INFORMATION FACILITY

GEOSS and Climate Change – the role of GBIF

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Outline

Introduce GBIF

Biodiversity and why it matters

The GBIF network and data portal

GBIF and the GEOSS IP3 climate change scenario

GBIF Mission

... to make the world's **biodiversity** data freely and universally available via the Internet

What is biodiversity?

GBIF follows the broadly outlined CBD recognition of levels of biological diversity:

- Molecules / genes
- Species
- Ecosystems / ecology

The species is the fundamental unit of biodiversity.

~1.8 million species have been described out of a possible total of between 5 and 100 million

Image source:
http://news.nationalgeographic.com/news/2006/03/0309_060309_yeti_crab.html

Threatened Species

15–37% of species are threatened with extinction

Main threats
- Land use change
- Climate change
- Nitrogen deposition
- Invasive species
- Over-exploitation
- Pollution
- Ecosystem compositional changes

Current extinction rates 100 – 1000 times greater than pre-human rates

according to - IUCN Red List of Threatened Species

Why conserve biodiversity?

…to enable sustainable use of the earth's resources.

Humans are ultimately dependent on biodiversity for various goods and ecosystem services.

Ecosystem services

- nutrient cycling
- atmospheric regulation
- soil formation / retention
- water purification
- pollination

Convention on Biological Diversity

Rio Earth Summit in 1992 adopted Agenda 21 as strategy for addressing human impacts on environment

The Convention on Biological Diversity (CBD) conceived as practical way of achieving goals of Agenda 21

3 main goals of CBD

- the conservation of biological diversity,
- the sustainable use of its components,
- the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

CBD 2010 Biodiversity Target

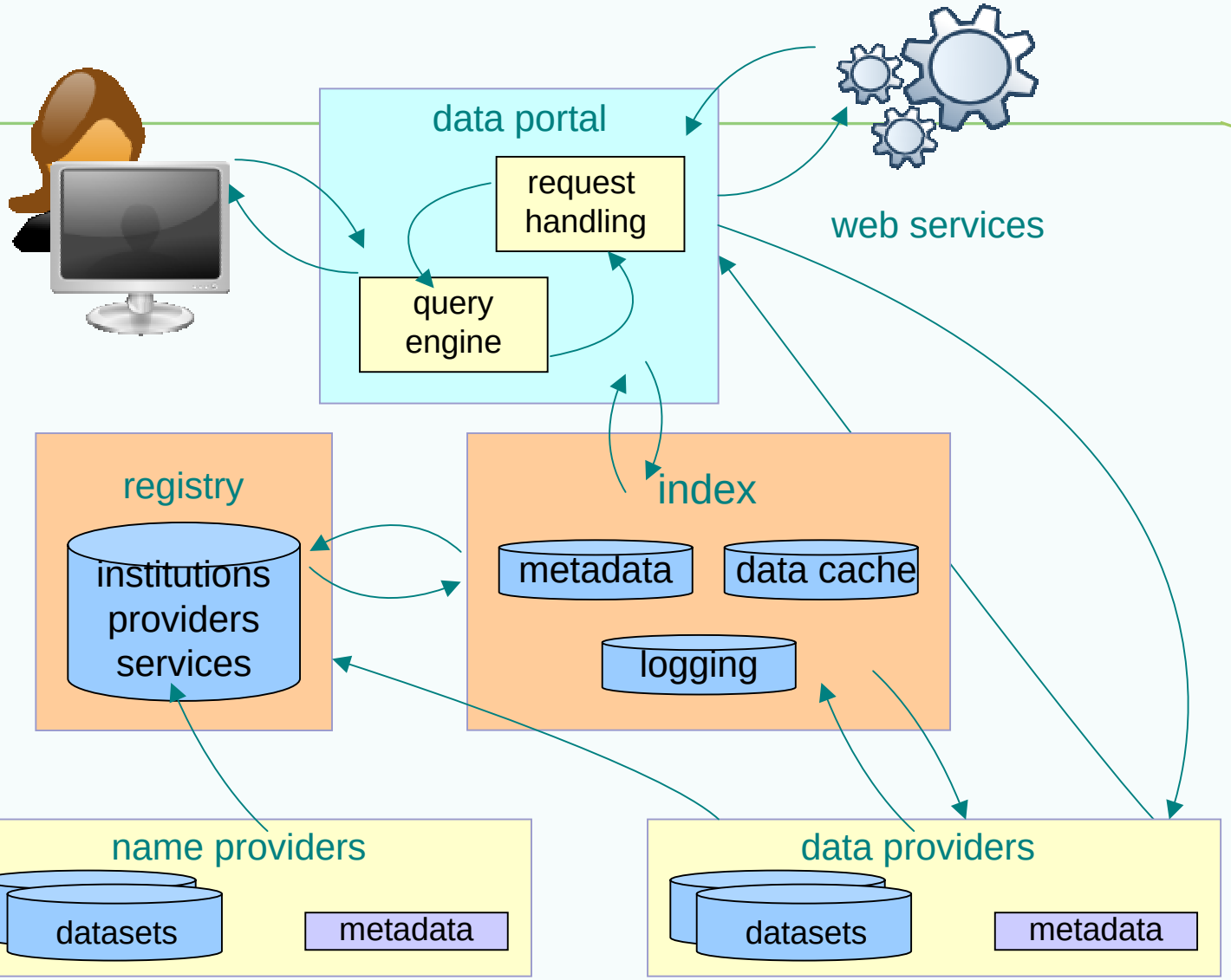
" to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth "

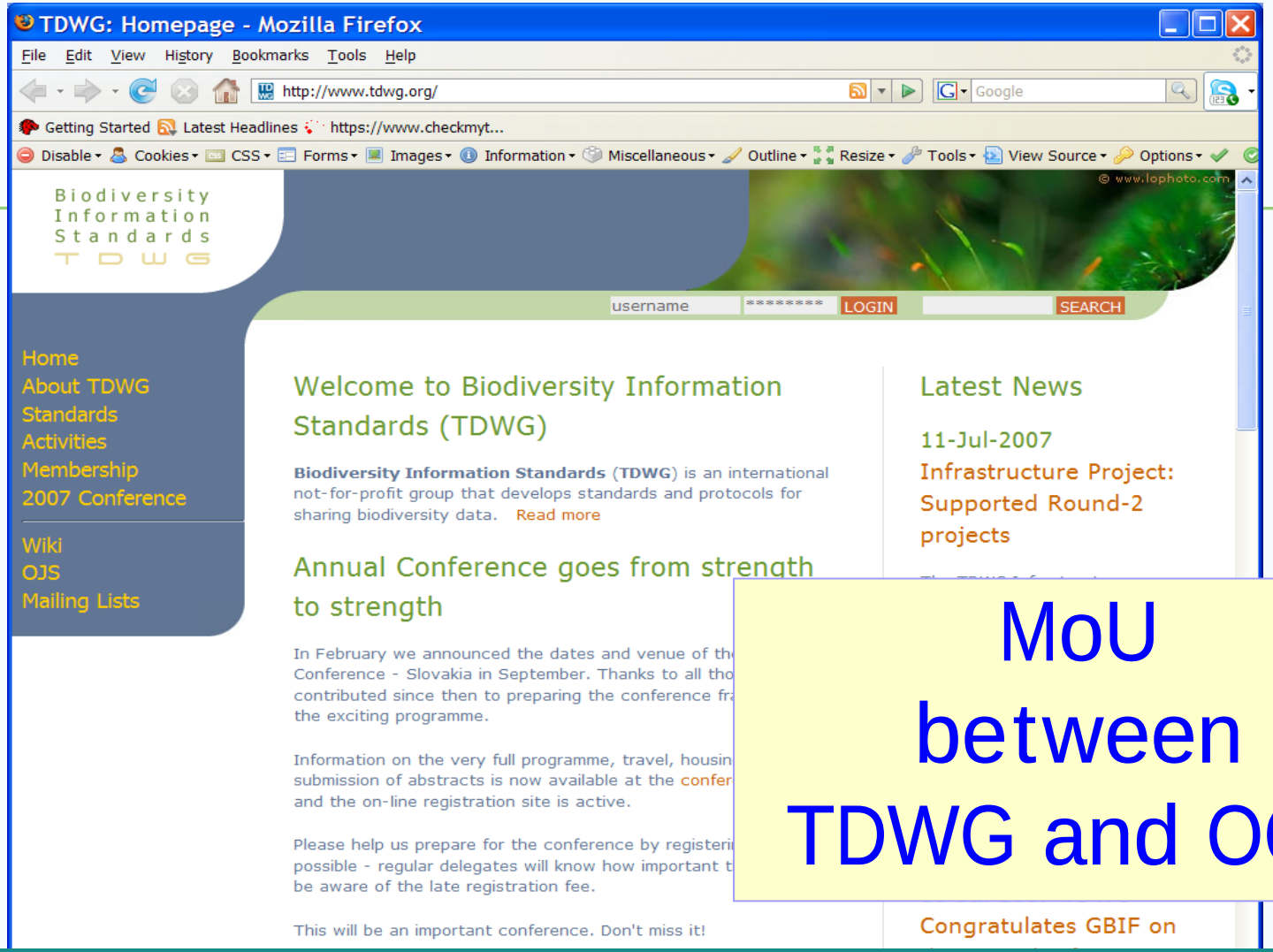
How is reduction in loss of biodiversity measured?

Indicators

- IUCN Red List of Threatened Species
- protected areas
- forest cover
- nitrogen deposition

Components of GBIF Architecture

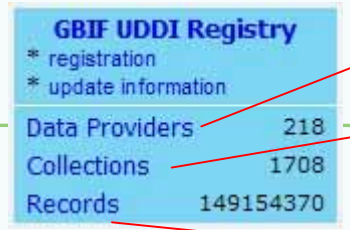




GBIF

MoU between TDWG and OGC

http://www.tdwg.org/



HOME > GBIF Data Providers

Data Providers

Data Collections | Search for Data | Availability | Statistics

HOME > GBIF Data Providers

Data Collections

Data Providers | Search for Data | Statistics

HOME > GBIF Data Providers

GBIF Participant Totals

Search for Data | Data Providers

GBIF Participant	Total Number of Records	Total Number of Data Providers
1. USA	50,458,164	62
2. UK	18,197,978	5
3. Sweden	13,697,970	1
4. Ocean Biogeographic Information System	12,307,677	5
5. Germany	5,653,065	16
6. France	4,264,518	7
7. Australia	4,094,344	6
8. Costa Rica	3,431,215	2
9. Austria	2,413,933	10
10. Netherlands	2,406,760	3
11. South Africa	2,118,214	1
12. Canada	2,114,146	8
13. Norway	1,906,564	1
14. Bioversity International	1,758,054	1
15. European Commission	1,646,269	1
16. Spain	1,642,059	5
17. Korea, Republic of	1,137,127	12
18. Poland	1,006,560	23
19. Japan	887,427	2
20. Mexico	721,732	3
21. NatureServe	624,880	1
22. Denmark	566,277	2
23. Iceland	504,985	1

GLOBAL BIODIVERSITY INFORMATION FACILITY

SPECIES COUNTRIES DATASETS OCCURRENCES SETTINGS ABOUT

... free and open access to biodiversity data

Search
species/country/dataset

Go!

Getting started

Test version 2007-05-14 See *About* for an introduction to using this portal. The default layout for this web site has been optimised for display on larger screens but can be changed through *Settings*.

http:/data.gbif.org

Explore Species

Find information for a species or a higher taxon, including names, occurrences and links to further resources.

Summary
This portal provides access to information on plants, animals, fungi and micro-organisms, organised by species and higher groups.

Example species:
Puma concolor (Linnaeus, 1771)

Explore Countries

Find information on the species recorded in a particular country.

Summary
This portal provides access to information on the occurrence of biodiversity in countries.

See data for:
France

Explore Datasets

Find information from a institution, dataset or project network, including occurrences and information about the datasets.

Summary
This portal includes biodiversity data from 1450 datasets shared by 217 data providers.

Latest dataset added:
Biological Records Centre - Ciidae (Coleoptera) records from Britain and Ireland to 2004

GBIF Portal - Species: Cerastoderma edule - The Global Biodiversity Information Facility: - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://data.gbif.org/species/13790179

Getting Started Latest Headlines https://www.checkmyt...

Disable Cookies CSS Forms Images Information Miscellaneous Outline Resize Tools View Source Options

Actions for *Cerastoderma edule*

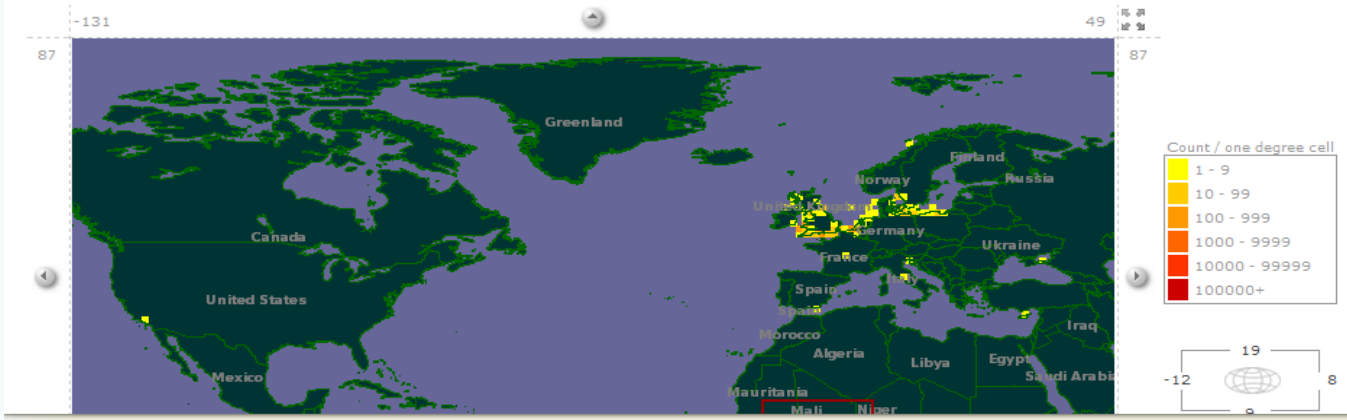
Explore: Occurrences Names and classification
List: Countries with occurrences Datasets with occurrences
Download: Darwin Core records One-degree cell density overlay for Google Earth Placemarks for Google Earth (limit 10,000)

Names and classification

According to Catalogue of Life: 2007 Annual Checklist: The Integrated Taxonomic Information System

Name	*Cerastoderma edule* (Linnaeus, 1758)
Classification	»Kingdom: Animalia »Phylum: Mollusca »Class: Bivalvia »Order: Veneroida »Family: Cardiidae »Genus: *Cerastoderma* »Species: *Cerastoderma edule*
Status	Accepted name
Synonyms	*Cardium edule*
Common names	English: Common Cockle, Common Edible Cockle Danish: Almindelig Hjertemusling, Hjertemusling Dutch: Kokkel French: Bucarde, Coque, Coque Commune German: Herzmuschel Italian: Cuore, Cuore Edule Portuguese: Berbigão Vulgar Spanish: Berberecho, Berberecho Común, Chica, Gurrimaña, Gurrimaño, Perdigón, Verdigón
Record identifier	ITS-80901
Record URL	http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=80901
Review date	25-Jan-2001
Feedback	Feedback to Catalogue of Life: 2007 Annual Checklist on the classification of *Cerastoderma edule* (Linnaeus, 1758)

Occurrence overview



Done

Occurrence search

Your current search

Classification includes Species:
Cerastoderma edule

- [ ] Show georeferenced records only
- [ ] Hide records with geospatial issues
- [ ] Hide records with taxonomic issues

Search

Add search filter

Scientific name | is | Add Filter

Taxonomy
- Scientific name
- Classification

Geospatial
- Country
- Continent
- Bounding box
- Latitude
- Longitude

Datasets
- Provider
- Data resource
- Occurrence date
- Year
- Month
- Institution code
- Collection code
- Catalogue no
- Basis of record

This search matches 860 occurrence records

What to do next

View records on map | View records as table | More actions (hide)

Specify...
- Limit data providers matched by search
- Limit data resources matched by search
- Limit countries matched by search

Lis
- List species for results

Sample results

Dataset	Scientific Name	Institution Code	Collection Code	Catalogue No.	Coordinates	Date	Country	
NLBIF	*Cerastoderma edule*	NMR	9930	NMR993000017127		31/03/1984		View
NLBIF	*Cerastoderma edule*	NMR	9930	NMR993000017128		31/05/1990		View
NLBIF	*Cerastoderma edule*	NMR	9930	NMR993000017129		16/06/1986		View
NLBIF	*Cerastoderma edule*	NMR	9930	NMR993000017130		31/08/1989		View
NLBIF	*Cerastoderma edule*	NMR	9930	NMR993000017131		27/07/1989		View

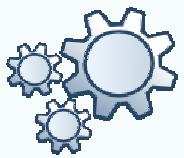
GBIF Web Services

occurrence record data
http://data.gbif.org/ws/rest/occurrence

taxon data
http://data.gbif.org/ws/rest/taxon

occurrence density data
http://data.gbif.org/ws/rest/density

Software applications that run over the internet and use a standardised message passing system to handle request and response, usually based on XML.



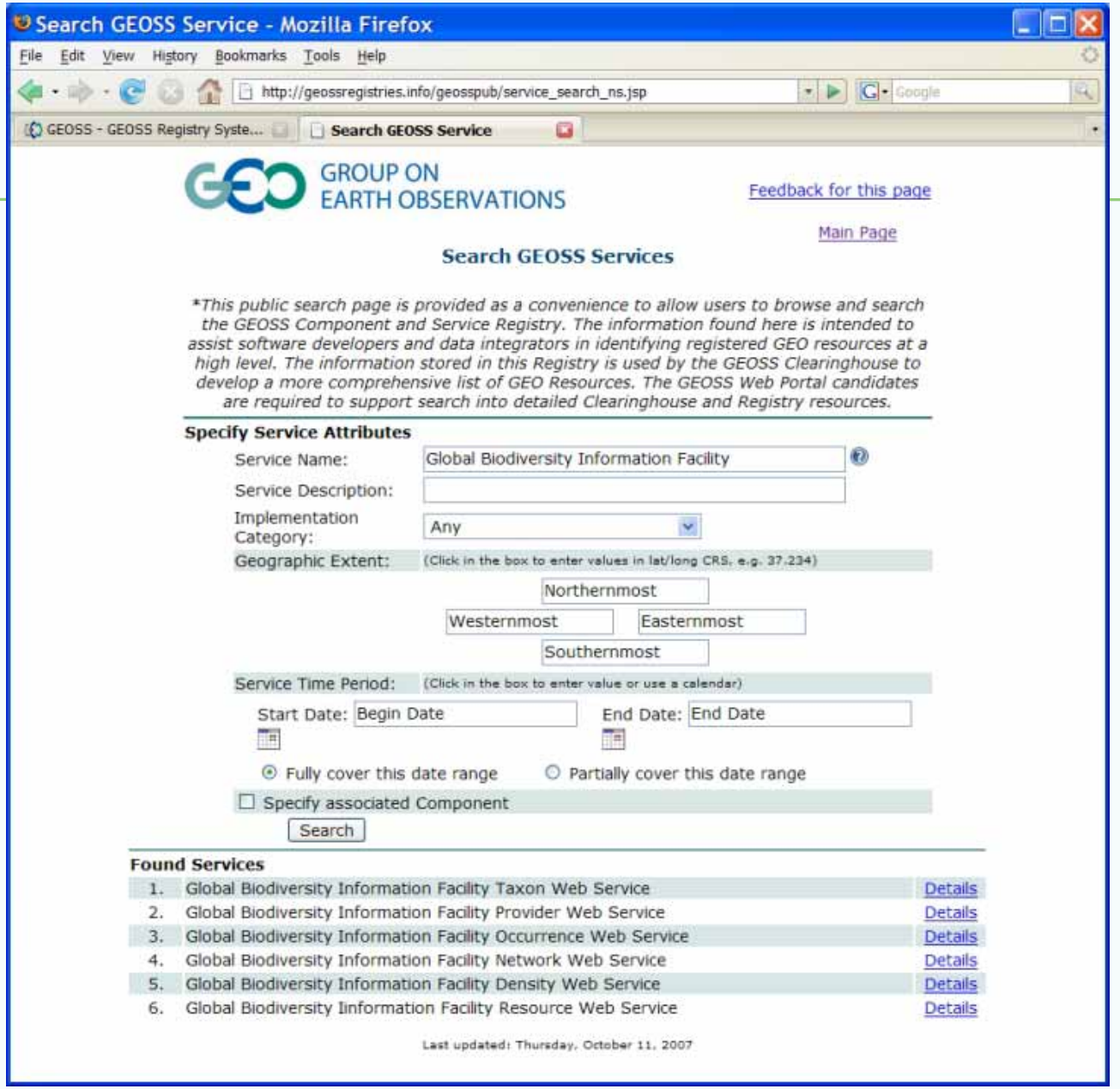
GBIF Web Services

GBIF's web services are based on the REST architecture style.

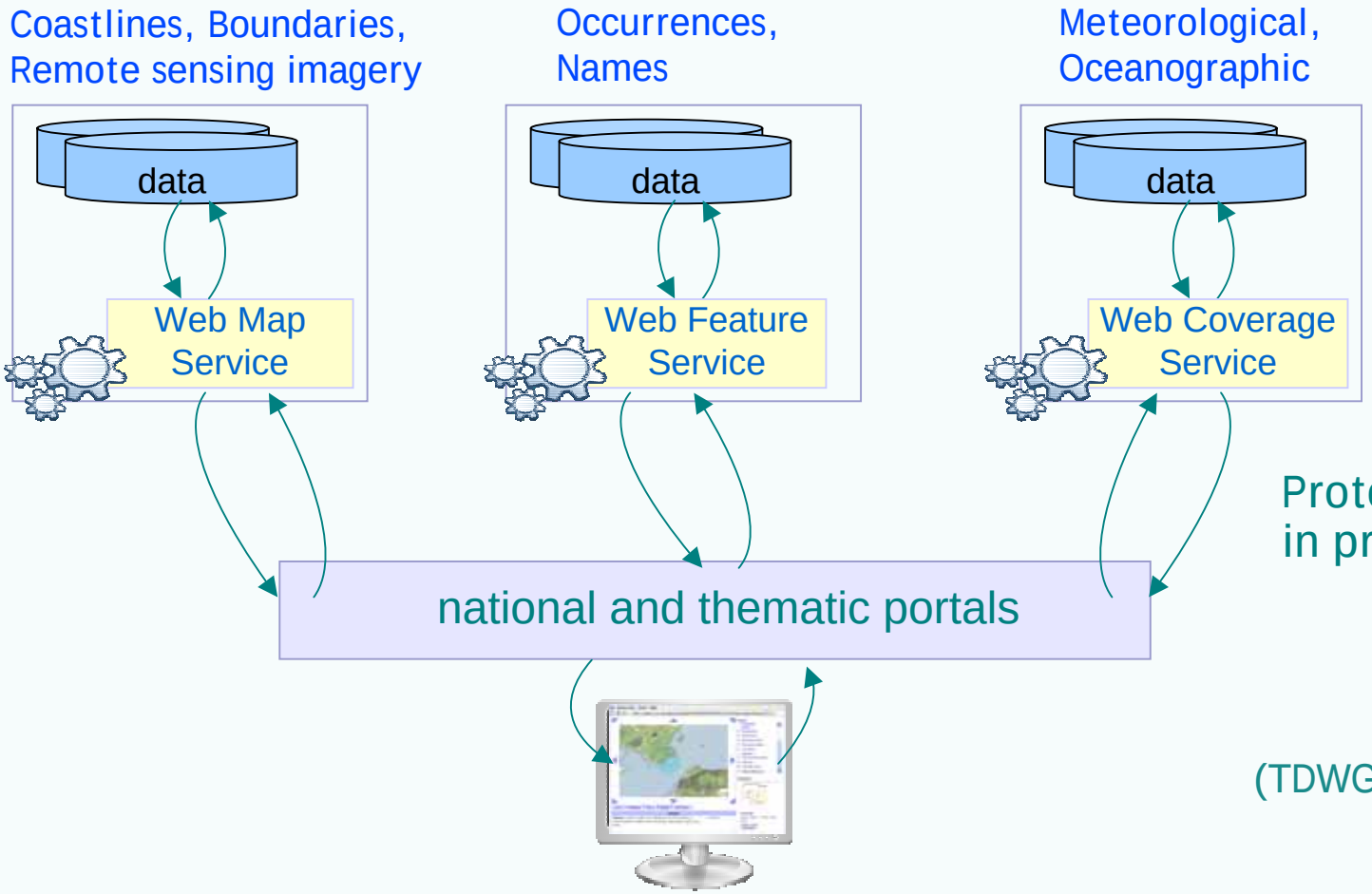
http://data.gbif.org/ws/rest/resource
dataset metadata

http://data.gbif.org/ws/rest/provider
data provider metadata

http://data.gbif.org/ws/rest/network
data network metadata


Search GEOSS Service - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://geossregistries.info/geosspub/service_search_ns.jsp
GEOSS - GEOSS Registry Syste...
Search GEOSS Service
GROUP ON EARTH OBSERVATIONS
Feedback for this page
Main Page
Search GEOSS Services
*This public search page is provided as a convenience to allow users to browse and search the GEOSS Component and Service Registry. The information found here is intended to assist software developers and data integrators in identifying registered GEO resources at a high level. The information stored in this Registry is used by the GEOSS Clearinghouse to develop a more comprehensive list of GEO Resources. The GEOSS Web Portal candidates are required to support search into detailed Clearinghouse and Registry resources.
Specify Service Attributes
Service Name: Global Biodiversity Information Facility
Service Description:
Implementation Category: Any
Geographic Extent: (Click in the box to enter values in lat/long CRS, e.g. 37.234)
Northernmost
Westernmost
Easternmost
Southernmost
Service Time Period: (Click in the box to enter value or use a calendar)
Start Date: Begin Date
End Date: End Date
Fully cover this date range
Partially cover this date range
Specify associated Component
Search
Found Services
1. Global Biodiversity Information Facility Taxon Web Service Details
2. Global Biodiversity Information Facility Provider Web Service Details
3. Global Biodiversity Information Facility Occurrence Web Service Details
4. Global Biodiversity Information Facility Network Web Service Details
5. Global Biodiversity Information Facility Density Web Service Details
6. Global Biodiversity Iinformation Facility Resource Web Service Details
Last updated: Thursday, October 11, 2007

The Geospatial Web - OGC[1] Web Services



Prototype OGC web services in preparation by GBIF:

- Web Map Service
- Web Feature Service

(TDWG GML[2] application schema)

[1]Open Geospatial Consortium

[2]Geography Markup Language

GBIF and Climate Change

Some implications of climate change for biodiversity

- altered species distributions
- spread of invasives
- spread of disease vectors
- increased risk of extinctions

Scientists must be able to assess potential impacts in order to advise decision makers on their policy options.

GBIF can support scientists by providing access to primary species occurrence data.

GBIF participated in the GEOSS Interoperability Process Pilot Project (IP3) -

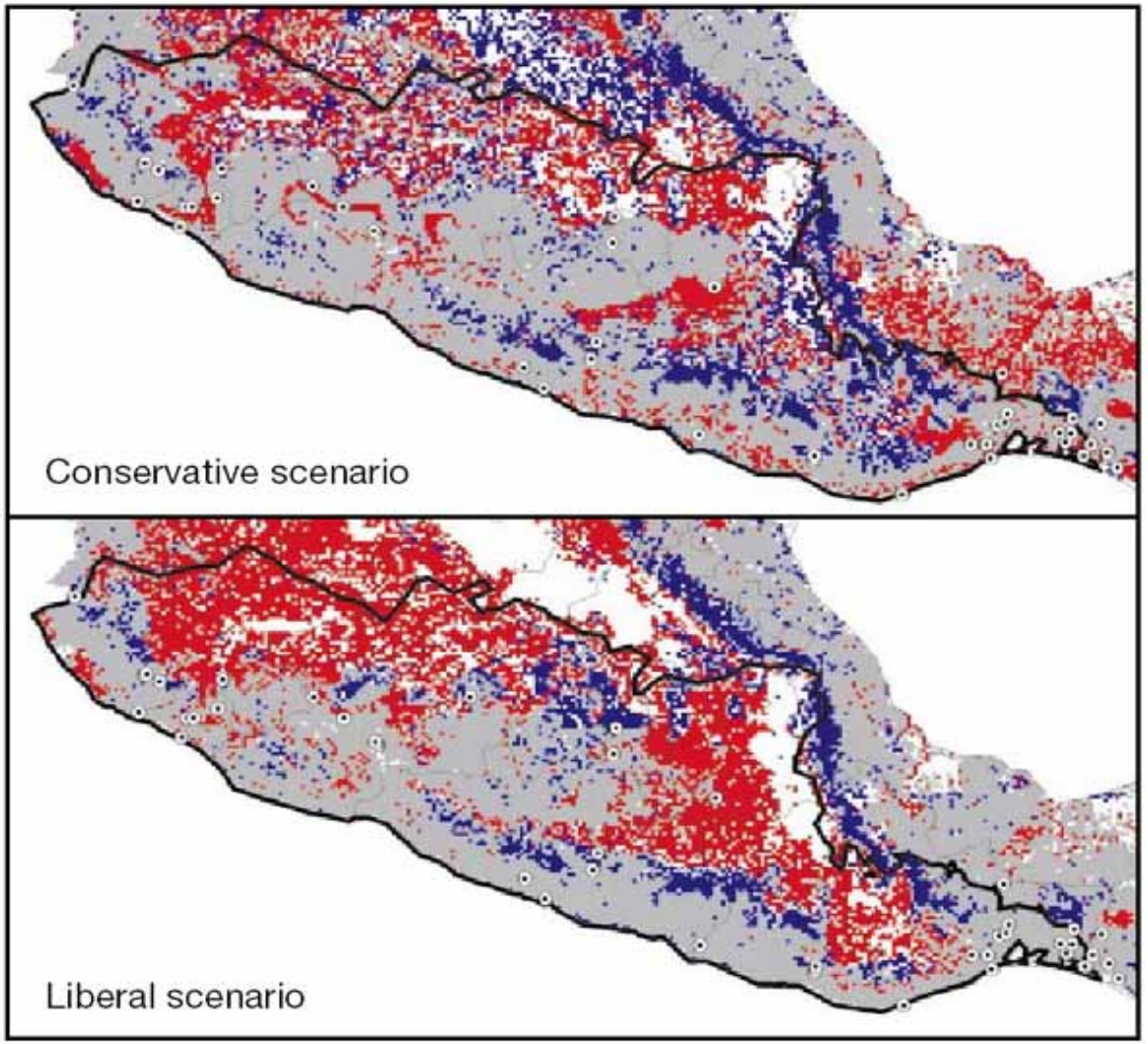
Predicting the impact of climate change on biodiversity – a GEOSS scenario

Ecological Niche Modelling

1. a modelling technique for defining the ecological requirements of a species – its ecological niche
2. many different algorithms in use (e.g. Maximum Entropy, GARP)
3. an algorithm uses a set of environmental variables (e.g. topographic, climatic) to define the ecological niche
4. once the ecological niche is defined it can then be used to query a set of environmental conditions (e.g. as predicted by a climate change model) to determine the potential distribution of the species
5. outputs as maps, statistics

Source: http://www.gbif.org/GBIF/zdepot/ReportonTarget2010Oct27.pdf

Effects of climate change on the distribution of the West Mexican Chachalaca, *Ortalis poliocephala*



The red areas, presently appropriate for the species, will become uninhabitable

The blue areas are not appropriate now but will become so.

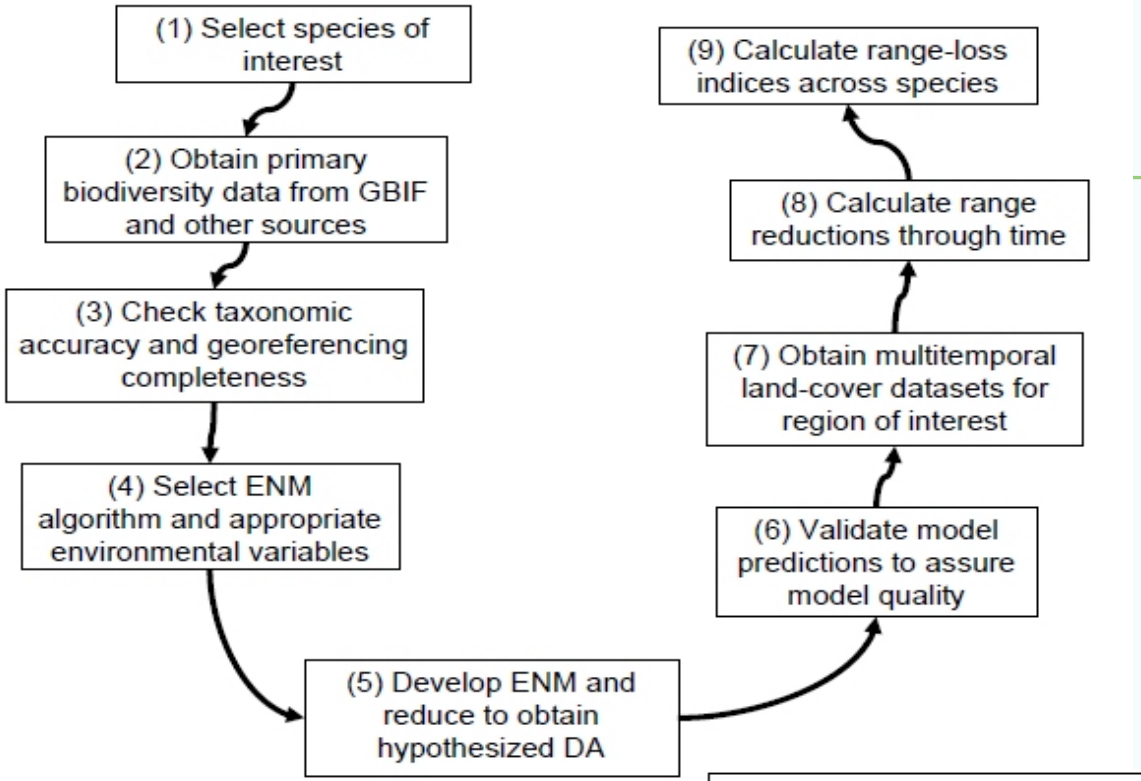
Source: Future projections for Mexican faunas under global climate change scenarios Peterson et al. Nature 416, 626-629 (11 April 2002) doi:10.1038/416626a

CBD objectives

GBIF mediated data can be used, in pursuit of CBD objectives -

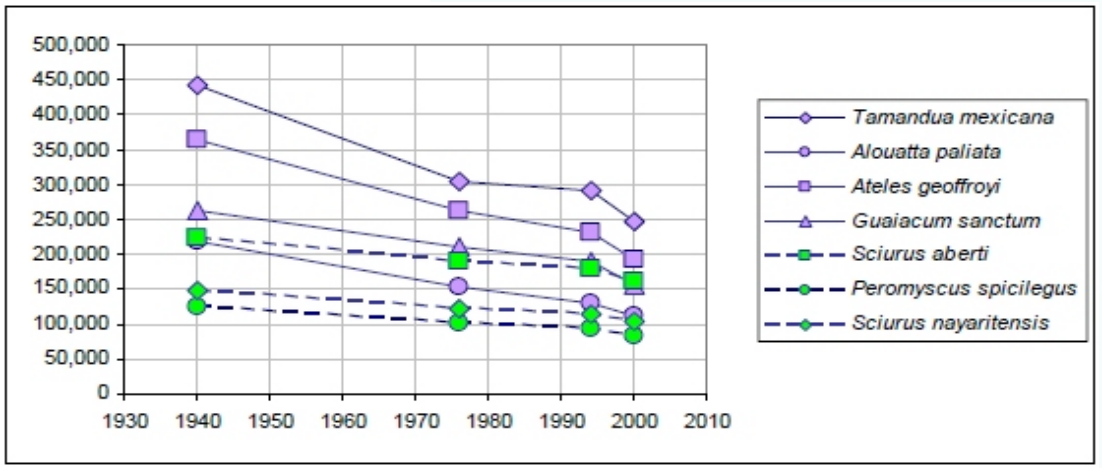
1. to provide indices of "trends in the abundance and distribution of selected species"
2. to develop indices of any kind of "selected species"
3. to develop indices at national, regional or global levels

Source: http://www.gbif.org/GBIF/zdepot/ReportonTarget2010Oct27.pdf



GBIF mediated data can be used to develop temporally-organised indicators to measure the effects of land-use change on the distribution of species

Effects of land use change on 7 Mexican species →



Source: Peterson & Soberón
http://www.gbif.org/

GEOSS IP3 Scenario

Predicting the impact of climate change on biodiversity – a GEOSS scenario

- demonstrating how the infrastructures of Climate Change research and Biodiversity research can be integrated in support of large scale ecological analysis using an approach that is compatible with the GEOSS framework.

Ref: Predicting the impact of climate change on biodiversity – a GEOSS scenario. Nativi et al. In "The Full Picture, A publication for the GEO Ministerial Summit, 'Earth Observation for Sustainable Growth and Development' Cape Town, 30 November 2007"

GEOSS IP3 Scenario

Identify the species to be used.

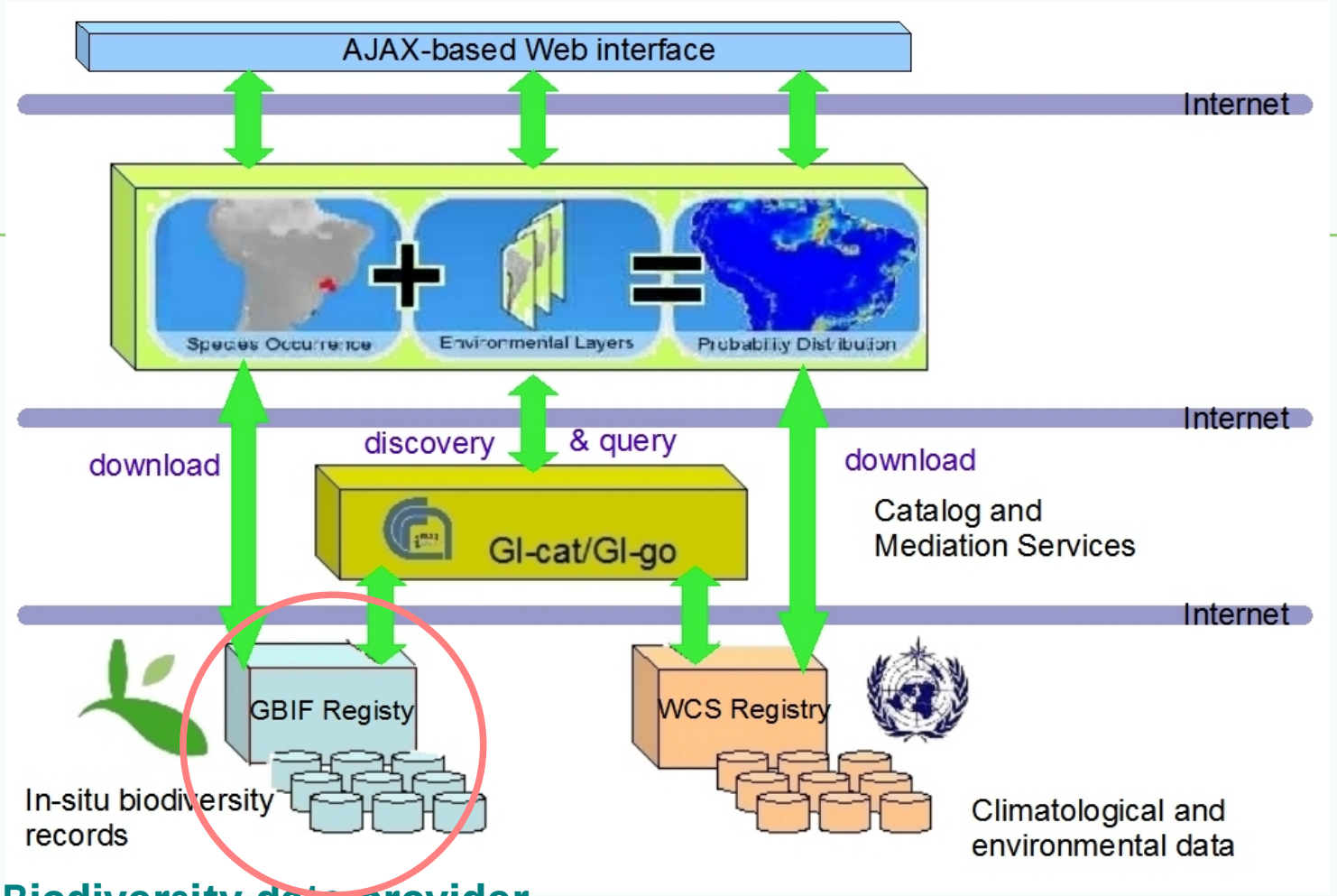
Assemble species datasets and map spatial and temporal distributions.

For the selected species, determine the following -

- which environmental characteristics are most likely to influence the ecological niches;
- which historical and future scenario climatological data are needed for Ecological Niche Modelling;
- which modelling algorithms most accurately predict shifts in distribution and abundance;

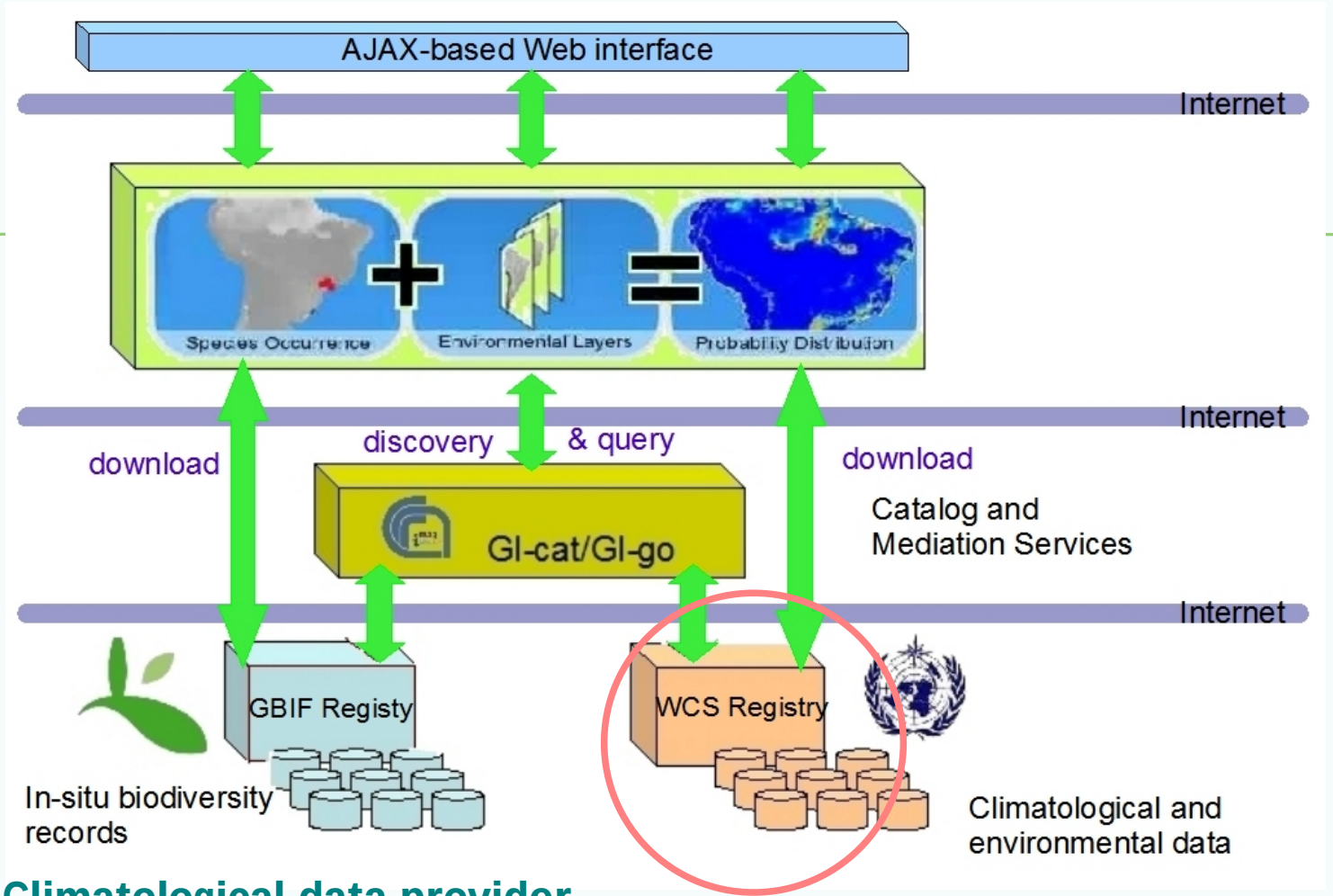
Download the selected species occurrence data and environmental and climate data to the modelling workbench.

Run the models and present outputs as series of maps and predicted species' ranges or abundances.



Biodiversity data provider

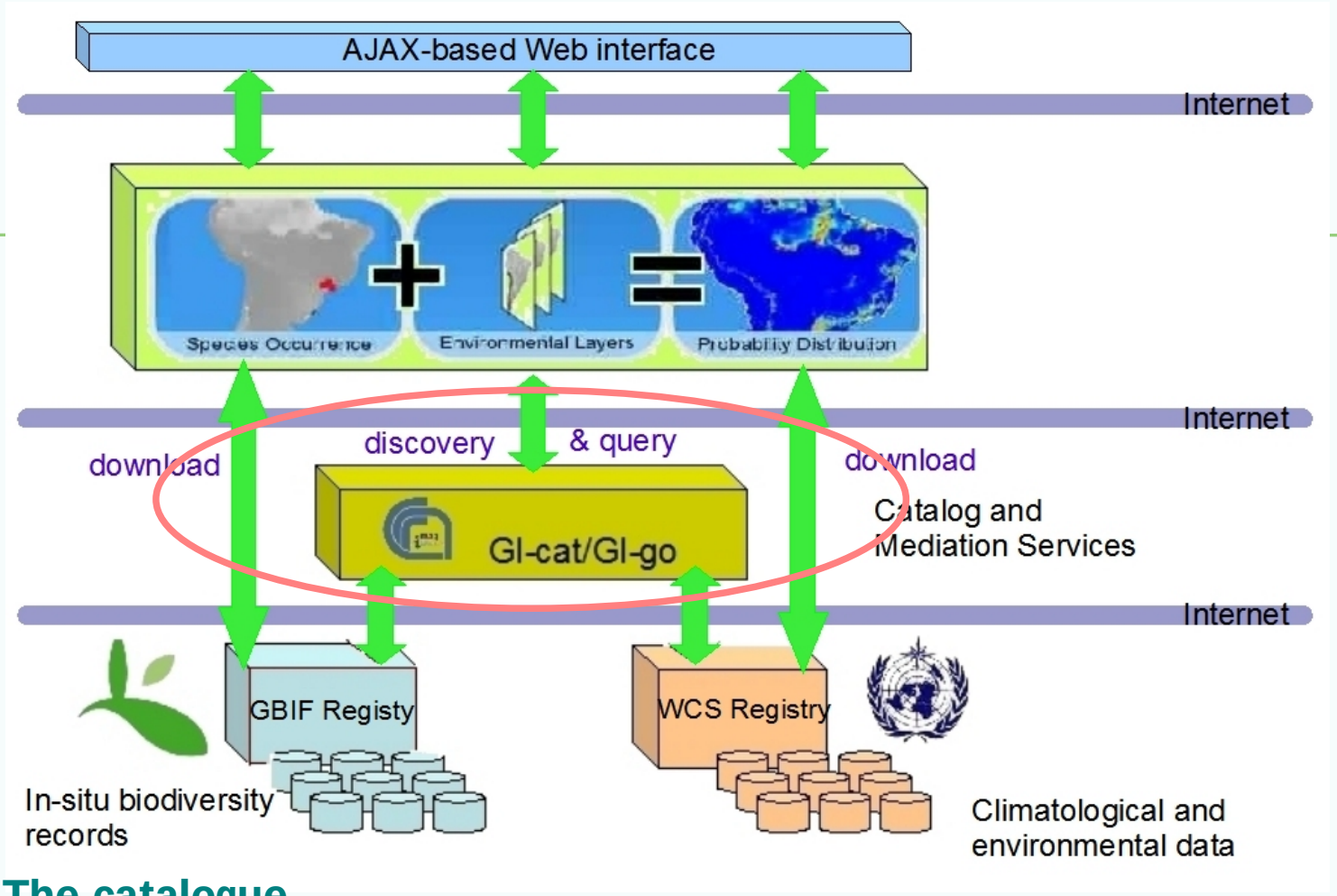
- GBIF data portal provides access to ca. 150 million occurrence records
- Unique resource for EO studies that require ground-truthing data
- Access to historical data



Climatological data provider

NCAR provides access to global datasets of climate change scenarios

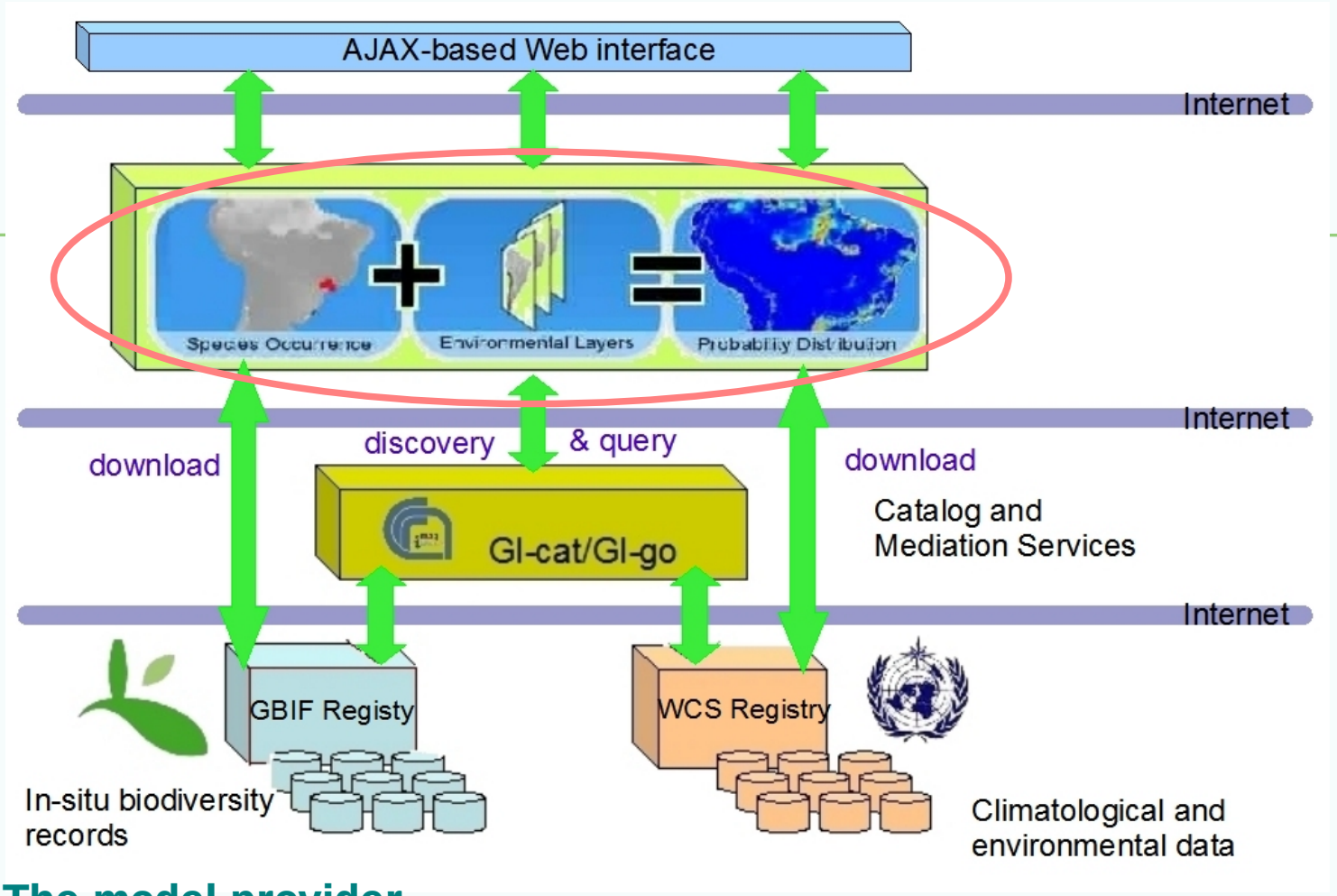
- Spanning 2000 – 2050
- Generated for 4th assessment of IPCC using Community Climate System Model (CCSM)
- Several climate change scenarios showing different degrees of future surface temperature change (constant 20th century scenario, B1, A1B, A2)



The catalogue

GI-cat provides discovery and access to biodiversity and climatological datasets

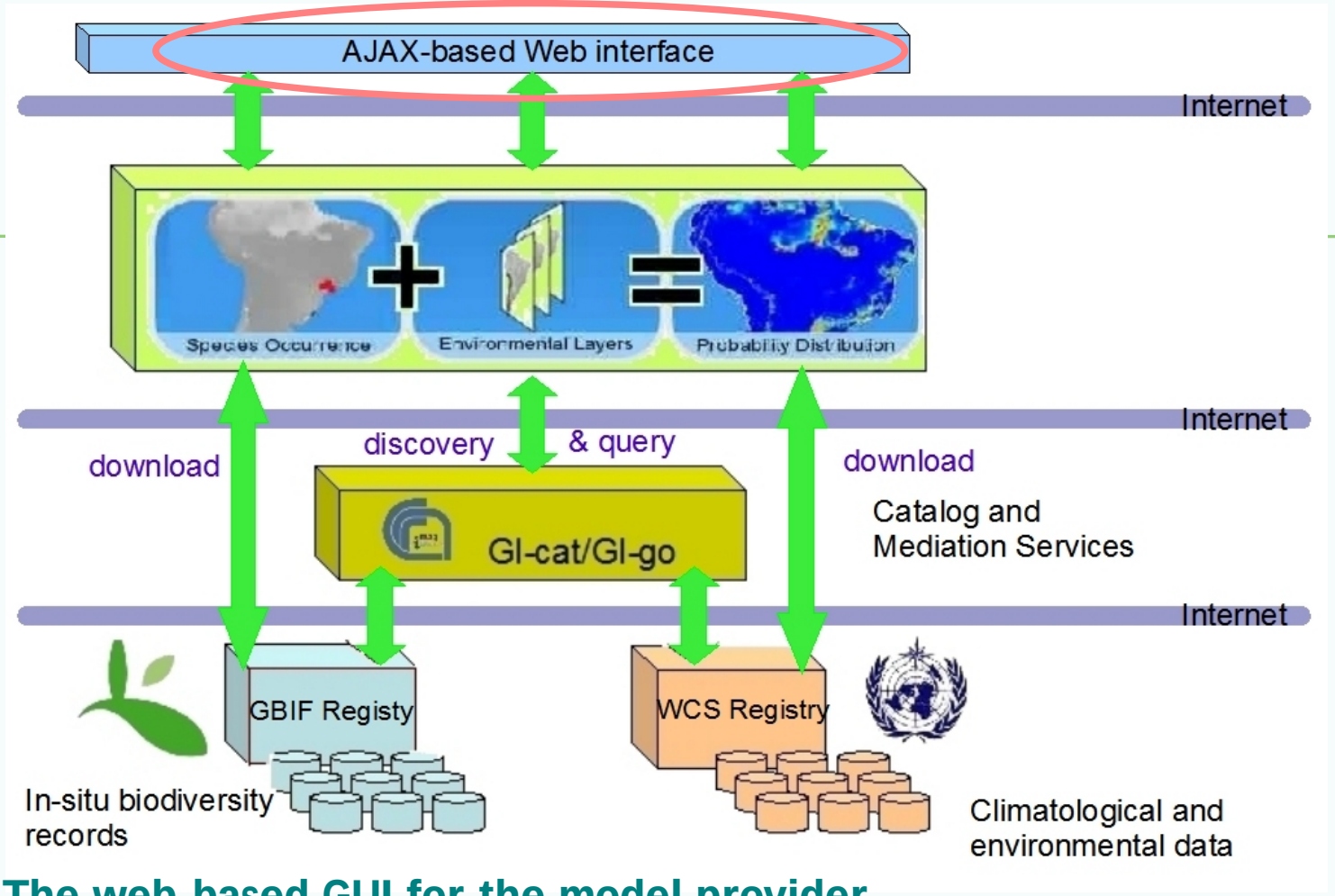
- Uniform interface for querying heterogeneous catalogues and accessing services that implement international geospatial standards
- Implements mediation server to access non-standard services by specifying “special interoparability arrangements”



The model provider

A component to allow modelling activities to be undertaken, e.g., selection of datasets, setting parameters, selection of modelling algorithm.

- OpenModeller software is available as both desktop application and modelling kernel that is accessible through an API.

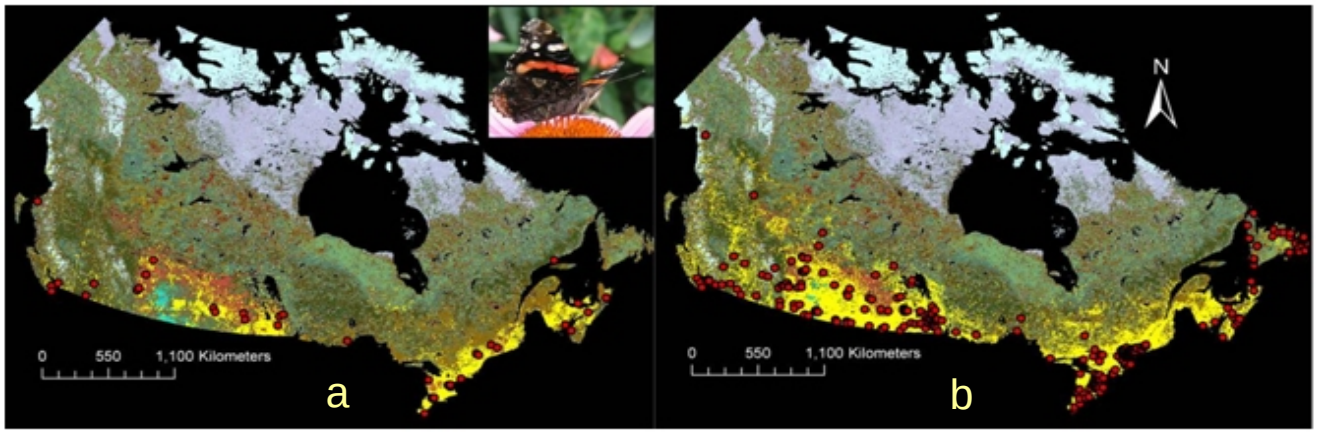


The web-based GUI for the model provider

This component functions as the workflow controller, providing -.

- access to the GEOSS Clearinghouse to locate other needed services
- discovery of suitable datasets through searching of GI-cat
- access to datasets via web services (GBIF, OGC WCS, NCAR data services
- running of Ecological Niche Model projections

Species Response to Climate Change



Distribution of *Vanessa atalanta*

Vanessa atalanta; Photo by Jeremy T.Kerr – August 1, 2005. Ottawa, Ontario

a) distribution derived from historical observations of climate, land use, and species location from 1900-1930

b) distribution derived from models run on the same data from 1960-1990

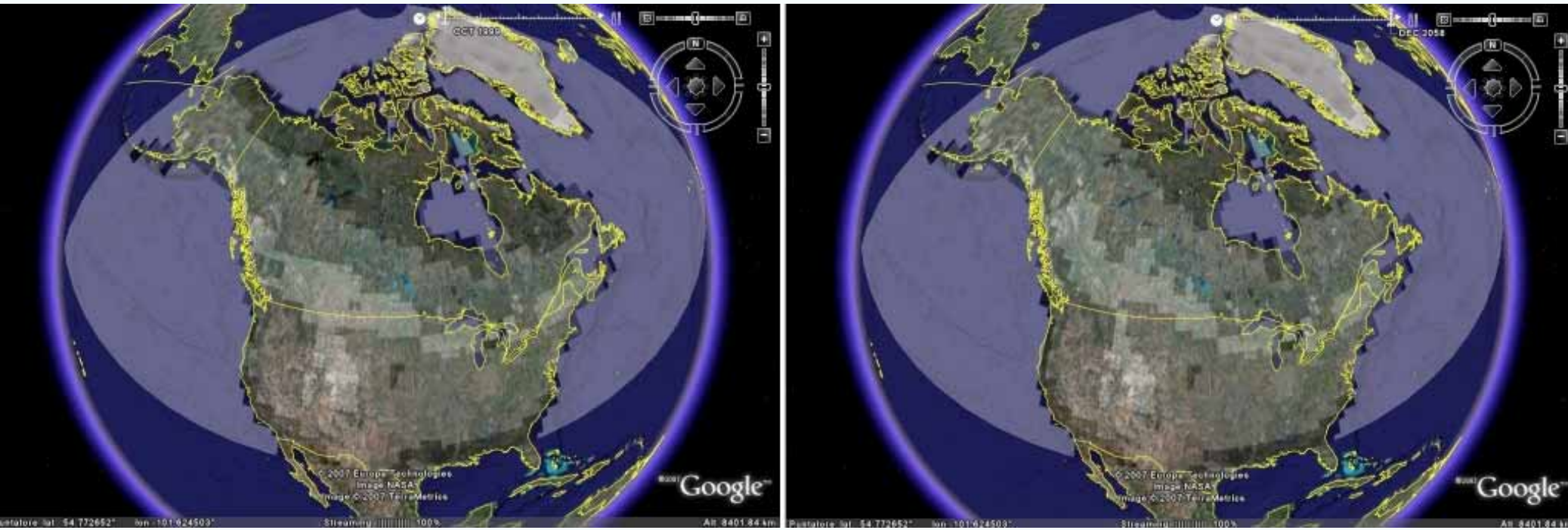
- Predicted distribution
- Oberved distribution

→ The species has expanded its range over time

→ Species can be highly responsive to climate change

Ref: Predicting the impact of climate change on biodiversity – a GEOSS scenario. Nativi et al. In "The Full Picture, A publication for the GEO Ministerial Summit, 'Earth Observation for Sustainable Growth and Development' Cape Town, 30 November 2007"

Species Response to Climate Change



The range of the common roadside skipper (*Amblyscirtes vialis*) will move about 300 km northwards by 2050 under the most conservative IPCC climate change scenario (B1)

Ref: Predicting the impact of climate change on biodiversity – a GEOSS scenario. Nativi et al. In "The Full Picture, A publication for the GEO Ministerial Summit, 'Earth Observation for Sustainable Growth and Development' Cape Town, 30 November 2007"

Next steps

- Continue to expand the GBIF network
- Improve metadata handling on GBIF network
- Develop robust OGC web services
- Develop the Protected Areas scenario
- Integrate scenario framework more fully in GEOSS framework

Acknowledgements

The modelling scenarios in this presentation are based on publications by Peterson & Soberón[1], Nativi et al.[2] and Peterson et al.[3]

1 Development of indicators of compliance with the 2010 target of the convention on biological diversity using primary biodiversity data provided by GBIF. A.T.Peterson & J. Soberón. http://www.gbif.org/GBIF/zdepot/ReportonTarget2010Oct27.pdf

2 Predicting the impact of climate change on biodiversity – a GEOSS scenario. Nativi et al. In "The Full Picture, A publication for the GEO Ministerial Summit, 'Earth Observation for Sustainable Growth and Development' Cape Town, 30 November 2007" http://www.earthobservations.org/documents/the_full_picture.pdf

3 Future projections for Mexican faunas under global climate change scenarios. Peterson et al. Nature 416, 626-629 (11 April 2002) doi:10.1038/416626a

How to contact GBIF:

Web site: www.gbif.org
Data portal: www.gbif.net

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