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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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

**QA/QC**

(US)

BISON

(US Data)

US Data

Consumer Access via Web Services & Web

http://bison.usgs.ornl.gov

Consumer Access via Web Services & Web

http://DataProvider.com

Machine Access

BISON API

All Data

GBIF

All Data

Consumer Access

http://www.gbif.org

* 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


- 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

- Consumer Access via Web Services & Web

- Machine Access
  - BISON API

- QA/QC

- (US) BISON
  - US Data

- (Global) GBIF
  - All Data

- Consumer Access
  - http://DataProvider.com
  - http://www.gbif.org

[this is you]
Data Fields

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

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who -</td>
<td>provider - resource</td>
</tr>
<tr>
<td>What -</td>
<td>scientific_name</td>
</tr>
<tr>
<td>Where -</td>
<td>decimal_latitude / decimal_longitude (or a place name e.g. state, county…)</td>
</tr>
<tr>
<td>When -</td>
<td>occurrence_date</td>
</tr>
</tbody>
</table>

!! 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

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 the Geodetic Mercator and Plate Carree projections. The particular version of Plate Carree that the application supports is EPSG:4326 as “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. After WMS version 1.3 EPSG:3857 is used as the axis ordering of latitude, longitude. 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. 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.

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 JSON. 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

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

![Halyomorpha halys in selected area of interest](image-url)
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

Biodiversity Information Serving Our Nation (BISON)

species name (common / scientific) [Search] [Reset]

by scientific name [by common name]

Found 93,845 matches for Calidris alpina
92,592 georeferenced

Basis of Record
- observation (91648)
- specimen (1926)
- unknown (271)

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

State
- Alabama (507)
- Alaska (2576)
- Arizona (290)
- Arkansas (371)
- California (13711)
- Colorado (104)
- Connecticut (1613)
- Delaware (2198)
- District of Columbia (2)

Search time: 3.527 seconds

Accessibility  FOIA  Privacy  Policies and Notices

URL: http://bison.usgs.ornl.gov/
Page Contact Information: Ask USGS
Page Last Modified: Wednesday, July 3, 2013
Data Retrieval and Download

Biodiversity Information Serving Our Nation (BISON)

Search for species name (common / scientific)

Found 781 matches for Bison bison
366 georeferenced

Download Options
781 Bison bison occurrences

File Type:
- Comma Separated Values (.CSV file)
- Google Earth KML file (.KML file)
- Zipped Shapefile bundle (.ZIP file)
Data Layers

Combine specimen and observation data with other data layers to detect relationships and patterns.
# Data Provider Statistics

## Biodiversity Information Serving Our Nation (BISON)

<table>
<thead>
<tr>
<th>Provider</th>
<th>Today Searches</th>
<th>This Week Searches</th>
<th>This Month Searches</th>
<th>This Year Searches</th>
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<tr>
<td>eBird</td>
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<td>Great Backyard Bird Count</td>
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<tr>
<td>BCCM/MIHEF - (Aero)Incremental Fungal and Yeasts Collection</td>
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</tbody>
</table>

Last Generated: Tue Jul 16 12:30:51 2013
Help and FAQs

Biodiversity Information Serving Our Nation (BISON)

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.

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?
Biodiversity Information Serving Our Nation (BISON):

http://bison.usgs.ornl.gov

For questions, additional information:
bison@usgs.gov

BISON Team (...@usgs.gov)

- Gerald (Stinger) Guala [Director] - gguala
- Derek Masaki - dmasaki
- Elizabeth Martin – elizabeth_martin
- Elizabeth Sellers – esellers
- Annie Simpson - asimson