VAT - interactive data exploration for geoscience

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Data-Driven Research

- Enabled by data availability
  - satellites, sensors and observations...
- Visualization often triggers new scientific ideas
Explorative Workflows

- Users explore data and various kinds of processing steps
  - Multiple paths are followed → separate workflows
- Requirements:
  - Low latency visualizations
    - Data abstraction and generalization
  - Citations + reproducibility
Visualization, Analysis & Transformation System

VAT
Adding (User) Data
Adding User Data
Adding User Data

- Item 1
  - Text
- Item 2
  - Text
Vector Layers
## Vector Layers – Data Table

### Data Table

<table>
<thead>
<tr>
<th>basisofrecord</th>
<th>gbifid</th>
<th>scientificname</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRESERVED_SPECIMEN</td>
<td>1.14511e+09</td>
<td><em>Loxodonta cyclota</em> (Matschie, 1900)</td>
</tr>
<tr>
<td>HUMAN_OBSERVATION</td>
<td>9.42872e+08 ± 1.36934e+08</td>
<td><em>Loxodonta cyclota</em> (Matschie, 1900)</td>
</tr>
<tr>
<td>HUMAN_OBSERVATION</td>
<td>1.2721e+09</td>
<td><em>Loxodonta cyclota</em> (Matschie, 1900)</td>
</tr>
<tr>
<td>HUMAN_OBSERVATION</td>
<td>1.25943e+09 ± 3.16561e+07</td>
<td><em>Loxodonta cyclota</em> (Matschie, 1900)</td>
</tr>
<tr>
<td>HUMAN_OBSERVATION</td>
<td>1.16102e+09 ± 1.01931e+08</td>
<td><em>Loxodonta cyclota</em> (Matschie, 1900)</td>
</tr>
<tr>
<td>HUMAN_OBSERVATION</td>
<td>1.33888e+09</td>
<td><em>Loxodonta cyclota</em> (Matschie, 1900)</td>
</tr>
<tr>
<td>HUMAN_OBSERVATION</td>
<td>1.08983e+09</td>
<td><em>Loxodonta cyclota</em> (Matschie, 1900)</td>
</tr>
</tbody>
</table>
## Vector Layers – Data Table

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<td>HUMAN_OBSERVATION</td>
<td>1.2721e+09</td>
<td>Loxodonta cyclotis (Matschie, 1900)</td>
</tr>
<tr>
<td>HUMAN_OBSERVATION</td>
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<td>Loxodonta cyclotis (Matschie, 1900)</td>
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<td>HUMAN_OBSERVATION</td>
<td>1.33888e+09</td>
<td>Loxodonta cyclotis (Matschie, 1900)</td>
</tr>
<tr>
<td>HUMAN_OBSERVATION</td>
<td>1.09691e+09</td>
<td>Loxodonta cyclotis (Matschie, 1900)</td>
</tr>
<tr>
<td>FOSSILSPECIMEN</td>
<td>7.7089e+08 + 3.28386e+08</td>
<td>Loxodonta cyclotis (Matschie, 1900)</td>
</tr>
<tr>
<td>HUMAN_OBSERVATION</td>
<td>1.08633e+09 + 1.72264e+08</td>
<td>Loxodonta cyclotis (Matschie, 1900)</td>
</tr>
</tbody>
</table>
Adding (Occurrence) Data
Adding Occurrence Data

Helmholtz Open Science Webinars on Research Data
Webinar 40 – 21 / 26 April 2017
Adding Occurrence Data

Helmholtz Open Science Webinars on Research Data
Webinar 40 – 21 / 26 April 2017
Occurrence Data – Errors?
Occurrence Data – Ranges

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Occurrence Data – Ranges

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Occurrence Data - Refinement

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Operator Toolbox

- **Raster Value Extraction**: Attach raster values to vector data
- **R Script**: Execute an R script (experimental)
- **Histogram**: Create a histogram from vector or raster data
- **Expression**: Calculate an expression on a raster
- **Numeric Attribute Filter**: Filter data via numeric range
- **Point in Polygon Filter**: Filter points that are enclosed by a polygon
Operators – Data Refinement

Map showing a point in polygon filter with data points and polygons.
Operator Results
Lineage
Lineage - Citations

Citation: New Mexico Museum of Natural History and Science
License: http://www.gbif.org/dataset/4e50e53a6-8d31-44bc-ad3d-de5311ad9543

Citation: Western Australian Museum: Western Australian Museum provider for OZCAM
License: http://www.gbif.org/dataset/7c93d920-6c8b-11de-8226-b4a30c30a662

Citation: Biodiversity Research and Teaching Collections, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX, USA.
License: http://www.gbif.org/dataset/bd715b56-6f96-43a3-8845-24f1895ae8f7

License: http://spatial-data.s3.amazonaws.com/groups/RedList%20Terms%20&%20Conditions%20of%20use.pdf
License: http://www.iucnredlist.org/

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Lineage - Workflows

Lineage for LA (IUCN\GBIF)

- GFBio Source
  - dataS... GBIF
  - scient... Loxodonta afric...
  - column... basisofrecord, ...

- Point in Polygon Filter

- Loxodonta africana (IUCN)

- LA (IUCN\GBIF)
Raster Layers
Raster Layer - Symbology
Vector / Raster Combination
Vector / Raster Combination
Vector / Raster Combination
Plots - Histogram
Plots - Histogram

Histogram of LA+TRE

Histogram of FE+TRE
Plots – R Integration

An example is `mapping.loadPoints(0, mapping.qrect)` for accessing the first raster.

```r
1. la <- mapping.loadPoints(0, mapping.qrect)
2. l <- la("TRE")
3. hist(l, breaks=(0,100,by=5))
```
Projects
**Overall Goal:** Sustainable, service oriented, national data infrastructure facilitating data sharing for biological and environmental research.

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[DFG](https://www.dfg.de) Deutsche Forschungsgemeinschaft

[www.gfbio.org](http://www.gfbio.org)

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GFBio - Search

Research Data Management
Step by step through the Data Life Cycle.

GET MORE INFORMATION

Submit
Search
Manage
Workbenches

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GFBio – Search Baskets

A detailed 'How-To-Search' guide is available [here](#).

**Search:** Whale sightings

**Data Center:** PANGAEA: Data Publisher for Earth & Environmental Science

**Summary:** From 13 March to 09 April 2012 Germany conducted a fisheries survey on board RV Polarstern in the Scotia Sea (Elephant Island - South Shetland Island - Joinville Island area under...) (5)

**Parameters:** DATE/TIME; LATITUDE; LONGITUDE; Whale species; Certainty of Identification; Individuals

**License/Rights:** CC-BY: Creative Commons Attribution 3.0 Unported

**Filter Results:** search filters

**Publication Year(s):** 2000 - 2014

**Geographical Region:** Atlantic Ocean (22)

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Visualization, Analysis & Transformation System
GFBio – Search Baskets

Whale sightings during POLARSTERN cruise ANT-XXVII/4
Authors: Burkhardt, Elke
Data center: PANGAEA: Data Publisher for Earth & Environmental Science
Metadata: Dataset landing page
Add dataset as layer

Whale sightings during POLARSTERN cruise ANT-XXVII/2
Authors: Burkhardt, Elke
Data center: PANGAEA: Data Publisher for Earth & Environmental Science
Metadata: Dataset landing page
Add dataset as layer

Whale sightings during POLARSTERN cruise ANT-XXII/3
Authors: Burkhardt, Elke
Data center: PANGAEA: Data Publisher for Earth & Environmental Science
Metadata: Dataset landing page
Add dataset as layer

Whale sightings during POLARSTERN cruise ANT-XXII/10
Authors: Burkhardt, Elke
Data center: PANGAEA: Data Publisher for Earth & Environmental Science
Metadata: Dataset landing page
Add dataset as layer
GFBio – Search Baskets

A detailed 'How-To-Search' guide is available here.

Digitization of plant specimens
Show 10 entries per page

Digitization of plant specimens from Rhoen and Vogelsberg (FLAD)
Data Center: Data Center SGN
Summary: The digitization from the possessions of the herbarium of the Rhönmuseum Fladungen comprises metadata from specimen labels, georeferencing of localities and a digital image of the...
License/Rights: Licence: CC-BY-SA 3.0

Digitization of plant specimens from Rhoen and Vogelsberg (FULD)
Data Center: Data Center SGN
Summary: The digitization from the possessions of the Verein für Naturschutz in Osthessen (FULD) comprises metadata from specimen labels, georeferencing of localities and a...
License/Rights: Licence: CC-BY-SA 3.0

Digitization of plant specimens from Rhoen and Vogelsberg (FR)
Data Center: Data Center SGN
Summary: The digitization from the possessions of the Herbarium Senckenbergianum Frankfurt (FR) comprises metadata from specimen labels, georeferencing of localities and a digital image of...
License/Rights: Licence: CC-BY-SA 3.0

Digitization of plant specimens from Rhoen and Vogelsberg (SMW)
Data Center: Data Center SGN
Summary: A preserved specimen record of the "Digitization of plant specimens from Rhoen and Vogelsberg (FULD)" dataset (ID: 6738)
License/Rights: Licence: CC-BY-SA 3.0
GFBio – Search Baskets

Digitization of plant specimens from Rhoen and Vogelsberg (FULD)

Authors: Data Center: Data Center SGN
Metadata: Dataset landing page

Units from multiple search results based on this dataset

<table>
<thead>
<tr>
<th>Unit</th>
<th>Type</th>
<th>Unit id</th>
</tr>
</thead>
</table>
| Rosa tomentosa Sm. | preserved specimen | 6710    

GFBio Search Baskets

Basket: 2017-04-17 18:49:03.835 - Digitize
<table>
<thead>
<tr>
<th>Identification/ScientificName</th>
<th>MultiMediaObjects/MultiMediaObject/Creator</th>
<th>MultiMediaObjects/MultiMediaObject/_fileURL</th>
<th>MultiMediaObjects/MultiMediaObject/Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubus sp., Rubus radula Weihe, Rosa tomentosa Sm.</td>
<td>Verein für Naturkunde in Osthessen</td>
<td>4 images, ...</td>
<td>jpg</td>
</tr>
<tr>
<td>Rumex maritimus L., Rumex longifolius DC., Gallium palustre L.</td>
<td>Verein für Naturkunde in Osthessen</td>
<td>3 images</td>
<td>jpg</td>
</tr>
<tr>
<td>Vinca major L.</td>
<td>Verein für Naturkunde in Osthessen</td>
<td>1 image</td>
<td>jpg</td>
</tr>
<tr>
<td>Carex humilis Leyss., Thymus praecox Opiz, Viola collina Besser, Viola mirabilis L., Zannichella palustris L.</td>
<td>Verein für Naturkunde in Osthessen</td>
<td>5 images, ...</td>
<td>jpg</td>
</tr>
<tr>
<td>Ergotostis pilosa (L.) P. Beauv., Lavandula angustifolia Mill.</td>
<td>Verein für Naturkunde in Osthessen</td>
<td>2 images</td>
<td>jpg</td>
</tr>
<tr>
<td>Pilago arvensis L.</td>
<td>Verein für Naturkunde in Osthessen</td>
<td>1 image</td>
<td>jpg</td>
</tr>
</tbody>
</table>
Try it now

vat.gfbio.org

Contact: droenner@mathematik.uni-marburg.de