



Supplementary Materials to the Technical Support Document for the Final “Revised Definition of ‘Waters of the United States’” Rule



U.S. Environmental Protection Agency
and
Department of the Army

December 2022

Supplementary Materials

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Supplementary Material A: Scientific Papers Selected for Forward-Citation Mapping

As discussed in section I.C of the Technical Support Document, subject-matter experts from the U.S. Environmental Protection Agency's Office of Research and Development (ORD) provided 553 papers relevant to the connectivity and effects of streams, floodplain wetlands and open waters, and non-floodplain wetlands and open waters for forward-citation mapping from within the Web of Science global citation database. Those 553 papers are listed below.

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Supplementary Material B: Papers Screened Early to Expediate Machine-Learning Model Building

In the SWIFT Active-Screener environment, model seed papers expedite the machine-learning process (Howard *et al.* 2020).¹ These seed papers for each aquatic system were identified by the ORD subject matter experts from known scientific literature on the connectivity and effects of ephemeral, intermittent, and perennial streams, floodplain wetlands and open waters, and non-floodplain wetlands and open waters.

Ephemeral, Intermittent, and Perennial Streams: Seed Papers

Abbott, B. W., G. Gruau, J. P. Zarnetske, F. Moatar, L. Barbe, Z. Thomas, O. Fovet, T. Kolbe, S. Gu, A.-C. Pierson-Wickmann, P. Davy, and G. Pinay. 2018. “Unexpected spatial stability of water chemistry in headwater stream networks.” *Ecology Letters* 21(2): 296-308.

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Floodplain Wetlands and Open Waters: Seed Papers

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Non-Floodplain Wetlands and Open Waters: Seed Papers

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Supplementary Material C: Questions Answered from Abstract of Each Included Scientific Paper

After initially reading the abstract in the SWIFT Active-Screener environment and concluding to include the peer-reviewed paper, the subject-matter experts (three per aquatic system type: streams, floodplain wetlands and open waters, and non-floodplain wetlands and open waters) answered the following questions about the contents of each paper to the best of their ability based on the abstract content.

Ephemeral, Intermittent, and Perennial Streams

1. Stream type
 - a. Ephemeral
 - b. Intermittent
 - c. Perennial
 - d. Headwater
 - e. Stream type not discernible
2. Connection/effect type
 - a. Physical
 - b. Chemical
 - c. Biological
 - d. Connection/effect type not discernible
3. Scale
 - a. Reach (individual connections/effects)
 - b. Watershed (cumulative connections/effects)
 - c. Scale not discernible
4. Geographic/physiographic location
 - a. US (or portions of the US)
 - b. Non-US (or geographic/physiographic region not discernible)
5. Interacting effects
 - a. Climate
 - b. Land use
 - c. Water use (*e.g.*, drinking water, agricultural use, industrial, etc.)
 - d. None
6. Specific topics
 - a. Distance (headwaters affecting downstream waters)
 - b. Ditched or impounded systems (*i.e.*, human alterations)
 - c. Flood/flooding
 - d. Baseflow
 - e. Groundwater recharge
 - f. Human health
 - g. None discernible
7. 2015 Science Report Major Conclusion: The scientific literature unequivocally demonstrates that streams, individually or cumulatively, exert a strong influence on the

integrity of downstream waters. All tributaries, regardless of size or flow duration, are physically, chemically, and biologically connected to downstream waters and strongly influence their function.

- a. Supports findings
 - b. Refutes findings
 - c. Cannot be discerned
8. General comment (*e.g.*, important paper, paper hyperlink if abstract missing, etc.)

Floodplain Wetlands and Open Waters

1. Wetland [and open water] system type
 - a. Floodplain (or riparian) system
 - b. Riverine (*i.e.*, within-channel)
 - c. Multiple wetland types and/or spatial locations noted (*e.g.*, floodplain, riverine, non-floodplain wetland (NFW), etc.)
 - d. Wetland type not discernible
2. Connection/effect type
 - a. Physical
 - b. Chemical
 - c. Biological
 - d. Connection/effect type not discernible
3. Scale
 - a. Individual (functions/connections/effects)
 - b. Landscape-scale (connections/functions/effects...to something)
 - c. Watershed (downstream and/or down-gradient cumulative connections/functions/effects)
 - d. Scale not discernible
4. Geographic/physiographic location
 - a. US (or portions of the US)
 - b. Non-US (or geographic/physiographic region not discernible)
5. Interacting effects
 - a. Climate
 - b. Land use
 - c. Water use (*e.g.*, drinking water, agricultural use, industrial, etc.)
 - d. None
6. Specific topics
 - a. Distance (floodplain wetlands affecting downstream waters)
 - b. Wetlands ditched, impounded, or behind levees/berms (*i.e.*, human alterations)
 - c. Farmed floodplain wetlands
 - d. Flood/flooding
 - e. Baseflow
 - f. Groundwater recharge
 - g. Human health
 - h. None discernible

7. 2015 Science Report Major Conclusion: Wetlands and open waters in riparian areas and floodplains are physically, chemically, and biologically integrated with rivers via functions that improve downstream water quality. These systems buffer downstream waters from pollution and are essential components of river food webs.
 - a. Supports findings
 - b. Refutes findings
 - c. Cannot be discerned
8. General comment (*e.g.*, important paper, paper hyperlink if abstract missing, etc.)

Non-Floodplain Wetlands and Open Waters

1. Wetland type
 - a. Paper explicitly about known non-floodplain type (*e.g.*, geographically isolated wetland (GIW), NFW, upland-embedded wetland, vernal pools, woodland pond, etc.).
 - b. Multiple wetland types and/or spatial locations noted (*e.g.*, NFW, floodplain wetlands, streams, etc.)
 - c. Wetland type not discernible
2. Connection/effect type
 - a. Physical
 - b. Chemical
 - c. Biological
 - d. Connection/effect type not discernible
3. Scale
 - a. Individual (functions/effects)
 - b. Landscape-scale (connections/functions/effects...to something)
 - c. Watershed-scale (downstream and/or down-gradient cumulative connections/functions/effects)
 - d. Scale not discernible
4. Geographic/physiographic location
 - a. US (or portions of the US)
 - b. Non-US (or geographic/physiographic region not discernible)
5. Interacting effects
 - a. Climate
 - b. Land use
 - c. Water use (*e.g.*, drinking water, agricultural use, industrial, etc.)
 - d. None
6. Specific topics
 - a. Distance (NFWs affecting downstream waters)
 - b. Wetlands ditched, impounded, or behind levees/berms (*i.e.*, human alterations)
 - c. Flood/flooding
 - d. Baseflow
 - e. Groundwater recharge
 - f. Human health

- g. None discernible
- 7. 2015 Science Report Major Conclusion: Wetlands and open waters located outside of riparian areas and floodplains, even when lacking surface water connections, provide numerous functions that could affect the integrity of downstream waters. Some benefits of these wetlands are due to their relative isolation rather than their connections.
 - a. Supports findings
 - b. Refutes findings
 - c. Cannot be discerned
- 8. General comment (*e.g.*, important paper, paper hyperlink if abstract missing, etc.)