

# Mapping Point Data in a Distributed Environment using XML and Mapserver

## Background

- In biodiversity / taxonomic applications, methods are required to capture and query point data from distributed sources.
- As part of ongoing research, mapping capability has been added to two point mapping applications:
  - the Integrated Taxonomic Information System (ITIS) / Biological Observations, Specimens and Collections (BIOSC Gateway)
  - the Generic Point Mapper

## Need

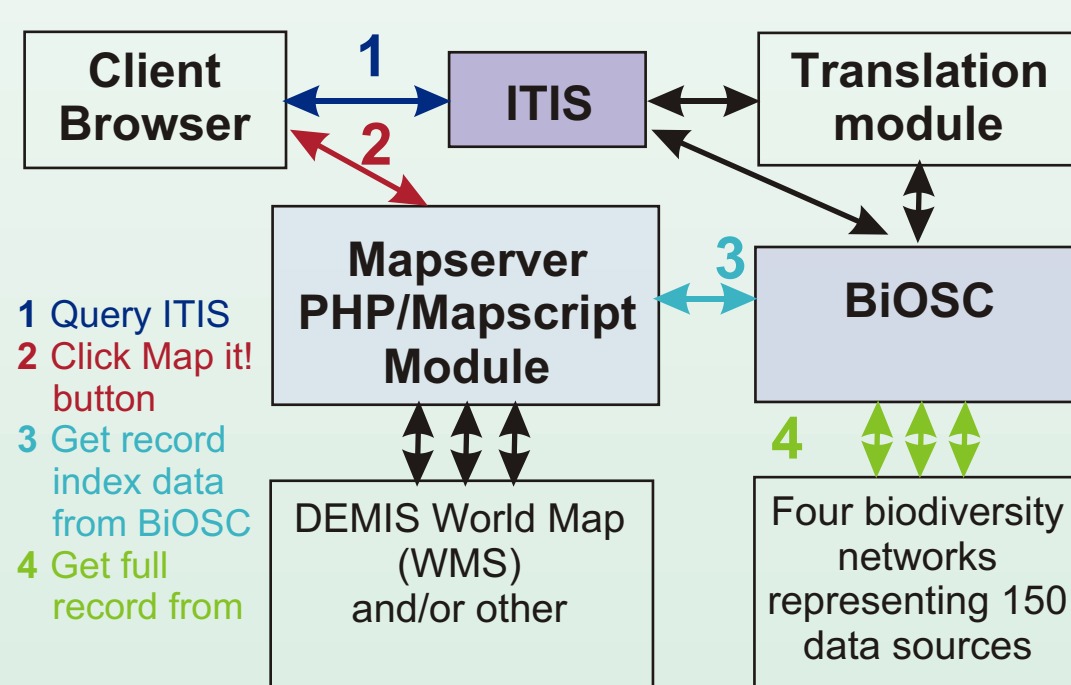
To incorporate point mapping into the ITIS / BIOSC Gateway online application.

## Biological Observations, Specimens and Collections (BIOSC Gateway)

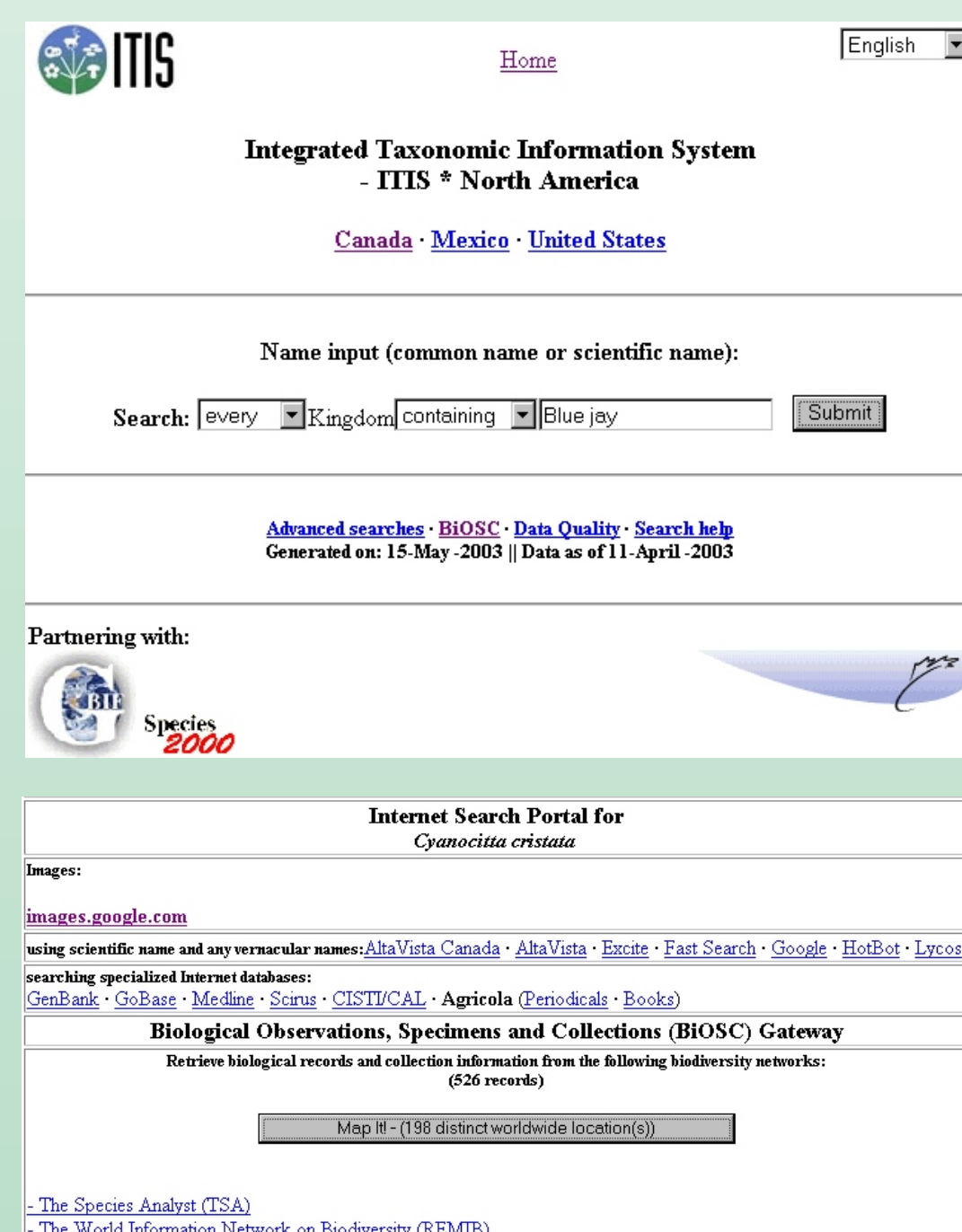
- BIOSC is a global metadata search engine that accesses holdings from multiple distributed biodiversity networks
- It contains approximately 4 million biological records from 120,000 taxa
- Interactive mapping is provided for records containing latitude and longitude data. An XML stream containing header information and biodiversity records is sent to a Mapserver PHP/Mapscript application.
- The Mapserver application extracts points from the XML stream and adds the points as features to a point maplayer. The points are displayed on a world map provided via Web Map Service (WMS) protocol. The user can zoom in and out, pan, and query an individual point.
- Querying the points on the maps results in the retrieval of information directly from the original source of the point data, in real time.
- The point distribution layers were made OpenGIS compliant. The WMS Getmap request can be used to display points in other web mapping applications that support the WMS OpenGIS protocol. The point layers can also be queried using the WMS GetFeatureInfo request.

ITIS: [http://sis.agr.gc.ca/pls/itisa/taxaget?p\\_ifx=plgt](http://sis.agr.gc.ca/pls/itisa/taxaget?p_ifx=plgt)  
 BIOSC White paper: [http://www.cbif.gc.ca/biosc/biosc\\_e.php](http://www.cbif.gc.ca/biosc/biosc_e.php)

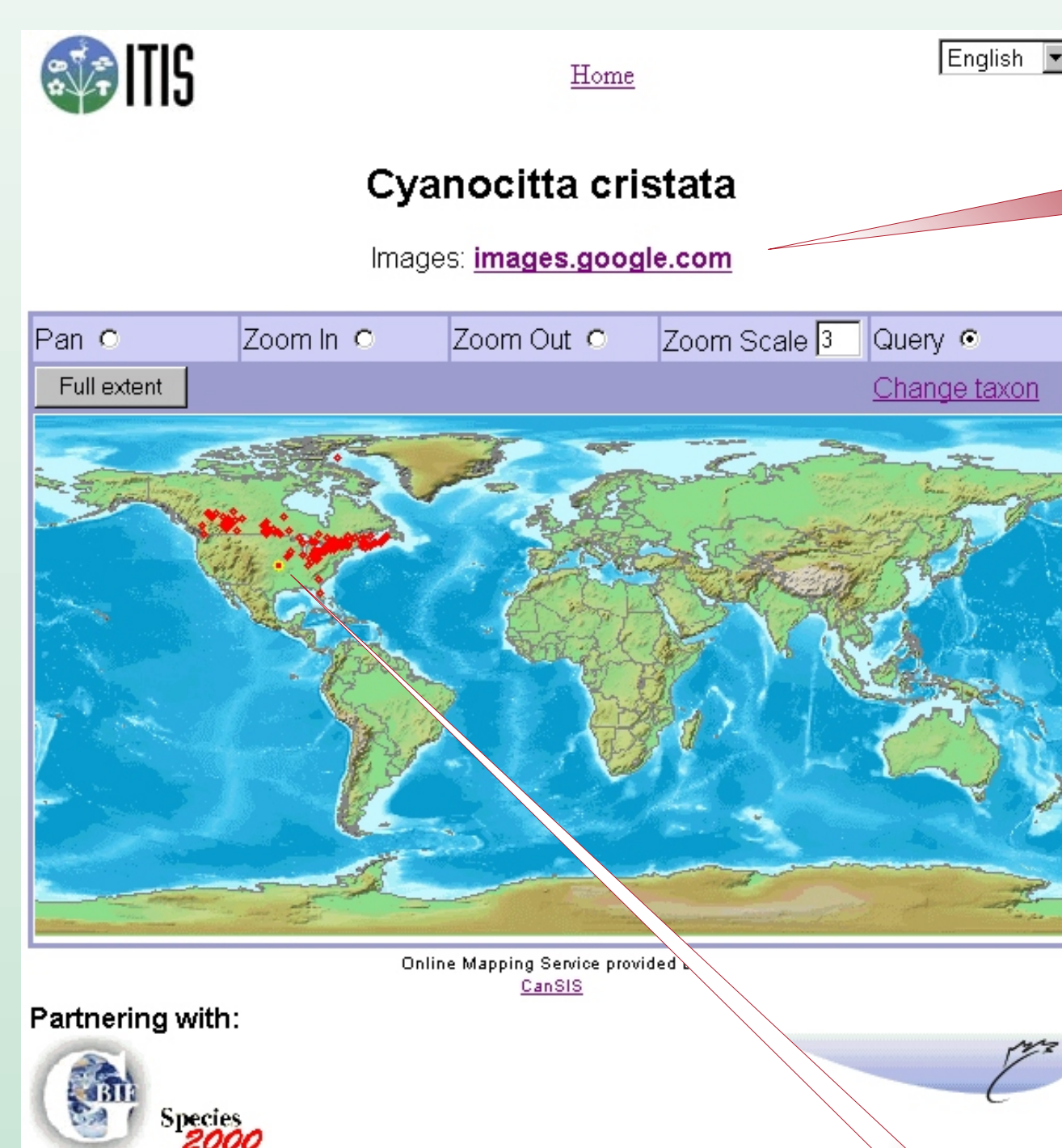
## Context Diagram



## Inputs

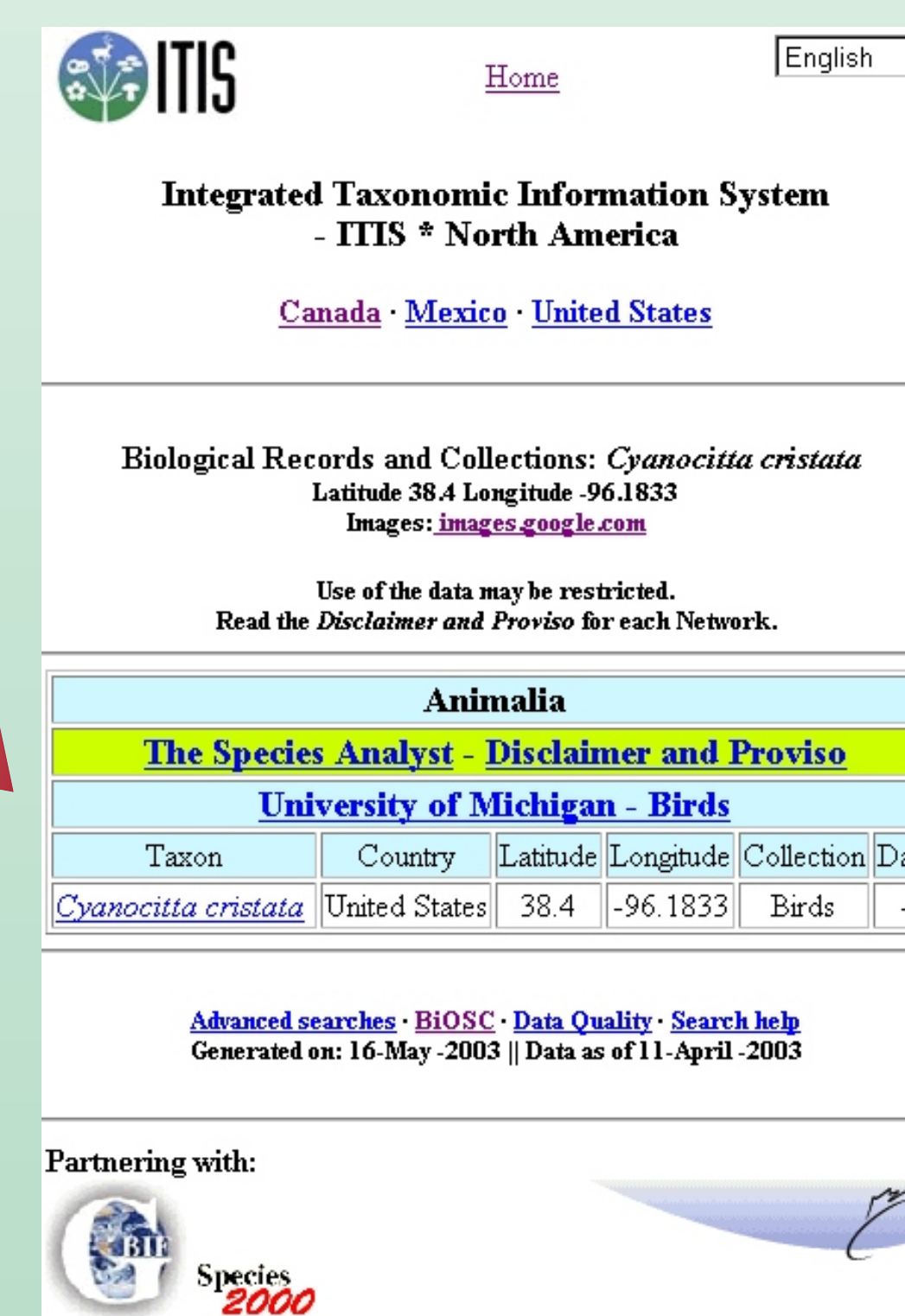


## Application



## Query results

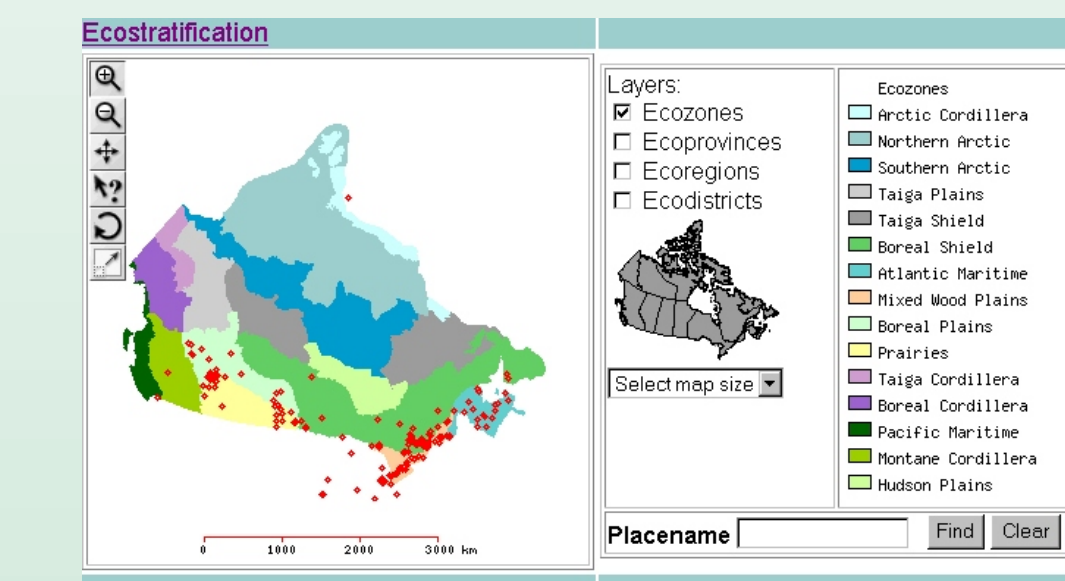
Resulting query information is retrieved directly from original data holder.



## OpenGIS capabilities

OpenGIS (<http://www.opengis.org/>) specifications enable spatial information sharing via interoperable solutions on the internet.

The Web Map service (WMS) Getmap request can be used to display points in other web mapping applications that support the WMS OpenGIS protocol.



WMS Getmap request for Cyanocitta cristata (Blue Jays) in another OpenGIS compliant application

## Results

- The point mapping is very fast: 4 seconds for >2000 points, 15 seconds for > 4000 points.
- The WMS Getmap request can be used to display points in other web mapping applications that support the WMS OpenGIS protocol.
- The application uses POST rather than GET method due to the potentially large XML stream sent via http.
- There is a challenge in making a proper GetCapabilities document due to the large number of potential map layers available (>120,000).

## Future activities

- The current XML stream is non-standard. It can be converted to be compliant with Web Feature Service (WFS) or Geography Markup Language (GML) specifications.
- If one of the new emerging web mapping clients (e.g. the CGDI WMS Client Component) that allows searching of WMS registries/catalogs is used, the points can be mapped on a variety of background map layers.
- There is a need to add the ability to map more than one taxa or other type of point distribution at a time.
- There is a need to add the ability to map different symbol types, colours and sizes via Style Layer Descriptor (SLD) specification

## Sample XML Stream

```

<?xml version="1.0" encoding="iso-8859-1"?>
<response>
  <header>
    <author>John Doe</author>
    <boundingbox>100 -90 180 90 World</boundingbox>
    <description></description>
    <title></title>
    <language en</language>
    <projection latlong</projection>
    <recordcount></recordcount>
    <timestamp>20030513T01:18:41Z</timestamp>
    <title>Map of Canadian Cities</title>
  </header>
  <records>
    <record>
      <longitude>-123.3666</longitude>
      <latitude>48.4333</latitude>
      <recordurl>http://www.city.victoria.bc.ca/common/index.shtml</recordurl>
    </record>
    <record>
      <longitude>75.75</longitude>
      <latitude>45.2666</latitude>
      <recordurl>http://www.city.ottawa.on.ca/</recordurl>
    </record>
    <record>
      <longitude>-79.416666</longitude>
      <latitude>43.7</latitude>
      <recordurl>http://www.city.toronto.on.ca/</recordurl>
    </record>
  </records>
</response>
  
```

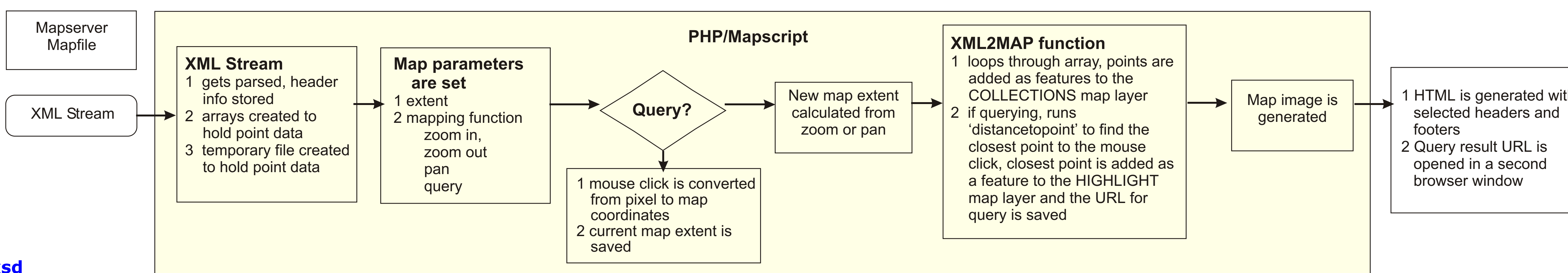
## Mapserver Mapfile

- contains 3 layers

- Basemap layer:** - World map provided via WMS from Demis by <http://www.demis.nl/>
- Collections layer:** - an empty point layer - sets symbol rendering: colour red, size 5
- Highlight layer:** - an empty point layer - sets symbol rendering: colour yellow, size 6

## XML Schema:

[http://sis.agr.gc.ca/xml/point\\_map.xsd](http://sis.agr.gc.ca/xml/point_map.xsd)



## Need

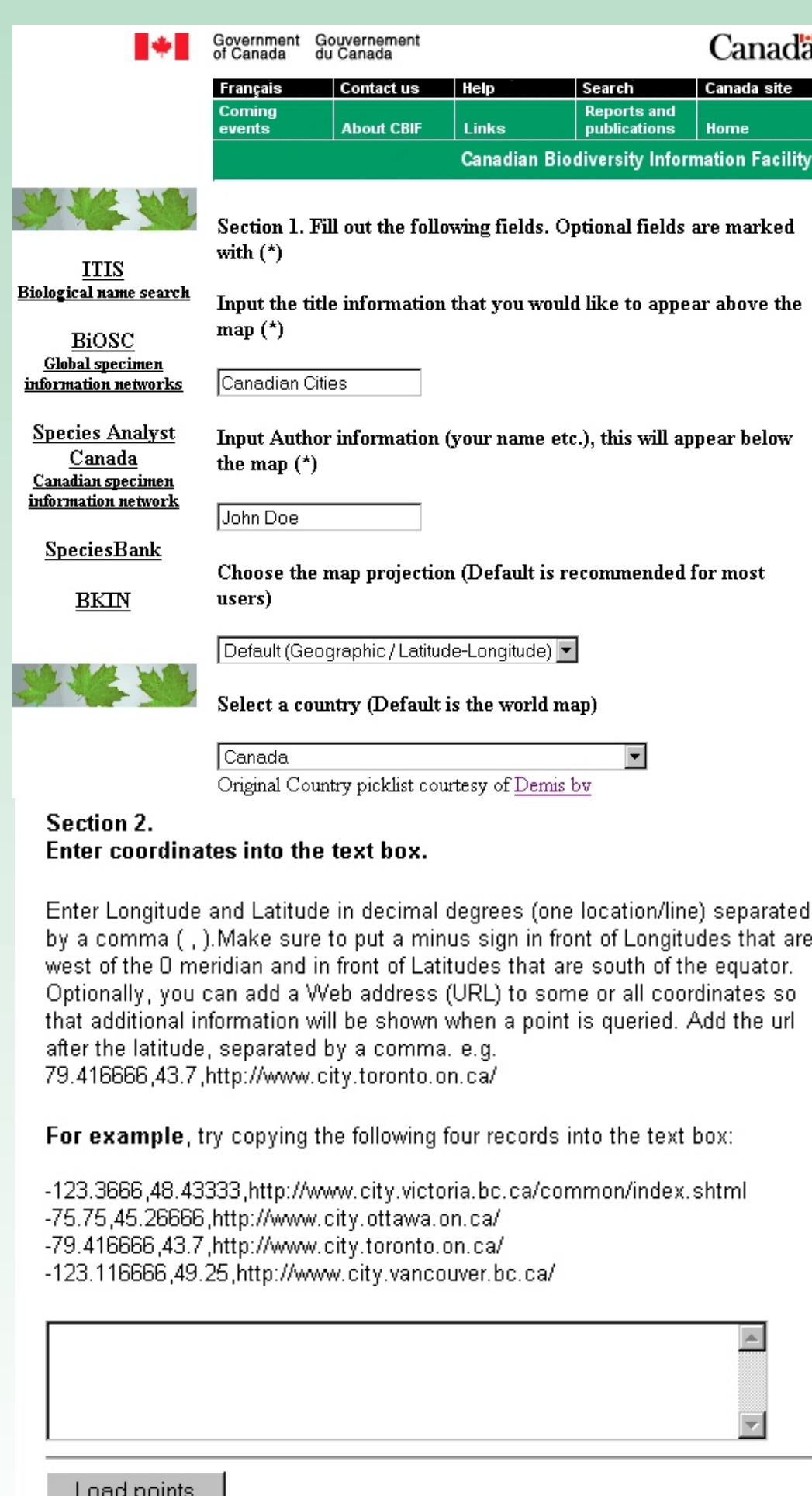
To provide users and application developers the ability to interactively map and query point data of any kind (e.g. biodiversity, health, etc.) in real time.

## Generic Point Mapper

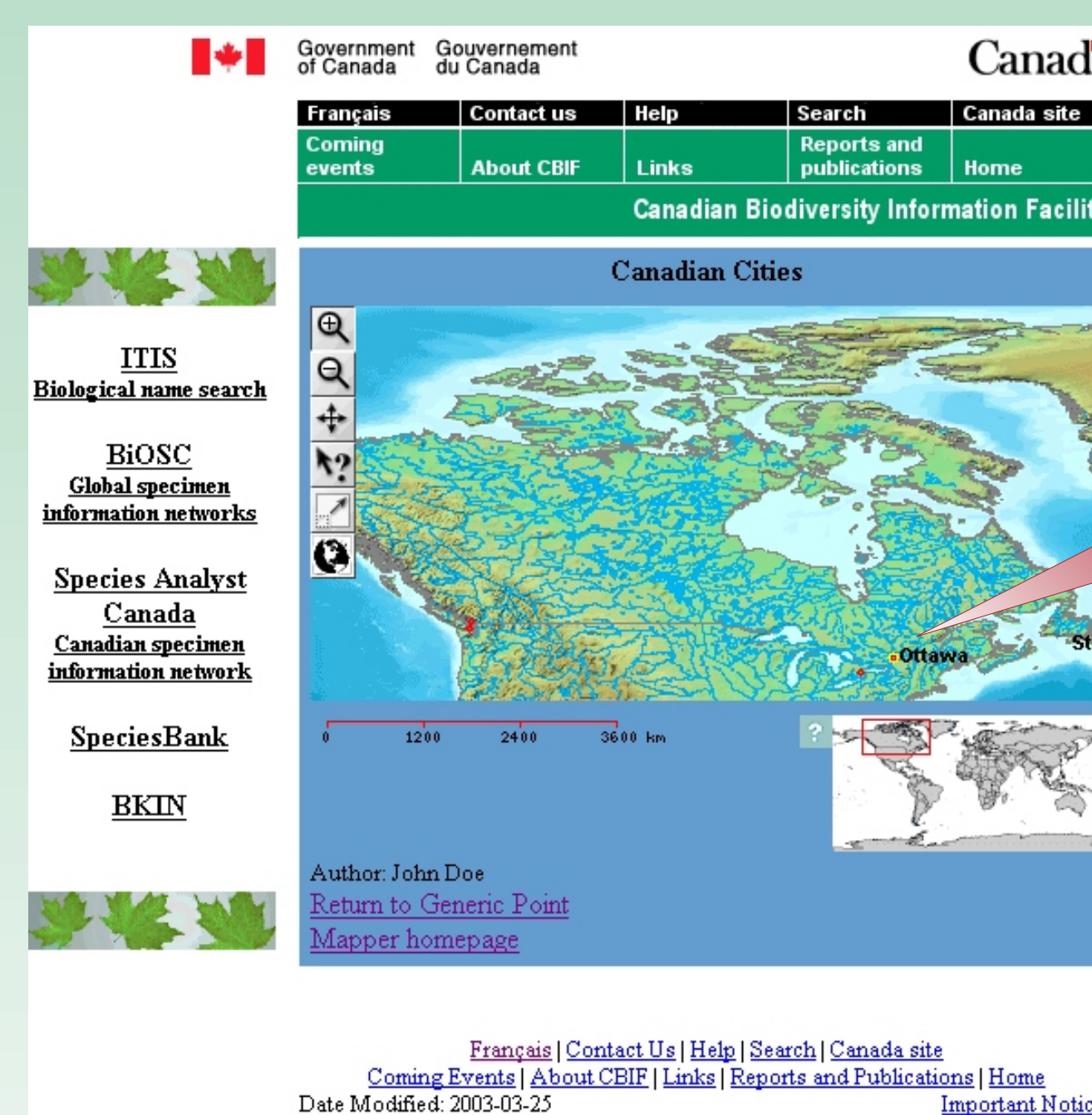
- This application can be used to map point distributions on any subject matter.
- Coordinate information can be cut and pasted into a browser window or a file can be uploaded.
- Coordinate information is added in the format: Longitude, Latitude, Query url (optional)
- If a point is queried, a new browser window is opened to display the URL provided with each coordinate.
- Potential uses of this application:
  - Biodiversity collections (e.g. map and query collection information representing many biological species from multiple remote data holding sources)
  - Point of interest applications (e.g. Cities and City homepages)
  - Health Mapping e.g. SARS
  - Plot temporal changes in species ranges due to human activities

CBIF: [http://www.cbif.gc.ca/mc/index\\_e.php](http://www.cbif.gc.ca/mc/index_e.php)

## Inputs



## Application



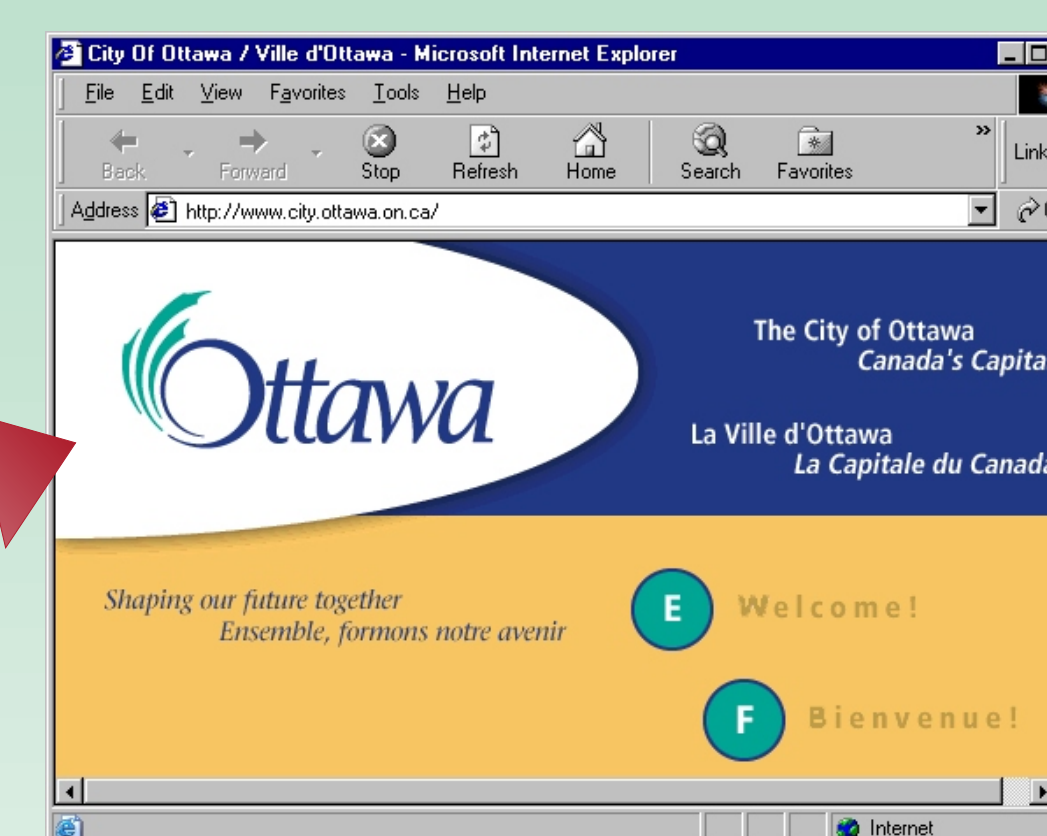
## List of records

Format for point records (note: the URL is optional)

- 75.75,45.26666,http://www.city.ottawa.on.ca/
- 79.416666,43.7,http://www.city.toronto.on.ca/
- 123.3666,48.4333,http://www.city.victoria.bc.ca/common/index.shtml
- 123.116666,49.25,http://www.city.vancouver.bc.ca/

## Query results

The query results appear in a new browser window



## Results

- Points provided in decimal degrees can be mapped in "geographic" or they can be projected on the fly and mapped in Robinson projection
- The user has the ability to map more than one taxon or other type of point distribution at a time.
- End users can use the Generic Point Mapper for their own use and application developers can wrap their own applications around this mapping application.

## Future activities

- More map projections can be provided in the application.
- If one of the new emerging web mapping clients (e.g. the CGDI WMS Client Component) that allows searching of WMS registries/catalogs is used, the points can be mapped on a variety of background map layers.
- The application can be built to accept UTM coordinates to facilitate GPS users.

This project relies on:  
 Mapserver: <http://mapserver.gis.umn.edu/home.html>  
 Demis bv world map server: <http://www.demis.nl/>

**Debbie Pagurek**, Agriculture and Agri-Food Canada, 960 Carling Avenue, Ottawa, Ontario, Canada, K1A 0C6, Email address: [pagurekd@agr.gc.ca](mailto:pagurekd@agr.gc.ca)  
 Telephone: (613) 759-1543 Fax: (613) 759-1937

**Derek Munro**, Agriculture and Agri-Food Canada, 960 Carling Avenue, Ottawa, Ontario, Canada, K1A 0C6, Email address: [munrodb@agr.gc.ca](mailto:munrodb@agr.gc.ca)  
 Telephone: (613) 759-6636, Fax: (613) 759-6639