Images to Info: the USGS Flow Photo Explorer (FPE)

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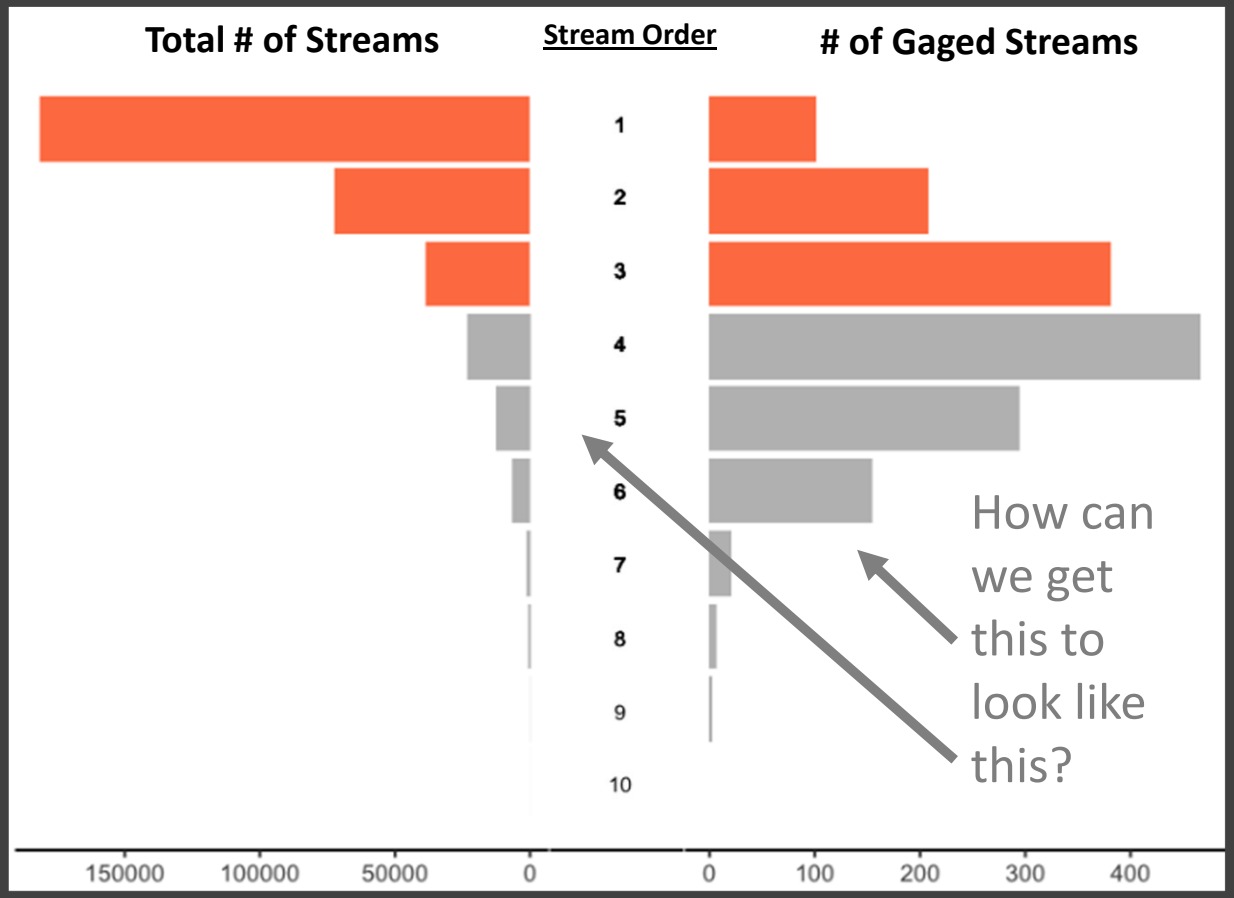
[2] U.S. Geological Survey, MD-DE-DC Water Science Center
[3] Microsoft AI for Good [4]Walker Environmental Research (Contractor to USGS)

Small streams are most abundant, but less widely monitored



Smallest Streams

Largest Streams

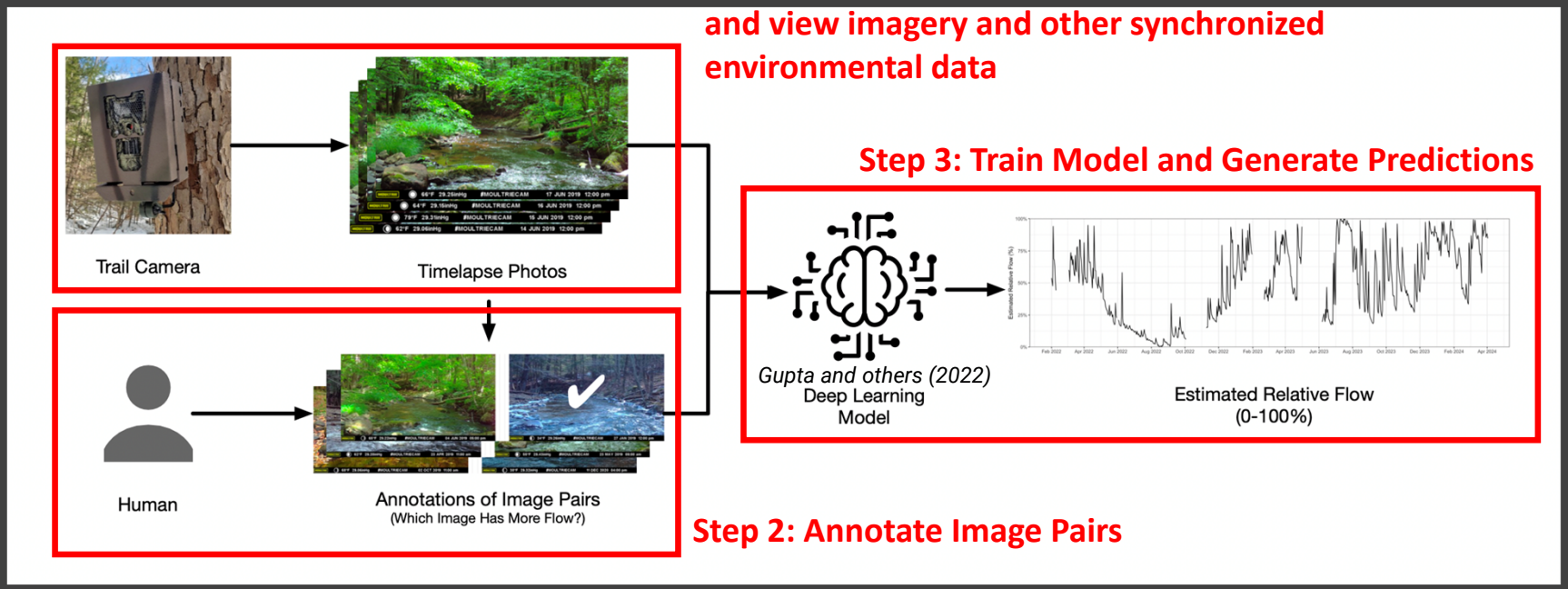
Relative number of USGS gages by stream order for the northeastern United States. Smallest stream are at the top. Number of streams is on the left and number of gaged streams is on the right. Headwaters in orange. Sources: USGS NWIS and NHDPlus. Figure developed in collaboration with Cee Nell.

How can we get data from small streams?

Cheap
Easy
Reliable
Safe

USGS science for a changing world

Low-cost, non-contact method for monitoring hydrologic conditions using timelapse imagery and a deep learning model *trained with human annotations*



Gupta, A., Chang, T., Walker, J., and B. Letcher (2022). ***Towards Continuous Streamflow Monitoring with Time-Lapse Cameras and Deep Learning.*** *In ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies (COMPASS) (COMPASS '22). Association for Computing Machinery, New York, NY, USA, 353–363. https://doi.org/10.1145/3530190.3534805*

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EcoSHEDS

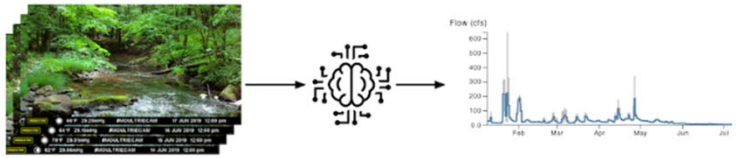
Flow Photo Explorer v2.2.2

HOME | ABOUT | USER GUIDE | PHOTO EXPLORER | ANNOTATE | MANAGE STATIONS | ACCOUNT

Welcome to the Flow Photo Explorer

The **Flow Photo Explorer (FPE)** is an integrated database, machine learning, and data visualization platform for monitoring streamflow and other hydrologic conditions using timelapse images.

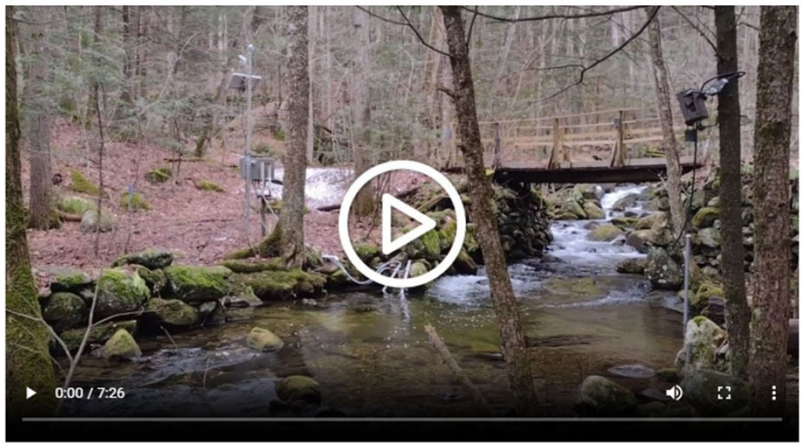
The goal of this project is to develop new approaches for collecting hydrologic data in streams, lakes, and other waterbodies, especially in places where traditional monitoring methods and technologies are not feasible or cost-prohibitive.



Timelapse Photos → Machine Learning Models → Continuous Streamflow

START EXPLORING >

Want to add your photos or help annotate? Request an account to upload your photos or help annotate photos uploaded by other users.
Want to receive periodic updates about the project? Sign up for our email newsletter.
Questions? You can reach us at ecosheds@usgs.gov.

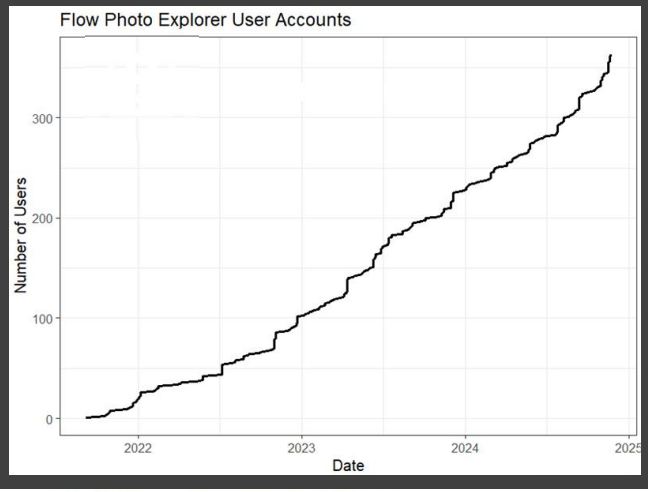


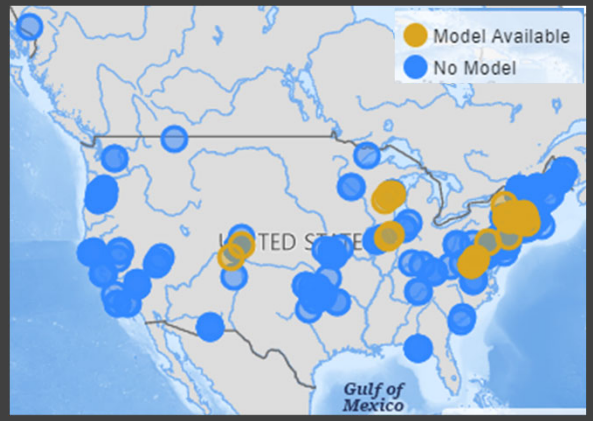
Video produced by the USGS MD-DE-DC Water Science Center

FPE is a collaboration between U.S. Geological Survey (USGS), U.S. Environmental Protection Agency (USEPA), Walker Environmental Research, Microsoft Research, and many contributing partners. Funding was provided by USGS, USEPA, and National Geographic Society. See About for more information.

https://www.usgs.gov/apps/ecosheds/fpe/

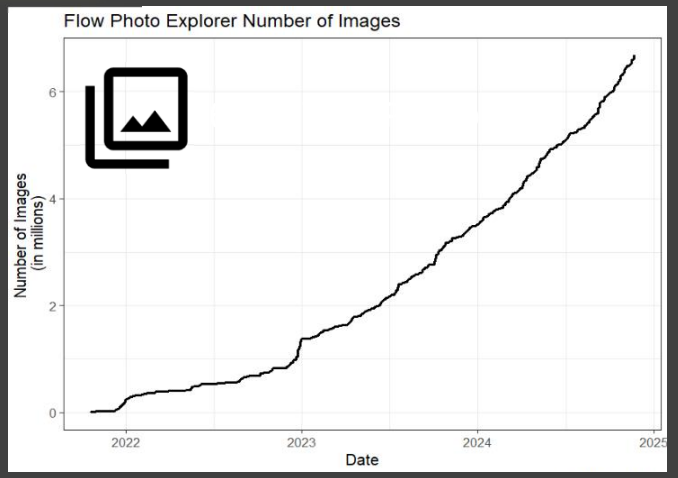
Flow Photo Explorer

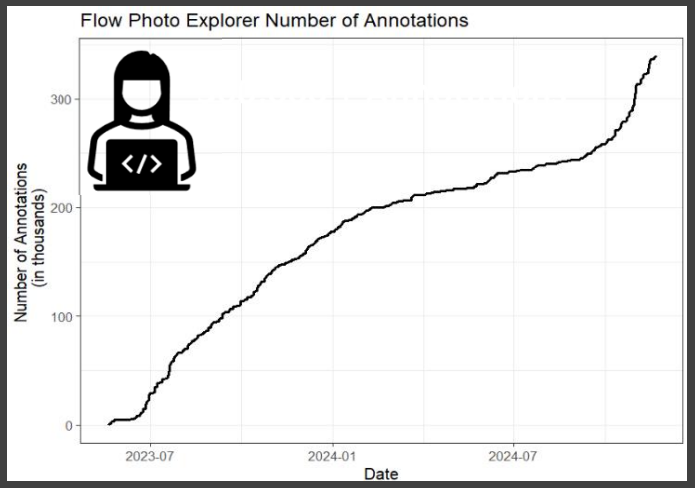


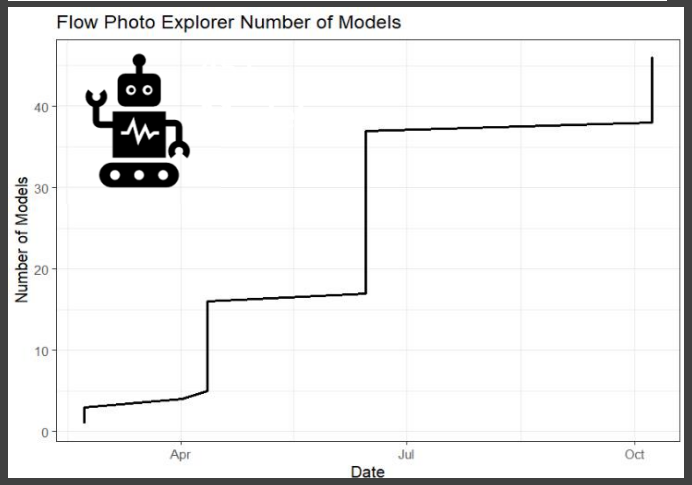


300+ Sites

Expanding rapidly since mid-2021!!







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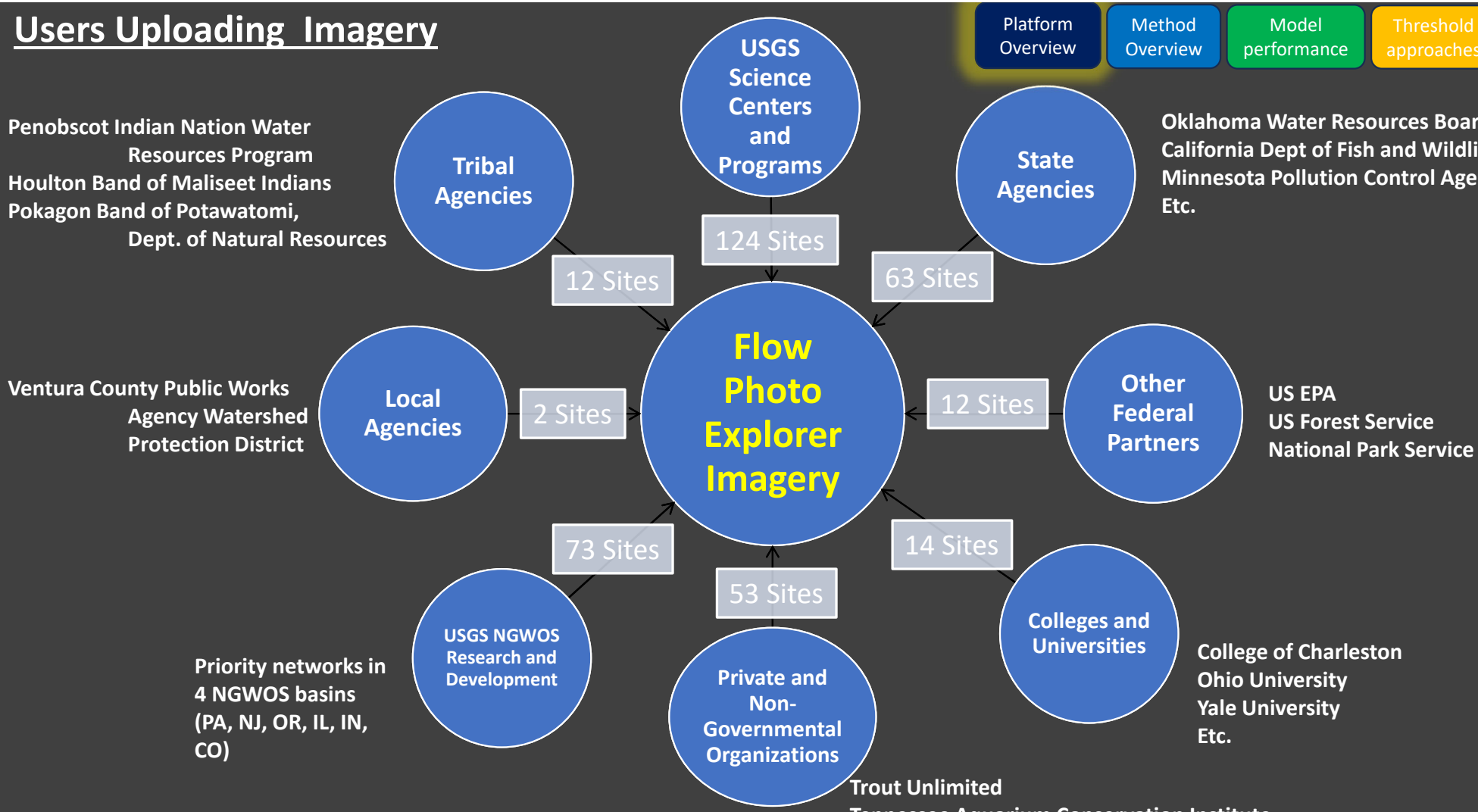
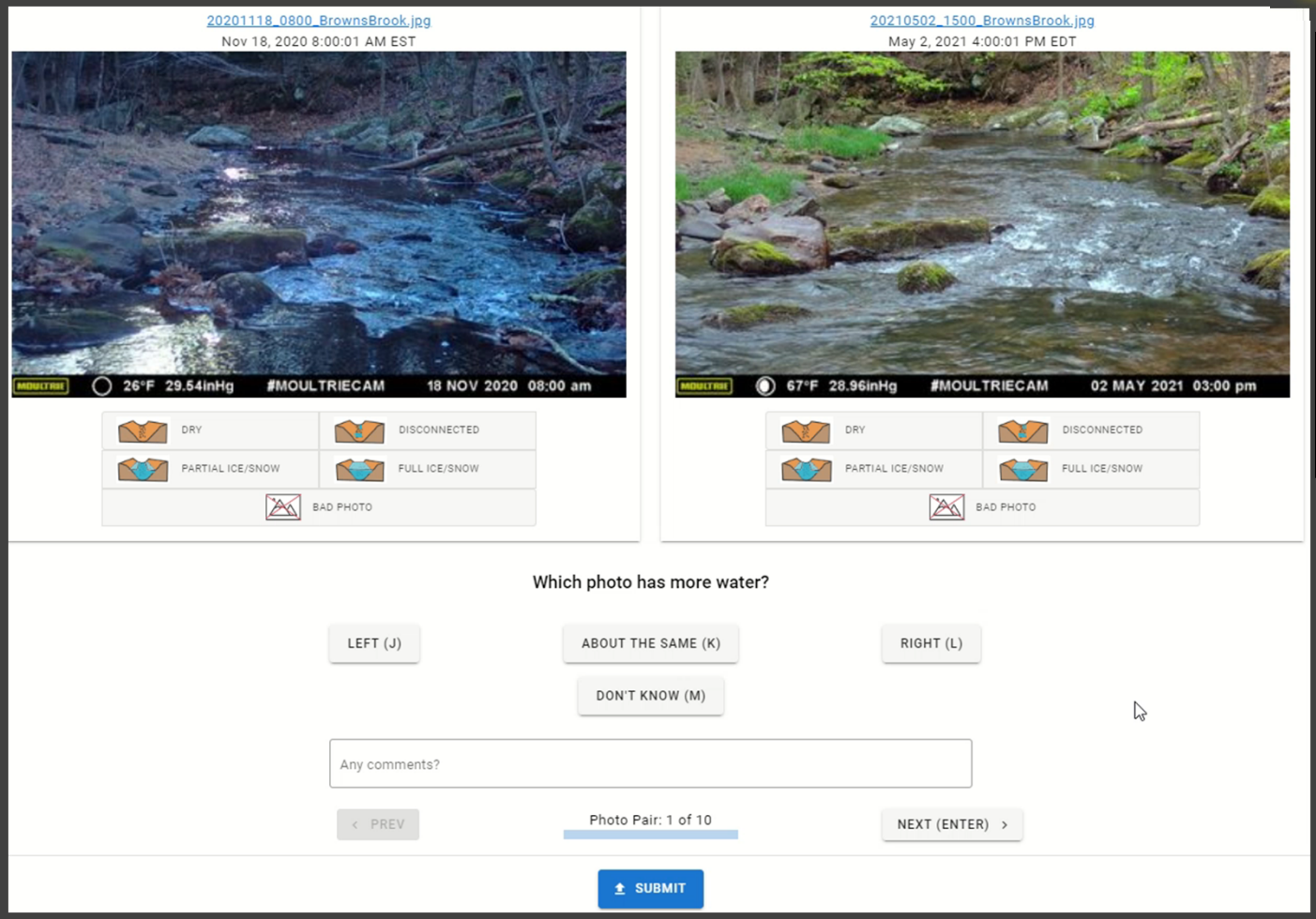
Last updated: Nov 21, 2024

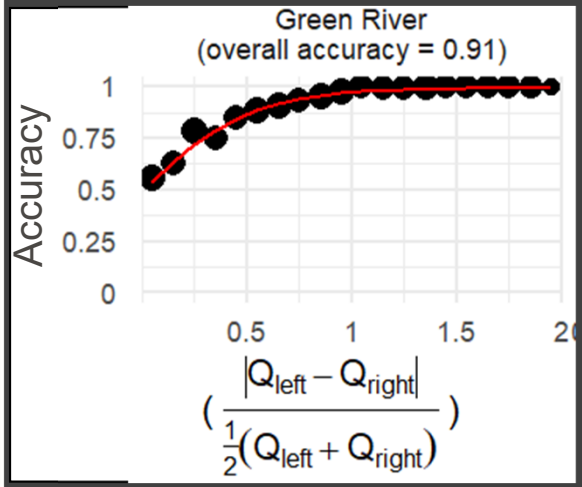
Users Uploading Imagery



Last updated: Dec 3rd, 2024

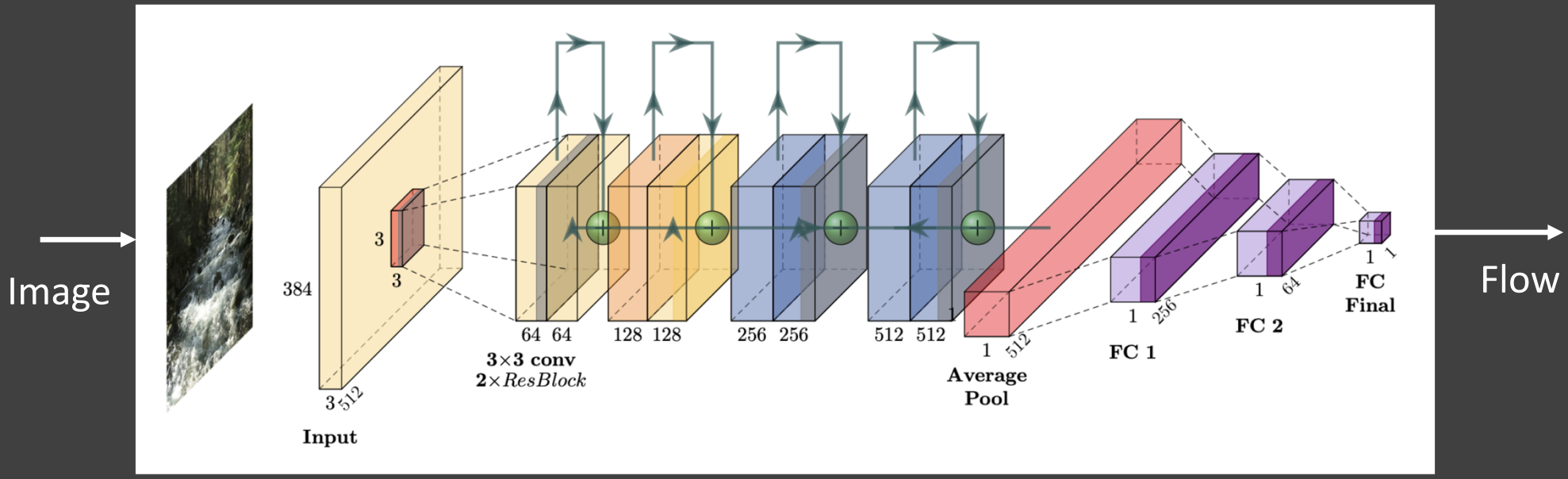
Creating Annotations





Most annotators are 70-90 % accurate!

Deep Learning Model



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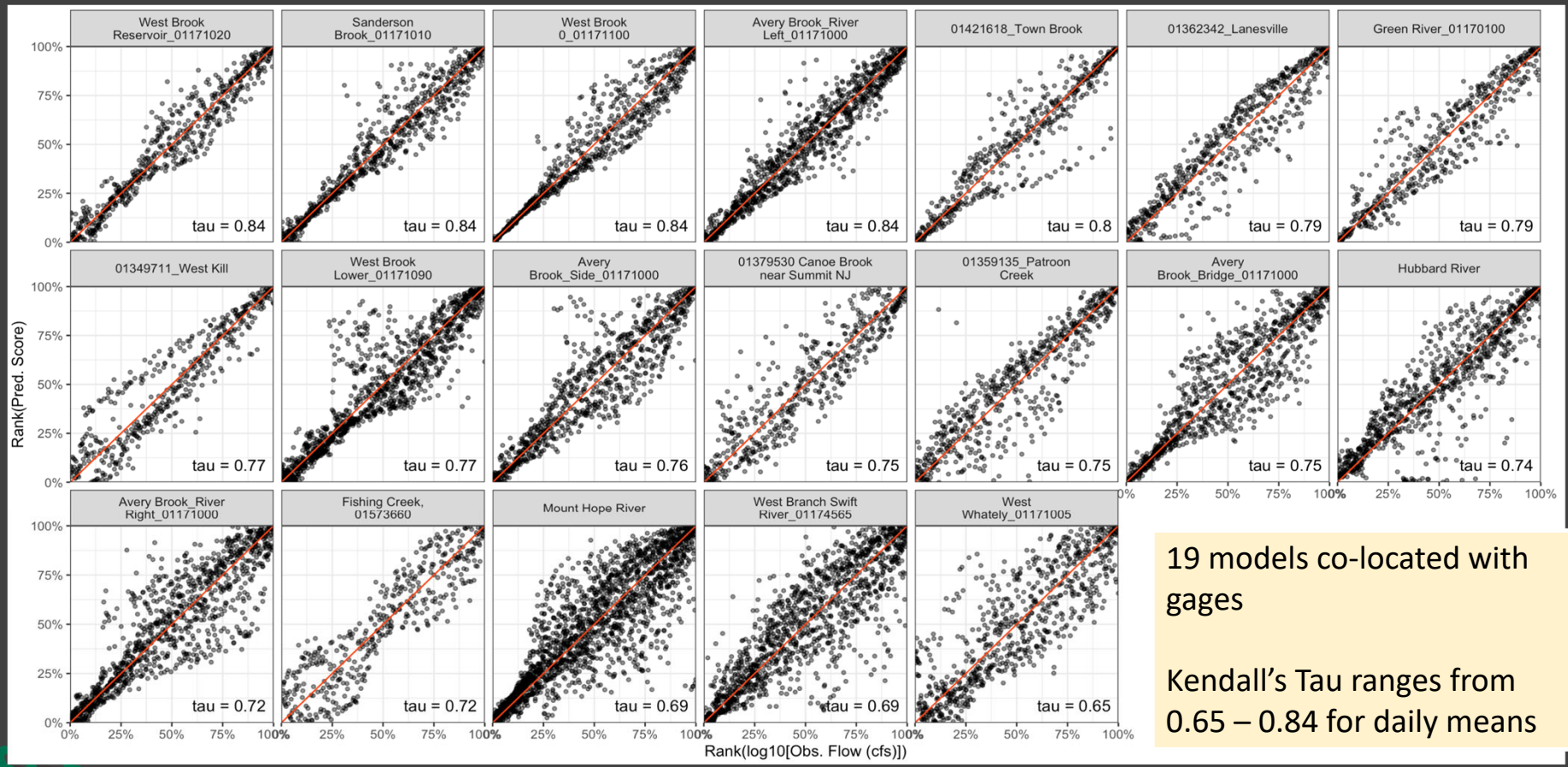
Ranks of Daily Mean Score and Observed Flow



19 models co-located with gages

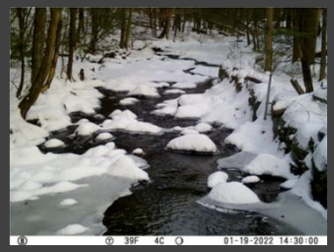
Kendall's Tau ranges from 0.65 – 0.84 for daily means

Common Image Issues

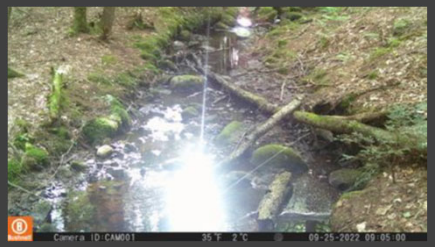
Camera shifts/changing field of view

Haze/foggy

B&W after sunset



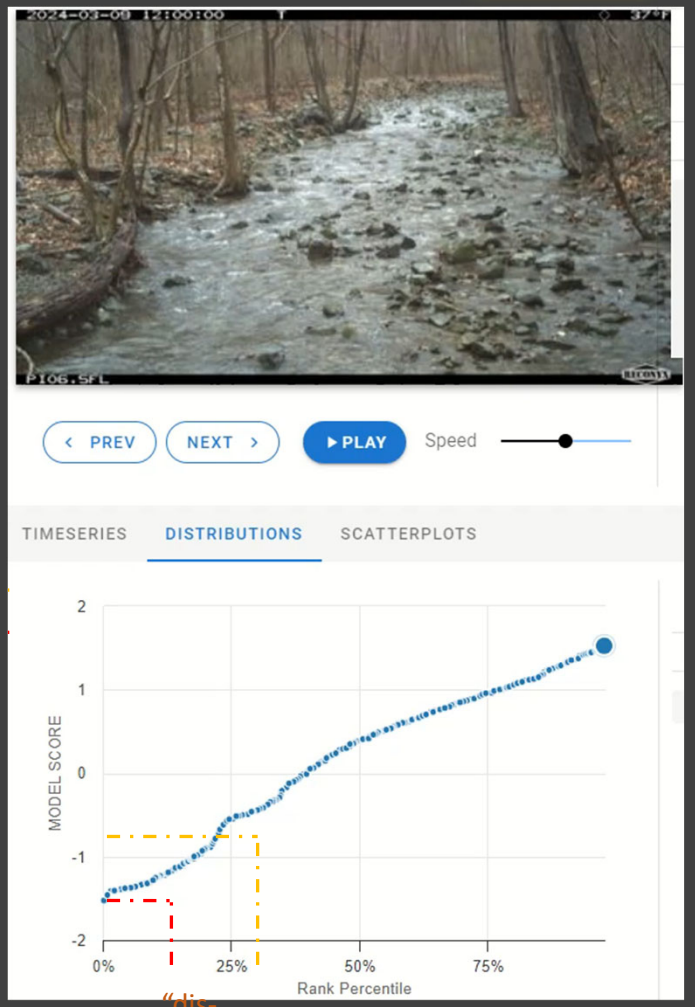
Snow/Ice Cover



Solar Glare

Vegetation Growth

We ***think*** addressing these programmatically is the next frontier in model improvement.



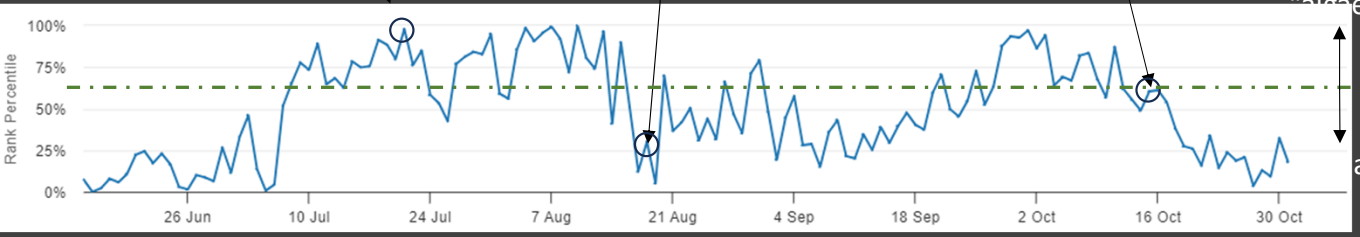
Use Case: Stream Drying

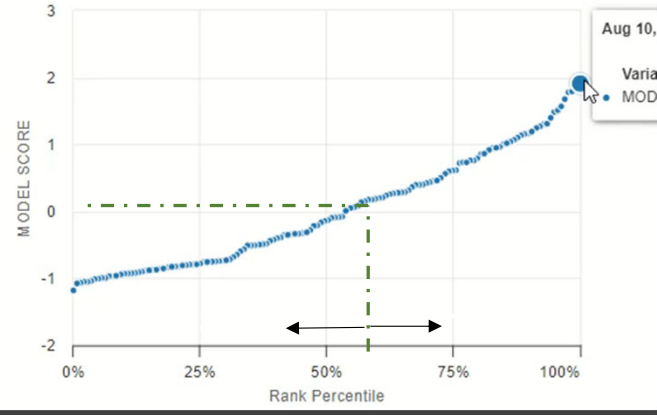
Platform Overview | Method Overview | Model performance | Threshold approaches | To do

Fox River above Little Kaukauna Dam

PREV | NEXT | PLAY | Speed

TIMESERIES | DISTRIBUTIONS | SCATTERPLOTS





Use Case: HABs

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Questions?

Reach the project team at **ecosheds@usgs.gov**

Want to receive periodic updates about the project?

Sign up for our email newsletter from the FPE homepage.

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