Using National Hydrography Linked Data to Better Understand Wild and Scenic River Protections

Grace Donovan[1], Alex Hurtado[1], Daniel Wieferich[2]

[1]Front Range Community College, [2]United States Geological Survey

Introduction

The National Hydrography Dataset Plus (NHDPlus) is a digital geospatial model of the hydrography network within the United States (McKay et al. 2012). Using the NHDPlus as a geospatial framework improves the efficiency of interdisciplinary research by enabling the linkage of supplemental hydrography-related information (e.g. National Fish Habitat Partnership's national assessment of fish habitat condition) into a common spatial context. The Wild and Scenic Rivers Act (WSR) is a federal designation designed to protect rivers with outstanding wild, scenic, and recreational classifications (refer to Figure 1). WSR protected rivers possess outstanding remarkable values (ORVs) (i.e. a fish ORV classifies a river to have exceptional fish habitat with direct correlation to the river segment) which deem them worthy of designation. We linked the WSR rivers to the NHDPlus spatial framework to provide researchers, resource managers and the public with additional information, promoting analyses to better understand and manage current and future protections of our nation's streams. Here we show two applications that explore the utility of linking the WSRs to the NHDPlus framework.

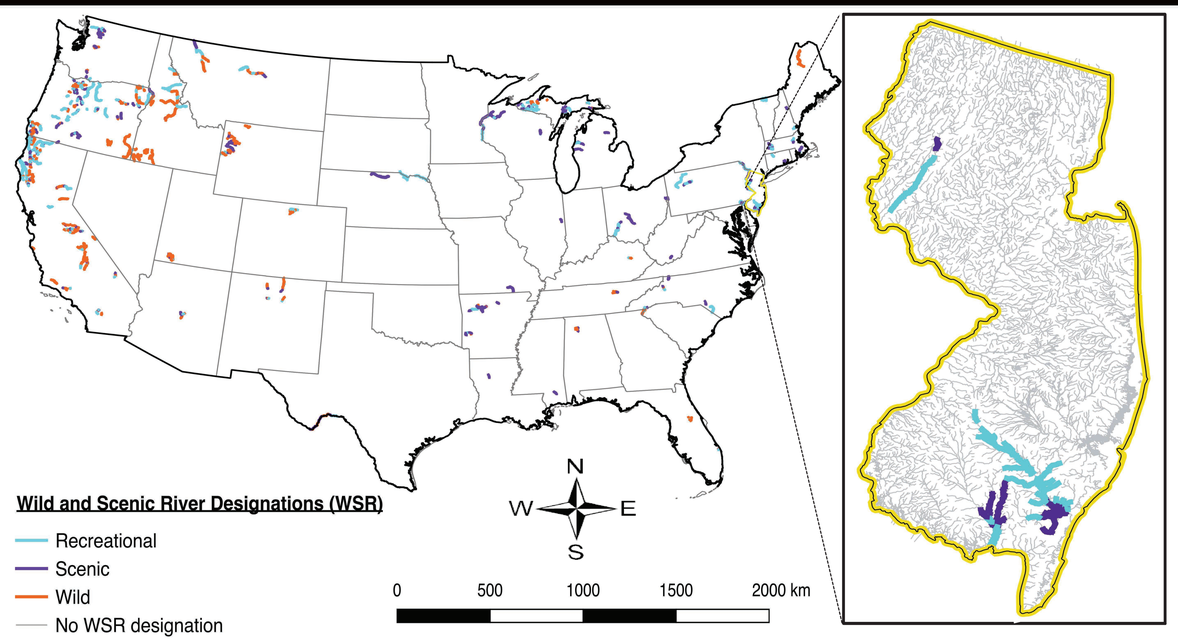

Figure 1: Map of the conterminous United States showing the designated rivers under the Wild and Scenic Rivers Act (WSR). The state of New Jersey is expanded to highlight Wild and Scenic Rivers and all other rivers as represented by the National Hydrography Dataset Plus Version 2.

Methods

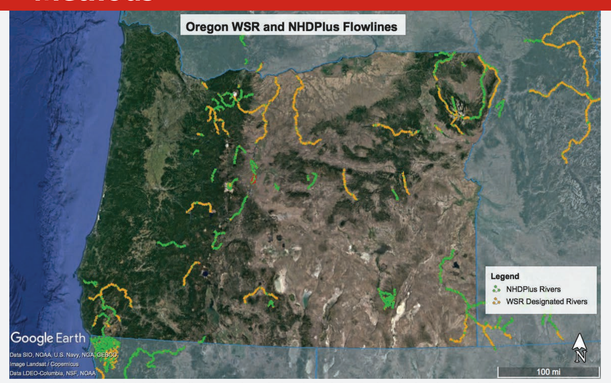

Figure 2: Map of WSR and NHDPlus flowline layers shown in Google Earth Pro. Designation location descriptions from rivers.gov were used to verify accuracy of WSR to NHDPlusV2 linkages. Polygons (shown in red) were used to highlight and resolve issues during quality assurance and quality control steps.

Linking WSR to NHDPlus

1.1 U.S. Forest Service geospatial data on Wild and Scenic Rivers were spatially joined to the NHDPlus Version 2.1 using a 250 meter buffer in ArcMap.

1.2 Google Earth Pro was used to verify stream segments as Wild and Scenic River segments (Figure 2).

Comparing WSR streams to the national representation of streams in the NHDPlusV2 (summaries performed in Python)

2.1 Classified streams by size using upstream catchment area, (headwaters: less than 10km², creeks: 10 to 100km², small rivers: 100 to 1,000 km², medium rivers: 1,000 to 10,000km², large rivers: 10,000 to 25,000km², and greater rivers: greater than 25,000km² as defined by Wang et al. 2011).

2.2 Calculated percentage of stream lengths (km) within each class size of both NHDPlusV2 and WSR designated streams. Segments identified by NHDPlus as canal ditches, coastlines, and pipelines were not included in these calculations.

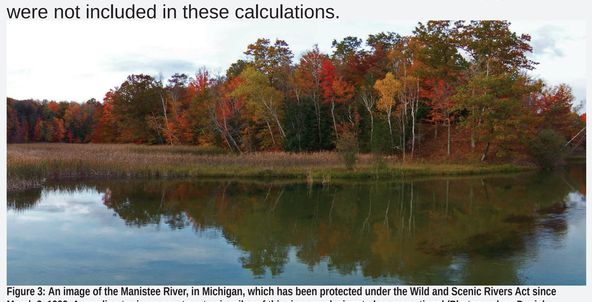

Figure 3: An image of the Manistee River, in Michigan, which has been protected under the Wild and Scenic Rivers Act since March 3, 1992. According to rivers.gov, twenty-six miles of this river are designated as recreational (Photographer: Daniel Wieferich).

Comparing fish ORV designated WSR streams to the National Fish Habitat Partnership's 2015 National Assessment of Fish Habitat Condition (summaries performed in Python)

3.1 NHDPlus was used to link WSR stream segments having fish ORVs with the National Fish Habitat Partnership's (NFHP) assessment of fish habitat degradation. NFHP data were originally linked to the NHDPlus Version 1. A crosswalk developed by the NHDPlus team was used to link NFHP data to NHDPlusV2.

3.2 Calculated length weighted average of NFHP fish habitat condition for each WSR segment designated with a fish ORV.

3.3 Counted the total number of WSR segments having fish ORV designations within each class of fish habitat degradation, based on the NFHP Fish Habitat Condition Index (Figure 7).

Figure 4: A Cutthroat Trout (Photographer: Daniel Wieferich).

Results

Percent of NHDPlusV2 stream length, within each size class (Figure 6):

~84% classified as headwaters and creeks
~14% classified as small rivers and medium rivers
~2% classified as large rivers and greater rivers

Percent of WSR stream segments as classified in NHDPlusV2 within each size class (Figure 6):

~19% of WSR streams classified by headwaters and creeks where 6% are designated as recreational, 4% designated as scenic, and 9% designated as wild
~62% of WSR streams classified by small rivers and medium rivers where 24% are designated as recreational, 18% designated as scenic, and 20% designated as wild
~19% of WSR streams classified by larger rivers and greater rivers where 9% are designated as recreational, 5% designated as scenic, and 5% designated as wild

Number of fish ORV designated WSR stream segments at risk of habitat degradation (Figure 7):

~81% of the stream segments show very low to low risk of habitat degradation
~14% of the stream segments show moderate risk of habitat degradation
~5% of the stream segments show very high to high risk of habitat degradation

Figure 5: A Sockeye Salmon (Photographer: Katrina Mueller, US Fish and Wildlife Service).

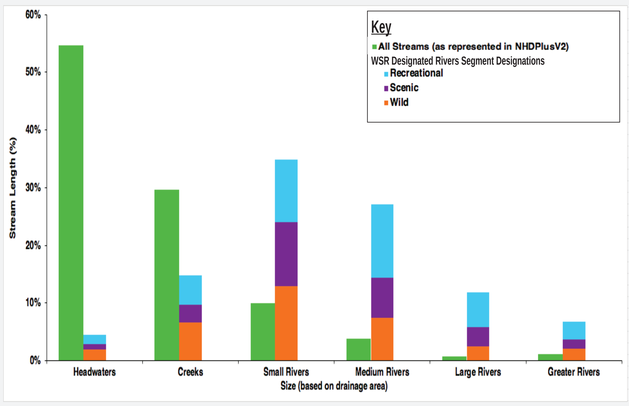

Figure 6: A graph comparing percent of stream length for all streams in the NHDPlus (blue) and WSR designated streams (light blue, purple, and orange representing recreational, scenic, and wild designations respectively).

Discussion

- As shown in Figure 6, the proportion of designated WSR streams within each size class is not representative of the stream size distribution of the national network.

- As shown in Figure 7, designated WSR stream segments reflect an overall very low to low risk of habitat degradation, although, some stream segments may be moderate to very high risk of habitat degradation.

- Stream size and fish habitat condition information may be helpful to consider when reviewing effectiveness and planning of current and future designations within WSR.

- A majority of segments within the very low and low classifications reinforces the current ORV fish designation for these streams.

- Using the NHDPlus as a geospatial framework allows for linkage to other data sets such as WSR and NFHP to support interdisciplinary research and to better understanding of the hydrography network in the United States.

- This effort helps justify the need for development of a nationwide freshwater protection database linked to the NHDPlus and should contain additional local, state, and federal protections.

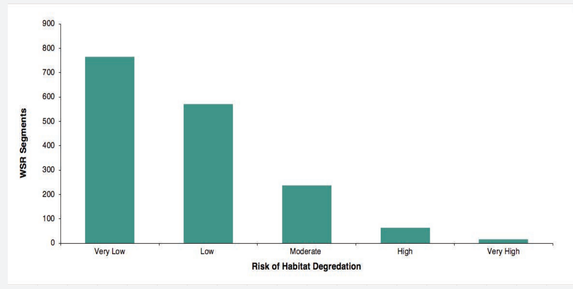

Figure 7: Number of Wild and Scenic River stream segments designated with fish outstanding remarkable value that are at risk of habitat degradation according to the Fish Habitat Condition Index from the 2015 National Assessment of Fish Habitat Condition conducted by the National Fish Habitat Partnership.

Figure 8: An image of the Rio Grande, in Texas, which has been protected under the Wild and Scenic Rivers Act since November 10, 1978. According to rivers.gov, ninety-five miles of this river are designated as wild and ninety-six miles are designated as scenic (Photographer: Emma Balunek).

Acknowledgements

Abigail Benson and Brandon Serna (USGS) for technical assistance.

Steve Aulenbach for poster review and mentorship.

The Core Science Analytics, Synthesis, and Libraries (CSASL) program within U.S. Geological Survey.

UNAVCO for supporting the Geo-Launchpad internship program.

This material is based upon work supported by the National Science Foundation under Grant No. 1540524. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

References:

Daniel, W.M, et al. (2017) National Fish Habitat Partnership (NFHP) 2015 Cumulative Habitat Condition Indices and Limiting Disturbances for the Conterminous United States linked to NHDPlusV1, https://doi.org/10.5066/F73R0R1P.

L. Wang, et al. (2011) A Hierarchical Spatial Framework and Database for the National River Fish Habitat Condition Assessment. Fisheries, 36: 436-449. doi:10.1080/03632415.2011.607075

McKay, L., et al. (2012) "NHDPlus Version 2: User Guide."

U.S. Forest Service (2018) National Wild and Scenic River Segments (Feature Layer). Retrieved from https://apps.fs.usda.gov/arcx/rest/services/EDW/EDW_WildScenicRiverSegments_01/MapServer/1