Identification of scientific and technical needs related to the implementation of the Strategic Plan for Biodiversity 2011-2020 and its Aichi Targets

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Here we respond to questions relating to area: **B. Adequacy of observations, and of data systems, for monitoring the biodiversity attributes addressed in the Aichi Biodiversity Targets**

Question 1. How adequate are the observations and data systems in your country for reporting on the issues addressed in each of the Aichi Biodiversity Targets?

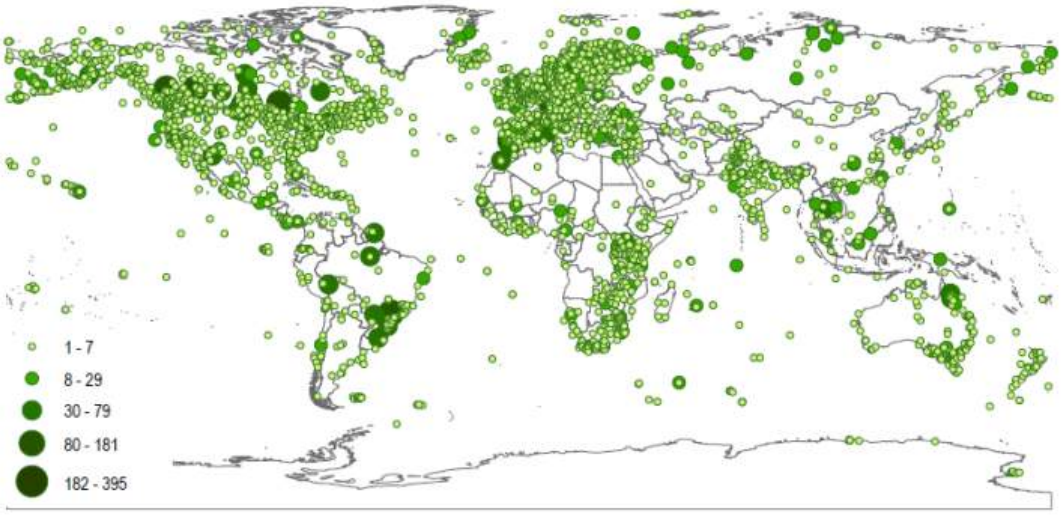
As an international group we do not represent a single country, though as individuals we are closely involved in the observations systems and biodiversity indicators in our respective countries. We know, and this is born out in national reporting to CBD, that national observation and data systems to report on the Aichi Biodiversity Targets are grossly inadequate and under-developed. There are considerable gaps and heterogeneity in geographic, taxonomic, and temporal coverage of existing biodiversity information and indicators, with fewer data for developing countries, for non-vertebrates, and from before 1980 and after 2005. To illustrate, the figure below shows the spatial distribution of the vertebrate populations used to calculate the Living Planet Index (the size of each point is proportional to the number of populations monitored).

That is not to say that there are not excellent national examples of observation, data and biodiversity indicator systems in some well-developed countries. For instance, the Terrestrial Ecological Research Network in Australia is establishing critical research infrastructure and fostering national networks of scientists, environmental managers and stakeholders, to collaboratively monitor Australia's biodiversity and ecosystems. This facility brings together scientists, in situ observations, remote sensing information, data management and analysis.

There are some excellent international initiatives too, e.g. the Living Planet Index, which is actually one of the best and most well-developed biodiversity indicators of its kind globally, but in the main, and for most Aichi Biodiversity Targets, countries lack basic observation systems covering key elements of biodiversity and the associated data storage and biodiversity indicator systems to collate, synthesise and communicate these data in a meaningful fashion.

There is however good theoretical and practical understanding of how such systems and indicators could be developed, including examples of best practice at national and continental scales.

We would also refer the CBD to: “Adequacy of Existing Biodiversity Observation Systems to support the CBD 2020 Targets”, A report prepared by the Group on Earth Observations Biodiversity Observation Network (GEO BON), for the Convention on Biological Diversity (2011).



Question 2. What would be needed to improve their adequacy?

GEO BON strongly recommends the development of a global set of ‘Essential Biodiversity Variables’ (EBVs)

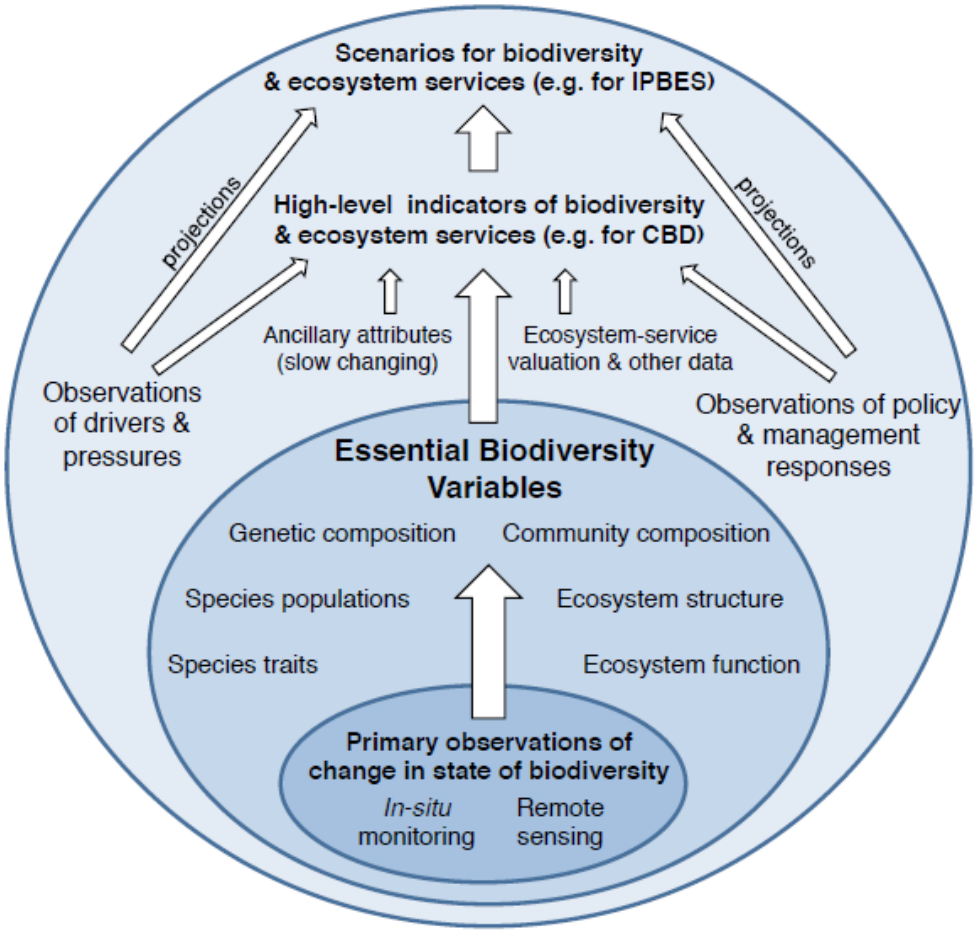
There is no global, harmonized observation system for delivering regular, timely data on biodiversity change and in the absence of such a system our ability to assess progress towards the Aichi Biodiversity Targets is severely limited. GEO BON is developing and seeking consensus around a set of ‘Essential Biodiversity Variables’ (EBVs) that could form the basis of monitoring programs worldwide. A global system of harmonized observations is desperately needed to inform scientists and policy-makers.

EBVs help prioritize by defining a minimum set of essential measurements to capture major dimensions of biodiversity change, complementary to one another and to other environmental change observation initiatives. EBVs also facilitate data integration by providing an intermediate abstraction layer between primary observations and indicators (see diagrammatic figure below). An EBV estimating population abundances for a group of species at a location sits between raw observations (e.g., from different sampling events or methods) and an aggregated population trend indicator that averages multiple species and locations.

The EBV process is inspired by the Essential Climate Variables (ECVs) that guide implementation of the Global Climate Observing System (GCOS) by Parties to the UN Framework Convention on Climate Change (UNFCCC). EBVs, whose development by GEO BON has been endorsed by the CBD (Decision XI/3), are relevant to derivation of

biodiversity indicators for the Aichi Targets. Although CBD biodiversity indicators are designed to convey messages to policy-makers from existing biodiversity data, EBVs aim to help observation communities harmonize monitoring, by identifying how variables should be sampled and measured.

Coordination of sampling schemes through EBVs across countries and scales would minimize costs and improve spatial representativeness hugely. Developing suitable financial mechanisms to share costs between developing countries, where most biodiversity occurs, and developed countries, which share in the benefits but drive many of the pressures, will play a key role in the development of a truly global system. We believe that EBVs could help to catalyse investment in biodiversity observations and provide a sharp focus for biological recording both *in situ* observations and remote sensing information.



Also, greater use needs to be made of fine spatial resolution LiDAR and optical data (including that from space-borne sensors) as input to species distribution models, particularly as a third dimension (structure) of vegetation is included. Such information can support scaling of biodiversity from field observations, through to local areas to regions. The use of unmanned airborne vehicles is also recommended given that these data can be used to complement field observations and provide data over large areas that can be used to scale biodiversity.

Question 3. What are the opportunities to make enhancements in the following areas: (i) in situ observations, (ii) remote sensing information, (iii) data management, (iv) data analysis and (v) preparation of decision support tools (e.g. indicators)?

(i) in situ observations

Having established the necessary collaborative infrastructure, there is an opportunity to improve integration, reuse, analysis and synthesis of ecological data for monitoring and application to environmental accounts and decision making. GEOSS is one network of scientists with a clear 'upstream' mandate to focus on this issue, bringing together many of the key international organisations such as GBIF, IUCN, EEA, etc.

(ii) remote sensing information

Some satellite missions (e.g., Landsat, SPOT) have been providing regular observations of the earth surface for decades and the recent release of the archive, free of charge, has had a huge impact in terms of allowing changes in land covers to be quantified, both in terms of their extent but also their condition (e.g., as reflected in vegetation indices). Other optical satellite systems such as MODIS, MERIS supply a decade of continuous data, with follow on data supply planned from the ESA Sentinel series. Other missions, such as Japan's ALOS PALSAR, have allowed systematic annual and cloud free observations at L-band for the world. Hence, there is a need to promote the acquisition of sufficient and appropriate remote sensing data that is comparable over time and can be used for monitoring changes in the Earth's environments. In other words, there is a continuing requirement for consistent data and classification schemes to allow global comparison – which is only possible using earth observation.

(iii) data management

GBIF addresses issues of centralised data management related to biological collections, but there are significant global gaps in institutional engagement in the process and considerable volumes of National biological data are yet to be digitised and quality assured. These gaps are an impediment to, and generate bias in, global models of biodiversity distribution for assessment and reporting. There are opportunities to enhance the digital federation of biological collections data in poorer countries, building on the experience of other countries, such as the Atlas of Living Australia and the ASEAN collective, in regions where significant gaps in a representative global coverage remain.

(iv) data analysis

AICHI Target 5 "Trends in extent, condition and vulnerability of ecosystems, biomes and habitats" is among several targets that are particularly relevant to GEOBON. An opportunity exists to develop globally consistent definitions, assessment and mapping methodologies for "condition", "vulnerability", "ecosystem" and "habitats" relevant to reporting on the target. These definitions and assessment methodologies at the global level need to have clear linkages with National definitions and assessment methodologies (e.g., a global ecosystem classification harmonised against National vegetation maps) and be informed by those National initiatives (e.g., agreement on common assessment standards and sharing of in situ and mapped datasets), where it is relevant to do so.

More specifically, GEOBON WG3 can make significant contributions to assessment methodologies informing on ecosystem condition and vulnerability, defining and mapping

ecosystems using a range of analytical tools, and in the process, identifying key habitats of concern for the retention or enhancement of biodiversity.

The greatest enhancement to areas (i)-(v), however, would be made by the development of a global set of 'Essential Biodiversity Variables (described above), but in addition GEO BON has a number of deliverables that provide opportunities to make enhancements. Here we give a few examples of interrelated and more specific deliverables under three major headings as related to terrestrial species monitoring:

1.Building up a global species monitoring network

1a. *Building up a global species monitoring network. Establish partnerships and integrate existing monitoring programs.*

This would involve establishing partnerships and communication between programs and integration of their activities as building blocks within an emerging global network based on an agreed-upon set of principles.

1b. *Capacity building for species monitoring in globally underrepresented regions ("gap regions").*

GEO BON will design a minimum set of monitoring activities that could be carried out in a capacity building context (recruitment and support of personnel, sampling design, field protocols, data collection and processing, data management, and information transfer to stakeholders).

2. Mobilizing species' data for describing biodiversity change

2a. Species' population trends dataset

This would be a Geo-referenced grid-based web dataset for several groups/regions that describes changes in the abundances of a representative set of species in a world grid and/or environmental strata.

2b. Catalogue of statewide or wider scale monitoring programs, datasets and data sources

This involves the compilation of meta-information on ongoing multi-species, systematic survey efforts for biodiversity monitoring over large spatial scales (e.g. nations, states). Each survey needs to fulfill minimum requirements, like multi-annual sampling, long-term perspective, quantitative data (e.g. counts) or detection and non-detection (i.e. presence data). Online database allowing input from within and outside of GEO BON and Regional BONs. Users will need to record the spatial and temporal extent and grain.

2c. The World's Worst: Priority invasive species across environments, taxa and regions

This would include baseline data sets, maps and publications consisting of designated priority invasive species (i.e. having adopted methods/approach outlined in the forthcoming GEO BON handbook) by taxon, environment and country.

3. Delivering products for users at national, regional and global scales in support of NBSAPs and Aichi targets

3a. Developing and integrating national species monitoring programs for the 2020 CBD targets (Policy brief)

This document will guide countries about the data sets, monitoring programs and analytical methodologies needed in order to report on indicators for the 2020 Aichi targets related to species. Results for two or three countries, developed and developing, will be used as case studies.

3b. Listing and Monitoring Priority Invaders: Manual for Countries, Data Providers and Managers

This online, reference material, will outline the rationale and include step by step methods for standardized and transparent listing (designation) and prioritization of invasive species. Methods may be applied at any geopolitical or bio-geographic scale, e.g. within and across environments, for countries, regions or management scales, such as protected areas.

3c. Manuals and Protocols (Reference materials, manuals, papers, protocols available online)

This will include protocols and methods for e.g. butterfly, bird, mammal, reptile monitoring; a catalogue of monitoring protocols; field-assessing techniques and procedures on EBVs; a gap analysis on species monitoring; global monitoring scheme for EBVs based on intensive sites; a case study of organizing biodiversity data around EBVs; assessing Aichi indicators against real datasets; integrating extensive and intensive network monitoring with EBVs and identifying gaps; and a manual of field-assessing techniques and procedures on EBVs to be used in capacity-building workshops in rural communities of high-diversity, developing countries etc.

Below we respond to questions relating to area: **C. Scientific and technical needs related to the implementation of the Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets**

Question 1. What tools and guidance have been adopted under the Convention that can support Parties implementing the Strategic Plan? What are the gaps?

In relation to Target 15 ("*By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification*"):

Whilst many countries have focused on mapping the changing extent of forest cover (and hence non-forest), there has been comparatively little effort aimed at monitoring different stages of forest regeneration but also degradation, with these being important for understanding the wider impacts on biodiversity as well as carbon. Brazil, for example, has excellent satellite-based capability for monitoring deforestation but secondary growth has not been mapped on an annual basis, although efforts are increasingly being focused on this. Hence, a major gap is differentiating the extent of secondary and primary forest and any degradation occurring at country and regional levels. A further gap is the links between these different forest states and both their biodiversity and carbon values.

In terms of restoration, spatial datasets on secondary and degraded forest extent are critical for planning purposes. However, equally essential, are datasets that quantify and map the histories of land use prior to abandonment to regrowth (noting that, in some cases, these lands are still in active use). Coupled with knowledge of impacts of prior land use on the capacity of regrowth forests to recovery biodiversity, carbon and other ecosystem values, such data layers can be used to plan for the restoration of at least some of the 15 % of the Aichi target amount. Key data layers that could be generated with existing time-series of

remote sensing datasets include:

- Clearance history.
- Burnt and unburnt area extent, fire frequency and intensity.
- Methods (e.g., tree pulling, evident within L-band SAR data)
- Frequencies of vegetation clearance.
- Regrowth forest age.
- Periods of active land use prior to abandonment to regrowth.

Question 2. What information and tools are available specifically to aid Parties in establishing national targets and monitoring or assessing progress towards them? What are the gaps?

A useful dataset to obtain relates to the distribution of ecosystems globally and where these are undisturbed. For example, in Queensland, Australia, maps exist of the extent of different regional ecosystems and where the remnants (or forests believed to be relatively undisturbed since European settlement) exist. Using these maps, it is possible to determine (using optical and radar remote sensing data and products) the relative difference between the characteristics of these remnant forests (within mapped ecosystem types) and all other forests, thereby giving a spatial representation of where ecosystems might be restored and the relative time for this to be achieved (either naturally or through intervention).

A major tool in providing the Parties information to establish national targets and monitor and assess progress towards them are species distribution models (SDMs). Such tools require high quality and consistent in situ biodiversity data complemented by standardized environmental data layers from which the SDM generates maps of species distribution and density. Environmental data layers are derived from earth observation, and change in the environmental data layers require frequent updates as provided by the continuous satellite systems such as Landsat and SPOT. For example, consistent land cover and habitat classification schemes (with translation between these) can be used at multiple scales and using a wide range of remote sensing and other data inputs. The EU BIOSOS project is one example which has adopted the Food and Agricultural Organisation (FAO) Land Cover Classification Scheme (LCCS) for land cover mapping from satellite data, which can be translated to General Habitat Categories (GHCs). From these maps and by retrieving biophysical properties describing plant function, structure, biomass and floristic composition, distributions of biodiversity can be mapped (e.g., through inclusion of species distribution models) and changes quantified.

There are a number of indicators that may be added. For instance, under Target 19 some obvious indicators already possible that should be added (using the A B C availability coding in the document):

1. Trends in the completion of the Catalogue of Life, the inventory of all known species (B)
2. Trends in rate of discovery of species new to science (i.e. progress in naming all species on Earth) (A)
3. Trends in data published in GBIF and OBIS, including geographic, taxonomic and time-series coverage (B)

4. Number of national marine (in WoRMS) and all-environment (in GBIF) national and regional species inventories (B)

Some further trends could likely be developed from the above. The responsible organisations would be Species 2000 and its participants (including the World Register of Marine Species, WoRMS), GBIF and OBIS who should be contacted or linked to these somehow. It might be possible for OBIS (for marine) and GBIF (for all) to provide data on time-series trends in particular species (marine species are missing from the Living Plant Index)

In terms of seeking information on the 'adequacy of observations and of data systems' this may also be achieved through items 1-4 above and further gap analyses by GBIF, OBIS, and Species 2000 partners (includes WoRMS, IPNI, etc..). If data are sliced by altitude and depth, taxa and time, the gaps become self-evident. Some thought is then needed as to which gaps are most significant in terms of compromising assessments of biodiversity.

In terms of biodiversity in general, the most fundamental but achievable gap, may be having a complete inventory of known species validated by experts (to account for known synonyms etc.) – this is probably 80% complete but is compromised by lack of funding to fill gaps and maintain the system, and perhaps needs governance-organisational issues addressed as well. Yet other assessments rely on this inventory to quality control species names. In conjunction with this, it is amazing that a global list of alien species is not available. We have a list of over 2,000 marine invasive/alien species, and there are probably ten times this for terrestrial and freshwater environments. The information, however, is there and can be collated.

Question 3. What technical and scientific cooperation already exists between Parties for implementing the Strategic Plan? What are the gaps?

A number of major global funders of biodiversity research have limited coordination in terms of the content and direction of research, project demonstration, and operational implementation (e.g. EU FP7, US NSF, Australia ARC, national space agencies, bilateral and multilateral development cooperation funds (such as SEDA, GTZ, World Bank, ADB, etc)). The CBD could play a major and incisive role here.

Question 4. What global initiatives and partnerships are available to support implementation of the Strategic Plan? What are the gaps?

Two global biodiversity information networks are the Global Earth Observation System of Systems (GEOSS) and the Eye on Earth (EoE).

The Global Earth Observation System of Systems (GEOSS) provides the 'upstream' biodiversity data and tools http://www.earthobservations.org/geoss.shtml. Within GEOSS, GEOBON is a substantial network of biodiversity experts working on developing tools and organizing data for biodiversity reporting.

An "Eye on Earth Alliance" formed during the recent Eye on Earth Conference in Dublin (March 2013) with its aim to:

- **converge** on the areas of mutual importance,

- **collaborate** with initiatives, and
- **convene** the worldwide community at the EoE Summit in Abu Dhabi

The Eye on Earth Alliance is an opportunity for these two important biodiversity networks to further harmonize and align their activities.

Question 5. What capacity building support is provided by the CBD Secretariat and partners for implementing the Strategic Plan? What are the gaps?

A number of GEO BON working groups have identified Capacity Building and education as a critical issue to ensure uptake and wide adoption of data and tools identified within the GEOSS/GEO BON framework.

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