climate Reanalyzer	

NOAA Climate Data Online (CDO)	Historical & near real-time weather & climate	Global	Station/Gridded	1700s-present	Hourly, Daily	CSV, JSON	NOAA CDO	
Copernicus Climate Data Store (CDS)	Quality-assured climate datasets	Global	0.25° x 0.25°, etc.	1979-present	Hourly, Daily, Monthly	NetCDF, GRIB, CSV	CDS	
KNMI Climate Explorer	Statistical analysis of climate data	Global	Gridded, Station	1850-present	Daily, Monthly	Graphs, CSV, NetCDF	KNMI	
IRI Data Library	Repository & analysis of climate datasets	Global	Gridded, Station	Varies	Daily, Monthly	NetCDF, CSV	IRI Data Library	
Berkeley Earth	High-res land & ocean temperature series	Global	0.25° x 0.25°, 1°	1750/1850-present	Monthly, Annual	CSV, NetCDF	Berkeley Earth	
ECMWF Datasets	Weather forecast & historical meteorological data	Europe (mainly)	Varies	Varies	Varies	Varies	ECMWF	
REGIONAL								
EasyClimate	High-res daily climate data	Europe	1 km	1950-2022	Daily	GeoTIFF, FTP	EasyClimate	
European Climate Assessment (ECA)	Station temperature & precipitation	Europe	Station (0.22°-0.44°)	1950-present	Daily, Monthly	ASCII	ECA data	Fire & drought stress indicators

ClimateSA	Climate data & software for South America	South America	Gridded	1901-2020	Monthly, Seasonal	Climate grids	ClimateSA	
Indian Polar Data Center	Meteorological data of polar stations	Indian Polar Stations	Station	Recent	Hourly, Daily	CSV, Web	Data portal link	
Asia-Pacific Climate Data Portal	Climate data links & repositories	Asia-Pacific	Various	Varies	Varies	Various	CSIRO	
Pacific Climate Change Portal	Historical climate info for Pacific Islands & Timor	Pacific Islands, Timor	Site-specific	Historical-present	Monthly	Various	Climate Portal	
Africa Climate Observer	Historical & current climate data	Africa	Regional, Country	Varies	Monthly, Yearly	Web-based	Climate Observer Africa Data Hub	
NATIONAL								
Deutscher Wetterdienst (DWD)	Official weather & climate data Germany	Germany	Station / Gridded	Historic-present	Various	ZIP, CSV, WMS	DWD	Germany's official dataset
UK Met Office	UK regional and national temperature data	UK	Station	1853-present	Various	CSV, NetCDF	UK Met Office	UK weather services
SA Weather Service (SAWS)	Official weather data for South Africa	South Africa	Station	Historic-present	Various	CSV, Web	SAWS	South Africa's official weather

Western Cape Weather Station Portal	Weather station data	Western Cape, South Africa	Station	Historical-present	Hourly, Daily	CSV, Web	Weather Portal	
NOAA NOWData	Real-time weather data in US	USA	Station	Historical-present	Daily	Web, CSV	NOAA NOWData	
NOAA Daily Temperature & Precip	Daily summaries US weather	USA	Station	Historical-present	Daily	TXT, PDF	NOAA	
China Meteorological Admin (CMA)	Temperature & weather data	China, Global	Station (1° or 2°)	1850-present	Monthly	CSV, Web	CMA	
Australian Bureau of Meteorology	Daily & monthly climate data	Australia	Station/Gridded (2.5 km)	1961-present	Daily, Monthly	ASCII, Shapefiles	BoM	
Japan Meteorological Agency (JMA)	Japan temperature & weather data	Japan	Station	2015-present	Daily	CSV, Web	JMA	
India Meteorological Dept (IMD)	Real-time & historical data	India	Station/Gridded	1951-present	Hourly, Daily	CSV, Binary	IMD	
IMD Data Service Portal	Historical & gridded meteorological data	India	Station/Gridded	Historical	Daily, Monthly	CSV, Binary	IMD DSP	

5.2 Ocean Acidification

Name of Data Source	Short Description	Spatial Coverage	Spatial Resolution	Temporal Coverage	Temporal Resolution	Data Format	Access Link	Notes/Comments
GLOBAL								
Global Ocean Acidification Observing Network (GOA-ON)	Real-time & historical ocean acidification data (pH, carbonate chemistry)	Global	Point measurements at stations; broader coverage from ship surveys	Early 2000–present	Hourly/daily (sensors), seasonal/annual (ship surveys)	CSV, NetCDF	https://portal.goa-on.org/Explorer	
Surface Ocean CO₂ Atlas (SOCAT)	Quality-controlled surface ocean fCO ₂ observations; global & coastal products	Global	1° global, 0.25° coastal	1957–2025	Monthly, yearly, per decade	Text files, NetCDF	https://socat.info	Supports ocean carbon sink & acidification modeling
Copernicus Global Sea Level Change Time Series	Tides, surge, SLR from reanalysis & CMIP6 models	Global	Variable	1950–2050	10-minute intervals via GTSM v3.0	NetCDF	Global sea level change time series from 1950 to 2050 derived from reanalysis and high resolution CMIP6 climate projections	Supports coastal flooding, erosion risk, water access studies

5.3 Sea Level Rise

Name of data source	Short description	Spatial coverage	Spatial resolution	Temporal coverage	Temporal resolution	Data format	Access Link	Notes/Comments
GLOBAL (WORLDWIDE)								
Copernicus Sea Level Change Indicators & ESA SL_cci	Satellite and tide-gauge sea level anomalies and projections	Global	~0.25° gridded	1993-2021	Monthly	NetCDF raster series	Copernicus SL	Trend analysis, regional variability
Extreme Sea Levels & Flooding Projections	Coastal flood extents, socioeconomic impacts	Global	5-50 km offshore	1979-2014 + projected futures	Variable	Raster layers, statistics	MDPI Dataset	Loss estimation, habitat degradation
NASA Sea Level Portal	Sea level data, visualizations, projections	Global	Gridded, station-based	1993-present	Monthly, annual	Interactive maps, CSV, NetCDF	NASA SL Portal	Planning support
NASA SEA Tool	Interactive tool for sea level readings	Global	Gridded, station	1993-2019	Monthly, annual	Interactive maps, reports	NASA SEA Tool	
NASA Sea Level Projection Tool (IPCC AR6)	Sea level projections from IPCC AR6	Global	Gridded, station	2020-2150	Annual, decadal	Interactive, CSV, NetCDF	NASA IPCC AR6 Tool	
VLIZ/IOC Sea Level Monitoring Facility	Real-time and historical sea level monitoring	Global	Station (GLOSS, networks)	Real-time	1-min, 5-min, hourly, daily	Graphs, CSV, API	VLIZ/IOC	High-frequency data

Global Sea Level Observing System (GLOSS)	Network of sea level stations	Global	Station (tide gauges)	1985-present	Real-time, daily	CSV, web, graphs	GLOSS	290+ stations
Permanent Service for Mean Sea Level (PSMSL)	Long-term tide gauge sea level data	Global	Station	1807-present	Monthly, annual	CSV, web, graphs	PSMSL	Quality-controlled data
SONEL (GNSS at Tide Gauges)	GNSS data for tide gauge vertical corrections	Global	Station	1990s-present	Daily, monthly	CSV, web, FTP	SONEL	Land movement corrections
University of Hawaii Sea Level Center (UHSLC)	Tide gauge data products	Global	Station	1980-present	Hourly, daily	NetCDF, CSV, web	UHSLC	Research-quality data
ESA Climate Change Initiative Sea Level	Satellite-derived sea level data	Global	0.25° gridded	1993-present	Monthly, annual	NetCDF	ESA SL	Long-term trends
Copernicus Marine Environment Monitoring Service (CMEMS)	Ocean monitoring (sea level, temperature, etc.)	Global/Europe	Up to 1/12° gridded	1993-present	Daily, monthly	NetCDF, API	CMEMS	Satellite and model data
REGIONAL								
Indian National Centre for Ocean	Real-time tide gauge sea level data	India, Indian Ocean	Station (tide gauges)	2000s-present	Real-time, hourly	Web, CSV, graphs	INCOIS	Operational tidal data

Information Services (INCOIS)								
Indian National Institute of Oceanography (NIO)	Coastal tide gauge data	India, Indian Ocean	Station	1970s-present	Hourly, daily	Web, CSV, graphs	NIO	Research-focused
Pacific Ocean Portal	Sea level and ocean data	Pacific Islands	Gridded, station	1950-present	Monthly	Graphs, tables	Pacific Portal	Includes forecasts
Digital Earth Pacific	Shoreline positions and change rates	Pacific Islands	Variable	2000-2023	Annual	Web	DEP	Beta product, under validation
PSMSL Caribbean Sea Level Projections Portal	Sea level projections, site-specific	Caribbean	Station	1986-2100 (projection)	Annual (projection)	CSV	PSMSL Caribbean	Projection data
Extreme sea levels and flooding in Europe	Frequency of extreme coastal floods	Europe	Site-based	1850-2100 (projection)	Biannual	m/year	EEA	Uses GESLA3
NATIONAL								
Instituto Nacional de Pesquisas Hidroviárias (Brazil)	Brazilian national tide and sea level data	Brazil	Station, coastal	1940s-present	Hourly, daily	Web, CSV	INPH	National monitoring
NOAA Sea Level Rise Viewer	Sea level rise impacts and flooding scenarios	USA	Local/community	Present, projected	Real-time, scenarios	Interactive maps	NOAA SL Viewer	Scenario planning

Korea Hydrographic Oceanographic Agency	Tide and sea level data	South Korea	Station, coastal	1970s-present	Hourly, daily	Web, CSV	KHOA (link in data)	Operational data
SHOM (France)	French tide gauge data	France	Station, coastal	1800s-present	Hourly, daily	Web, CSV	SHOM	National data
UK National Tide Gauge Network (NOC)	UK tide gauge data	UK	Station, coastal	1915-present	Hourly, daily	Web, CSV	NOC	Long-term monitoring
Instituto Español de Oceanografía (IEO)	Spanish tide gauge network	Spain	Station	1943-present	Minutes	ASCII, CSV	IEO	Long-term data
Puertos del Estado (Spain)	Spanish port tide and sea level data	Spain	Station	1992-present	Minutes	CSV, API	Puertos	Operational data
Environment Agency Tide Data (UK)	UK agency tide data	UK	Station	Various	Various	Various	(data link in original)	Operational da
China Oceanic Data Center	Chinese coastal tide gauge data	China	Station, gridded	1980s-present	Daily, monthly	Web, CSV	China Data Center	National sea level data
Japan Meteorological Agency	Tide and sea level data	Japan	Station, coastal	1950s-present	Hourly, daily	Web, CSV	JMA	Operational data
Environment Canada	Tide and sea level data	Canada	Station, coastal	1900-present	Real-time, hourly	Web, CSV	Environment Canada	National data
South African Weather Service	Tide gauge data	South Africa	Station, coastal	1980s-present	Hourly, daily	Web, CSV	SAWS	Operational data
Bureau of Meteorology	Australian tide gauge network	Australia	Station	1990s-present	Real-time, daily	Web, CSV	BoM	Operational data

5.4 Glacial Retreat

Name of data source	Short description	Spatial coverage	Spatial resolution	Temporal coverage	Temporal resolution	Data format	Access Link	Notes/Comments
GLOBAL (WORLDWIDE)								
World Glacier Monitoring Service (WGMS)	Global glacier fluctuation repository	Global, National, Regional	Glacier, regional	1894–present	Annual, multi-year, near real	CSV, NetCDF, GIS, database, browser, graphs	WGMS	
GLIMS (Global Land Ice Measurements from Space)	Satellite-based glacier outlines	Global	Glacier, regional	1850–present	Multi-year, periodic	KML, Shapefile, GeoTIFF, GMT, MapInfo, GML	GLIMS	
GLIMS at NSIDC	Glacier outlines/area/change data	Global	Glacier	1850–present	Multi-year, periodic	Shapefile, GeoTIFF, KML, CSV	NSIDC GLIMS	
Randolph Glacier Inventory (RGI)	Glacier catalog for climate modeling	Global	Glacier	Near 2000; updates	Snapshot, periodic	Shapefile, GeoTIFF	RGI	
ESA CCI Glaciers	Satellite glacier area and change	Global, Europe	Glacier, regional	1990s–present	Annual, periodic	NetCDF, GeoTIFF, web	ESA CCI	
REGIONAL								
Himalaya: GLACIER (India)	Himalayan glacier inventory	India (Himalaya, Karakoram)	Glacier, basin	2000s–present	Annual, periodic	Reports, maps	NCPOR	
Andes Glacier Inventory	Glaciers in Andes, Argentina	Argentina	Glacier, basin	2000s–present	Periodic, annual	Reports, maps	IANIGLA	

Central Asian Monitoring	Central Asian glacier monitoring	Central Asia	Glacier, basin	2000s–present	Periodic, annual	Reports, maps	CAWa Project	
South African Antarctic	Antarctic and sub-Antarctic glacier monitoring	Sub-Antarctic, Antarctica	Glacier, ice sheet	1960s–present	Periodic	Reports, web	SANAP	
Australian Antarctic	Australian-led Antarctic glacier monitoring	Antarctica	Glacier, ice sheet	1950s–present	Periodic, annual	Reports, web	AAD	
NATIONAL								
USGS Benchmark Glaciers Program	Long-term glacier mass balance US (Alaska, NW)	USA (Alaska, NW)	Glacier	1966–present	Annual	Reports, CSV	USGS Benchmark Glacier	
Swiss Glacier Monitoring Network (GLAMOS)	Real-time/historical glacier monitoring Switzerland	Switzerland	Glacier	1880–present	Annual, near real	Maps, CSV, web	GLAMOS	
Andes Glacier Monitoring (INAIGEM, Peru)	Mass balance & retreat Peru	Peru (Andes)	Glacier, basin	2000s–present	Annual, periodic	Reports, web	INAIGEM	
New Zealand Glacier Monitoring (NIWA)	Annual glacier monitoring	New Zealand	Glacier	1977–present	Annual	Reports, photos, web	NIWA	
China Glacier Inventory (CAS, CMA)	National glacier inventory	China	Glacier, basin	1950s–present	Periodic, annual	Reports, maps, digital	Cryosphere Data Center	
Russian Glacier Monitoring (RAS)	Glacier monitoring and inventory in Russia	Russia	Glacier, basin	1950s–present	Periodic, annual	Reports, maps, web	Geos MSU	

Norwegian Water Resources and Energy Directorate (NVE)	Norway glacier mass balance	Norway	Glacier	1948–present	Annual	Reports, CSV	NVE	
Greenland Ice Sheet Monitoring (PROMICE, GEUS)	Greenland mass balance and retreat	Greenland	Ice sheet, glacier	2007–present	Real-time, annual	Web, CSV, reports	PROMICE	
Icelandic Glacier Monitoring (IMO)	Iceland glacier area and retreat	Iceland	Glacier	1930s–present	Annual, periodic	Reports, maps, web	IMO Iceland	
Chilean Glacier Monitoring (DGA)	Glacier inventory for Chile	Chile	Glacier	2000s–present	Periodic, annual	Reports, web	DGA	
Canadian Cryosphere watch	Canada's glacier mass balance & retreat	Canada	Glacier	1960s–present	Annual	Reports, web	CCIN	
Alaska science centre	Data for Alaskan glaciers	USA (Alaska)	Glacier	1960s–present	Annual, some near real	Reports, CSV	Alaska Science Center	
Norwegian Polar institute (NPI)	Svalbard glacier monitoring	Svalbard	Glacier	1960s–present	Annual	Reports, web	NPI NorDataNet	

Outlook:

Future priorities involve improving early warning systems and downscaled projections to anticipate ecosystem thresholds and tipping points. Cross-disciplinary integration of climate and ecosystem models will facilitate impact assessments. Strengthening institutional capacities for long-term monitoring and embedding slow onset event data into biodiversity strategies is imperative for effective ecosystem stewardship.