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science for a changing world

Data Informing Decisions and Actions

Fish Habitat Partnership Workshop

"To those devoid of imagination a blank place on the map is a useless waste; to others, the most valuable part." -Aldo Leopold

Daniel Wieferich (USGS)

October 15, 2018

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

U.S. Geological Survey Mission Areas

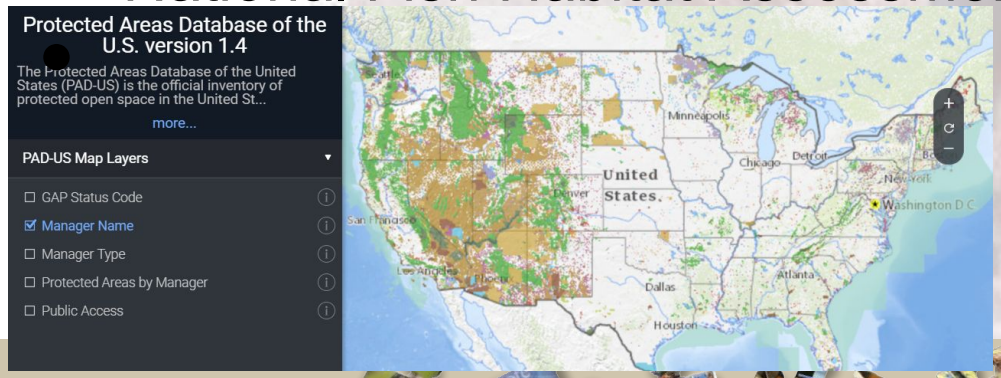
- **Core Science Systems -> CSASL (Wieferich*)**
  - Characterizing and understanding complex Earth and biological systems through research, modeling, mapping, and the production of high-quality data

- **Ecosystems**
- **Energy and Minerals**
- **Environmental Health**
- **Land Resources (e.g. Doug Beard)**
- **Natural Hazards**
- **Water Resources (e.g. Peter Ruhl)**

CSASL Biogeographic Characterization

National Scale Products

- Protected Areas Database (PAD-US 2.0)
- GAP Analysis Range and Distributions
- National Vegetation Classification System (NVCS)
- Integrated Taxonomic Information System (ITIS)
- Ocean Biogeographic Information System USA
- Biodiversity Information Serving Our Nation (BISON)
- Dam Removal Information Portal (DRIP)
- Species of Greatest Conservation Need (National List)
- National Fish Habitat Assessment (NFHP 2010, 2015)



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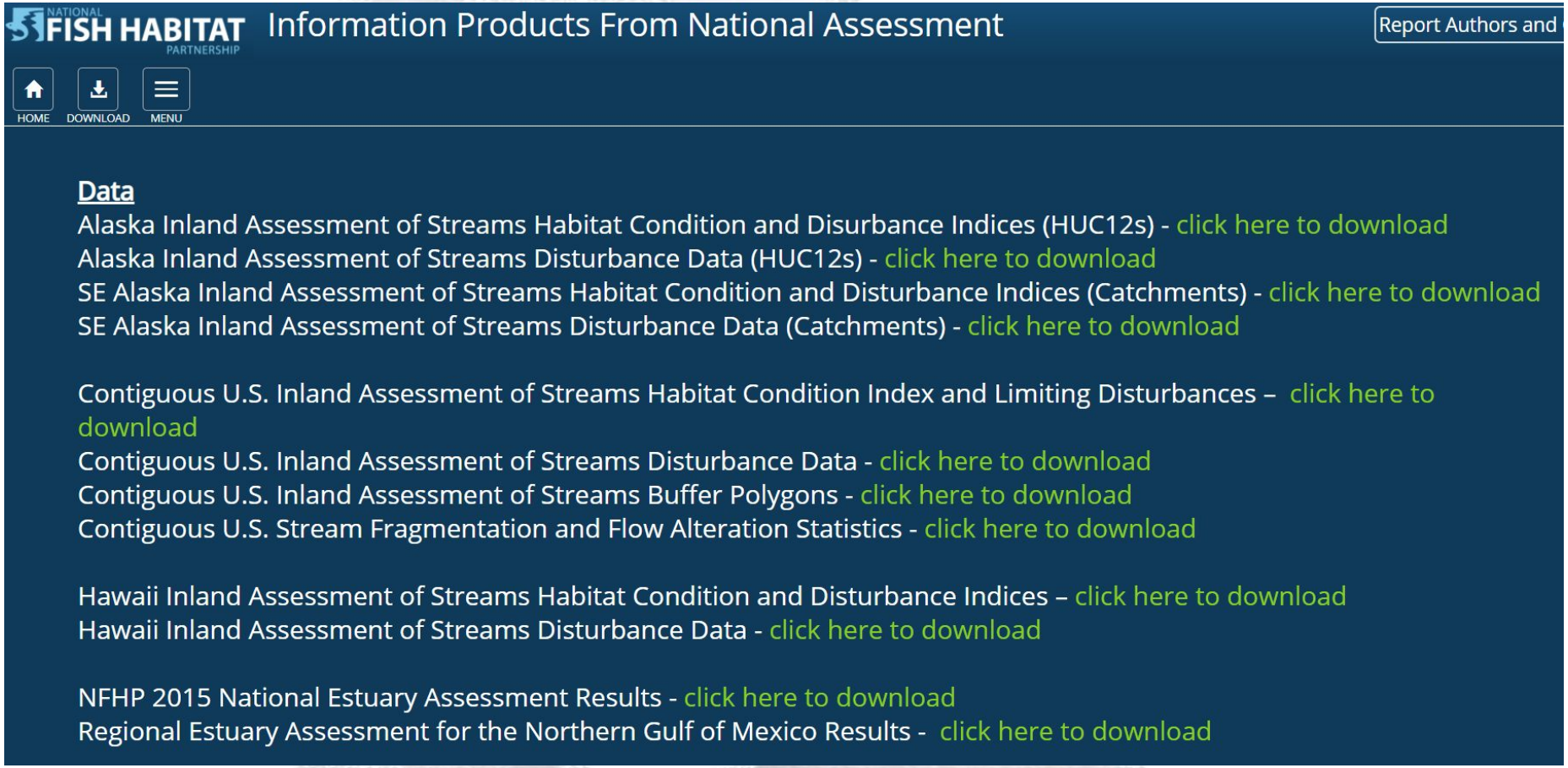
2015 Assessment Products

http://assessment.fishhabitat.org/#578d5e34e4b0c1aacabb4ca4/578d5e34e4b0c1aacabb4ca4SingleItem



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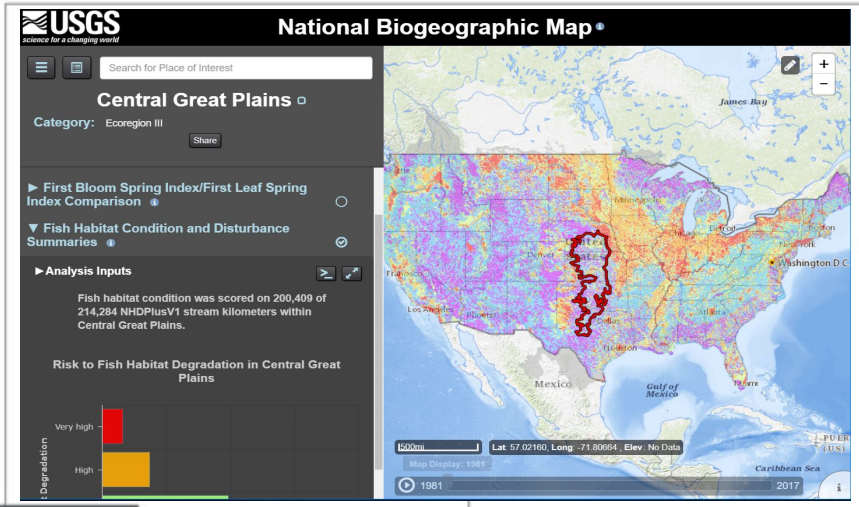
National Biogeographic Map

https://maps.usgs.gov/biogeography

Species and Habitats

- LOCATION
- PROTECTION STATUS
- THREATS AND STRESSORS
- MANAGEMENT OPTIONS



Explore management questions

Rapid response to: what species where, how well protected, how vulnerable, what options?

USGS Modular Science Framework

Biogeographic Analytical Toolkit

Knowledge System

Co-developed processes and methods for decision analysis

Biodiversity (species, habitat)

Conservation (management, protection)

Risk (vulnerability, exposure)

Linked data (Science, Management)

USGS INTEGRATED DATA ASSETS

Information platform

USGS foundational data and information assets, integrated and synthesized from source data streams, and enhanced through continuous linked data

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FHP - USGS Potential Collaborations

What Specific Information would help?

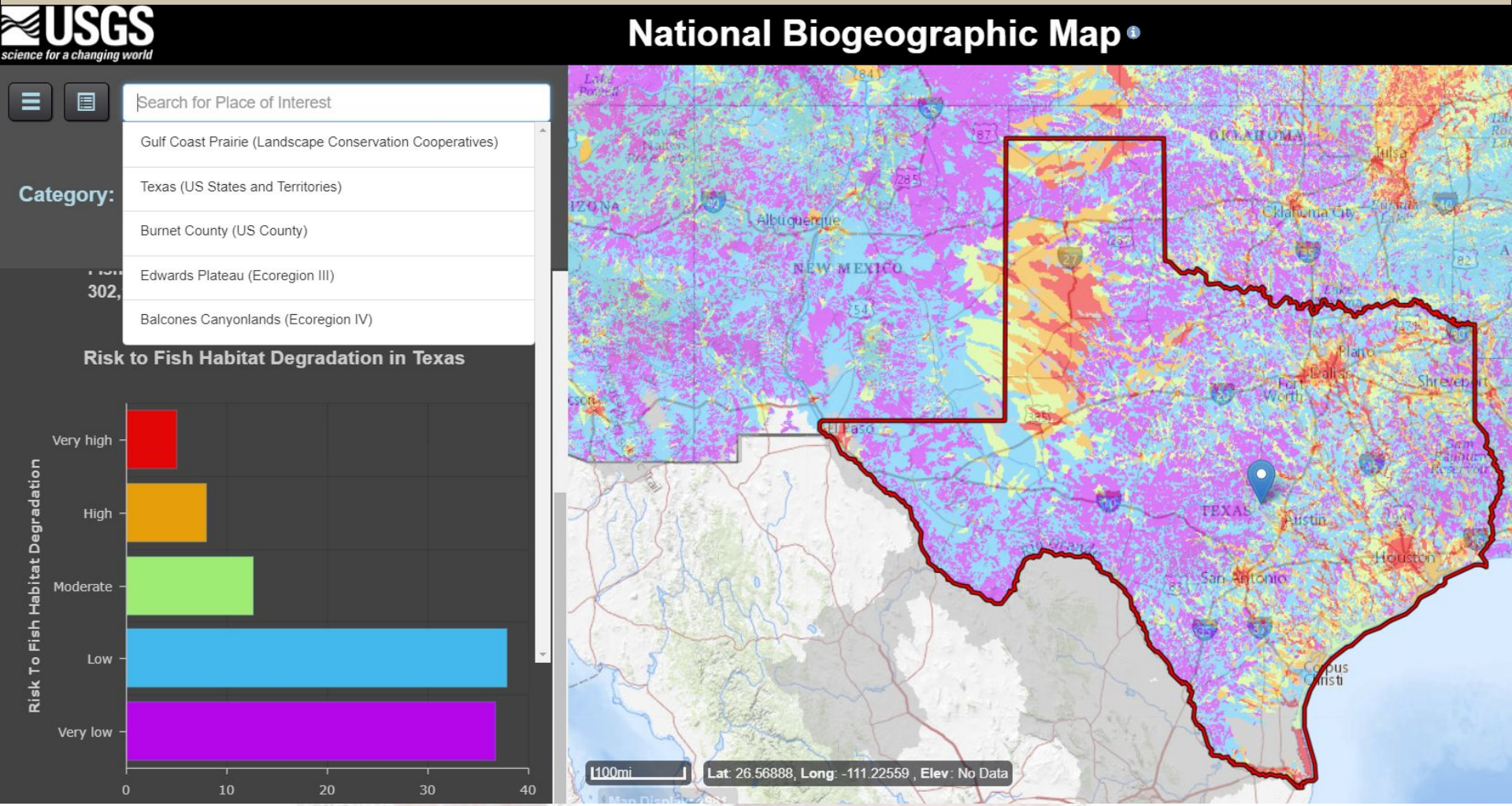
Support Funding Decisions:

- Prioritizing projects by watershed or other criteria
- Validate statements in proposals
- ??????

Support Science:

- Input datasets
- Data documentation and delivery
- ??????

National Biogeographic Map



Taxa Information Registry

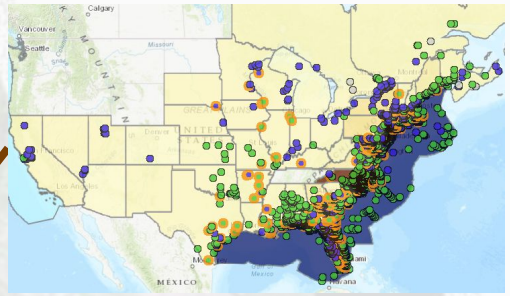
Public facing API actively being developed

ECOS

ITIS

Spatial:

Range, Distribution, Occurrence



Trait Databases

IUCN

SGCN

WORMS

Nature Serve

USGS

Spatial (-Temporal) Feature Registry

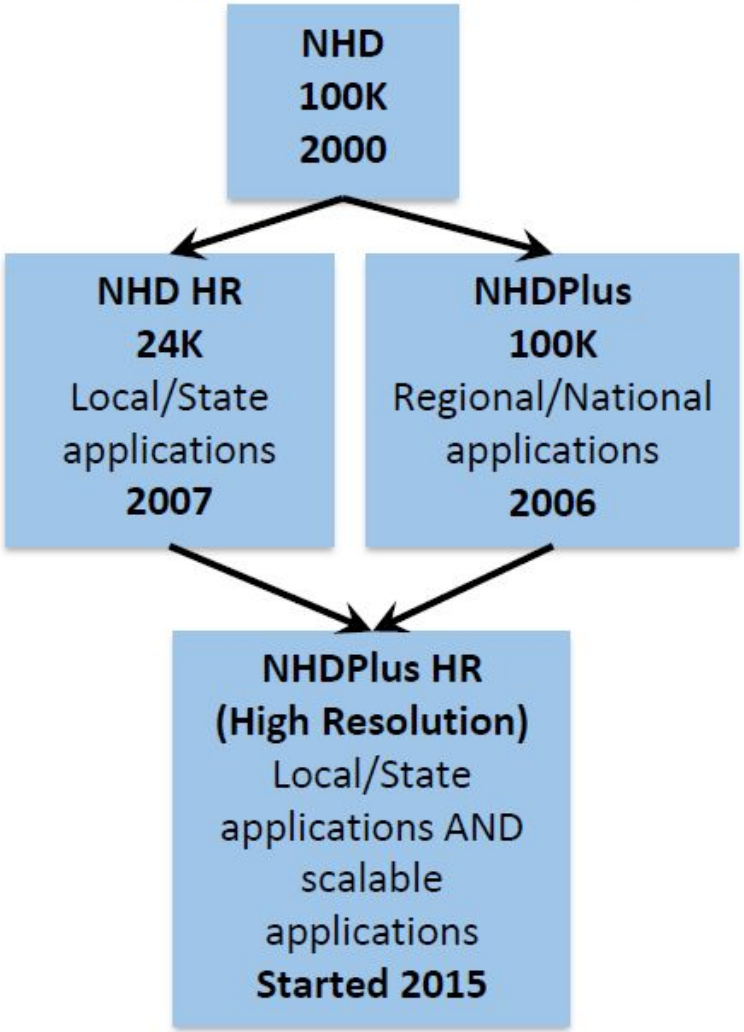
Public facing API actively being developed

More detail: https://my.usgs.gov/confluence/pages/viewpage.action?pageId=608440581

- **Feature of interest playing a role in analyses (e.g. jurisdictional boundaries, ecological boundaries, anthropogenic features, natural features, sample locations)**
- **Tracks relationships between features**
- **Accounts for temporal aspect (e.g. dam was built in 1920 and removed in 1999, or wetland delineation in 1999 vs. 2010)**

Evolution of NHDPlus HR

Taking NHDPlus v2 (Med Res) to a new level



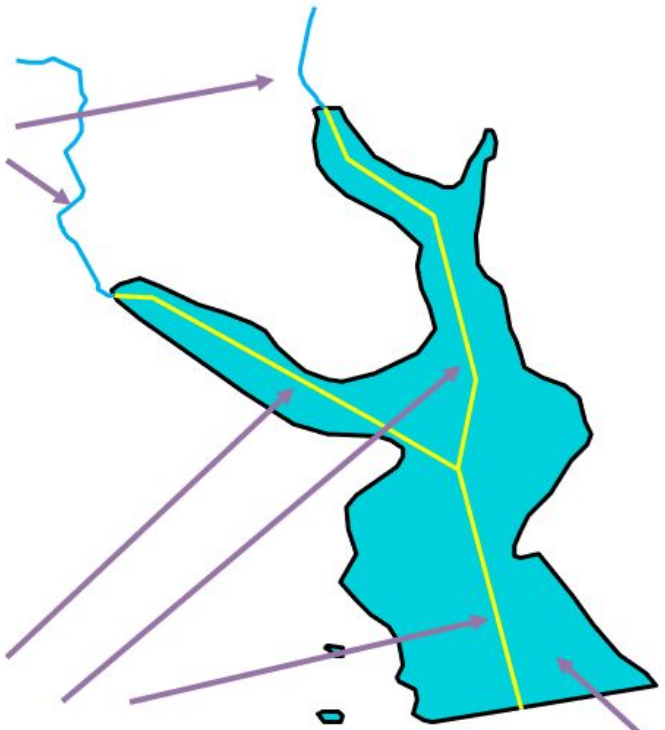
- The best of NHDPlus and NHD HR (24K or better) data
- Addresses the need for a single hydrographic frame of reference
- Link data to one network and generalize to many different scales

HydroLinking Data (Definition)

- **Assigning a spatial relationship between information and the hydrographic network**

- **Examples of information that can be linked**
  - **field observations (e.g. electro-fishing site)**
  - **features (location of a dam or road crossing)**
  - **landscape characteristics (% catchment ag)**

Linking Data to the NHD: Reaches & Reachcodes



On Linear Features

On Artificial Paths through Waterbody Features

On Waterbody Features

HydroLinking

Currently Many Efforts Many Techniques

- **Hydrography: NHDPlusV1 vs. NHDPlusV2 vs. NHD HighResPlus vs. Local versions**
- **Aggregation: NFHP, StreamStats, NAQWA, StreamCat**
- **Point Referencing: HEM Desktop Tool, ArcGIS workflows, HEM services….**

Working Towards Many Efforts Similar Techniques

HydroLinking: Tools

https://maps.usgs.gov/hydrolink/

HydroLink Tool

Generate a hydrologic linear reference for point data representing locations of geographic features or field samples using the HydroLink Tool. This web-based GIS application allows for upload of a shapefile for easy linkage of spatial data records to the National Hydrography Dataset (NHD) Plus Medium Resolution and NHD High Resolution hydrology layers. The outputted value-added dataset can be associated with NHD parameters and other data linked to the NHD.

The application accesses, and modifies feature services stored in your USGS ArcGIS Online account. Use the "Login" button below to sign into the HydroLink Tool using your ArcGIS Online credentials or "Request ArcGIS Online Account (USGS only)" if one is needed.

Login | Request ArcGIS Online Account (USGS only) | Report Issues or Provide Feedback

https://github.com/dwief-usgs/batch-hydrolink

Batch HydroLink

Contact:

Daniel Wieferich (dwieferich@usgs.gov)

Purpose:

Linking observation and spatial feature data to the National Hydrography Dataset (NHD) provides context to the hydrographic network and provides access to additional hydrography information within the NHD for research and analitical purposes. This repository contains Python code that explores methods that link sampling and feature information to the NHDPlusV2 and NHDHR datasets using a batch approach and providing a level of certainty.

Additional Details:

This code performs a hydrolink batch process on a text file (.csv) or shapefile (.shp) using user defined latitude and longitude fields. The code returns the reachcode and measure of the closest position on the High Resolution National Hydrography Datas
neces
are a

```
#Set variable list to store output data as it is processed
out_data = []
#
df = import_file(input_file, latitude_field, longitude_field, stream_name_field, identifier_field)

if run_on.lower() == 'nhdhr':
    for row in df.itertuples():

        #Define variables based on row,field values
        lat = row.lat
        lon = row.lon
        input_id = row.id
        stream = str(row.stream)

        print ('working on : ' + str(input_id))

        reachcode_hr,meas_hr,smdate_hr,perm_id_hr,xy_hr,gnis_name_hr = hydrolink_hr(lat,lon,input_id)
        stream_clean = clean_stream_name(stream)
        gnis_cert_hr = hr_certainty(stream_clean, gnis_name_hr)

        #record data in outData, this will be used to create dataframe
        out_data.append({"id":input_id,"reach_hr":reachcode_hr,"meas_hr":meas_hr,"smdate_hr":smdate_hr, "p
erm_id_hr": perm_id_hr, "xy_hr":xy_hr, "gnis_name_hr":gnis_name_hr, "gnis_cert_hr":gnis_cert_hr })
```

HydroLinking… So What!

Improves capability and efficiencies for data integration!!!

FHP - USGS Potential Collaborations

What Specific Information would help?

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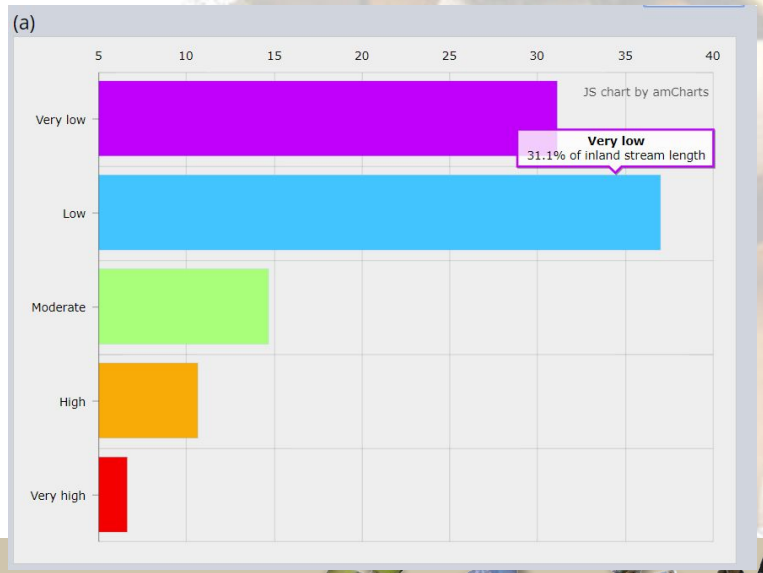
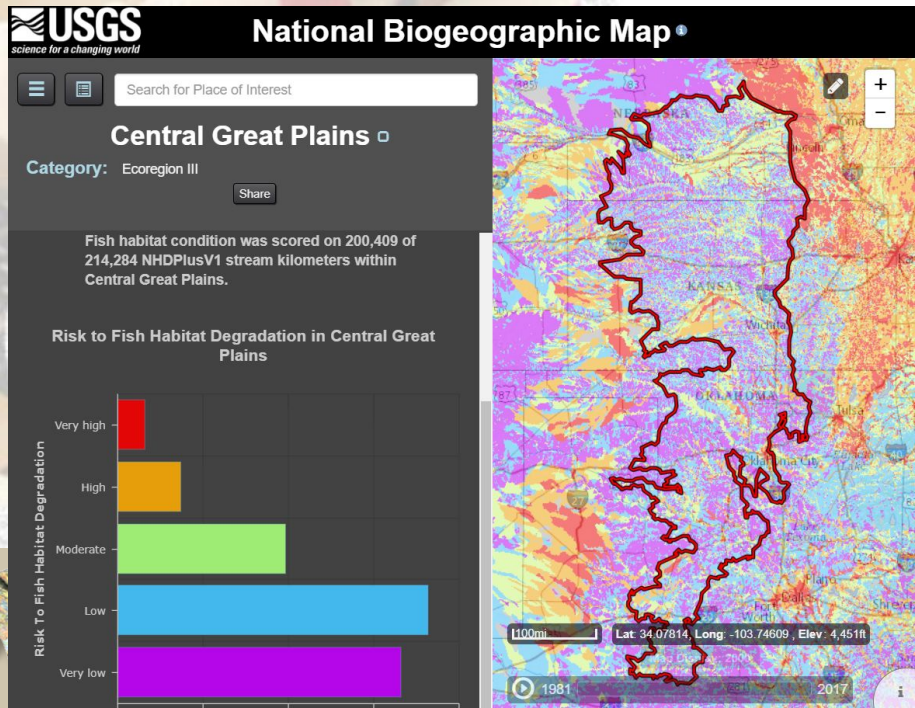
NFHP 2015 Fish Habitat Condition Summaries Use Case

Developing code to allow summaries (based of Through A Fish's Eye) to be ran against any jurisdictional or ecological boundary of interest

Through A Fish's Eye State Groupings



National Biogeographic Map -> same analysis, multiple spatial unit summaries to choose from



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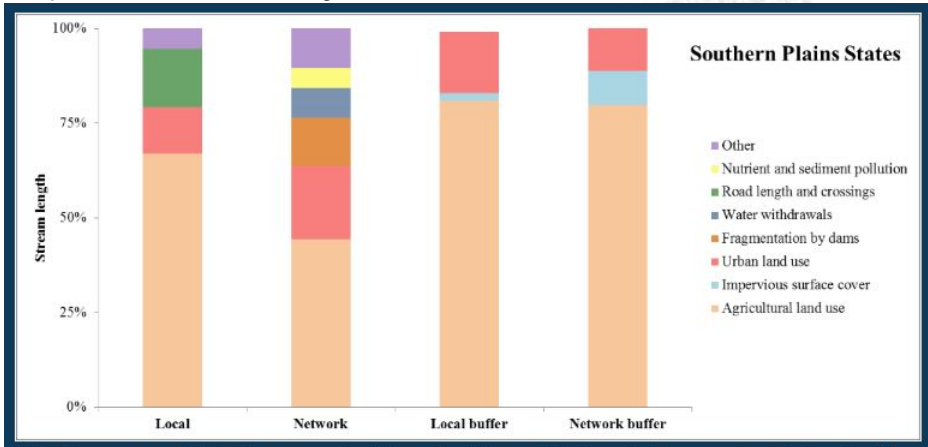
NFHP 2015 Fish Habitat Condition Summaries Use Case

http://assessment.fishhabitat.org/#578a9994e4b0c1aacab895b1/578a9a20e4b0c1aacab896df



Most severe disturbances in the Southern Plains States associated with stream reaches being scored as having high or very high risk of habitat degradation. Disturbances are grouped into large groups (fragmentation by dams; nutrient and sediment pollution; human population; road length and crossings; water withdrawals; urban land use; agricultural land use; mines and impervious surface cover) within the four spatial scales (local catchment, network catchment, local buffer, and network buffer). Only disturbance groups that have greater than 5% of stream length in a given category are represented in this figure. Note that not all disturbance categories are available for each spatial scale; buffers have only urban land use, agricultural land use, and impervious surface cover. See Detailed Inland Stream Methodology for more details.

A. Pervasive disturbances: The most common disturbances based on total stream length in a given region.

Top five overall most pervasive disturbances **to all stream reaches**, regardless of stream size and across all spatial scales (ranked highest first):

- Low intensity urban land use
- Impervious surface
- Pasture and hay land use
- Population density
- Crop land use

Top five most pervasive disturbances, **specific to spatial scales** :

B. Most severe disturbances (a subset of pervasive disturbances): Disturbances associated with stream reaches in a given region that were scored as having high or very high risk of habitat degradation (red and orange color groups).

Top five overall most severe disturbances to **all stream reaches**, regardless of stream size and across all spatial scales (ranked highest first):

- Pasture and hay land use
- Crop land use
- Low intensity urban land use
- Road length density
- Upstream dam density

Top three most severe disturbances to **creeks** (<100 km ^{2} watersheds) **across all spatial scales**:

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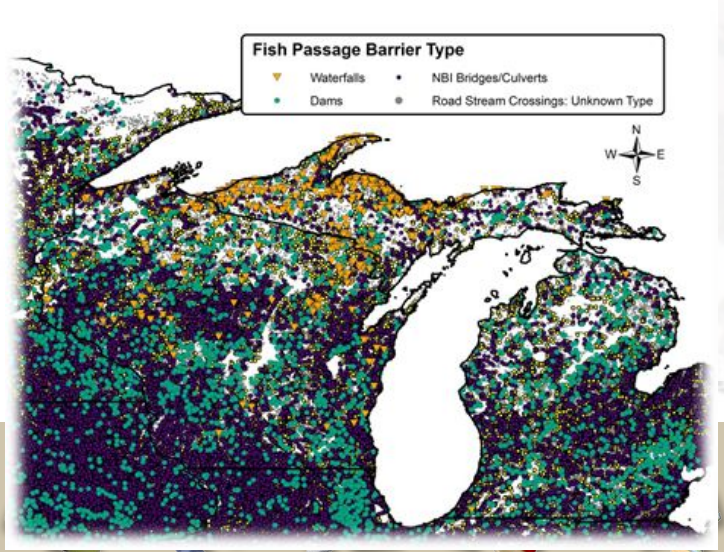
Connectivity As (An Example) Use Case

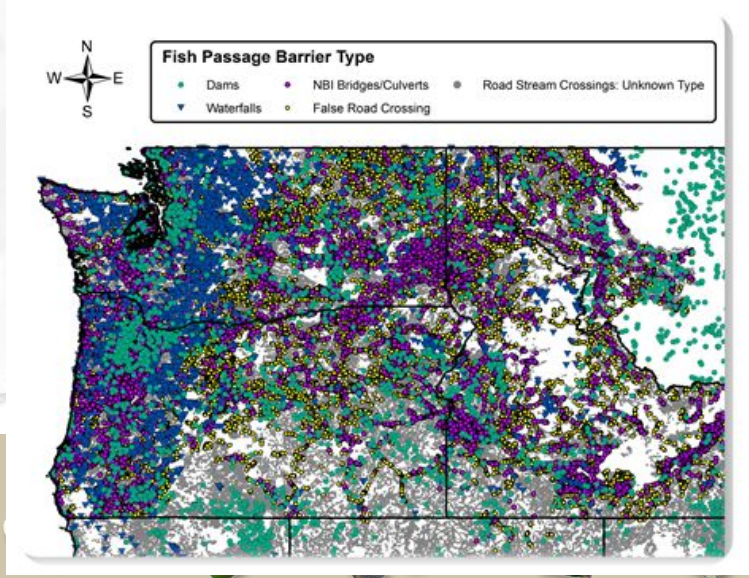
- Road Stream Crossings
- Bridges
- Large Dams
- Dam Removals
- Some Regions Small Dams
- Waterfalls
- NFHP 2015 Assessment Stream Fragmentation Statistics

Connectivity As (An Example) Use Case

Work together with FHPs to:

- **Understand how national data can be used in a regional setting… specific use cases**
- **Improve upon and/or build national data from regional efforts**





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Connectivity: Example Analyses

- **fragmentation from anthropogenic vs. natural features in different watersheds**
- **upstream habitat availability of a barrier**
- **relationships between traits and connected habitats**

USGS Resource:
Community of Data Integration

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science for a changing world

COMMUNITY FOR DATA INTEGRATION

• CLIMATE AND LAND USE CHANGE • WATER
• CORE SCIENCE SYSTEMS • ECOSYSTEMS
• NATURAL HAZARDS
• ENERGY AND MINERALS • ENVIRONMENTAL HEALTH

Community For Data Integration:

Open Community

Monthly Meetings

Solving USGS Data Integration Issues

Technical Working Groups

Seed Funding

USGS

Thank you!!!

- Questions
- Uses Cases
- Discussion

End of Presentation, but hopefully the START of conversation

Daniel Wieferich - dwieferich@usgs.gov