Catalog Services

ScienceBase provides two different methods of standards-based interface to items.

- Open Geospatial Consortium Catalogue Service for Web (OGC-CSW)
- Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH)

These are both implemented from an item level that takes advantage of the item hierarchy to establish many virtual catalogs within the larger ScienceBase system (see CSW URLs and OAI PMH URLs). The majority of our use cases involve harvesting or running queries for a particular collection of resources within ScienceBase. Both services are implemented RESTfully through the ScienceBase REST API.

OGC-CSW

ScienceBase has a built-in OGC CSW 2.0.2 Service implementation to support basic querying and harvesting. It is not a full implementation of the standard, but supports many use cases.

Use cases and reasons for developing the service

- I can harvest my collection via CSW to another catalog
- I can search ScienceBase via CSW with some basic search terms
- I can retrieve an ISO-19115 representation of my ScienceBase items via CSW
- CSW requests can use ScienceBase security

GetCapabilities

As with other OGC web service standards, you can make a GetCapabilities call for information about what is supported by the service. It returns an XML document containing metadata describing the server. There are two types of requests accepted: key-value pairs (KVP) and XML POST.

Request

Key-Value Pairs

Key-value pairs are provided as parameters on the request URL.

https://www.sciencebase.gov/catalog/csw?service=CSW&version=2.0.2&request=getCapabilities

XML POST

Content-type: application/xml

POST Data

```
<GetCapabilities xmlns="http://www.opengis.net/cat/csw/2.0.2"
xmlns:ows="http://www.opengis.net/ows"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/cat/csw/2.0.2 ../../../csw/2.0.2/CSW-discovery.xsd"
service="CSW">
  <ows:AcceptVersions>
    <ows:Version>2.0.2</ows:Version>
   </ows:AcceptVersions>
  <ows:AcceptFormats>
    <ows:OutputFormat>application/xml</ows:OutputFormat>
  </ows:AcceptFormats>
</GetCapabilities>
```

Response

CSW Response

```
<csw:Capabilities xmlns:csw='http://www.opengis.net/cat/csw/2.0.2' xmlns:gml='http://www.opengis.net/gml' xmlns:
gmd='http://www.isotc211.org/2005/gmd' xmlns:ows='http://www.opengis.net/ows' xmlns:ogc='http://www.opengis.net
/ogc' xmlns:xlink='http://www.w3.org/1999/xlink' xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
version='2.0.2' xsi:schemaLocation='http://www.opengis.net/cat/csw/2.0.2 http://schemas.opengis.net/csw/2.0.2
/CSW-discovery.xsd'>
  <ows:ServiceIdentification>
```

```
    <ows:Title>ScienceBase Catalog OGC CSW 2.0.2 Service</ows:Title>
    <ows:Abstract>EXPERIMENTAL:  The purpose of this implementation is to provide rudimentary CSW access to the
ScienceBase Catalog</ows:Abstract>
    <ows:Keywords>
      <ows:Keyword>keyword</ows:Keyword>
    </ows:Keywords>
    <ows:ServiceType>CSW</ows:ServiceType>
    <ows:ServiceTypeVersion>2.0.2</ows:ServiceTypeVersion>
    <ows:Fees />
    <ows:AccessConstraints />
  </ows:ServiceIdentification>
  <ows:ServiceProvider>
    <ows:ProviderName>ScienceBase Catalog</ows:ProviderName>
    <ows:ProviderSite xlink:href='https://www.sciencebase.gov/catalog' />
    <ows:ServiceContact>
      <ows:IndividualName>admin</ows:IndividualName>
      <ows:PositionName>Administrator</ows:PositionName>
      <ows:ContactInfo>
        <ows:Phone>
          <ows:Voice />
          <ows:Facsimile />
        </ows:Phone>
        <ows:Address>
          <ows:DeliveryPoint>USGS Fort Collins Science Center</ows:DeliveryPoint>
          <ows:DeliveryPoint>2150 Centre Ave., Bldg C</ows:DeliveryPoint>
          <ows:City>Fort Collins, CO</ows:City>
          <ows:AdministrativeArea />
          <ows:PostalCode>80526</ows:PostalCode>
          <ows:Country>us</ows:Country>
          <ows:ElectronicMailAddress>sciencebase@usgs.gov</ows:ElectronicMailAddress>
        </ows:Address>
        <ows:HoursOfService />
        <ows:ContactInstructions />
      </ows:ContactInfo>
      <ows:Role>gov</ows:Role>
    </ows:ServiceContact>
  </ows:ServiceProvider>
  <ows:OperationsMetadata>
    <ows:Operation name='GetCapabilities'>
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href='https://www.sciencebase.gov/catalog/csw' />
        </ows:HTTP>
      </ows:DCP>
      <ows:Parameter name='sections'>
        <ows:Value>ServiceIdentification</ows:Value>
        <ows:Value>ServiceProvider</ows:Value>
        <ows:Value>OperationsMetadata</ows:Value>
        <ows:Value>Filter_Capabilities</ows:Value>
      </ows:Parameter>
    </ows:Operation>
    <ows:Operation name='DescribeRecord'>
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href='https://www.sciencebase.gov/catalog/csw' />
        </ows:HTTP>
      </ows:DCP>
      <ows:Parameter name='typeName'>
        <ows:Value>csw:Record</ows:Value>
      </ows:Parameter>
      <ows:Parameter name='outputFormat'>
        <ows:Value>application/xml</ows:Value>
      </ows:Parameter>
      <ows:Parameter name='schemaLanguage'>
        <ows:Value>http://www.w3.org/TR/xmlschema-1/</ows:Value>
      </ows:Parameter>
      <ows:Parameter name='typeName'>
        <ows:Value>csw:Record</ows:Value>
      </ows:Parameter>
    </ows:Operation>
    <ows:Operation name='GetRecords'>
```

```
    <ows:DCP>
      <ows:HTTP>
        <ows:Get xlink:href='https://www.sciencebase.gov/catalog/csw' />
      </ows:HTTP>
    </ows:DCP>
    <ows:Parameter name='resultType'>
      <ows:Value>results</ows:Value>
    </ows:Parameter>
    <ows:Parameter name='outputFormat'>
      <ows:Value>application/xml</ows:Value>
    </ows:Parameter>
    <ows:Parameter name='outputSchema'>
      <ows:Value>http://www.opengis.net/cat/csw/2.0.2</ows:Value>
      <ows:Value>http://www.isotc211.org/2005/gmd</ows:Value>
    </ows:Parameter>
    <ows:Parameter name='typeNames'>
      <ows:Value>csw:Record</ows:Value>
    </ows:Parameter>
    <ows:Parameter name='ElementSetName'>
      <ows:Value>brief</ows:Value>
      <ows:Value>summary</ows:Value>
      <ows:Value>full</ows:Value>
    </ows:Parameter>
    <ows:Parameter name='CONSTRAINTLANGUAGE'>
      <ows:Value>Filter</ows:Value>
    </ows:Parameter>
    <ows:Constraint name='SupportedCommonQueryables'>
      <ows:Value>AnyText</ows:Value>
      <ows:Value>Title</ows:Value>
      <ows:Value>Abstract</ows:Value>
      <ows:Value>Subject</ows:Value>
    </ows:Constraint>
    <ows:Constraint name='AdditionalQueryables'>
      <ows:Value>sb:collection</ows:Value>
      <ows:Value>sb:servicetype</ows:Value>
    </ows:Constraint>
  </ows:Operation>
  <ows:Operation name='GetRecordById'>
    <ows:DCP>
      <ows:HTTP>
        <ows:Get xlink:href='https://www.sciencebase.gov/catalog/csw' />
      </ows:HTTP>
    </ows:DCP>
    <ows:Parameter name='resultType'>
      <ows:Value>results</ows:Value>
    </ows:Parameter>
    <ows:Parameter name='outputFormat'>
      <ows:Value>application/xml</ows:Value>
    </ows:Parameter>
    <ows:Parameter name='outputSchema'>
      <ows:Value>http://www.opengis.net/cat/csw/2.0.2</ows:Value>
      <ows:Value>http://www.isotc211.org/2005/gmd</ows:Value>
    </ows:Parameter>
    <ows:Parameter name='typeNames'>
      <ows:Value>csw:Record</ows:Value>
    </ows:Parameter>
    <ows:Parameter name='ElementSetName'>
      <ows:Value>brief</ows:Value>
      <ows:Value>summary</ows:Value>
      <ows:Value>full</ows:Value>
    </ows:Parameter>
  </ows:Operation>
</ows:OperationsMetadata>
<ogc:Filter_Capabilities>
  <ogc:Spatial_Capabilities>
    <ogc:GeometryOperands>
      <ogc:GeometryOperand>gml:Point</ogc:GeometryOperand>
    </ogc:GeometryOperands>
    <ogc:SpatialOperators>
      <ogc:SpatialOperator name='BBOX' />
    </ogc:SpatialOperators>
```

```
    </ogc:Spatial_Capabilities>
    <ogc:Scalar_Capabilities>
      <ogc:ComparisonOperators>
        <ogc:ComparisonOperator>Like</ogc:ComparisonOperator>
      </ogc:ComparisonOperators>
    </ogc:Scalar_Capabilities>
    <ogc:Id_Capabilities>
      <ogc:EID />
    </ogc:Id_Capabilities>
  </ogc:Filter_Capabilities>
</csw:Capabilities>
```

DescribeRecord

Request

Key-Value Pairs

https://www.sciencebase.gov/catalog/csw?service=CSW&version=2.0.2&request=describeRecord

XML POST

Content-type: application/xml

POST Data

```
<DescribeRecord
xmlns="http://www.opengis.net/cat/csw/2.0.2"
xmlns:ows="http://www.opengis.net/ows"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/cat/csw/2.0.2 ../../../csw/2.0.2/CSW-discovery.xsd"
service="CSW"
version="2.0.2"
outputFormat="application/xml"
schemaLanguage="http://www.w3.org/2001/XMLSchema">
  <TypeName>csw:Record</TypeName>
</DescribeRecord>
```

Response

CSW Response

```
<DescribeRecord xmlns='http://www.opengis.net/cat/csw/2.0.2' xmlns:csw='http://www.opengis.net/cat/csw/2.0.2'
xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance' service='CSW' version='2.0.2' outputFormat='application
/xml' schemaLanguage='http://www.w3.org/2001/XMLSchema' xsi:schemaLocation='http://www.opengis.net/cat/csw/2.
0.2 http://schemas.opengis.net/csw/2.0.2/CSW-discovery.xsd'>
  <TypeName>csw:Record</TypeName>
</DescribeRecord>
```

GetRecords

A constraint must be specified for the ScienceBase CSW service to return any records. However, *CONSTRAINTLANGUAGE and Constraint* are optional if *sb:collection* is implicitly specified using the item ID URL method (see *sb:collection*).

Supported Parameters

resultType

The specification allows for the values *hits, results,* and *validate.* Currently, only *results* is supported.

outputFormat

The supported outputFormat is *application/xml*

outputSchema

The ScienceBase CSW service supports two output schemas:

- http://www.isotc211.org/2005/gmd will return ISO-19115 metadata formatted records in the search results section of the response. If a ScienceBase item has an original ISO metadata file attached to it, the contents of that file will be returned for that item. If it does not have an original ISO metadata file attached to it, the sbJSON of the item will be run through an ISO-19115 transform and that will be returned for that item.
- http://www.opengis.net/cat/csw/2.0.2 will return the sbJSON of each item transformed into the csw:Record format. This is the default.

startPosition

Tells the service which record from the search results to start on. The default is *1.*

maxRecords

Tells the service how many records to return. The maximum value allowed is 10,000.

SortBy

Accepts *field:[A|D].* If *A* is specified, results are sorted in ascending order, and if *D* is specified, results are sorted in descending order. *Field* is the sbJSON field on which to sort the results. Currently only a single sort field is accepted.

typeNames

The only accepted value currently is *csw:Record.*

ElementSetName

Note that when requesting ISO-19115 data, the value of this parameter is ignored.

- *summary* (Default) returns the summary form of the record.
- *brief* returns the brief form of the record.
- *full* returns the full form of the record.

CONSTRAINTLANGUAGE

- *CQL_TEXT* specifies that the constraint is to be interpreted as CQL text.
- *FILTER* Specifies that the constraint is to be interpreted as ogc:Filter XML.

Constraint

The CQL implementation is very limited. Queries can be specified as *field=value (AND field=value...).* Only *equals* and *AND* are currently supported (the parser splits on all upper-case *AND*s). Because of the rudimentary CQL parser in the ScienceBase CSW service, it is recommended only for very simple queries.

ogc:Filter implementation is also limited. Only *AND*ing of queryables is currently supported. *PropertyIsLike*, *PropertyIsEqualTo*, and *BBOX* are currently supported. All three can be used in the same query.

Both CQL and ogc:Filter queries are transformed into a ScienceBase native search, which uses elasticsearch. As such, results using *equals* can return results that are not an exact match.

Supported Common Queryables

AnyText

The *AnyText* queryable searches the full indexed content of the sbJSON. It is equivalent to a *q=<search terms>* search in the ScienceBase REST API.

Title

The *Title* queryable searches the sbJSON title *field*. It is equivalent to a *lq=title:<search terms>* search in the ScienceBase REST API.

Abstract

The *Abstract* queryable searches the sbJSON *body* field. It is equivalent to a *lq=body:<search terms>* search in the ScienceBase REST API.

Subject

The *Subject* queryable searches tag names in the sbJSON. it is equivalent to a *filter=tags=<search terms>* search in the ScienceBase REST API.

Additional Queryables

sb:collection

The *sb:collection* queryable can be used to retrieve all records from a ScienceBase collection. It is equivalent to a *ancestors=<ancestor ID>* search in the ScienceBase REST API.

An alternative way to specify the *sb:collection* ID, is by specifying the collection item's URL, and appending the *csw* designation. For example, the following URL will return all records in ScienceBase harvested from the USGS Publications Warehouse:

https://www.sciencebase.gov/catalog/item/4f4e4771e4b07f02db47e1e4/csw?service=CSW&version=2.0.2&request=getRecords

This is equivalent to

https://www.sciencebase.gov/catalog/csw?service=CSW&version=2.0.2&request=getRecords&constraintlanguage=CQL_TEXT&constraint=sb:collection=4f4e4771e4b07f02db47e1e4

sb:servicetype

The *sb:servicetype* queryable can be used to retrieve records for OGC WFS and WCS services hosted by ScienceBase.

- *OGC-WFS* specifying this value will return items which contain a shapefile facet
- *OGC-WCS* specifying this value will return items which contain a raster facet

Examples

CQL Title Query

```
title=Water National Spatial Data Infrastructure Node
```

ogc:Filter Title Query

```
<ogc:Filter xmlns="http://www.opengis.net/ogc" xmlns:ogc="http://www.opengis.net/ogc">
    <ogc:PropertyIsLike escape="\" singleChar="_" wildCard="%">
        <ogc:PropertyName>title</ogc:PropertyName>
        <ogc:Literal>Water National Spatial Data Infrastructure Node</ogc:Literal>
    </ogc:PropertyIsLike>
</ogc:Filter>
```

ogc:Filter Bounding Box Query

```
<ogc:Filter xmlns="http://www.opengis.net/ogc" xmlns:ogc="http://www.opengis.net/ogc">
    <ogc:BBOX>
        <ogc:PropertyName>dct:spatial</ogc:PropertyName>
        <gml:Envelope xmlns:gml="http://www.opengis.net/gml" srsName="urn:x-ogc:def:crs:EPSG:6.11:4326">
            <gml:lowerCorner>47.0 -4.5</gml:lowerCorner>
            <gml:upperCorner>52.0 1.0</gml:upperCorner>
        </gml:Envelope>
    </ogc:BBOX>
</ogc:Filter>
```

ogcFilter ANDing multiple queryables

```
<ogc:Filter xmlns="http://www.opengis.net/ogc" xmlns:ogc="http://www.opengis.net/ogc">
    <ogc:PropertyIsLike escape="\" singleChar="_" wildCard="%">
        <ogc:PropertyName>AnyText</ogc:PropertyName>
        <ogc:Literal>Barcalounger</ogc:Literal>
    </ogc:PropertyIsLike>

    <ogc:PropertyIsEqualTo>
        <ogc:PropertyName>subject</ogc:PropertyName>
        <ogc:Literal>2-d and 3-d seismic reflection</ogc:Literal>
    </ogc:PropertyIsEqualTo>

    <ogc:PropertyIsLike escape="\" singleChar="_" wildCard="%">
        <ogc:PropertyName>subject</ogc:PropertyName>
        <ogc:Literal>accc</ogc:Literal>
    </ogc:PropertyIsLike>

    <ogc:PropertyIsEqualTo>
        <ogc:PropertyName>title</ogc:PropertyName>
        <ogc:Literal>Mary had a little lamb</ogc:Literal>
    </ogc:PropertyIsEqualTo>

    <ogc:PropertyIsLike escape="\" singleChar="_" wildCard="%">
        <ogc:PropertyName>abstract</ogc:PropertyName>
        <ogc:Literal>This is a really abstract concept</ogc:Literal>
    </ogc:PropertyIsLike>
</ogc:Filter>
```

Request

Key-Value Pairs

https://www.sciencebase.gov/catalog/csw?service=CSW&version=2.0.2
&request=getRecords&resultType=results&constraintlanguage=CQL_TEXT&constraint=AnyText=water

XML POST

Content-type: application/xml

POST Data

```
<csw:GetRecords
xmlns:csw="http://www.opengis.net/cat/csw/2.0.2"
maxRecords="10"
outputFormat="application/xml"
outputSchema="http://www.opengis.net/cat/csw/2.0.2"
resultType="results" service="CSW" version="2.0.2">
    <csw:Query typeNames="csw:Record">
        <csw:ElementSetName>summary</csw:ElementSetName>
        <csw:Constraint version="1.1.0">
            <ogc:Filter xmlns:ogc="http://www.opengis.net/ogc" xmlns="http://www.opengis.net/ogc"
            xmlns:gml="http://www.opengis.net/gml">
                <ogc:PropertyIsLike escape="" singleChar="_" wildCard="%">
                    <ogc:PropertyName>AnyText</ogc:PropertyName>
                    <ogc:Literal>water</ogc:Literal>
                </ogc:PropertyIsLike>
            </ogc:Filter>
        </csw:Constraint>
    </csw:Query>
</csw:GetRecords>
```

Response

CSW Response


```
<csw:GetRecordsResponse xmlns:xml='http://www.w3.org/XML/1998/namespace' xmlns:xsd='http://www.w3.org/2001
/XMLSchema' xmlns:csw='http://www.opengis.net/cat/csw/2.0.2' xmlns:dc='http://purl.org/dc/elements/1.1/' xmlns:
dcmiBox='http://dublincore.org/documents/2000/07/11/dcmi-box/' xmlns:dct='http://purl.org/dc/terms/' xmlns:
gml='http://www.opengis.net/gml' xmlns:ows='http://www.opengis.net/ows'>
  <csw:SearchResults numberOfRecordsMatched='592522' numberOfRecordsReturned='20' nextRecord='21'
recordSchema='http://www.opengis.net/cat/csw/2.0.2'>
    <csw:SummaryRecord>
      <dc:identifier>52824fe6e4b08f1425d6e23c</dc:identifier>
      <dc:title>Water National Spatial Data Infrastructure Node</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Collection</dc:type>
      <dct:modified>2014-10-08T15:35:07.974Z</dct:modified>
      <dct:abstract>Metadata collection for the National Spatial Data Infrastructure maintained by the Water
Mission Area in USGS</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>505bc673e4b08c986b32bf81</dc:identifier>
      <dc:title>Water Resources Data, New Jersey, Water Year 1990. Volume 2. Ground-Water Data</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:44:53.211Z</dct:modified>
      <dct:abstract>Water Resources data for the 1990 water year for New Jersey consists of records of stage,
discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water
levels and water quality of ground water. This volume of the report contains ground water levels for 218
observation wells and water-quality data for 176 wells. These data represent that part of the National Water
Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Jersey.<
/dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>504216b9e4b04b508bfd337d</dc:identifier>
      <dc:title>Environmental Tracers of Surface-Water / Ground-Water Exchanges</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Project</dc:type>
      <dc:subject>Unsaturated Zone</dc:subject>
      <dc:subject>Groundwater-Surface Water Interactions</dc:subject>
      <dct:modified>2013-12-05T07:33:59.592Z</dct:modified>
      <dct:abstract>&lt;p&gt; Objectives are quantitative scientific examination of hydrologic processes in the
near-stream environment to determine spatial and temporal patterns of stream exchanges with shallow ground, for
the purpose of improved understanding of streambed exchanges and resulting impacts on water resources and
stream ecology.&lt;/p&gt;</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>53d9082be4b0387c5080ad34</dc:identifier>
      <dc:title>National Ground-Water Monitoring Network</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Data</dc:type>
      <dc:subject>United States</dc:subject>
      <dc:subject>groundwater</dc:subject>
      <dc:subject>ground water</dc:subject>
      <dc:subject>ground-water</dc:subject>
      <dc:subject>U.S. Principal Aquifers</dc:subject>
      <dc:subject>lithology</dc:subject>
      <dc:subject>groundwater levels</dc:subject>
      <dc:subject>water quality</dc:subject>
      <dc:subject>well construction</dc:subject>
      <dc:subject>water data</dc:subject>
      <dc:subject>NGWMN</dc:subject>
      <dc:subject>National Ground-Water Monitoring Network</dc:subject>
      <dct:modified>2014-10-07T17:54:01.510Z</dct:modified>
      <dct:abstract>The National Ground-Water Monitoring Network (NGWMN) is a compilation of selected
groundwater monitoring wells from Federal, State, and local groundwater monitoring networks across the nation.
&amp;amp;nbsp;The NGWMN is a product of the Subcommittee on Groundwater of the Federal Advisory Committee on Water
Information (ACWI).&amp;amp;nbsp;The NGWMN Data Portal provides access to groundwater data from multiple, dispersed
databases in a web-based mapping application. The portal contains current and historical data including water
levels, water quality, lithology, and well construction. The NGWMN is transitioning from a pilot phase into
full implementation. In the future we will be adding additional data providers to the network.</dct:abstract>
      <ows:WGS84BoundingBox>
        <ows:LowerCorner>-160.0 25.0</ows:LowerCorner>
        <ows:UpperCorner>-70.0 50.0</ows:UpperCorner>
      </ows:WGS84BoundingBox>
    </csw:SummaryRecord>
```

```
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a62e4b07f02db6369dc</dc:identifier>
      <dc:title>Reconnaissance of the water resources of Beaver County, Oklahoma</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Hydrologic Atlas</dc:subject>
      <dct:modified>2014-07-21T19:53:21.450Z</dct:modified>
      <dct:abstract>Ground water is the major source of water supply in Beaver County. Because of the rapidly
increasing demand for the limited supply of water for irrigation, additional geologic and hydrologic data are
needed for management of ground-water resources. This report presents general information on the availability
of ground water, on the chemical quality of water, and on streamflow. The chemical quality of water generally
is poorer than that of water elsewhere in the Oklahoma Panhandle, and the ability to obtain good quality water
may become increasingly difficult as the water resources are developed. Further studies are needed to determine
the annual change in water levels, the rate of water-level decline in heavily pumped areas, the volume of water
stored in the ground-water reservoir, and the quantity of water that may be withdrawn safely in a given area.<
/dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a0de4b07f02db5fd2c3</dc:identifier>
      <dc:title>Water Resources Data - Texas, Water Year 2003, Volume 6. Ground Water</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:43:05.890Z</dct:modified>
      <dct:abstract>Water-resources data for the 2003 water year for Texas consists of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water
quality in wells. Volume 6 contains water levels for 880 ground-water observation wells and water-quality data
for 158 monitoring wells. These data represent that part of the National Water Data System operated by the U.S.
Geological Survey and cooperating Federal, State, and local agencies in Texas.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>505770dce4b01ad7e027b99e</dc:identifier>
      <dc:title>Advanced water treatment as a tool in water scarcity management</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Treatment</dc:subject>
      <dc:subject>Water Resources Management</dc:subject>
      <dc:subject>Water Demand</dc:subject>
      <dc:subject>Water Scarcity</dc:subject>
      <dc:subject>Available Water</dc:subject>
      <dc:subject>Water Use</dc:subject>
      <dc:subject>Water Supply</dc:subject>
      <dc:subject>Water Reuse</dc:subject>
      <dc:subject>Water Conservation</dc:subject>
      <dc:subject>Water management</dc:subject>
      <dc:subject>Water demand (see also Water consumption)</dc:subject>
      <dc:subject>Water supplies</dc:subject>
      <dc:subject>Water re-use</dc:subject>
      <dc:subject>Resource management</dc:subject>
      <dc:subject>Purification</dc:subject>
      <dc:subject>Public opinion</dc:subject>
      <dc:subject>SW 3060 Water treatment and distribution; SW 1040 Conservati</dc:subject>
      <dc:subject>Water Resources Abstracts; Aqualine Abstracts; Pollution Abs</dc:subject>
      <dct:modified>2014-07-04T04:42:33.087Z</dct:modified>
      <dct:abstract />
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a0de4b07f02db5fd129</dc:identifier>
      <dc:title>Water Resources Data for California, Water Year 1988. Volume 5. Ground-Water Data for
California</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:43:17.932Z</dct:modified>
      <dct:abstract>Water resources data for the 1988 water year for California consist of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water-
quality in wells. Volume 5 contains water levels for 980 observation wells and water-quality data for 239
observation monitoring wells. These data represent that part of the National water Data System operated by the
U.S. Geological Survey and cooperating State and Federal agencies in California.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a0de4b07f02db5fd10e</dc:identifier>
      <dc:title>Water Resources Data for California, Water Year 1987. Volume 5. Ground-water Data for
California</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
```

```
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:43:17.402Z</dct:modified>
      <dct:abstract>Water resources data for the 1987 water year for California consist of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water
quality in wells. Volume 5 contains water levels for 786 observation wells and water-quality data for 168
observation wells. These data represent that part of the National Water Data System operated by the U.S.
Geological Survey and cooperating State and Federal agencies in California.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a0be4b07f02db5fc1ab</dc:identifier>
      <dc:title>Water Resources Data, California, Water Year 1989. Volume 5. Ground-Water Data</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:44:05.526Z</dct:modified>
      <dct:abstract>Water resources data for the 1989 water year for California consist of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water
quality in weils. Volume 5 contains water levels for 1,037 observation wells and water-quality data for 254
monitoring wells. These data represent that part of the National Water Data System operated by the U.S.
Geological Survey and cooperatine State and Federal agencies in California.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>537f6c0ce4b021317a871b74</dc:identifier>
      <dc:title>Safe Drinking Water Coverage Rate Data for Uganda - 2008</dc:title>
      <dc:subject>africa</dc:subject>
      <dc:subject>safe water coverage</dc:subject>
      <dc:subject>health</dc:subject>
      <dc:subject>afrique</dc:subject>
      <dct:modified>2014-05-23T15:41:00.669Z</dct:modified>
      <dct:abstract>Rural safe water coverage as defined by the Directorate of Water Development, Ministry of
Water and Environment, Uganda.</dct:abstract>
      <ows:WGS84BoundingBox>
        <ows:LowerCorner>29.5727 -1.4788</ows:LowerCorner>
        <ows:UpperCorner>35.0003 4.2341</ows:UpperCorner>
      </ows:WGS84BoundingBox>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a0ae4b07f02db5fb83c</dc:identifier>
      <dc:title>Water Resources Data, Iowa, Water Year 2003--Volume 2. Ground Water and Quality of
Precipitation</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:44:30.343Z</dct:modified>
      <dct:abstract>Water resources data for Iowa for the 2003 water year consists of records of ground water
levels and water quality of ground-water wells. This report volume contains water-level records for 166 ground-
water observation wells; water-quality data for 150 municipal wells; and precipitation-quality data for 2
precipitation sites.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a4ae4b07f02db62525c</dc:identifier>
      <dc:title>Water resources data - Texas water year 2001 : Volume 6. Ground water</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:46:53.025Z</dct:modified>
      <dct:abstract>Water-resources data for the 2001 water year for Texas consists of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water
quality in wells. Volume 6 contains water levels for 908 observation wells and water-quality data for 155
monitoring wells. These data represent that part of the National Water Data System operated by the U.S.
Geological Survey and cooperating Federal, State, and local agencies in Texas.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>50576e5be4b01ad7e027ac68</dc:identifier>
      <dc:title>Water and world population growth</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Resources Management</dc:subject>
      <dc:subject>Water Supply</dc:subject>
      <dc:subject>Available Water</dc:subject>
      <dc:subject>Urban Areas</dc:subject>
      <dc:subject>Industrial Water</dc:subject>
      <dc:subject>Municipal Water</dc:subject>
      <dc:subject>Drinking Water</dc:subject>
      <dc:subject>Surface Water</dc:subject>
```

```
      <dc:subject>Groundwater</dc:subject>
      <dc:subject>Water Demand</dc:subject>
      <dc:subject>Water management</dc:subject>
      <dc:subject>Water supplies</dc:subject>
      <dc:subject>Water supplies (Industrial)</dc:subject>
      <dc:subject>Water supplies (Potable)</dc:subject>
      <dc:subject>Surface water (see also Lakes, Ponds, Streams)</dc:subject>
      <dc:subject>Groundwater (see also Aquifers)</dc:subject>
      <dc:subject>Water demand (see also Water consumption)</dc:subject>
      <dc:subject>SW 4020 Evaluation process; AQ 00001 Water Resources and Sup</dc:subject>
      <dc:subject>Water Resources Abstracts; Aqualine Abstracts</dc:subject>
      <dct:modified>2014-07-04T04:40:55.558Z</dct:modified>
      <dct:abstract />
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a0ce4b07f02db5fc7a2</dc:identifier>
      <dc:title>Water Resources Data - Texas Water Year 2000, Volume 6. Ground Water</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:43:05.417Z</dct:modified>
      <dct:abstract>Water-resources data for the 2000 water year for Texas consists of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water
quality in wells. Volume 6 contains water levels for 898 observation wells and 145 water-quality data for
monitoring wells. These data represent that part of the National Water Data System operated by the U.S.
Geological Survey and cooperating Federal, State, and local agencies in Texas.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a0de4b07f02db5fd04f</dc:identifier>
      <dc:title>Water Resources Data - Texas, Water Year 2002, Volume 6. Ground Water</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:43:05.848Z</dct:modified>
      <dct:abstract>Water-resources data for the 2002 water year for Texas consists of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water
quality in wells. Volume 6 contains water levels for 960 observation wells and water-quality data for 173
monitoring wells. These data represent that part of the National Water Data System operated by the U.S.
Geological Survey and cooperating Federal, State, and local agencies in Texas.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a09e4b07f02db5fb04e</dc:identifier>
      <dc:title>Water Resources Data - Texas Water Year 1999, Volume 6. Ground Water</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:43:05.098Z</dct:modified>
      <dct:abstract>Water-resources data for the 1999 water year for Texas consists of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water
quality in wells. Volume 6 contains water levels for 759 observation wells and 146 water-quality data for
monitoring wells. These data represent that part of the National Water Data System operated by the U.S.
Geological Survey and cooperating Federal, State, and local agencies in Texas.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4aabe4b07f02db669b90</dc:identifier>
      <dc:title>Description of the ground-water flow system in the Portland Basin, Oregon and Washington</dc:
title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Supply Paper</dc:subject>
      <dct:modified>2014-07-21T17:56:23.873Z</dct:modified>
      <dct:abstract>An increasing dependence on ground-water resources in the Portland Basin has made it
necessary for State and local governments to evaluate the capability of the ground-water system to meet present
and future demands for water. This report describes the regional ground-water system and provides a
conceptualization of the aquifer system. Aquifer geometry, recharge, ground-water flow directions, ground-water
/surface water relations, water use, and water-level changes with time are presented.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a00e4b07f02db5f7d0f</dc:identifier>
      <dc:title>Water resources data Texas, water year 2004, volume 6. ground water</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:46:56.090Z</dct:modified>
      <dct:abstract>Water-resources data for the 2004 water year for Texas consists of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water
```

```
quality in wells. Volume 6 contains water levels for 913 groundwater observation wells and water-quality data
for 150 monitoring wells. These data represent that part of the National Water Data System operated by the U.S.
Geological Survey and cooperating Federal, State, and local agencies in Texas.</dct:abstract>
    </csw:SummaryRecord>
    <csw:SummaryRecord>
      <dc:identifier>4f4e4a0de4b07f02db5fd120</dc:identifier>
      <dc:title>Water Resources Data for California, Water Year 1986. Volume 5. Ground-Water Data for
California</dc:title>
      <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Publication</dc:type>
      <dc:subject>Water Data Report</dc:subject>
      <dct:modified>2014-07-21T20:43:17.010Z</dct:modified>
      <dct:abstract>Water resources data for the 1986 water year for California consist of records of stage,
discharge, and water quality of streams; stage and contents in lakes and reservoirs; and water levels and water
quality in wells. Volume 5 contains water levels for 765 observation wells and water-quality data for 174
observation wells. These data represent that part of the National Water Data System operated by the U.S.
Geological Survey and cooperating State and Federal agencies in California.</dct:abstract>
    </csw:SummaryRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

GetRecordById

Supported Parameters

outputFormat

outputSchema

ElementSetName

id

A list of ScienceBase item IDs to retrieve. In KVP requests, it is a comma-separated list. In XML POST requests, each ID must be enclosed in *</id>...</id>* tags.

Request

Key-Value Pairs

https://www.sciencebase.gov/catalog/csw?service=CSW&version=2.0.2&request=getRecordById&id=4f4e4771e4b07f02db47e1e4

XML POST

Content-type = application/xml

POST Data

```
<csw:GetRecordById
xmlns:csw="http://www.opengis.net/cat/csw/2.0.2"
maxRecords="10"
outputFormat="application/xml"
outputSchema="http://www.opengis.net/cat/csw/2.0.2"
resultType="results" service="CSW" version="2.0.2">
    <Id>4f4e4771e4b07f02db47e1e4</Id>
</csw:GetRecordById>
```

Response

CSW Response


```
<csw:GetRecordByIdResponse xmlns:xml='http://www.w3.org/XML/1998/namespace' xmlns:xsd='http://www.w3.org/2001
/XMLSchema' xmlns:csw='http://www.opengis.net/cat/csw/2.0.2' xmlns:dc='http://purl.org/dc/elements/1.1/' xmlns:
dcmiBox='http://dublincore.org/documents/2000/07/11/dcmi-box/' xmlns:dct='http://purl.org/dc/terms/' xmlns:
gml='http://www.opengis.net/gml' xmlns:ows='http://www.opengis.net/ows'>
  <csw:SummaryRecord>
    <dc:identifier>4f4e4771e4b07f02db47e1e4</dc:identifier>
    <dc:title>USGS Publications Warehouse</dc:title>
    <dc:type>https://www.sciencebase.gov/vocab/vocabulary/4f4e475de4b07f02db47ded7/Collection</dc:type>
    <dc:subject>Aquatic biology</dc:subject>
    <dc:subject>Atmospheric sciences</dc:subject>
    <dc:subject>Biochemistry</dc:subject>
    <dc:subject>Biological informatics</dc:subject>
    <dc:subject>Botany</dc:subject>
    <dc:subject>Climate change</dc:subject>
    <dc:subject>Computer science</dc:subject>
    <dc:subject>Ecology</dc:subject>
    <dc:subject>Genetics</dc:subject>
    <dc:subject>Geochemistry</dc:subject>
    <dc:subject>Geography</dc:subject>
    <dc:subject>Geology</dc:subject>
    <dc:subject>Geophysics</dc:subject>
    <dc:subject>Glaciology</dc:subject>
    <dc:subject>Hydrology</dc:subject>
    <dc:subject>Information sciences</dc:subject>
    <dc:subject>Land use change</dc:subject>
    <dc:subject>Limnology</dc:subject>
    <dc:subject>Marine biology</dc:subject>
    <dc:subject>Ocean sciences</dc:subject>
    <dc:subject>Planetary sciences</dc:subject>
    <dc:subject>Soil sciences</dc:subject>
    <dc:subject>Zoology</dc:subject>
    <dc:subject>Astrogeology</dc:subject>
    <dct:modified>2014-07-08T21:42:20.213Z</dct:modified>
    <dct:abstract>The USGS Publications Warehouse is a citation clearinghouse provides access to over 120,000
publications written by USGS scientists over the century-plus history of the bureau. Since June 2003, all USGS
series publications published after that date are available digitally through the USGS web. Since 2009, all
scholarly publications authored by USGS staff including those published outside the USGS (scholarly journals,
university presses, etc.) are cataloged with links to original published sources. The USGS Publications
Warehouse is managed and operated as part of the USGS Libraries Program. ScienceBase harvests all records
nightly from the Publications Warehouse via a web service interface that provides original records in the
Metadata Object Description Standard (MODS) XML format. These records are ingested into a ScienceBase
collection in order to make them available to the ScienceBase community of users and provide alternate methods
of access, including geospatial services that expose those publications that have been documented with a
spatial context. This collection record provides those interface options along with links to the Publications
Warehouse web site and search system, the primary mode of access to these resources.</dct:abstract>
    <ows:WGS84BoundingBox>
      <ows:LowerCorner>-180 -89</ows:LowerCorner>
      <ows:UpperCorner>180 89</ows:UpperCorner>
    </ows:WGS84BoundingBox>
  </csw:SummaryRecord>
</csw:GetRecordByIdResponse>
```


OAI-PMH

http://www.openarchives.org/pmh/

Metadata records can be retrieved via a basic Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) service that is built in to ScienceBase.

Parameters

The following parameters are supported by the ScienceBase OAI-PMH service.

verb

Specifies the OAI-PMH operation to perform. Currently implemented verbs are:

- Identify
- ListMetadataFormats
- ListSets
- ListIdentifiers
- ListRecords

resumptiontoken

A *resumption token* will be returned in the *ListIdentifiers* and *ListRecords* requests that are too large to be returned all at once. The value should be sent back on the next request to get the next set of results. For example, the following resumption token is returned in the response from a *ListIdentifiers* request:

```
<resumptionToken>54495b4de4b0f888a81bb517</resumptionToken>
```

The subsequent request will include that value to get the next page of results (note that the URL parameter must be lower-case):

https://www.sciencebase.gov/catalog/oai-pmh?verb=ListIdentifiers&set=4f4e4771e4b07f02db47e1e4&metadataPrefix=oai_dc&resumptiontoken=54495b4de4b0f888a81bb517

set

The *set* parameter is used to retrieve all records from a ScienceBase collection. It is equivalent to a *ancestors=<ancestor ID>* search in the ScienceBase REST API.

An alternative way to specify the *set* ID, is by specifying the collection item's URL, and appending the *oai-pmh* designation. For example, the following URL will return all records in ScienceBase harvested from the USGS Publications Warehouse:

https://www.sciencebase.gov/catalog/item/4f4e4771e4b07f02db47e1e4/oai-pmh?verb=ListIdentifiers&metadataPrefix=oai_dc

Two subsets are supported, mainly for the Science Data Catalog. Those subsets are accessed by appending *:featured* and *:nonfeatured* to the set ID. For example *set=4f4e4771e4b07f02db47e1e4:featured.* Note that only SDC collections have featured records.

from

Specifies the start date for a date range search. The date is searched against the ScienceBase items' last updated date.

until

Specifies the end date for a date range search. The date is searched against the ScienceBase items' last updated date.

metadataPrefix

Specifies which metadata format to return for the ScienceBase item.

oai_dc

Returns records in the OAI Dublin Core transform of the sbJSON.

fgdc

Returns records in the FGDC transform of the sbJSON.

fgdc-orig

If the ScienceBase item has an original FGDC XML file attached, the contents of that file are returned. Otherwise, the FGDC transform of the sbJSON is returned.

iso

Returns records in the ISO transform of the sbJSON.

iso-orig

If the ScienceBase item has an original ISO XML file attached, the contents of that file are returned. Otherwise, the ISO-19115 transform of the sbJSON is returned.

mods

Returns records in the MODS transform of the sbJSON.

mods-orig

If the ScienceBase item has an original MODS XML file attached, the contents of that file are returned. Otherwise, the MODS transform of the sbJSON is returned.

Supported Verbs

The following verbs are supported by the ScienceBase OAI-PMH service.

Identify

Identify returns basic information about the repository. If this verb is specified, no additional parameters are accepted.

Request

https://www.sciencebase.gov/catalog/oai-pmh?verb=identify

Response

OAI-PMH XML Response

```
<?xml version='1.0' encoding='UTF-8'?>
<OAI-PMH xmlns='http://www.openarchives.org/OAI/2.0/' xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance' xsi:
schemaLocation='http://www.openarchives.org/OAI/2.0/ http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd'>
  <responseDate>2014-10-23T19:25:27Z</responseDate>
  <request verb='identify'>https://www.sciencebase.gov/catalog/oai-pmh</request>
  <Identify>
    <repositoryName>ScienceBase Catalog</repositoryName>
    <baseURL>https://www.sciencebase.gov/catalog/oai-pmh</baseURL>
    <protocolVersion>2.0</protocolVersion>
    <adminEmail>cwero@usgs.gov</adminEmail>
    <earliestDatestamp>2009-10-01</earliestDatestamp>
    <deletedRecord>no</deletedRecord>
    <granularity>YYYY-MM-DD</granularity>
  </Identify>
</OAI-PMH>
```

ListMetadataFormats

ListMetadataFormats returns the metadata formats available from the repository. The optional parameter *identifier* is not supported.

Request

https://www.sciencebase.gov/catalog/oai-pmh?verb=ListMetadataFormats

Response

OAI-PMH XML Response

```
<?xml version='1.0' encoding='UTF-8'?>
<OAI-PMH xmlns='http://www.openarchives.org/OAI/2.0/' xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance' xsi:
schemaLocation='http://www.openarchives.org/OAI/2.0/ http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd'>
  <responseDate>2014-10-23T19:32:41Z</responseDate>
  <request verb='ListMetadataFormats'>https://www.sciencebase.gov/catalog/oai-pmh</request>
  <ListMetadataFormats>
    <metadataFormat>
      <metadataPrefix>oai_dc</metadataPrefix>
      <schema>http://www.openarchives.org/OAI/2.0/oai_dc.xsd</schema>
      <metadataNamespace>http://www.openarchives.org/OAI/2.0/oai_dc</metadataNamespace>
    </metadataFormat>
    <metadataFormat>
      <metadataPrefix>fgdc</metadataPrefix>
      <schema>fgdc-std-012-2002.xsd</schema>
      <metadataNamespace></metadataNamespace>
    </metadataFormat>
    <metadataFormat>
      <metadataPrefix>fgdc-orig</metadataPrefix>
      <schema>fgdc-std-012-2002.xsd</schema>
      <metadataNamespace></metadataNamespace>
    </metadataFormat>
  </ListMetadataFormats>
</OAI-PMH>
```

ListSets

ListSets returns the available sets in the repository. The ScienceBase OAI-PMH server implementation does not support the additional parameter *resumptionToken* for *ListSets*. This is not fully implemented in the ScienceBase OAI-PMH service.

Request

https://www.sciencebase.gov/catalog/oai-pmh?verb=ListSets

Response

OAI-PMH XML Response

```
<?xml version='1.0' encoding='UTF-8'?>
<OAI-PMH xmlns='http://www.openarchives.org/OAI/2.0/' xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance' xsi:
schemaLocation='http://www.openarchives.org/OAI/2.0/ http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd'>
  <responseDate>2014-10-23T19:34:34Z</responseDate>
  <request verb='ListSets'>https://www.sciencebase.gov/catalog/oai-pmh</request>
  <ListSets />
</OAI-PMH>
```

ListIdentifiers

ListIdentifiers returns headers rather than full records. Required parameters when *ListIdentifiers* is specified are *resumptionToken*, *metadataPrefix*, and *set* (required by the ScienceBase OAI-PMH service, although the specification allows this to be optional).

Request

https://www.sciencebase.gov/catalog/oai-pmh?verb=ListIdentifiers&set=4f4e4771e4b07f02db47e1e4&metadataPrefix=oai_dc

Response

OAI-PMH XML Response

```
<?xml version='1.0' encoding='UTF-8'?>
<OAI-PMH xmlns='http://www.openarchives.org/OAI/2.0/' xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance' xsi:
schemaLocation='http://www.openarchives.org/OAI/2.0/ http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd'>
  <responseDate>2014-10-23T19:47:25Z</responseDate>
  <request verb='ListIdentifiers' set='4f4e4771e4b07f02db47e1e4' metadataPrefix='oai_dc'>https://www.
```

```
sciencebase.gov/catalog/oai-pmh</request>
  <ListIdentifiers>
    <header>
      <identifier>4f4e4aaae4b07f02db6692bb</identifier>
      <datestamp>2014-07-21T17:31:43.902Z</datestamp>
      <setSpec>4f4e4771e4b07f02db47e1e4</setSpec>
    </header>
    <header>
      <identifier>4f4e4aa9e4b07f02db668122</identifier>
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ListRecords

ListRecords is used to harvest records from the repository. Required parameters when *ListRecords* is specified are *resumptionToken*, *metadataPrefix*, and *set* (required by the ScienceBase OAI-PMH service, although the specification allows this to be optional).

Request

https://www.sciencebase.gov/catalog/oai-pmh?verb=ListRecords&set=4f4e4771e4b07f02db47e1e4&metadataPrefix=oai_dc

Response

OAI-PMH XML Response

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the Terror Rift of the Ross Sea, Antarctica</dc:title>
<dc:type>Publication</dc:type>
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<dc:date>Thu Jun 12 16:31:00 MDT 2014</dc:date>
<dc:description>Volcanic sills and dikes inferred from seismic reflection profiles and geophysical studies of
the Ross Sea are thought to be related to the rift basins in the region, and their emplacement to be coeval
with extension. However, lack of precise geochronology in the Terror Rift of the Ross Sea region has left these
inferred relationships poorly constrained and has hindered neotectonic studies, because of the large temporal
gaps between seismic reflectors of known ages. New 40Ar/39Ar geochronology presented here for submarine
volcanic rocks provides better age constraints for neotectonic interpretations within the Terror Rift. Several
samples from seamounts yielded young ages between 156 ± 21 and 122 ± 26 Ka. These ages
support interpretations that extension within the Terror Rift was active at least through the Pleistocene.
Three evenly spaced samples from the lowermost 100 m of Franklin Island range in age from 3.28 ±
0.04 to 3.73 ± 0.05 Ma. These age determinations demonstrate that construction of a small volcanic
edifice such as Franklin Island took at least several hundred thousand years, and therefore that much larger
ones in the Erebus Volcanic Province are likely to have taken considerably longer than previously inferred.
This warrants caution in applying a limited number of age determinations to define the absolute ages of events
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River 2008-2010</dc:title>
<dc:type>Publication</dc:type>
<dc:date>Mon Jul 21 14:09:33 MDT 2014</dc:date>
<dc:description>The Lower Columbia River in Oregon and Washington, USA, is an important resource for aquatic
and terrestrial organisms, agriculture, and commerce. An 86-mile stretch of the river was sampled over a 3 year
period in order to determine the spatial and temporal trends in the occurrence and concentration of water-borne
organic contaminants. Sampling occurred at 10 sites along this stretch and at 1 site on the Willamette River
using the semipermeable membrane device (SPMD) and the polar organic chemical integrative sampler (POCIS)
passive samplers. Contaminant profiles followed the predicted trends of lower numbers of detections and
associated concentrations in the rural areas to higher numbers and concentrations at the more urbanized sites.
Industrial chemicals, plasticizers, and PAHs were present at the highest concentrations. Differences in
concentrations between sampling periods were related to the amount of rainfall during the sampling period. In
general, water concentrations of wastewater-related contaminants decreased and concentrations of legacy
contaminants slightly increased with increasing rainfall amounts.</dc:description>
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<dc:title>Second progress report on the cooperative investigation of springs and stream flow in the Tecolote
Tunnel area of Santa Barbara County, California</dc:title>
<dc:type>Publication</dc:type>
<dc:subject>Open-File Report</dc:subject>
<dc:date>Mon Jul 21 14:02:00 MDT 2014</dc:date>
<dc:description><p>This report represents the second of a series of progress reports giving the results
of discharge measurements made at more than 100 locations in the Santa Ynez Mountains from the Refugio Canyon
on the west to the San Marcos Pass and Painted Cave area on the east. The flow in all the developed springs and
headwater streams within this area, here designated as the Tecolote Tunnel Area of the purpose of this report,
is generally measured monthly. The primary purpose of this second progress report is to make available to the
public all factual data regarding the flow at these locations obtained since the preparation of the first
progress report, issued in May 1949. </p>

 Near the mid-point of this area the Bureau of Reclamation and the Santa Barbara County Water
Agency proposed a tunnel, known as Tecolote Tunnel, for the purpose of diverting a portion of the runoff of the
Santa Ynez River drainage area into water-deficient Santa Barbara and the coastal areas to the east and west,
Because the water users of the mountain springs in the Tecolote Tunnel Area are somewhat apprehensive as to the
influence this tunnel may have on their present water supply, the Santa Barbara Water Agency has requested the
Geological Survey to obtain records of flow in their springs at frequent and regular intervals. During the
current fiscal year these observations have been made as a result of a cooperative agreement between the
Geological Survey and the Santa Barbara County Water Agency whereby each paid half the cost of the
investigation. During the previous fiscal year all the costs to the Geological Survey in obtaining these
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<dc:date>Mon Jul 21 14:02:36 MDT 2014</dc:date>
<dc:description>All sediment-hosted gold deposits (as a single population) share one characteristic—they all
have disseminated micron-sized invisible gold in sedimentary rocks. Sediment-hosted gold deposits are
recognized in the Great Basin province of the western United States and in China along with a few recognized
deposits in Indonesia, Iran, and Malaysia. Three new grade and tonnage models for sediment-hosted gold deposits
are presented in this paper: (1) a general sediment-hosted gold type model, (2) a Carlin subtype model, and (3)
a Chinese subtype model. These models are based on grade and tonnage data from a database compilation of 118
sediment-hosted gold deposits including a total of 123 global deposits. The new general grade and tonnage model
for sediment-hosted gold deposits (n=118) has a median tonnage of 5.7 million metric tonnes (Mt) and a gold
grade of 2.9 grams per tonne (g/t). This new grade and tonnage model is remarkable in that the estimated
parameters of the resulting grade and tonnage distributions are comparable to the previous model of Mosier and
others (1992). A notable change is in the reporting of silver in more than 10 percent of deposits; moreover,
the previous model had not considered deposits in China. From this general grade and tonnage model, two
significantly different subtypes of sediment-hosted gold deposits are differentiated: Carlin and Chinese. The
Carlin subtype includes 88 deposits in the western United States, Indonesia, Iran, and Malaysia, with median
tonnage and grade of 7.1 Mt and 2.0 g/t Au, respectively. The silver grade is 0.78 g/t Ag for the 10th
percentile of deposits. The Chinese subtype represents 30 deposits in China, with a median tonnage of 3.9 Mt
and medium grade of 4.6 g/t Au. Important differences are recognized in the mineralogy and alteration of the
two sediment-hosted gold subtypes such as: increased sulfide minerals in the Chinese subtype and
decalcification alteration dominant in the Carlin type. We therefore recommend using the appropriate grade and

tonnage model presented in this study for mineral resource assessments depending on the geologic and mineralogical data available for a region. Tonnage and contained gold within the general sediment-hosted gold model are analyzed based on major geologic features such as tectonic setting and magmatic (dikes, sills, and stocks) or amagmatic environment. The results show a significant difference in tonnage and contained gold, with higher median values in deposits spatially associated with igneous rocks, regardless of structural style of the deposit. These results suggest that magmatic environments control mineralization intensity—an important consideration in the regional assessment of prospective areas for sediment-hosted gold deposits.</dc:
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<dc:description>The Optical Collection Suite (OCS) is a ground-truth sampling system designed to perform in
situ measurements that help calibrate and validate optical remote-sensing and swath-sonar surveys for mapping
and monitoring coastal ecosystems and ocean planning. The OCS system enables researchers to collect underwater
imagery with real-time feedback, measure the spectral response, and quantify the water clarity with simple and
relatively inexpensive instruments that can be hand-deployed from a small vessel. This article reviews the
design and performance of the system, based on operational and logistical considerations, as well as the data
requirements to support a number of coastal science and management projects. The OCS system has been
operational since 2009 and has been used in several ground-truth missions that overlapped with airborne lidar
bathymetry (ALB), hyperspectral imagery (HSI), and swath-sonar bathymetric surveys in the Gulf of Maine,
southwest Alaska, and the US Virgin Islands (USVI). Research projects that have used the system include a
comparison of backscatter intensity derived from acoustic (multibeam/interferometric sonars) versus active
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<dc:type>Publication</dc:type>
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<dc:date>Mon Jul 21 12:43:15 MDT 2014</dc:date>
<dc:description><p>The Cul-de-Sac Plain is perhaps the most important agricultural area in Haiti because
of its nearness and accessibility to Port-au-Prince, the nation's capital, metropolis, and principal seaport.
Most of the agricultural produce consumed in Port-au-Prince as well as a considerable part of that exported
from Haiti is grown in the plain.</p>

<p>Because of variable and poorly distributed rainfall, high temperature, and high evaporation, semiarid

climatic conditions prevail in the plain. Irrigation is, therefore, necessary for successful farming. There are no regulatory or storage facilities on the streams that enter the plain, but the mean and low-water stream flow and the discharge of springs are almost entirely appropriated for irrigation. Ground water has been utilized for irrigation to an increasing extent by the Haitian American Sugar Company, which has put down about 100 wells in the plain since 1919.</p>

<p> Outside the existing irrigated areas of the plain are large tracts of potentially irrigable land that are uncultivated and agriculturally unproductive for lack of water. The object of the present study was to determine the possibilities of bringing these lands into cultivation by irrigation from wells. This study was part of a larger program of the Food Supply Division, Institute of Inter-American Affairs, to increase the production of food in Haiti.</p>

<p> From September through November 1948 the senior author, a member of the U. S. Geological Survey, spent three months in the field in an investigation of the geology and ground-water resources of the Cul-de-Sac Plain. He was ably assisted by Mr. Rémy C. Lemoine, Haitian engineer-geologist, employed by the Food Supply Division. The field work included principally the geologic mapping of' the plain and the adjacent mountain borders, a ground-water inventory of existing wells and springs, and a general evaluation of significant geologic and hydrologic features.</p></dc:description>
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<dc:type>Publication</dc:type>
<dc:date>Mon Jul 21 13:05:01 MDT 2014</dc:date>
<dc:description><p>The popularity of implanting electronic devices such as transmitters and data loggers into captive and free-ranging animals has increased greatly in the past two decades. The devices have become smaller, more reliable, and more capable (Printz 2004; Wilson and Gifford 2005; Metcalfe et al. 2012). Compared with externally mounted devices, implanted devices are largely invisible to external viewers such as tourists and predators; exist in a physically protected, thermally stable environment in mammals and birds; and greatly reduce drag and risk of entanglement. An implanted animal does not outgrow its device or attachment method as can happen with collars and harnesses, which allows young animals to be more safely equipped. However, compared with mounting external devices, implantation requires greater technical ability to perform the necessary anesthesia, analgesia, and surgery.</p>

<p>More than 83% of publications in the 1990s that used radiotelemetry on animals assumed that there were no adverse effects on the animal (Godfrey and Bryant 2003). It is likely that some studies using implanted electronic devices have not been published due to a high level of unexpected mortality or to aberrant behavior or disappearance of the implanted animals, a phenomenon known as the “file drawer” problem (Rosenthal 1979; Scargle 2000). The near absence of such studies from the published record may be providing a false sense of security that procedures being used are more innocuous than they actually are. Similarly, authors sometimes state that it was unlikely that device implantation was problematic because study animals appeared to behave normally, or authors state that previous investigators used the same technique and saw no problems. Such statements are suppositions if no supporting data are provided or if the animals were equipped because there was no other way to follow their activity. Moreover, such suppositions ignore other adverse effects that affect behavior indirectly, and animals often mask the signs of infection to avoid attracting predators (Wobeser 2006).
</p>

<p>Guidance specific to sterilization of electronic devices for implantation is limited in the wildlife record (Burger et al. 1994; Mulcahy 2003). Few biologists have been formally trained in aseptic technique, but most biologists know that electronic devices should be treated in some way to reduce the chance for infection of the host animal by bacteria, viruses, parasites, and fungi. Most biologists (73%) who implant devices into fishes believe aseptic techniques are important (Wagner and Cooke 2005). However, I maintain that many biologists find it difficult to place the concept of asepsis into practice in their work because of confusion about what constitutes aseptic technique, a lack of surgical knowledge and training, the perception of

increased costs, or the belief that aseptic surgeries are impractical or unnecessary for their application. Some have even argued that, while compromising surgical techniques in the field might result in complications or mortalities, the money saved would allow for a compensatory increase in sample size (Anderson and Talcott 2006).</p>

<p>In this paper I define aseptic surgical techniques, document the legal and professional guidance for performing aseptic surgeries on wild animals, and present options for sterilizing electronic devices and surgical instruments for field use.</p></dc:description>
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<dc:type>Publication</dc:type>
<dc:subject>Open-File Report</dc:subject>
<dc:date>Mon Jul 21 11:26:36 MDT 2014</dc:date>
<dc:description><p><u>History of Small Watershed Projects in Texas</u></p>

<p>The U.S. Soil Conservation Service is actively engaged in the installation of flood and soil erosion reducing measures in Texas under the authority of the "Flood Control Act of 1936 and 1944" and "Watershed Protection and Flood Prevention Act" (Public Law 566), as amended. The Soil Conservation Service has found a total of approximately 3,500 floodwater-retarding structures to be physically and economically feasible in Texas. As of September 30, 1970, 1,439 of these structures had been built.</p>

<p>This watershed-development program will have varying but important effects on the surface and ground-water resources of river basins, especially where a large number of the floodwater-retarding structures are built. Basic hydrologic data under natural and developed conditions are needed to appraise the effects of the structures on the yield and mode of occurrence of runoff.</p>

<p>Hydrologic investigations of these small watersheds were begun by the Geological Survey in 1951 and are now being made in 12 study areas (fig. 1). These investigations are being made in cooperation with the Texas Water Development Board, the Soil Conservation Service, the San Antonio River Authority, the city of Dallas, and the Tarrant County Water Control and Improvement District No. 1. The 12 study areas were chosen to sample watershed having different rainfall, topography, geology, and soils. In five of the study areas, (North, Little Elm, Mukewater, little Pond-North Elm, and Pin Oak Creeks), streamflow and rainfall records were collected prior to construction of the floodwater-retarding structures, thus affording the opportunity for analyses of the conditions "before and after" development. A summary of the development of the floodwater-retarding structures in each study areas of September 30, 1970, is shown in table 1.</p>

<p><u>Objectives of the Texas Small Watersheds Project</u></p>

<p>The purpose of these investigations is to collect sufficient data to meeting the following objectives:
</p>

<p>1. To determine the net effect of floodwater-retarding structures on the regimen of streamflow at downstream points.</p>

<p>2. To determine the effectiveness of the structures as ground-water recharge facilities.</p>

<p>3. To determine the effect of the structures on the sediment yield at downstream points.</p>

<p>4. To develop relationships between maximum rates and/or volumes of runoff with rainfall in small natural watersheds.</p>

<p>5. To develop a stream-system model for basins with floodwater-retarding structures.</p>

<p>6. To determine the minimum instrumentation necessary for estimating the flood hydrographs below a system of structures, as needed for downstream water-management operation.</p>

<p><u>Purpose and Scope of this Basic-Data Report</u></p>

<p>This report, which is the tenth in a series of basic-data reports published annually for the Escondido Creek study area, contains the rainfall, runoff, and storage data collected during the 1970 water year for the 72.4-square-mile area above the stream-gaging station Escondido Creek at Kenedy, Texas. The location of floodwater-retarding structures and hydrologic-instrument installations in the Escondido Creek study area are shown on figure 2.</p>

<p>This investigation is scheduled to continue through a period of both above- and below-normal precipitation to define the various factors used in the analyses of rainfall-runoff relationship.</p>

<p>To facilitate the publication and distribution of this report at the earliest feasible time, certain material contained herein does not conform to the formal publication standards of the U.S. Geological Survey.
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<dc:description>Arkansas experienced wide extremes in climate variability during the period of 2005 to 2010,
recording the largest annual precipitation ever recorded in the State (100.05 inches) in 2009. Many weather
stations across the State reported between 80 to 90 inches of rainfall in 2009. For comparison, the average
annual precipitation in Little Rock, Arkansas, for the period 1878 to 2010 was 47.1 inches. In contrast, 2005
and 2010 were the 7th and 14th driest years on record in Little Rock with 34.55 and 36.52 inches, respectively;
both tied as the hottest years ever recorded in Arkansas. The wettest year on record in Little Rock (2009) was
interspersed within these dry years, with a total of 81.79 inches. Fifteen weather stations within the State
ranked 2009 as the wettest year on record. Extremes in annual precipitation rates may lead to greater
variability in groundwater recharge rates and water use, particularly in the agricultural areas in eastern
Arkansas that rely heavily on groundwater produced from the Mississippi River Valley alluvial aquifer
(hereafter referred to as the alluvial aquifer). How does this variability affect the groundwater system and
water use therein? Are the effects of this variability discernable in measured water levels in wells? Czarnecki
and Schrader examined these questions and provided some insights, the results of which are presented here.</dc:
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<dc:title>Local-area-enhanced, 2.5-meter resolution natural-color and color-infrared satellite-image mosaics of
the Baghlan mineral district in Afghanistan: Chapter P in Local-area-enhanced, high-resolution natural-color
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<dc:date>Mon Jul 21 13:07:11 MDT 2014</dc:date>
<dc:description>The U.S. Geological Survey (USGS), in cooperation with the U.S. Department of Defense Task
Force for Business and Stability Operations, prepared databases for mineral-resource target areas in
Afghanistan. The purpose of the databases is to (1) provide useful data to ground-survey crews for use in
performing detailed assessments of the areas and (2) provide useful information to private investors who are
considering investment in a particular area for development of its natural resources. The set of satellite-
image mosaics provided in this Data Series (DS) is one such database. Although airborne digital color-infrared
imagery was acquired for parts of Afghanistan in 2006, the image data have radiometric variations that preclude

their use in creating a consistent image mosaic for geologic analysis. Consequently, image mosaics were created using ALOS (Advanced Land Observation Satellite; renamed Daichi) satellite images, whose radiometry has been well determined (Saunier, 2007a,b). This part of the DS consists of the locally enhanced ALOS image mosaics for the Baghlan mineral district, which has industrial clay and gypsum deposits. ALOS was launched on January 24, 2006, and provides multispectral images from the AVNIR (Advanced Visible and Near-Infrared Radiometer) sensor in blue (420–500 nanometer, nm), green (520–600 nm), red (610–690 nm), and near-infrared (760–890 nm) wavelength bands with an 8-bit dynamic range and a 10-meter (m) ground resolution. The satellite also provides a panchromatic band image from the PRISM (Panchromatic Remote-sensing Instrument for Stereo Mapping) sensor (520–770 nm) with the same dynamic range but a 2.5-m ground resolution. The image products in this DS incorporate copyrighted data provided by the Japan Aerospace Exploration Agency (©JAXA, 2006, 2007, 2008), but the image processing has altered the original pixel structure and all image values of the JAXA ALOS data, such that original image values cannot be recreated from this DS. As such, the DS products match JAXA criteria for value added products, which are not copyrighted, according to the ALOS end-user license agreement. The selection criteria for the satellite imagery used in our mosaics were images having (1) the highest solar-elevation angles (near summer solstice) and (2) the least cloud, cloud-shadow, and snow cover. The multispectral and panchromatic data were orthorectified with ALOS satellite ephemeris data, a process which is not as accurate as orthorectification using digital elevation models (DEMs); however, the ALOS processing center did not have a precise DEM. As a result, the multispectral and panchromatic image pairs were generally not well registered to the surface and not coregistered well enough to perform resolution enhancement on the multispectral data. Therefore, it was necessary to (1) register the 10-m AVNIR multispectral imagery to a well-controlled Landsat image base, (2) mosaic the individual multispectral images into a single image of the entire area of interest, (3) register each panchromatic image to the registered multispectral image base, and (4) mosaic the individual panchromatic images into a single image of the entire area of interest. The two image-registration steps were facilitated using an automated control-point algorithm developed by the USGS that allows image coregistration to within one picture element. Before rectification, the multispectral and panchromatic images were converted to radiance values and then to relative-reflectance values using the methods described in Davis (2006). Mosaicking the multispectral or panchromatic images started with the image with the highest sun-elevation angle and the least atmospheric scattering, which was treated as the standard image. The band-reflectance values of all other multispectral or panchromatic images within the area were sequentially adjusted to that of the standard image by determining band-reflectance correspondence between overlapping images using linear least-squares analysis. The resolution of the multispectral image mosaic was then increased to that of the panchromatic image mosaic using the SPARKLE logic, which is described in Davis (2006). Each of the four-band images within the resolution-enhanced image mosaic was individually subjected to a local-area histogram stretch algorithm (described in Davis, 2007), which stretches each band’s picture element based on the digital values of all picture elements within a 315-m radius. The final databases, which are provided in this DS, are three-band, color-composite images of the local-area-enhanced, natural-color data (the blue, green, and red wavelength bands) and color-infrared data (the green, red, and near-infrared wavelength bands). All image data were initially projected and maintained in Universal Transverse Mercator (UTM) map projection using the target area’s local zone (42 for Baghlan) and the WGS84 datum. The final image mosaics were subdivided into two overlapping tiles or quadrants because of the large size of the target area. The two image tiles (or quadrants) for the Baghlan area are provided as embedded geotiff images, which can be read and used by most geographic information system (GIS) and image-processing software. The tiff world files (tfw) are provided, even though they are generally not needed for most software to read an embedded geotiff image.</dc:description>
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formation of Jurassic age from samples taken in the Jo Dandy area, Montrose County, Colo., was made to
determine average chemical composition of mudstone and sandstone and to determine the magnitude of variations
in concentrations of elements within similar rock types. Analytical data were obtained by semiquantitative
spectrographic and radiometric methods.</p>

<p>Results of the study show that variations in concentrations of about 20 elements commonly detected by
semiquantititive spectrographic analyses of sedimentary rocks are small for a specific rock type; therefore,
considerable confidence may be placed upon the average chemical appears to be no significant relation between
chemical composition of mudstone or sandstone and distance from known uranium-vanadium ore or mineralization
rock.</p>
<p>
 </p>
<p>Mudstone generally contains greater concentrations of the elements studied than sandstone. The
chemical composition of red mudstone is similar to the chemical composition of green mudstone except that red
mudstone was found to contain almost twice as much calcium as green mudstone in the Jo Dandy area.</p>

<p>Samples of the unoxidized sandstone from the Jo Dandy area contain about twice as much calcium, three
times as much strontium, but only about one-half as much as zirconium as oxidized sandstone; except for these
elements the chemical compositions of both categories of sandstone are similar. Samples of sandstone of the
Salt Wash member in the Jo Dandy area contain more potassium, magnesium, vanadium, and nickel than “average
sandstone” of the Salt Wash member.</p>

<p>The distribution of bismuth in rocks of the Jo Dandy area suggests that bismuth and perhaps part of
the potassium and magnesium found in rocks of the Salk Wash member were either derived from solutions which
ascended from the underlying salt- and gypsum-bearing Paradox member that was incorporated with rocks of the
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types of phosphatic rock found in Florida. This report is concerned primarily with the land-pebble deposits, the only type which contains a significant amount of uranium. The most productive part of the land-pebble district is in Polk and Hillsborough Counties, in the west-central part of the Florida peninsula.</p>

<p>Phosphate occurs in both the Hawthorn formation of lower middle Miocene age and the Bone Valley formation of Pliocene age. The phosphate in the Bone Valley is generally of higher grade, probably as the result of mechanical reworking and further precipitation during submergence in Pliocene time. In a few places, leached parts of the Hawthorn formation are also of minable grade. , Pleistocene terrace deposits and beach sands unconformably overlie the Bone Valley.</p>

<p>In Polk and Hillsborough Counties, the high-grade part of the land-pebble phosphate district, uranium occurs principally in the Bone Valley formation and is concentrated in the upper part of the formation, which has been leached by ground water. The maximum tenor found to date is 0.1 percent uranium. The basal member of the Bone Valley has a maximum grade of .02 percent uranium, and averages about .01 percent uranium. Fresh, unweathered Hawthorn formation has little or no uranium, but leached Hawthorn, rich in P₂O₅, contains a maximum of 0.01 percent uranium. The Pleistocene sands have no uranium except where they contain reworked phosphatic material from the Bone Valley formation.</p>

<p>South of the high- grade district, in Manatee and Hardee Counties, the Bone Valley, Hawthorn, and Pleistocene formations contain only very minor amounts of uranium.</p>

<p>The uranium in the land-pebble deposits was probably syngenetic in origin. Subsequent leaching of soluble material has resulted in residual enrichment of uranium. The uranium seems to be associated with the phosphate mineral.</p></dc:description>
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<dc:description><p>Herbivory has played a major role in dictating vegetation abundance and species composition at Kingman Marsh in Anacostia Park, Washington, D.C., since restoration of this tidal freshwater wetland was initiated in 2000. The diverse and robust vegetative cover that developed in the first year post-reconstruction experienced significant decimation in the second year, after the protective fencing was removed, and remained suppressed throughout the five-year study period. In June 2009 a herbivory study was initiated to document the impacts of herbivory by resident and nonmigratory Canada geese (Branta canadensis) to vegetation at Kingman Marsh. Sixteen modules consisting of paired fenced plots and unfenced control plots were constructed. Eight of the modules were installed in vegetated portions of the restoration site that had been protected over time by pre-existing fencing, while the remaining eight modules were placed in portions of the site that had not been protected over time and were basically unvegetated at the start of the experiment. Exclosure fencing was sufficiently elevated from the substrate level to allow access to other herbivores such as fish and turtles, while hopefully excluding mature Canada geese. The study was designed with an initial exclosure elevation of 20 cm. This elevation was chosen based on the literature, as adequate to exclude mature Canada geese, while maximizing access to other herbivores such as fish and turtles.</p>

<p>Repeated measures analysis of variance (ANOVA) was used to analyze the differences between paired fenced and unfenced control plots for a number of variables including total vegetative cover. Differences in total vegetative cover were not statistically significant for the baseline data collected in June 2009. By contrast, two months after the old protective fencing was removed from the initially-vegetated areas to allow Canada geese access to the unfenced control plots, total vegetative cover had declined dramatically in the initially-vegetated unfenced control plots, and differences between paired fenced and unfenced control plots were statistically significant. These differences have remained steady and significant throughout the remainder of these first three years of the study.</p>

<p>Total vegetative cover has followed a somewhat different path in the initially-unvegetated modules, where cover in the fenced plots did not significantly exceed cover in the unfenced control plots until the August 2010 sampling event. In spite of the slow start in the initially-unvegetated modules, differences between paired fenced plots and unfenced control plots have remained significant and even increased significantly over time. This indicates that total vegetative cover in the initially-unvegetated fenced plots and unfenced control plots is continuing to diverge over time as vegetation increases in the protected plots compared to the basically unvegetated unfenced control plots.</p>

<p>Total vegetative cover has been composed almost entirely of native species during the first three years of the study, with cover by exotics averaging less than 1% during each sampling event.</p>

<p>Species richness did not differ significantly between fenced plots and unfenced control plots during 2009, the first year of the study. Since August 2010, species richness has remained significantly greater in the fenced plots than in the unfenced control plots. These differences have remained relatively steady over time for both the initially-vegetated and initially unvegetated modules.</p>

<p>During the study it became apparent that our elevated fence plots were more accessible to mature geese than we had expected. Even after lowering the exclosure fencing to 15 cm in 2010 and 10 cm in 2011, we documented geese inside exclosures in both years. Nonetheless the data indicate that even at 10 cm, we have limited the numbers of mature geese entering the fenced plots, rather than totally preventing their access through low spots in the uneven substrate surface. At an exclosure elevation of 10 cm and with a soft, mucky substrate, we are assuming that non-goose herbivores such as fish and turtles still have free access to the fenced plots. Annual wildrice (Zizania aquatica), known from previous studies to be especially palatable to Canada geese, has seen the greatest impact from partial access to the fenced plots by mature geese, moving from an overwhelming dominant in the initially-vegetated plots to a minor presence there by August 2011. Interestingly, pickerelweed (Pontederia cordata), also known to be highly palatable to Canada geese, has so far shown only minor herbivory in the fenced plots. By August 2011, pickerelweed had actually increased to significantly greater cover levels in the fenced plots compared to the unfenced control plots.</p>

<p>In conclusion, the first three years of data document that vegetation exposed to full herbivory by resident and nonmigratory Canada geese for three years in the unfenced control plots showed significantly lower total vegetative cover and species richness compared to the vegetation in the fenced plots, which experienced reduced herbivory by resident and nonmigratory Canada geese. These effects were documented for modules located in both initially-vegetated and initially-unvegetated habitats.</p></dc:description>
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literature to provide a basis for research regarding the occurrence and distribution of Ga worldwide, as well
as between types of bauxite deposits. In addition, this report is an attempt to bring together reported Ga
concentration data into one database to supplement ongoing U.S. Geological Survey studies of critical mineral
resources.&lt;/p&gt;
&lt;br /&gt;
&lt;p&gt;The compilation of Ga data consists of location, deposit size, bauxite type and host rock, development
status, major oxide data, trace element (Ga) data and analytical method(s) used to derive the data, and tonnage
values for deposits within bauxite provinces and districts worldwide. The range in Ga concentrations for
bauxite deposits worldwide is &amp;lt;10 to 812 parts per million (ppm), with an average of 57 ppm. Gallium
concentrations in lateritic bauxites range from below detection (&amp;lt; 8 ppm) to 146 ppm; the average
concentration is 57 ppm Ga. The average Ga concentration for karst bauxite deposits is 58 ppm with a range
between &amp;lt;10 to 180 ppm Ga. As a result, there are no substantial differences in gallium concentrations
between karst- and laterite-type bauxites. We calculate the range in geologically available Ga in bauxite
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places and beach and dune erosion occurred along most of the Mid-Atlantic coast. As a part of the National
Assessment of Coastal Change Hazards project, the U.S. Geological Survey collected post-Hurricane Sandy oblique
aerial photography and lidar topographic surveys to document the changes that occurred as a result of the
storm. Comparisons of post-storm photographs to those collected prior to Sandy’s landfall were used to
characterize the nature, magnitude, and spatial variability of hurricane-induced coastal changes. Analysis of
pre- and post-storm lidar elevations was used to quantify magnitudes of change in shoreline position, dune
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obtaining data that would aid in estimating the quantities of materials to be excavated from the cut required
for the construction of Route 3. A report in the geology of the site together with the interpretation of the
seismic data that were obtained at this time was submitted by Robert O. Castle and Robert M. Haslewood (file
report of October 1951). Additional seismic work was performed at this site in July 1953. This later work was
done to obtain information that would help in planning for the construction of the inner and outer loops of the
northwest ramp, and the western approach of Route 62 to Route 3. This report contains the geologic
interpretation of the supplementary seismic data that were obtained during the July 1953 survey. The work was
performed as a part of a cooperative project of the Massachusetts Department of Public Works and the United
States Geological Survey.</p>

<p>Mr. M. E. Chandler and Mr. W. L. Carney, Department of Public Works' Engineers, performed all
pertinent survey work required for this project, and prepared the essential plans and profiles. Mr. Chandler
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activity (SVA) at 6 volcanic centers in 1995: Mount Martin (Katmai Group), Mount Veniaminof, Shishaldin,
Makushin, Kliuchef/Korovin, and Kanaga. In addition to responding to eruptive activity at Alaska volcanoes, AVO
also disseminated information for the Kamchatkan Volcanic Eruption Response Team (KVERT) on the 1995 eruptions
of 2 Russian volcanoes: Bezymianny and Karymsky. This report summarizes volcanic activity in Alaska during 1995
and the AVO response, as well as information on the 2 Kamchatkan eruptions. Only those reports or inquiries

that resulted in a "significant" investment of staff time and energy (here defined as several hours or more for reaction, tracking, and follow-up) are included. AVO typically receives dozens of phone calls throughout the year reporting steaming, unusual cloud sightings, or eruption rumors. Most of these are resolved quickly and are not tabulated here as part of the 1995 response record.</dc:description>
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₄) and, separately, deuterated water (D
₂O) to the shale, we have identified the fraction of pores that are accessible to these compounds over this size range. The total pore size distribution is essentially identical for the two samples. At pore sizes >250 nm, >85% of the pores in both samples are accessible to both CD
₄ and D
₂O. However, differences in accessibility to CD
₄ are observed in the smaller pore sizes (~25 nm). In one sample, CD
₄ penetrated the smallest pores as effectively as it did the larger ones. In the other sample, less than 70% of the smallest pores (<25 nm) were accessible to CD
₄, but they were still largely penetrable by water, suggesting that small-scale heterogeneities in methane accessibility occur in the shale samples even though the total porosity does not differ. An additional study investigating the dependence of scattered intensity with pressure of CD
₄ allows for an accurate estimation of the pressure at which the scattered intensity is at a minimum. This study provides information about the composition of the material immediately surrounding the

pores. Most of the accessible (open) pores in the 25 nm size range can be associated with either mineral matter or high reflectance organic material. However, a complementary scanning electron microscopy investigation shows that most of the pores in these shale samples are contained in the organic components. The neutron scattering results indicate that the pores are not equally proportioned in the different constituents within the shale. There is some indication from the SANS results that the composition of the pore-containing material varies with pore size; the pore size distribution associated with mineral matter is different from that associated with organic phases.</dc:description>
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<dc:description>Waters with low salinity and high sodium adsorption ratios (SARs) present a challenge to
irrigation because they degrade soil structure and infiltration capacity. In the Powder River Basin of Wyoming,
such low salinity (electrical conductivity, EC 2.1 mS cm
&lt;sup&gt;-1&lt;/sup&gt;) and high-SAR (54) waters are co-produced with coal-bed methane and some are used for
subsurface drip irrigation(SDI). The SDI system studied mixes sulfuric acid with irrigation water and applies
water year-round via drip tubing buried 92 cm deep. After six years of irrigation, SAR values between 0 and 30
cm depth (0.5-1.2) are only slightly increased over non-irrigated soils (0.1-0.5). Only 8-15% of added Na has
accumulated above the drip tubing. Sodicity has increased in soil surrounding the drip tubing, and geochemical
simulations show that two pathways can generate sodic conditions. In soil between 45-cm depth and the drip
tubing, Na from the irrigation water accumulates as evapotranspiration concentrates solutes. SAR values &amp;gt;
12, measured by 1:1 water-soil extracts, are caused by concentration of solutes by factors up to 13. Low-EC
(&amp;lt;0.7 mS cm
&lt;sup&gt;-1&lt;/sup&gt;) is caused by rain and snowmelt flushing the soil and displacing ions in soil
solution. Soil below the drip tubing experiences lower solute concentration factors (1-1.65) due to excess
irrigation water and also contains relatively abundant native gypsum (2.4 &amp;plusmn; 1.7 wt.%). Geochemical
simulations show gypsum dissolution decreases soil-water SAR to &amp;lt;7 and increases the EC to around 4.1 mS
cm-1, thus limiting negative impacts from sodicity. With sustained irrigation, however, downward flow of excess
irrigation water depletes gypsum, increasing soil-water SAR to &amp;gt;14 and decreasing EC in soil water to
3.2 mS cm-1. Increased sodicity in the subsurface, rather than the surface, indicates that deep SDI can be a
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basis of many monetary systems. The metal has played an important part in world history. Silver from the mines
at Laurion, Greece, for example, financed the Greek victory over the Persians in 480 B.C. Silver from Potosi,
Bolivia, helped Spain become a world power in the 16th and 17th centuries. And silver from the gold-silver ores
at the Comstock Lode in Virginia City, Nev., helped keep the Union solvent during the Civil War.</dc:
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specialty clay industry worldwide for 1997 is discussed. The specialty clays mined in the U.S. are ball clay,
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<dc:type>Publication</dc:type>
<dc:subject>Resource Publication</dc:subject>
<dc:date>Mon Jul 21 13:21:38 MDT 2014</dc:date>
<dc:description>&lt;p&gt;A nationwide State-Federal cooperative study was initiated in 1978 to examine effects
of September hunting on nesting mourning doves (&lt;i&gt;Zenaida macroura&lt;/i&gt;). This study was designed
to (1) determine the proportion of the annual total of dove nesting activity and production that occurs in
September and October, and (2) determine if survival rates of mourning dove eggs and nestlings are lower in
zones where early September dove hunting is permitted than in zones where it is prohibited.&lt;/p&gt;
&lt;br /&gt;
&lt;p&gt;During 1979 and 1980, 6,950 active nests were monitored to obtain data on nesting patterns. Nest
initiation was estimated using two measurements, backdating from hatch dates and counting numbers of nests
found for the first time. The nationwide percentage of the annual total of nests that were initiated in
September and October was 1.0% based on backdating from hatch dates and 2.7% based on nests found for the first
time. Nesting activity was measured by numbers of eggs and nestlings present in weekly counts. Nationally, 4.5%
of the annual nesting activity occurred in September and October. The activity of 80% of the observed nests was
within the period of 22 April to 4 September. The measure of production used in this study was numbers of young
fledged. Nationally, 10.3% of all observed fledging occurred in September and October. Because a decline in
nests found in the latter half of the nesting season preceded the 1 September start of hunting, we concluded
that the reduction in nesting activity at the end of the season is a natural phenomenon and is not caused by
hunting disturbance.&lt;/p&gt;
&lt;br /&gt;
&lt;p&gt;In a separate part of this study, we estimated survival rates in adjacent hunted and nonhunted zones
from data on 668 nests. The estimated daily survival rates for individual eggs and nestlings were 95.8% in the
nonhunted and 95.0% in the hunted zones; the corresponding fledging rates were 33 and 26%, respectively. The
fledging rates are lower because they are the daily survival rates operating over a 26-day nesting period.
Neither differences in survival nor fledging rates between nonhunted and hunted zones were found to be
statistically significant (P &amp;gt; 0.05). We determined that the statistical test was powerful enough to
detect a reduction due to hunting from a hypothetical 96.0 to 94.2% in daily nestling survival rates (from 35
to 21 o/o in fledging rates) with 80% probability. An undetected reduction in fledging rate of that magnitude
would probably reduce the overall fledging rate by less than 1 percentage point, because only a small
proportion of the nesting doves are exposed to hunting for the full 26-day nesting cycle.&lt;/p&gt;
&lt;br /&gt;
&lt;p&gt;In conclusion, we found that only a small proportion of total annual nesting attempts occurred after
the start of hunting season. There was no statistically significant difference in survival rates in zones where
hunting was permitted compared with zones where it was prohibited. We concluded from this study that dove
hunting under current regulations has no substantial effect on recruitment of fledglings into the mourning dove
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<dc:title>Comparison of DNA preservation methods for environmental bacterial community samples</dc:title>
<dc:type>Publication</dc:type>
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<dc:description>Field collections of environmental samples, for example corals, for molecular microbial
analyses present distinct challenges. The lack of laboratory facilities in remote locations is common, and
preservation of microbial community DNA for later study is critical. A particular challenge is keeping samples
frozen in transit. Five nucleic acid preservation methods that do not require cold storage were compared for
effectiveness over time and ease of use. Mixed microbial communities of known composition were created and
preserved by DNAgard™, RNAlater
®, DMSO–EDTA–salt (DESS), FTA
® cards, and FTA Elute
® cards. Automated ribosomal intergenic spacer analysis and clone libraries were
used to detect specific changes in the faux communities over weeks and months of storage. A previously known
bias in FTA
® cards that results in lower recovery of pure cultures of Gram-positive
bacteria was also detected in mixed community samples. There appears to be a uniform bias across all five
preservation methods against microorganisms with high G + C DNA. Overall, the liquid-based preservatives
(DNAgard™, RNAlater
®, and DESS) outperformed the card-based methods. No single liquid method
clearly outperformed the others, leaving method choice to be based on experimental design, field facilities,
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<dc:type>Publication</dc:type>
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<dc:description>Recent (2009-10) studies documented significantly higher concentrations of polycyclic aromatic
hydrocarbons (PAHs) in settled house dust in living spaces and soil adjacent to parking lots sealed with coal-
tar-based products. To date, no studies have examined the potential human health effects of PAHs from these
products in dust and soil. Here we present the results of an analysis of potential cancer risk associated with
incidental ingestion exposures to PAHs in settings near coal-tar-sealed pavement. Exposures to benzo[a]pyrene
equivalents were characterized across five scenarios. The central tendency estimate of excess cancer risk
resulting from lifetime exposures to soil and dust from nondietary ingestion in these settings exceeded 1 &
times; 10
^{−4}, as determined using deterministic and probabilistic methods. Soil was the primary
driver of risk, but according to probabilistic calculations, reasonable maximum exposure to affected house dust

in the first 6 years of life was sufficient to generate an estimated excess lifetime cancer risk of 6 & times; 10
^{–5}. Our results indicate that the presence of coal-tar-based pavement sealants is associated with significant increases in estimated excess lifetime cancer risk for nearby residents. Much of this calculated excess risk arises from exposures to PAHs in early childhood (i.e., 0–6 years of age).</dc:description>
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<dc:title>Commissioned Review. Carbon: freshwater plants</dc:title>
<dc:type>Publication</dc:type>
<dc:date>Mon Jul 21 11:46:10 MDT 2014</dc:date>
<dc:description>13C values for freshwater aquatic plant matter varies from 11 to 50‰ and is not a clear indicator of photosynthetic pathway as in terrestrial plants. Several factors affect 13C of aquatic plant matter. These include: (1) The 13C signature of the source carbon has been observed to range from +1‰ for HCO3 derived from limestone to 30‰ for CO2 derived from respiration. (2) Some plants assimilate HCO3, which is –7 to –11‰ less negative than CO2. (3) C3, C4, and CAM photosynthetic pathways are present in aquatic plants. (4) Diffusional resistances are orders of magnitude greater in the aquatic environment than in the aerial environment. The greater viscosity of water acts to reduce mixing of the carbon pool in the boundary layer with that of the bulk solution. In effect, many aquatic plants draw from a finite carbon pool, and as in terrestrial plants growing in a closed system, biochemical discrimination is reduced. In standing water, this factor results in most aquatic plants having a 13C value similar to the source carbon. Using Farquhar's equation and other physiological data, it is possible to use 13C values to evaluate various parameters affecting photosynthesis, such as limitations imposed by CO2 diffusion and carbon source.</dc:description>
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<dc:description>The article offers information on pumice, an important commodity for the construction, horticulture and abrasives industries. The commodity is described as an extremely light, highly porous extrusive volcanic rock which was formed due to the rapid cooling of air-pocketed lava. It is noted that the characteristics of pumice make it as an ideal aggregate material in lightweight building blocks in the U.S. and abroad. The leading countries in terms of pumice production are Greece and the U.S.</dc:description>
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<dc:type>Publication</dc:type>
<dc:date>Mon Jul 21 11:37:53 MDT 2014</dc:date>
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<i>(U. S. Fish and Wildl. Serv., Spec. Sci. Rept.; Fish, No. 55)</i> and the subsequent development
of means to control lampreys in the Great Lakes, biologists have accumulated much additional information on
adult lampreys. Larval lampreys, however, are difficult animals to observe in the field, and many facets of
their behavior are still unknown. While working with the U. S. Fish and Wildlife Service, I kept ammocetes in
captivity, and was able to observe their burrowing activities.</dc:description>
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<dc:type>Publication</dc:type>
<dc:date>Mon Jul 21 13:06:40 MDT 2014</dc:date>
<dc:description>The possibility of using lithium in batteries to power electric vehicles and as fuel for
thermonuclear power has focused attention on the limited resources of lithium other than in pegmatite minerals.
The Clayton Valley, Nev., subsurface lithium brine has been the major source of lithium carbonate since about
1967, but the life of this brine field is probably limited to several more decades at the present rate of
production. Lithium is so highly soluble during weathering and in sedimentary environments that no lithium-rich
sedimentary minerals other than clays have been identified to date. The known deposits of lithium, such as the
clay mineral hectorite and the lithium-rich brines, occur in closed desert basins of the Southwest in
association with nonmarine evaporites. However, the ultimate source for the lithium in these deposits may be
from hydrothermal solutions. The search for previously unreported deposits of nonpegmatitic lithium should
consider its probable association, not only with nonmarine evaporite minerals, but also with recent volcanic
and tectonic activity, as well as with deposits of boron, beryllium, fluorine, manganese, and possibly
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<dc:type>Publication</dc:type>
<dc:subject>Fact Sheet</dc:subject>
<dc:date>Mon Jul 21 13:12:21 MDT 2014</dc:date>
<dc:description>Federal public lands in the western United States are becoming increasingly surrounded by
Gateway Communities. These communities are undergoing landscape change due to population growth, economic
growth, and the resulting land-use development. Socioeconomic, demographic, and land-use changes in Gateway
Communities are often perceived as threats to Federal land resources, natural amenities, cultural resources,
and recreational opportunities. However, land-surface disturbances on Federal public lands, such as
conventional and alternative energy development (which impact surrounding Gateway Communities), are also
environmental and societal issues that Federal land and adjacent regional community planners need to consider
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<dc:type>Publication</dc:type>
<dc:subject>Technical Publication</dc:subject>
<dc:date>Mon Jul 21 12:43:56 MDT 2014</dc:date>
<dc:description>The central Virgin River basin, in Washington and Iron Counties, Utah, includes about 1,000
square miles in the drainage basin of the Virgin River downstream from the Hurricane Cliffs. Aquifers in both
consolidated and unconsolidated rocks supply water for public supply, irrigation, stock, industry, and domestic
uses. The chief unconsolidated-rock aquifers are alluvial fans and channel-fill deposits, which supply about 80
percent of the water withdrawn by wells in the basin. The chief consolidated-rock aquifers include the
Moenkopi, Chinle, Moenave, and Kayenta Formations, the Navajo Sandstone, basalt, and Tertiary igneous rocks of
the Pine Valley Mountains. These aquifers supply water to about half the wells and most of the springs in the
project area.</dc:description>
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<dc:title>Comparison of historical streamflows to 2013 Streamflows in the Williamson, Sprague, and Wood Rivers,
Upper Klamath Lake Basin, Oregon</dc:title>
<dc:type>Publication</dc:type>

<dc:subject>Open-File Report</dc:subject>
<dc:date>Mon Jul 21 11:46:48 MDT 2014</dc:date>
<dc:description><p>In 2013, the Upper Klamath Lake Basin, Oregon, experienced a dry spring, resulting in an executive order declaring a state of drought emergency in Klamath County. The 2013 drought limited the water supply and led to a near-total cessation of surface-water diversions for irrigation above Upper Klamath Lake once regulation was implemented. These conditions presented a unique opportunity to understand the effects of water right regulation on streamflows.</p>

<p>The effects of regulation of diversions were evaluated by comparing measured 2013 streamflow with data from hydrologically similar years. Years with spring streamflow similar to that in 2013 measured at the Sprague River gage at Chiloquin from water years 1973 to 2012 were used to define a Composite Index Year (CIY; with diversions) for comparison to measured 2013 streamflows (no diversions). The best-fit 6 years (1977, 1981, 1990, 1991, 1994, and 2001) were used to determine the CIY.</p>

<p>Two streams account for most of the streamflow into Upper Klamath Lake: the Williamson and Wood Rivers. Most streamflow into the lake is from the Williamson River Basin, which includes the Sprague River. Because most of the diversion regulation affecting the streamflow of the Williamson River occurred in the Sprague River Basin, and because of uncertainties about historical flows in a major diversion above the Williamson River gage, streamflow data from the Sprague River were used to estimate the change in streamflow from regulation of diversions for the Williamson River Basin. Changes in streamflow outside of the Sprague River Basin were likely minor relative to total streamflow.</p>

<p>The effect of diversion regulation was evaluated using the “Baseflow Method,” which compared 2013 baseflow to baseflow of the CIY. The Baseflow Method reduces the potential effects of summer precipitation events on the calculations. A similar method using streamflow produced similar results, however, despite at least one summer precipitation event. The result of the analysis estimates that streamflow from the Williamson River Basin to Upper Klamath Lake increased by approximately 14,100 acre-feet between July 1 and September 30 relative to prior dry years as a result of regulation of surface-water diversions in 2013.</p>

<p>Quantifying the change in streamflow from regulation of diversion for the Wood River Basin was likely less accurate due to a lack of long-term streamflow data. An increase in streamflow from regulation of diversions in the Wood River Basin of roughly 5,500 acre-feet was estimated by comparing the average August and September streamflow in 2013 with historical August and September streamflow.</p>

<p>Summing the results of the estimated streamflow gain of the Williamson River Basin (14,100 acre-feet) and Wood River (5,500 acre-feet) gives a total estimated increase in streamflow into Upper Klamath Lake resulting from the July 1–September 2013 regulation of diversions of approximately 19,600 acre-feet.</p><
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