PGEOG 38304/PGEOG 70508

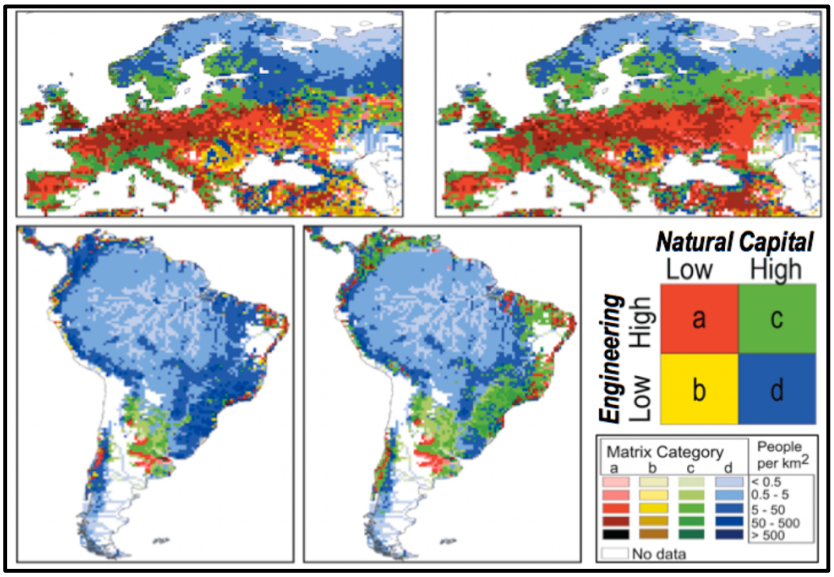
Macro-Hydrology (3 credits)

Thursdays: 5:30PM – 8:15PM

Spring 2025

Instructor: C. Vörösmarty

ROOM: Hunter North 1090B-2



The primary goals of this course are to introduce students to the topic of macro-scale hydrology and to practice some of the fundamental elements of scientific research: manuscript reading and reviewing and the preparation of a scientific study. The course is organized as a mix of formal lectures by the instructor with open discussion during class. A team-based student project will be pursued during the course of the semester. Topics to be covered will feature the water cycle and water resources in the context of:

- *Planetary Boundaries*
- *Biogeochemistry & Pollution*
- *Water Engineering*
- *Water & Economic Development*
- *Green-Grey Engineering*
- *Global Climate Change*
- *Land Use and Cover Change*
- *Land-Coastal Zone Links*
- *Private Sector Innovation*
- *Monitoring of the Water Cycle*

The course is open to Graduate Students & Upper-Level Undergraduates.

CONTACT: Professor C. Vörösmarty <cvorosmarty@gmail.com>

SUBJECT LINE Macro-Hydrology: xxxxxx

Macro-Hydrology
PGEOG 38304/PGEOG 70508
Spring 2025
Instructor: C. Vörösmarty
Tuesdays: 5:30-8:15 PM
North Building 1090B-2 (Hunter College)

GRADING AND ASSIGNMENTS

The primary goals of this course are to introduce students to the topic of macro-scale hydrology and to practice some of the fundamental elements of manuscript reading, reviewing and preparation, in a form that would be potentially publishable in the scientific literature. To this end, the course is organized to maximize a fruitful collaboration among students and the instructor. Students should come prepared to participate in this interactive effort, armed with a cooperative and creative spirit. Unfortunately, as egalitarian as we might wish to be, PGEOG 38304/PGEOG 70508 is a credit-bearing course that will ultimately require judgment on the part of the instructor as to the performance of each student.

Grading will be based on student contributions to the overall course goals and therefore students will be judged on:

- Knowledge of the assigned literature
- Meeting assigned deadlines
- *Active* participation in class, including formal presentations
- Any technical analyses performed
- Content of writing
- Demonstrating initiative

READINGS

Reading of the scientific literature will be an integral part of the course. Both the instructor and students will be presenting summaries of the current scientific literature. Some of the assigned readings are unavailable (e.g. manuscripts in review or in press) and will be posted on DropBox and made available to each student free of charge, as needed. Others are in the open literature and each student

is expected to locate and read relevant papers, and then make short reports on these during discussion within each class period.

The publications for a particular date deal with thematic material that will be covered in the upcoming lecture. These papers are representative of what in many cases are literally volumes upon volumes of material treating the subject. The papers in the reading list are thus only a beginner's "library" on the subject of macro-scale hydrology. These papers, plus the references cited at the end of each, should form an excellent source of raw material that can be consulted throughout the duration of the course. Students are expected to locate, read and report upon papers not included in the initial lists that will be handed-out during the first lecture. Electronic copies should be made of student-selected papers to be shared with other members of the class, which might not otherwise be readily available.

Based on the readings, specific products will need to be prepared, submitted, and presented by each student, by small teams and by the class as a whole. The purpose of these assignments is to:

(a) facilitate the students' ability to locate the relevant existing literature;
(b) establish a "habit" of assessing such work; and,
(c) offer practice in critical scientific writing and presentation.

These assignments will also allow the instructor to monitor the progress of the class and to fine-tune the format/content of the course. The specific due dates for the assignments are attached. *For group-based assignments, all students on each team will jointly agree to and then document the specific contributions of each individual student.*

Student Presentations: A research topic will be determined in late March. The research on this topic will evolve through a series of sub-group projects, which will contribute ultimately to a larger group project. The work will proceed as follows:

• Student teams (assuming 2-3 students each, depending on topic/size of class) will each prepare a first 250-word **Sub-team Report (Draft 1.0)**, deliver a 15-20 minute presentation, and lead discussion on one or more aspects of the chosen topic. Each **Report** should clearly review the existing literature, provide the students' assessment of the current state-of-the-art, and assess the readiness of a small team to work on such a topic. The **Report** should clearly highlight the connections to ongoing work and why the work would represent value-added over other existing research. Each sub-team will be expected to present and defend their collective submission, and answer questions from the rest of the class during an open discussion. Three questions should guide each student in this task:

(1) What is the main idea that is being worked on?
(2) How does this relate to the work so far by the scientific community?
(3) What are the time and personnel requirements for the particular sub-topic being considered, that is, in order to contribute analysis and writing to the larger team effort?

The instructor and remainder of the class (i.e., those not in a particular sub-group that is reporting) will give constructive criticism to improve the work.

• A revised **Sub-team Report (Draft 2.0)** will also need to be prepared and submitted. An oral presentation of similar scope and content to the first presentation will also be delivered, but improved by consideration of the earlier critique.

• In the mid-to-late April timeframe, an **Overall Study Team**, comprising all of the earlier Sub-Teams, will be formed. The new, larger team will consolidate the individual elements and bring them into a synthesis of the entire project. This is NOT simply "stapling" the individual elements together, but will require an integration and elaboration and interpretation of all findings. A 2000-word **Overall Study Team Report**, emulating a professional scientific paper, will be prepared and submitted by the end of the semester. There will be two versions that can be sequentially improved upon (1.0 and 2.0). A joint team presentation will be required as well.

This **Report** should constitute a succinct document, in the format of a *Science* report (http://www.sciencemag.org/authors/science-information-authors). The inclusion of graphics and tables is encouraged. A properly-prepared LITERATURE CITED section must be included. Use of a spell-checker is required. Depending on the merits of the topic and the **Report** content, instructor would be willing to work past the end of the semester for those wishing to develop their manuscript further. This could be arranged on a credit-bearing basis.

SPECIFIC GRADING FORMULA

QUIZZES[1,2]…….…	50%
CLASS PARTICIPATION, DISCUSSION OF ASSIGNED AND "DISCOVERED" READINGS……	10%
SUB-TEAM REPORTS AND PRESENTATIONS.....	25%
FINAL MANUSCRIPT & PRESENTATIONS ……..…	15%

Note: +/- (e.g. B to B-) deducted from each assignment turned in late. Full grade deducted for any assignment one week late and each week thereafter.

[1] Lowest quiz grade dropped [2] Make-up quizzes by appointment (see below)

Students who have an unavoidable and serious emergency or severe illness that prevents them from attending a required class period, or submitting an assignment, exam, project, etc. on the day it was due, will not be penalized provided that they provide official documentation that excuses them. The documentation may be reviewed by the GSOE Dean, and must justify the student's absence for the required class period or their inability to submit work on the day it was due.

ACADEMIC INTEGRITY

This course seeks to promote scientific professionalism and professional integrity will be a central cornerstone of the effort. For students this means academic integrity. All students are therefore fully expected to read and understand the *CUNY Academic Integrity Policy*, which the instructor will make available at the start of each semester. The instructor is available if there are any questions or need for clarification. Violations (e.g., copying text verbatim, cheating on quizzes, etc.) will be grounds for immediate expulsion from this course, which unfortunately has occurred in the past. There is no reason or excuse for violations of the academic integrity policy and students will be rewarded for honest efforts and dedication to the work.

COVID ADDENDUM

This class will be held in person. Please consult information on University policies associated with COVID and the return to campus https://www.ccny.cuny.edu/return-campus).

OFFICE HOURS for C. Vörösmarty (by appointment; cvorosmarty@gmail.com)
SUBJECT LINE: Macro-Hydrology: xxxxxx

MACRO-HYDROLOGY SCHEDULE & ASSIGNMENT TIMETABLE (Spring 2025)

DATE	TOPIC	ASSIGNMENT
Thurs 30 **JANUARY**	*Introductions, Handouts of Syllabus, Reading/Reviewing Instructions, Grading Expectations*	----------
Thurs 6 **FEBRUARY**	*Course Topical Framing, Some of the Basics, Planetary Boundaries*	Read: Postel et al. 1996; Steffen et al. 2015; Rockström et al. 2009; Jaramillo and Destouni 2015; Fekete 2013
Thurs 13 ***Class starts at 6:30 PM*	*Climate Change-1: Global Issues* Quiz on previous lecture/readings	Read: Gleick 2000 (*Executive Summary, to p. 20*); Huntington 2006, Vörösmarty et al. 2013b; NCA [Nat'l Climate Assessment] (2013)-Chapter 3
Thurs 20	*Climate Change-2: A Focus on the Arctic* Quiz on previous lecture/readings	Read: USARC 2010; Hinzman et al. 2013; Vörösmarty et al. 2018c (NSF Report); Rawlins et al. 2010
Thurs 27	*Water Engineering* Quiz on previous lecture/readings	Read: Vörösmarty et al. 1997; Nilsson et al. 2005; Vörösmarty et al. 2005b (*Section 7.3.2*); Hanasaki et al. 2007; WWF 2007; Zarfl et al. 2015
Thurs 6 **MARCH**	**NO CLASS (WEDNESDAY SCHEDULE)**	
Thurs 13	*Land Use and Cover Change* Quiz on previous lecture/readings	Read: Douglas et al. 2005; FAO 2005; D'Almeida et al. 2007
Thurs 20	*Biogeochemistry/Constituent Fluxes-1* Quiz on previous lecture/readings	Read Green et al. 2004, Wollheim et al. 2006, Syvitski et al. 2005, Syvitski et al. 2022

SCHEDULE AND ASSIGNMENT TIMETABLE (cont.)

Thurs	27	**MARCH**	*Biogeochemistry/Constituent Fluxes-2* Quiz on previous lecture/readings **Instructor presents overall topic, sub-topics** **Form 2-3 person study sub-teams**	Same as above
Thurs	3	**APRIL**	*Land-coastal zone connections: Deltas* Quiz on previous lecture/readings	Tessler et al. 2015, Stive et al. 2013, Ericson et al. 2006, Syvitski et al. 2009
Thurs	10		*Global Water Resources and Their Assessment* Quiz on previous lecture/readings	*Read: Postel et al. 1996; Vörösmarty et al. 2000;* Vörösmarty et al. 2005a, b (*Sections 7.1, 7.2.1, 7.2.2, 7.2.3*); Lawford et al. 2013 **Initiate work as Sub-teams/make brief oral reports** **Discussion on sub-teams' progress**
Thurs	17	**APRIL**	**NO CLASS (SPRING BREAK)**	
Thurs	24		*The Great Water Debates of 2015* Quiz on previous lecture/readings	Read: Vörösmarty et al. & Hering et al. 2015, Fekete et al. & Famiglietti et al. 2015, Palmer et al. and Muller et al. 2015; McKinsey 2009. **Discussion on sub-teams' progress** **Make brief oral reports**

SCHEDULE AND ASSIGNMENT TIMETABLE (cont.)

Thurs	1	**MAY**	*The Future, Natural Capital & the SDGs* **Consolidate sub-groups as single team**	**250-word Sub-team Reports (Draft 1.0) due** **Discussion on sub-teams' progress** **Make brief oral reports** Quiz on previous lecture/readings Read: Green et al. 2015, Harrison et al. 2016, Hoekstra 2016, Poff et al. 2015, Dudley et al. 2003; Palmer 2010; Vörösmarty et al. 2018a,b
Thurs	8	**MAY**	**Discussion on full group progress** Quiz on previous lecture/readings	**Discussion on sub-teams' progress** **250-word Sub-team Reports (Draft 2.0) due** **Make brief oral reports**
Thurs	15		**Discussion on full group progress**	**Make brief oral reports** Read other students' team writing and be ready to comment
Thurs	22		**FINAL PRESENTATION** *(final time period)*	**2000-word Overall Team Report due (Draft 3.0)** **Overall Team Oral Presentation**

See list of assigned readings (handed-out on first day of class). This listing will indicate if (a) students will have access during customary digital access provided by the University or (b) the professor has uploaded a digital version, usually when these references are obscure or otherwise difficult to access.

MACRO-HYDROLOGY ASSIGNED READING LIST

*** Signifies digital version that students can download from DROP-BOX, to which the instructor will invite students*

**Cak, Anthony D., Emilio F. Moran, Ricardo de O. Figueiredo, Dengsheng Lu, Guiying Li & Scott Hetrick (2015). Urbanization and small household agricultural land use choices in the Brazilian Amazon and the role for the water chemistry of small streams. *Journal of Land Use Science*, DOI: 10.1080/1747423X.2015.1047909.

**D'Almeida, C., C. Vörösmarty, G. Hurtt, J. Marengo, S.L. Dingman, and B. Keim (2007). The effects of deforestation on the hydrological cycle in Amazonia: A review on scale and resolution. *International Journal of Climatology* 27: 633-647.

**Douglas, E.M., K. Sebastian, C. J. Vörösmarty and S. Wood. 2005. The role of tropical forests in supporting biodiversity and hydrological integrity: A synoptic overview. World Bank Policy Research Working Paper #3635. 23 pp.

Dudley, N., S. Stolton, "Running Pure: The Importance of Forest Protected Areas to Drinking Water" (A research report for the World Bank / WWF Alliance for Forest Conservation and Sustainable Use, World Bank/WWF Alliance for Forest Conservation and Sustainable Use, 2003), (available at https://openknowledge.worldbank.org/handle/10986/15006).

**Ericson, J.P., C.J. Vörösmarty, S.L. Dingman, L.G. Ward, and M. Meybeck. 2006. Effective sea-level rise in deltas: sources of change and human-dimension implications. *Global & Planetary Change* 50: 63-82.

**FAO (UN Food and Agriculture Organization). 2005. Forests and floods: Drowning in fiction or thriving on facts? RAP Publication 2005/03. Forest Perspectives 2. FAO, Rome. 40 pp.

**FC/GWSP (Framing Committee of the GWSP). 2004. Humans transforming the Global Water System. Framing Committee of the Global Water System Project (C. Vörösmarty, D. Lettenmaier, C. Lévêque, M. Meybeck, C. Pahl Wostl, J. Alcamo, W. Cosgrove, H. Grassl, H. Hoff, P. Kabat, F. Lansigan, R. Lawford, R. Naiman). *AGU-Eos* 85: 509, 513-14.

**FC/GWSP (Framing Committee of the GWSP). 2005. *The Global Water System Project: Science Framework and Implementation Activities*. Earth System Science Partnership. Available online at http://www.gwsp.org/products.html.

**Fekete, B. M. State of the world's water resources. In: *Climate Vulnerability: Understanding and Addressing Threats to Essential Resources.* (Elsevier Inc., Academic Press, Cambridge, MA, USA, pp.11–23, 2013).

**Fekete et al. and Famiglietti et al. 2015. Watching water: From sky or stream. *Science* 349: 684-686.

**Gleick, P. 2000. Water: *The Potential Consequences of Climate Variability and Change for the Water Resources of the United States*. The Report of the Water Sector Assessment Team of the National Assessment of the Potential Consequences of Climate Variability and Change for the U.S. Global Change Research Program. US Geological Survey. 160 pp.

**Green, P., C. J. Vörösmarty, M. Meybeck, J. Galloway, and B.J. Peterson. 2004. Pre-industrial and contemporary fluxes of nitrogen through rivers: A global assessment based on typology. *Biogeochemistry* 68: 71-105.

Green, P.A., C.J. Vörösmarty, I. Harrison, T. Farrell, L. Saenz, and B.M. Fekete (2015). Freshwater ecosystem services supporting humans: Pivoting from water crisis to water solutions. *Global Environmental Change* 34:108-118.

**Hanaski, N., Kanae, S., Oki, T., and Shirakawa, N. 2007. An integrated model for the assessment of global water resources: Part 2: Anthropogenic activities modules and assessment. *Hydrology and Earth System Sciences* 4: 3583-36-26.

Harrison, I.J., P.A. Green, T.A. Farrell, D. Juffe-Bignoli, L. Sáenz, and C.J. Vörösmarty (2016). Protected areas and freshwater provisioning: A global assessment of freshwater provision, threats and management strategies to support human water security. *Aquatic Conservation: Marine and Freshwater Ecosystems* 26(Suppl. 1): 103-120.

Hinzman, L.D. et al. (2013). Trajectory of the Arctic as an integrated system. *Ecological Applications* 23: 1837–1868.

Hoekstra, J. (2013). What is Conservation 3.0 and why does it matter? https://www.worldwildlife.org/blogs/science-driven/posts/what-is-conservation-3-0-and-why-does-it-matter

**Huntington, T.G. 2006. Evidence for intensification of the global water cycle: Review and synthesis. *Journal of Hydrology* 319: 83-95.

Jaramillo, F. and G. Destouni, 2015. Comment on "Planetary boundaries: Guiding human development on a changing planet". *Science* 348: 1217-c.

Lawford et al. (2013). Earth observations for global water security. *Current Opinion in Environmental Sustainability* 5:633–643.

**McKinsey (2009). Charting Our Water Future: *Economic frameworks to inform decision-making*. The 2030 Water Resources Group. McKinsey, Inc. 198 pp.

**McCluney, K.E., N.L. Poff, M. Palmer, J.H. Thorp, G.C. Poole, B.S. Williams, M.R. Williams & J.S. Baron (2014). Riverine macrosystems ecology: sensitivity, resistance, and resilience of whole river basins with human alterations. *Frontiers in Ecology and the Environment* 12: 48-58. http://dx.doi.org/10.1890/120367.

** NCA (2013). *National Climate Assessment*, Chapter 3 on Water. US Global Change Research Program. Washington, DC.

**Nilsson, C., C. Reidy, and C. Revenga. 2005. Fragmentation and flow regulation of the world's large river systems. *Science* 308: 405 - 408. DOI: 10.1126/science.1107887.

**NSF (National Science Foundation). 2010. U.S. National Science Foundation's Program on: Decadal and Regional Climate Prediction using EarthSystem Models (EaSM). Program Solicitation NSF 10-554.

**Oki, T. and S. Kanae. 2006. Global hydrological cycles and world water resources. *Science* 313: 1068-72.

**Palmer, M. (2010). Beyond infrastructure. *Nature* 467: 534-35.

**Palmer et al. and Muller et al. 2015. Water security: Gray or green? *Science* 349: 584-86.

Poff, N.L. *et al.*, Sustainable water management under future uncertainty with eco-engineering decision scaling. *Nat. Clim. Change*. **6**, 25–34 (2015).

**Postel, S.L., G.C. Daily, P.R. Ehrlich. 1996. Human appropriation of renewable fresh water. *Science* 271: 785-88.

**Rawlins, M.A. and 29 others. 2010. Analysis of the Arctic system for freshwater cycle intensification: Observations and expectations. *J. of Climate* 23: 5715-37.

Rockström, J. et al., 2009. A safe operating space for humanity. *Nature* 461: 472-75.

**Soranno PA, Cheruvelil KS, Bissell EG, Bremigan MT, Downing JA, Fergus CE et al. (2014). Cross-scale interactions: quantifying multi-scaled cause-effect relationships in macrosystems. *Fron. Ecol. Environ*. 12: 65-73.

**Stive et al. 2013. The Sand Engine: A solution for vulnerable deltas in the 21st Century? *Coastal Dynamics 2013*, pp. 1537-46.

Steffen, W. et al., 2015. Planetary boundaries: Guiding human development on a changing planet. *Science* 13 Feb 2015: Vol. 347, Issue 6223, 1259855; DOI: 10.1126/science.1259855

**Syvitski, J.P.M., C.J. Vörösmarty, A.J. Kettner, and P. Green (2005). Impact of humans on the flux of terrestrial sediment to the global coastal ocean. *Science* 308: 376-380.

Syvitski, J.P.M., A.J. Kettner, I. Overeem, E.W.H. Hutton, M.T. Hannon, G.R. Brakenridge, J. Day, C. Vörösmarty, Y. Saito, L. Giosan, and R.J. Nicholls (2009). Sinking deltas due to human activities. *Nature Geoscience*, 2: 681-686.

Syvitski, J., J. Restrepo Ángel, Y. Saito, I. Overeem, C.J. Vörösmarty, H. Wang, and D. Olago (2022). Earth's sediment cycle during the Anthropocene. *Nature Reviews Earth and Environment* (in press).

Tessler, Z. et al. 2015. Profiling risk and sustainability in coastal deltas of the world. *Science* 349: 638-643.

**USARC (Arctic Research Commission). 2010. *Scaling studies in Arctic system science and policy support: A call-to-research.* A report from the US Arctic Research Commission. US Arctic Research Commission, Arlington, VA. 84 pp.

**Vörösmarty, C.J. K. Sharma, B. Fekete, A.H. Copeland, J. Holden, J. Marble, and J.A. Lough. 1997. The storage and aging of continental runoff in large reservoir systems of the world. *Ambio* 26: 210-19.

**Vörösmarty, C.J., P. Green, J. Salisbury, and R. Lammers. 2000. Global water resources: Vulnerability from climate change and population growth. *Science* 289: 284-288.

Vörösmarty, C.J., E.M. Douglas, P.A. Green, and C. Revenga. 2005a. Geospatial indicators of emerging water stress: An application to Africa. *Ambio*. 34: 230-236.

**Vörösmarty, C.J., C. Leveque, C. Revenga (Convening Lead Authors). 2005b. Chapter 7: Fresh Water, pages 165-207 in: *Millennium Ecosystem Assessment, Volume 1: Conditions and Trends Working Group Report*, (with R. Bos, C. Caudill, J. Chilton, E. M. Douglas, M. Meybeck, D. Prager, P. Balvanera, S. Barker, M. Maas, C. Nilsson, T.Oki, C. A. Reidy). Island Press. 966 pp.

Vörösmarty, C.J., E.M. Douglas, P.A. Green, and C. Revenga. 2005c. Geospatial indicators of emerging water stress: An application to Africa. *Ambio* 34: 230-236.

Vörösmarty, C.J., P.B. McIntyre, M.O. Gessner, D. Dudgeon, A. Prusevich, P. Green, S. Glidden, S.E. Bunn, C.A. Sullivan, C. Reidy Liermann, and P.M. Davies. 2010a. Global threats to human water security and river biodiversity *Nature* 467: 555-561.

**Vörösmarty, C.J., C. Pahl-Wostl, S. Bunn and R. Lawford. 2013a. Global water, the Anthropocene and the transformation of a science. *Current Opinion in Sustainability Science* (*COSUST* Special Issue on: *Water in the Anthropocene: Challenges for Science and Governance*. *COSUST* 5:539–550.

**Vörösmarty, C.J., L. Bravo de Guenni, W.M. Wollheim, B. Pellerin, D. Bjerklie, M. Cardoso, C. D'Almeida, P. Green, and L. Colon. 2013b. Extreme rainfall, vulnerability and risk: A continental-scale assessment for South America. *Philosophical Transactions of the Royal Society A* (in press).

** Vörösmarty, C.J., M. Meybeck, and C.L. Pastore . 2015a. Impair-then-repair: A brief history and global-scale hypothesis regarding human-water interactions in the Anthropocene. *Daedalus* 144:94-109.

**Vörösmarty, C.J., et al. 2015b. *Motivating Research on the Science Communications Front*. A Workshop Report. 48pp.
**Vörösmarty et al and Hering et al. 2015. What scale for water governance? *Science* 349: 478-80
**Vörösmarty, C.J. and L. Hinzman. 2016. Arctic Change—So what?: Linkages and impacts. In: *Arctic Report Card 2016*. Published by NOAA.
Vörösmarty et al. 2018a. Ecosystem-based water security and the Sustainable Development Goals (SDGs). *Ecohydrology & Hydrobiology* 18: 317-333.
Vörösmarty, C.J. et al. 2018b. Scientifically assess impacts of sustainable investments. *Science* 359: 523-525.
**Vörösmarty, C., Rawlins, M., Hinzman, L., Francis, J., Serreze, M., Liljedahl, A., McDonald, K., Piasecki, M. & Rich, R. 2018c. *Opportunities and Challenges in Arctic System Synthesis: A Consensus Report from the Arctic Research Community*. New York, NY. City University of New York, 92 pp. (A report to NSF).
Vörösmarty, C.J., B. Stewart-Koster, P.A. Green, E.L. Boone, M. Flörke, Günther Fischer, D.A. Wiberg, S.E. Bunn, A. Bhaduri, P.B. McIntyre, C.Sadoff, H. Liu, and D. Stifel (2021). A green-gray path to global water security and sustainable infrastructure**.** *Global Environmental Change*, 2021, 70, 102344.
**Wollheim, W.M. C.J. Vörösmarty, B. J. Peterson, S. P. Seitzinger, and C. S. Hopkinson. 2006. Relationship between river size and nutrient removal. *Geophysical Research Letters* VOL. 33, L06410, doi:10.1029/2006GL025845, 2006.
**WWF (World Wildlife Fund). 2007. *Pipe Dreams? Interbasin Water Transfers and Water Shortages*. WWF Global Freshwater Programme, Zeist, Netherlands.
Zarfl, Z. A. E. Lumsdon, J. Berlekamp, L. Tydecks, K. Tockner. (2015). A global boom in hydropower dam construction. *Aquat. Sci*. DOI 10.1007/s00027-014-0377-0

TIPS ON READING SCIENTIFIC ARTICLES

GOOD PAPERS ANSWER THE FOLLOWING QUESTIONS:

(ask yourself these 3 questions when reading)
(also use these questions as guidelines when YOU write research papers)

(1) ASK YOURSELF: WHAT IS THIS PAPER ABOUT?

Should be found in the Abstract and Introduction and it lays-out for you the "foundation" for the paper:

-- Let's you identify the specific knowledge gap that this paper will fill, typically based on a short review of the recent scientific literature
-- Presents the upcoming structure of the paper that you will be reading *(typically this will be reflected directly by the headings and sub-headings)*

(2) ASK YOURSELF: SO WHAT?

A good paper should connect facts and findings:

-- Linking them to the knowledge of the authors or contained in any published references that were cited within the paper
-- In other words.....How are the facts related? And, Why does reading this paper make a difference in moving the particular field of science forward?

This question basically assesses the importance of the findings.....so:

-- What are the most important findings?
-- Why are these important?
-- How does the study you have just read build on prior work to move it forward?
-- Does the research reported on solve some previous puzzle?

(3) ASK YOURSELF: SO WHAT NOW?

The paper should propose what should happen next:

-- Remember: Science builds on itself *(that is why there is this whole peer-reviewed publication process!)*
-- What do the authors suggest should be the next phase of study?

Now you come in:

-- Do you agree with the next steps? Do you have other ideas? *(this is often where graduate students and professional researchers can discover opportunities for topics in their own future work)*

FOLLOW THESE STEPS WHEN READING SCIENTIFIC ARTICLES

especially when time is of the essence

- Preview what is to come
- Read and digest the title
  - -- Ask yourself what is it that you expect will be presented?
- Read the Abstract
- Look at the Major/Minor headings
- Read the Conclusions
- Examine the graphics
- Re-read the Abstract
  - -- Ask yourself if what you expected to be presented was indeed presented?
- Read relevant portions of the text
- Do you agree / disagree with the central findings
  - -- Are they reasonable?
  - -- Do they fit your world view?
  - -- How do they relate to the work of other authors?
  - -- What, if anything, did you learn from this work?
  - -- What, if anything, did you learn from this work that you could use in your own research?

MANUSCRIPT REVIEWING (How to)

--Purpose of a review

- Improve the writing your have been asked to review
- Discourage publication of work that is poorly executed, inconsequential, or difficult to understand in its published form
- Reviews that we receive – can encourage / educate us OR discourage / infuriate

--How to provide advice to the authors

- Use the simplest, least contentious wording to convey your ideas
- Understand & correctly represent the studies you cite, especially when refuting elements of the paper you are reviewing

--Assume a Non-confrontational Attitude

- Write to convince author
  - -- Avoid insults
  - -- Be even-handed
  - -- Be a detective, but give the authors the benefit of the doubt (i.e., assume they are not trying to do something purposefully incorrect or unethical)
  - -- Avoid “absolutes”
  - -- Pinpoint good/bad

--Some more specifics

- Focus on what you know and give your opinion
- Discuss w/ colleagues if necessary
- Place into larger (coherent) context
- Demand scholarship in citations
  - -- Proper attribution of ideas
  - -- Economy of space
- Write to assist editor
- Describe the contribution or benefit of the paper to the scientific literature and in particular to specific audiences (e.g., climate science paper to support carbon management policies)
- Write the review w/ “economy, clarity, precision”
- Be prompt