



## Bugs and BISON:

How can the Biodiversity Information Serving  
Our Nation Project help BMSB-NEIPM?

*BISON: A national unified resource for discovery,  
linkage and reuse of species occurrence data.*

<http://bison.usgs.ornl.gov>

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Core Science Systems (CSS) Mission Area

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U.S. Department of the Interior  
U.S. Geological Survey



# The BISON system

- **Developed by the U.S. Geological Survey**
  - **Core Science Analytics and Synthesis (CSAS) Program (Core Science Systems Mission Area)**
- **A species occurrence data aggregator providing 110+M species occurrence records for the U.S. and Territories including:**
  - Various taxonomic groups (animals, plants, fungi)
  - Terrestrial and aquatic species
  - Various data types: observation-based data, natural history collections (specimen-based) data, and literature-based data
  - Federal and non-federal data

# **BISON Goals**

**Increase Data Access, Exposure,  
Discoverability, and Quality**

**Data Mobilization through integration  
and application of standards, open data  
technologies, machine readable access**

# BISON Data Acquisition Priorities

## Federal data:

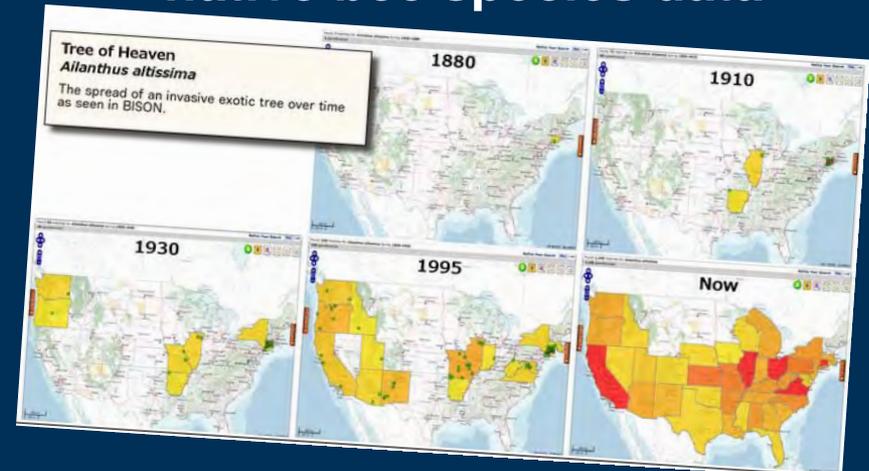
1. USGS data (science centers, individual scientists, etc.)
2. Other DOI agency (FWS, NPS, etc.) data
3. Other Federal & State agency data
4. Other/non-Federal data

## Collections data:

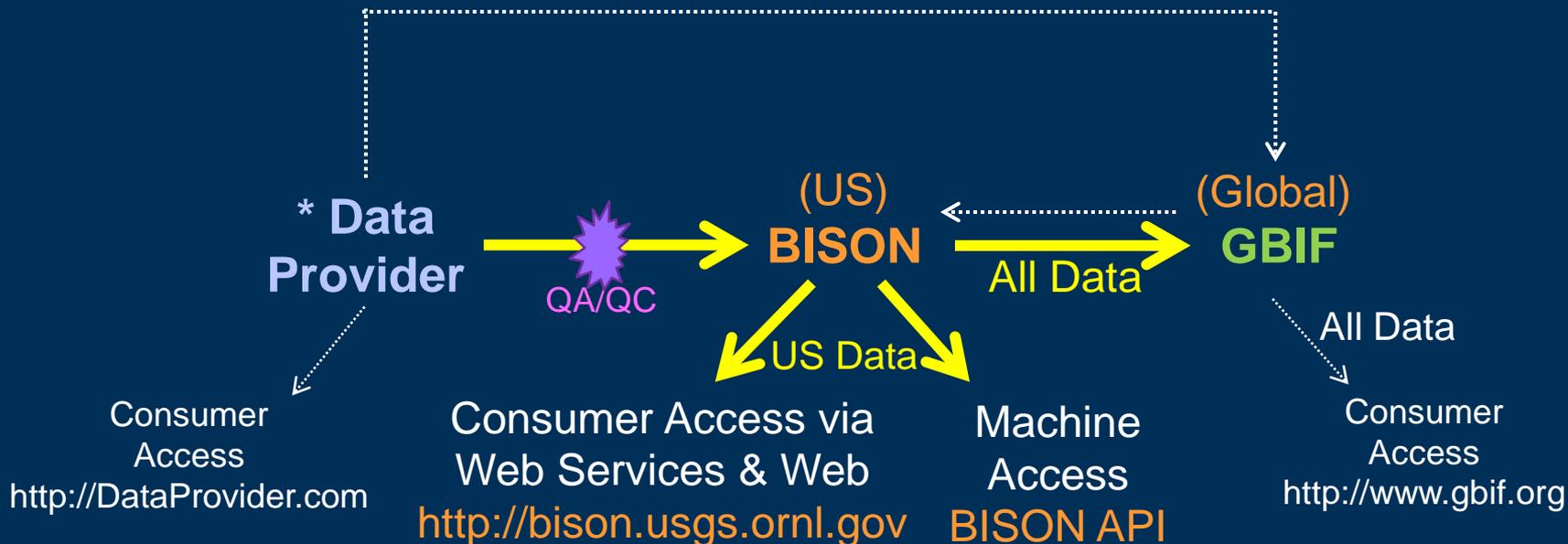
BISON is designated as the gateway for digitized Federal collections data

## Thematic data:

- non-native species data
- native bee species data



# Basic BISON Data Workflow



\* Data Provider = USGS Science Center, Individual Scientist/Researcher, Institution, Aggregator, Data Network, etc.

# BISON Data Workflow Products

- **Final Package** – original dataset + BISON (enhanced) dataset + metadata record (linked and archived) + ReadMe file (record of BISON data modifications)
- **Standardized data** – Darwin Core format, Scientific Name mapping to ITIS, FIPS Code location references
- **Data updates** – ongoing for *living* datasets
- **Data Quality** – improvement reports/recommendations sent to Data Provider
- **Web and Web Services access** – inc. mapping and visualization, and integration with other data layers
- **Multi-format data download** – .csv, .kml, .zip
- **Machine access** – via API

# BISON Hardware

- Hosted by/on the Dept. of Energy  
– USGS – NASA Computer Cluster
- Sharing space with Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC) infrastructure (High Performance Storage System, TITAN supercomputing facilities, and TeraGrid\* are available for use by BISON)
- **Re-using existing infrastructure** that also hosts the USGS Core Science Metadata Clearinghouse, DataOne and other projects



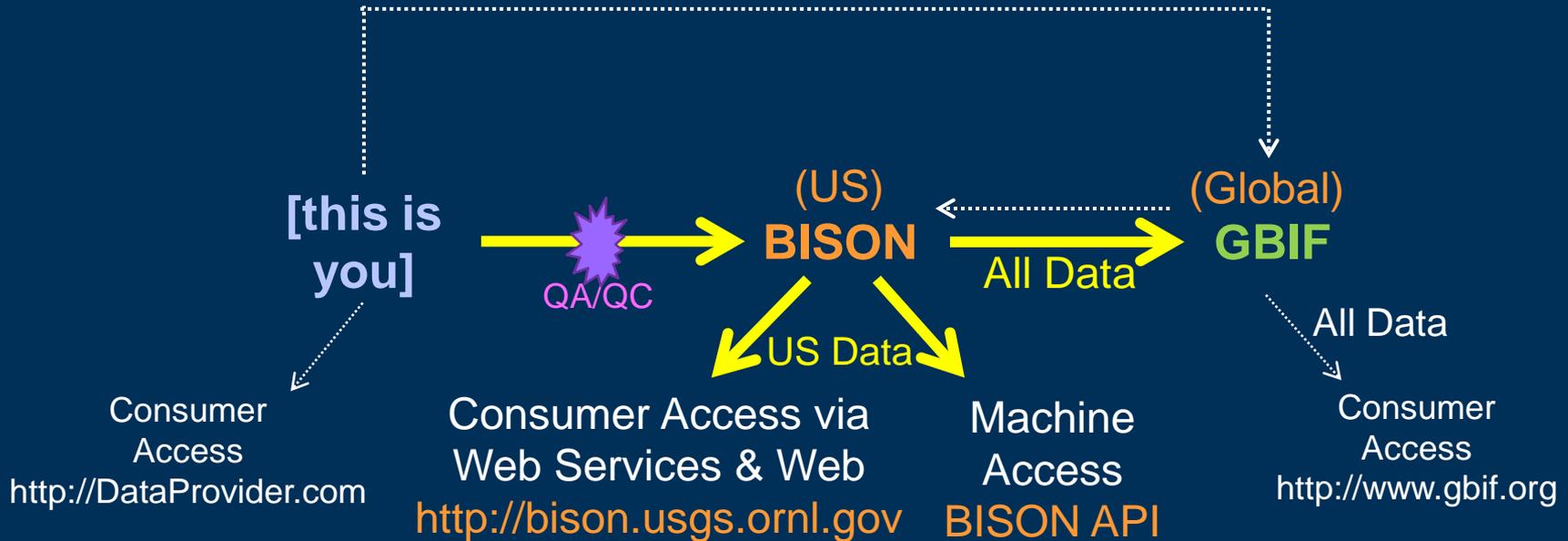
\* TeraGrid – now replaced by the NSF’s XSEDE - Extreme Science and Engineering Discovery Environment project

# BISON & BMSB-NEIPM

*How can BISON help members of the BMSB-NEIPM working group?*

1. “Submit-a-dataset”
2. Search for host species occurrences
3. Post BISON API search results on your Web pages
4. Use BISON data or visualizations in your publications

# 1. Submit a dataset to BISON



# Data Fields

- Darwin Core standard fields desirable
- Minimum fields necessary for new datasets to be successfully added into BISON

	Field
Who -	provider - resource
What -	scientific_name
Where -	decimal_latitude / decimal_longitude (or a place name e.g. state, county...)
When -	occurrence_date

**!! Additional data fields are welcome/encouraged !!**

e.g. [record-level] id, iso\_country\_code, taxon\_id (e.g. ITIS TSN), common\_name, collector, catalog\_number, geodetic\_datum, reproductive data, etc.

# 2. Search for host species occurrences



*Prunus persica*  
common cherry



*Ailanthus altissima*  
tree of heaven



*Ulmus procera*  
English elm



*Morus alba*  
White mulberry

# 3. BISON API search results on your Web pages



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## Biodiversity Information Serving Our Nation (BISON)

### Developer Tools

Several demos have been created that use the BISON API to enable developers and scientists to create unique custom applications.

[OpenLayers Brook Trout occurrences in Mount Desert Island \(Acadia National Park\)](#)

[OpenLayers Blue Jay heat map](#)

[HTML 5 Hawk](#)

[HTML 5 Alpine Sweet Grass on Alaska's North Slope using Plate Carree Projection](#)

The application supports both Spherical Mercator and Plate Carree projections. The particular version of Plate Carree that the application supports is EPSG:4326 (latitude, longitude). EPSG:4326 has different axis ordering (the specification of longitude, latitude or latitude, longitude) depending upon what version of WMS you are using. Before WMS version 1.3 the axis ordering was longitude, latitude. The [EPSG Geodetic Parameter Registry](#) defines EPSG:4326 as latitude, longitude. The [Open Geospatial Consortium](#) defines EPSG:4326 as longitude, latitude. **BISON supports WMS 1.1.1 and the axis ordering of longitude, latitude.**

#### Brook Trout Occurrences in Mount Desert Island

Using [OpenLayers](#) and the BISON search API, occurrence records are retrieved for Brook Trout on Mount Desert Island, [Acadia National Park](#) in Maine. The [USGS National Map](#) is called for base layer information. The circles are Brook Trout occurrences.

The code creates a polygon that surrounds Mount Desert Island. It is important to realize that BISON uses a Spherical Mercator projection and that is why we convert from EPSG:4326 to EPSG:3857 for the bounding rectangle. EPSG codes are standardized numbers that [OpenLayers](#) uses to define projections and transformations precisely.

[View Source](#)

[View Demo](#)

<http://bisonapi.usgs.gov/index.html>

# BISON Web Services



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## Biodiversity Information Serving Our Nation (BISON)

### BISON Web Services

BISON supports several data interchange formats to enable developers to write custom applications. The BISON search API supports [JavaScript Object Notation \(JSON\)](#). The SOLR search API supports [JSONP](#). The Web Mapping Services support [Portable Network Graphics \(PNG\)](#). Example applications have been written using OpenLayers, and HTML 5 and we are working on mobile applications that will be available shortly.

#### BISON web services:

- [BISON Search](#)
- [Web Map Service \(WMS\)](#)
- [Apache Solr Interface](#)
- [Data Use Requirements](#)

<http://bison.usgs.ornl.gov/services.html>

#### BISON Search:

BISON can be searched using an OpenSearch API. Here's an example of how to pass a search term to the BISON Service

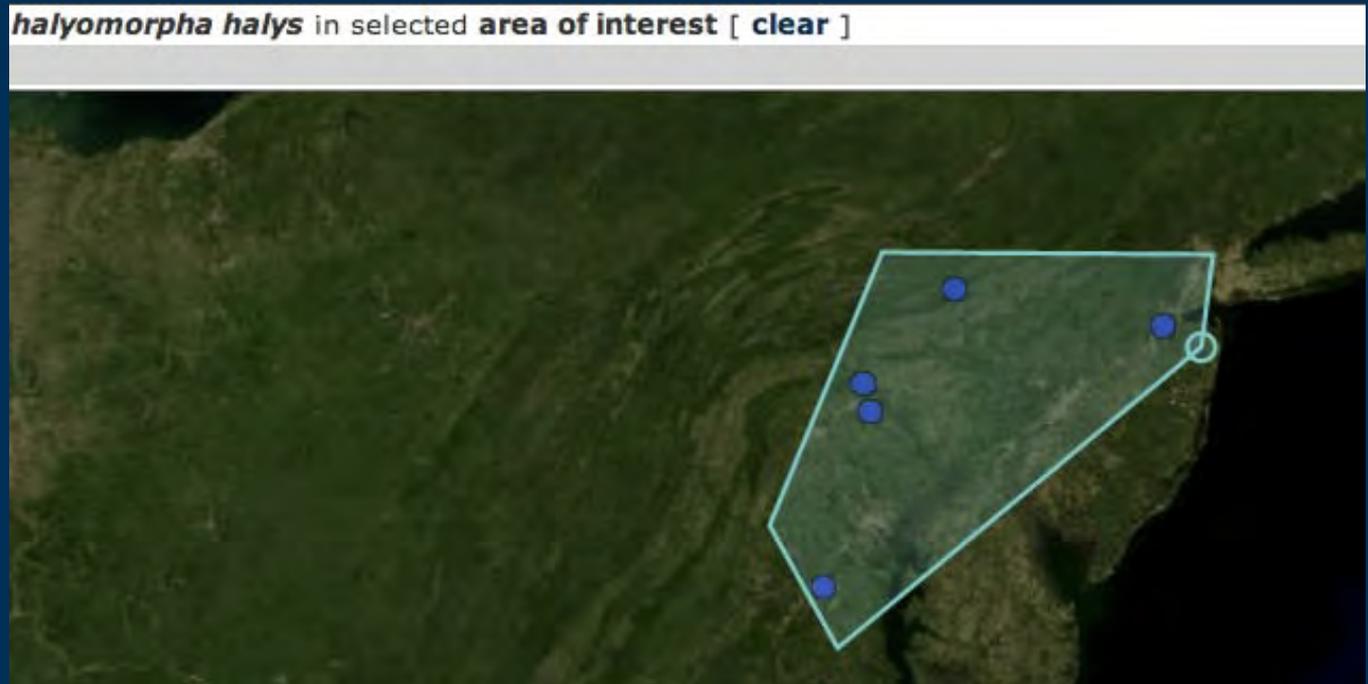
```
http://bison.usgs.ornl.gov/api/search?
```

```
species=Bison bison  
&type=scientific_name  
&start=0&count=1
```

The response will be formatted as JSON (JavaScript Object Notation). The response will include the number of occurrences in each county and state in the United States. It will also return a legend and the exact location of the first BISON occurrence in Solr.

## 4. BISON data in your publications

- GIS & data visualization component (Web portal)
- Refine search by provider and/or specific polygon



# BISON Components

- **GIS & data visualization component (Web portal)**
- **Services component**
  - Access to web services, widgets, templates for partners
- **Citizen science component**
  - Engage the public
- **Social science component**
  - Understand BISON use & track relevance

# Future Attractions

- **ITIS integration**
  - Add Integrated Taxonomic Information System (ITIS) indexing for improved search (e.g. group search for all records in the Genus *Halyomorpha*)
- **Add non-native status tags to species**
  - Annotated lists of native and nonnative species for the U.S. 48 contiguous states, Hawaii, and Alaska
- **Species lists by protected area (e.g. Refuge)**
- **Link to images of specimens and other media**

# Query/Search & Filtering Capabilities



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species name (common / scientific)

Search

Reset

by scientific name  by common name

Found **93,845** matches for *Calidris alpina*

92,592 georeferenced

[Refine Your Search](#) [Map](#) [List](#)



LEGEND

### Basis of Record

- observation (91648)
- specimen (1926)
- unknown (271)

[ [Check All](#) | [Uncheck All](#) ]

### Provider

- American Museum of Natural History (4)
  - Birds (4)
- Avian Knowledge Network (91507)
  - eBird (88326)
  - Great Backyard Bird Count (1034)

[ [Check All](#) | [Uncheck All](#) ]

### State

- Alabama (607)
- Alaska (2576)
- Arizona (290)
- Arkansas (371)
- California (13711)
- Colorado (104)
- Connecticut (1613)
- Delaware (2198)
- District of Columbia (7)

[ [Check All](#) | [Uncheck All](#) ]

[Hide Search Details](#)

[Update Search Results](#)

1000 km  
500 mi



-50.50030, 65.64549

Search time: 3.527 seconds

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# Data Retrieval and Download

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species name (common / scientific)

Search

Reset

by scientific name  by common name

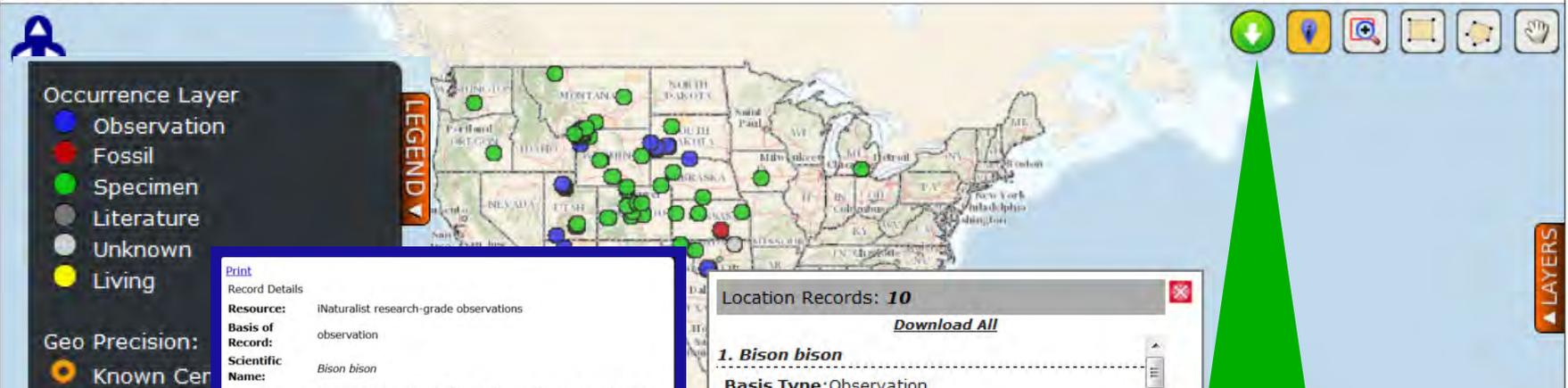
Found **781** matches for *Bison bison*

366 georeferenced

Refine Your Search

Map

List



- Occurrence Layer
- Observation
  - Fossil
  - Specimen
  - Literature
  - Unknown
  - Living
- Geo Precision:
- Known Center

[Print](#)

Record Details

**Resource:** iNaturalist research-grade observations

**Basis of Record:** observation

**Scientific Name:** *Bison bison*

**Common Names:** American bison, Amerika bizonu, Amerika bizonu, Amerikaanse bizon, Amerikako bison, Amerikanesche Bison, Amerikanische Bison, Amerikanischer Bison, Amerikansk bison, Amerikas bizons, Awya Yala Bisuntl, Biloni, Bison Amerika, Bison d'Amérique du Nord, Bisonoxe, Bisont american, Bisonte american, Bisonte americano, Bisonur, Bisao americano, Bizon, Bizon Amerika, Bizonas, Hotoa'e, Valzcxw metjcouh, bison

**State:** Oklahoma

**County:** Comanche

**Country\_code:** US

**Provider:** iNaturalist.org

**Provider URL:** <http://www.inaturalist.org>

**Collector:** Greg Lasley

**Latitude:** 34.7365

**Longitude:** -98.704

**Precision:** N/A

**Year:** 2007

**Occurrence Date:** 2007-04-09

For more information, or to make comments on this occurrence, please contact the provider.

Location Records: **10**

[Download All](#)

1. *Bison bison*

**Basis Type:** Observation

**Occurrence Date:** 2007-04-09

**Provider:** iNaturalist.org

**Resource:** iNaturalist research-grade observations

[Show Details](#) | [Download](#)

2. *Bison bison*

**Basis Type:** Observation

**Downloading Options**

781 *Bison bison* occurrences

**File Type:**

- Comma Separated Values (.CSV file)
- Google Earth KML file (.KML file)
- Zipped Shapefile bundle (.ZIP file)

OK Cancel

# Data Layers

**USGS**  
science for a changing world

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**Biodiversity Information Serving Our Nation (BISON)**

Home Search About Data Providers Help

species name (common / scientific) Search Reset

by scientific name by common name

Found 220 matches for *Acer spicatum* of type specimen  
143 georeferenced

Refine Your Search Map List

Climate and Weather

- Annual Mean Daily Average Temperature
- Annual Mean Daily Average Temperature - Hawaii
- January Annual Mean Daily Average Temperature
- July Annual Mean Daily Average Temperature

A < 40.1  
B 40.1 - 45.0  
C 45.1 - 50.0  
D 50.1 - 55.0  
E 55.1 - 60.0  
F 60.1 - 65.0  
G 65.1 - 70.0  
H 70.1 - 75.0  
I > 75.0

500 km  
200 mi

Search time: 3.53 seconds

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USA.gov TAKE PRIDE IN AMERICA

**LAYERS**

- Basemap Layers
- BISON Layers
- Climate and Weather
- Agriculture & Soils
- Ecosystems and Regions
- National Atlas & Demographic
- HUCs, Catchments, Land cover
- Protected Areas
- Other

Combine specimen and observation data with other data layers to detect relationships and patterns.

# Data Provider Statistics



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## Biodiversity Information Serving Our Nation (BISON)

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	Today		This Week		This Month		This Year	
	Searches	DLs	Searches	DLs	Searches	DLs	Searches	DLs
<b>Australian Museum</b>								
Australian Museum provider for OZCAM	11	0	64	0	234	5	236	16
<b>Australian National Herbarium (CANB)</b>								
Australian National Herbarium (CANB)	11	0	60	0	266	9	274	32
<b>Australian National Insect Collection, CSIRO Entomology</b>								
Australian National Insect Collection	10	0	46	0	205	4	207	10
<b>Avian Knowledge Network</b>								
eBird	10	0	84	0	301	11	313	26
Great Backyard Bird Count	10	0	79	0	285	7	289	25
Hawk Migration Association of North America - HawkCount	10	0	62	0	219	4	220	14
Macaulay Library - Audio Data	12	1	76	4	273	13	282	30
Macaulay Library - Video Data	10	0	49	0	210	4	212	11
Point Reyes Bird Observatory - Point Counts	10	0	52	0	220	4	221	11
Project FeederWatch	10	0	83	0	281	6	284	24
U.S.D.A. Forest Service, Redwood Sciences Laboratory - Lamna Point Count	10	0	56	0	213	4	214	11
<b>BeBIF Provider</b>								
BCCM/MUCL - (Agro)Industrial Fungal and Yeasts Collection	10	0	27	0	185	4	185	0

Last Generated: Tue Jul 16 12:30:51 2013

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# Help and FAQs



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BISON has a collection of [developer tools](#) and [Web Services](#) which can be used to create custom applications and widgets. Below are questions we frequently receive from people interested in BISON. Clicking on the question will expand it to view the answer. Clicking again on the question will collapse the view. If you still have questions about BISON or would like to provide comments, feedback, or report an error, please contact us at [BISON@USGS.gov](mailto:BISON@USGS.gov).

- 1 [What information does BISON offer?](#)
- 2 [What are the sources of BISON's data?](#)
- 3 [What is BISON's scope of coverage? Are there geographical limits to the range of BISON data?](#)
- 4 [What is "species occurrence data" and why is it important?](#)
- 5 [What is the authoritative source for the species scientific names used in searching BISON data?](#)
- 6 [Who sponsors or produces BISON?](#)
- 7 [What browsers are best for viewing and using the BISON site?](#)
- 8 [What are the best display screen resolutions or browser settings for viewing the BISON site?](#)
- 9 [Do I need to adopt any special technology in order to make best use of BISON?](#)
- 10 [How can I get started using and navigating through BISON?](#)
- 11 [What is the BISON Search actually searching?](#)
- 12 [How do I use the features and control buttons on the BISON Search page? What are they for and what do they do?](#)
- 13 [How do I download data from BISON?](#)
- 14 [What data fields are provided in BISON species records?](#)
- 15 [Can I access the data using Web Services?](#)
- 16 [Why is my map layer not working?](#)
- 17 [How do I cite BISON and BISON data as a source in an article or scientific paper?](#)
- 18 [If I have further questions about BISON, is there anyone I can contact with my questions?](#)

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# Biodiversity Information Serving Our Nation (BISON):

<http://bison.usgs.ornl.gov>

For questions, additional information:

[bison@usgs.gov](mailto:bison@usgs.gov)

BISON Team (...@usgs.gov)

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