

Right Answers to Wrong Questions? The focus of this note is fear that FEMA floodplain maps are taken as actual floodplain maps, when in fact they are highly political and were intended to serve as insurance rate setting. This is a sketch of big troubles.

For friends at 2019 CWCB and South Platte Forum. From John Wiener, J.D., Ph.D., research affiliate at the University of Colorado but NOT representing CU, NCAR/UCAR or any organization. john.wiener@colorado.edu . <https://ibs.colorado.edu/wiener> . All postings are intended to help and be used. Posting slides are not oral slides; and are heavily referenced. Latest presentation: 2 different audience versions of 2018 with new updates. Apologies for **density** here; the goal is to help friends find resources. Tip: expensive articles are *sometimes* free by inter-library loan; usually abstracts are free and can be good leads to authors' other work. Some journals also provide reference lists with abstracts—goldmine. Use author's names and professional affiliations for home pages with publication lists.

IF THIS SEEMS IRRELEVANT: See two items with very good graphics and two other items.

<https://www.nytimes.com/interactive/2019/09/11/us/midwest-flooding.html> New York Times, 11 Sep 19, Almkhhtar, Sarah, and 3 others: The Great Flood of 2019: A Complete Picture of a Slow-motion Disaster. This is the real picture of 2019 Missouri and Mississippi Basin Floods. And see Farms under Threat: <https://www.farmland.org/>. This is the real picture of how rapidly we are taking the best lands out of production. And see Edelman, 2016, Testimony to Senate Banking Committee (below) and Wing et al. 2018, (below).

THE BIG ASSESSMENTS: Clearly, the **Fourth National Climate Assessment** is big news. Released 23 November 2018. <https://www.globalchange.gov/nca4>. Ag is Chap 4. There was some media coverage, but not much detail. And, volume 2, the big assessment soft-pedaled, in my opinion, the most important part of volume 1, the **Climate Science Special Report**: <https://science2017.globalchange.gov/> : Chap. 15 on “tipping points”. Vol 2 has “key messages” and both volumes have summaries, so this note will focus on new information since the Fourth National Climate Assessment. A lot of new economics, e.g. Besley, Timothy and Avinash Dixit, 2018, **Environmental Catastrophes and Mitigation Policies in a Multiregion World**. Proceedings of the National Academy of Science. Published ahead of print, 25 Sep 18: www.pnas.org/cgi/doi/10.1073/pnas.1802864115; (about that money problem – we could do right!); Lemoine, D. et al, 2016, **The Economics of Tipping the Climate Dominoes**. Nature Climate Change 6: 514-519, DOI: 10.1038/NCLIMATE2902 . **Intergovernmental Panel on Climate Change: 2018: Special Report on Global Warming of 1.5°C** – what that will do and what going warmer will risk. <https://www.ipcc.ch/sr15/> . **NEWEST:** Intergovernmental Panel on Climate Change: report on Climate Change and Land – not formally final, Summary for Policymakers is dated 07 Sep 2019, and there is a good press release 08 Aug 2019; <https://www.ipcc.ch/srcccl-report-download-page/> and https://www.ipcc.ch/2019/08/08/land-is-a-critical-resource_srcccl/ . Excellent graphics. **Why care?** Because dramatic increases in land degradation affect ET and flooding. And land degradation affects food security, including impacts on global to local security: www.fao.org/state-of-food-security-nutrition/en/ . This may stimulate attempts to increase commodity production by means which are themselves seriously degrading soils and water-holding capacity. United Nations Food and Agriculture Organization, 2019. And see USDA Office of the Chief Economist, Climate Hubs Regional Assessments: <https://www.climatehubs.usda.gov/>

WATERS OF THE US: The repeal of the “substantial nexus” of a source of pollution and a water flow as basis for jurisdiction was said to provide certainty for abused farmers, but it severely limits control of pollution not flowing on the surface; e.g. toxic coal ash, and mining wastes. Colorado Geological Survey reports “*an estimated 23,000 abandoned mine sites on both public and private land.*” <http://coloradogeologicalsurvey.org/geologic-hazards/abandoned-mine-lands/> [Heap leaching: mercury or cyanide to leach ore. Sites not all known; They were sometimes small and not near a single mine, as several may have been needed for profits after moving mills, and they may be concealed by sediments and overgrowth.] There is also industrial waste, sometimes under impervious cover and relatively immobilized by what was formerly adequate storm drainage. See: <https://www.nytimes.com/2019/06/07/nyregion/south-street-seaport-mercury.html?action=click&module=Well&pgtype=Homepage§ion=New%20York> but note lack of mention of sea level rise plus acid precipitation and sea water, suggesting that Hg mobilization is inevitable without remediation. **Why Care?** Because this threatens water quality for both water providers and for agriculture. The next step, recently announced, is repeal of Sec. 401 of Clean Water Act that allowed States to add water rights and water quality standards to Federal Permits. The Western Governors Association has led a coalition against that: <http://westgov.org/explore/water> .

EVERYONE'S COASTAL PROBLEM: Where will the money go? We'll all be bitten by the costs of Coastal flooding, and loss of real estate value: S Jevrejeva, et al., **Flood damage costs under the sea level rise with warming of 1.5 °C and 2 °C**. *Environmental Research Letters*, 2018; 13 (7): 074014 DOI: [10.1088/1748-9326/aacc76](https://doi.org/10.1088/1748-9326/aacc76); and Cleetus, R., Union of Concerned Scientists, **Underwater: Rising Seas, Chronic Flooding and the Implications for US Coastal Real Estate**, using Zillow real estate values. <https://www.ucsusa.org/sites/default/files/attach/2018/06/underwater-analysis-full-report.pdf> ; Garner, Andra J., Michael E. Mann, Kerry A. Emanuel, et al., **Impact of Climate Change on New York City's Coastal Flood Hazard: Increasing Flood Heights from the Preindustrial to 2300 CE**. Proceedings of the National Academy of Sciences (2017) 114 (45): 11861-11866. www.pnas.org/cgi/doi/10.1073/pnas.1703568114 . **But it gets worse:** Altman, Jan, et al. 2015, **Poleward Migration of the Destructive Effects of Tropical Cyclones during the 20th Century**. Proceedings of the National Academy of Sciences, (2018) 115 (45): 11543-11548. www.pnas.org/cgi/doi/10.1073/pnas.1808979115 Rahmstorf, Stefan, 2017, **Rising Hazard of Storm Surge Flooding**. Proceedings of the National Academy of Sciences, (2017) 114 (45): 11806-11808. www.pnas.org/cgi/doi/10.1073/pnas.1715895114 ; Anderson, Tiffany R., et al., 2018, **Modeling Multiple Sea Level Rise Stresses Reveals up to Twice the Land at Risk Compared to Strictly Passive Flooding Methods**. Scientific Reports 8 article number 14484 DOI:10.1038/s41598-018-32658-x ; Regeuro, Borja G., et al., 2019, **A Recent Increase in Global Wave Power as a Consequence of Oceanic Warming**. Nature Communications 10, Article number 205; <https://doi.org/10.1038/s41467-018-08066-0> (Wave height is on top of storm surge which is on top of sea level.)

RIVERINE/FLUVIAL FLOODING PLUS COASTAL FLOODING: Moftakhari, Hamed R. et al., 2017, **Compounding Effects of Sea Level Rise and Fluvial Flooding**. Proceedings of the National Academy of Sciences (2017) 114: (37): 9785-9790. DOI: 10.1038/NCLIMATE2923 ; Piecuch, Christopher G., et al., 2018, **River-discharge Effects on United States Atlantic and Gulf Coast Sea-level Changes**. Proceedings of the National Academy of Sciences, (2018) 115 (30): 7729-7734. www.pnas.org/cgi/doi/10.1073/pnas.1805428115. Adds to huge diversion of funding. **And it gets worse...for inland flooding...**

FLOODS: SNOW ON RAIN: SNOWPACK AND MELT: Musselman, Keith N., and 7 others, 2018, **Projected Increases and Shifts in Rain-on-snow Flood Risk over Western North America**. Nature Climate Change 8: 808-812. <https://doi.org/10.1038/s41558-018-0236-4> ; Huning, Laurie S, and Amir Agha Kouchak, 2018, **Mountain Snowpack Response to Different Levels of Warming**. Proceedings of the National Academy of Sciences. (2018) 115 (43): 10932-10937. www.pnas.org/cgi/doi/10.1073/pnas.1805953115 ; Harpold, Adrian A., and Paul D. Brooks, 2018, **Humidity Determines Snowpack Ablation Under a Warming Climate**. Proceedings of the National Academy of Sciences, 115 (6): 1215-1220. www.pnas.org/cgi/doi/10.1073/pnas.1716789115; **Intense Precipitation:** an item for your management: Witze, Alexandra, 2018, **Why Extreme Rains are Gaining Strength as the Climate Warms**. Nature (News feature, 20 Nov 18) 563: 458-460. doi: 10.1038/d41586-018-07447-1 Dottori, Francesco, and 10 others, 2018, **Increased Human and Economic Losses from River Flooding with Anthropogenic Warming**. Nature Climate Change <https://doi.org/10.1038/s41558-018-0257-z> Giuntoli, Ignazio, et al., 2018, **Uncertainties in Projected Runoff over the Conterminous United States**. Climatic Change. <https://doi.org/10.1007/s10584-018-2280-5> Diffenbaugh, Noah S. and 10 others, 2017, **Quantifying the Influence of Global Warming on Unprecedented Extreme Climate Events**. Proceedings of the National Academy of Science. www.pnas.org/cgi/doi/10.1073/pnas.1618082114 PNAS | May 9, 2017 | vol. 114 | no. 19 | 4881–4886; Neelin, J. David and 3 others, 2018, **Global Warming Precipitation Accumulation Increases Above the Current-Climate Cutoff Scale**. Proceedings of the National Academy of Science. 1258–1263 | PNAS | February 7, 2017 | vol. 114 | no. 6 www.pnas.org/cgi/doi/10.1073/pnas.1615333114; Tullos, Desiree, 2018, **Opinion: how to Achieve Better Flood-risk Governance in the United States**, Proceedings of the National Academy of Science. www.pnas.org/cgi/doi/10.1073/pnas.1722412115 PNAS | April 10, 2018 | vol. 115 | no. 15 | 3731–3734.

FIRE AND WATER QUALITY: Charles Rhoades, of the U.S. Forest Service in Fort Collins has been conducting the first long-term observations of water quality after a major fire, and has published his 10 year findings; his 15 year findings are in progress. Rhoades, C.C. et al., 2012, **Water Quality Effects Following a Severe Fire**. Fire Management Today 72(2): 35-59. (Published by U.S.F.S.: www.fs.fed.us/fire/fmt .) Some toxics are still elevated years after the initial sediment etc. pulse.

ABOUT FEMA MAPS: they are for insurance purposes, and subject to huge political push-backs. **See: Edelman, 2016, Testimony to Senate Banking Committee:** <https://www.banking.senate.gov/hearings/the-national-flood-insurance-program-reviewing-the-recommendations-of-the-technical-mapping-advisory-councils-2015-annual-report>. For a reality check, see Wing et al, 2018, **Estimates of Present and Future Flood Risk in the Conterminous United States**, Environmental Research Letters 13 (2018) 034023. Note that they are NOT using future conditions except for noting continued growth of population and assets in the real floodplains. The real GIS, using FEMA definitions **found 41 million people in floodplains, rather than the 13 million using FEMA maps**. (URL through CU libraries is worthless for others.) And see **USGS Bulletin 17-C** for pressure to use the whole handle of the hockey stick, to wipe out climate change.

What would help? (1) Agricultural Resilience through **diversification and support** which need not be in cash; see <https://ibs.colorado.edu/wiener> (2) **Erosion and soil quality** improvement through cover crops – experiment with what mix works best for you. (3) **Watershed defense** against flooding. (4) Control expenses by a **benefit co-op for big expense** (“benefit” means can if done right prevent hijacking by money). Use for equipment economically maintained as a fleet, (city shops and mechanics?) and suitable for rotations across farms. (4) Design **better farming** without working in squares and struggling to make the world be uniform – it is not and does not want to be. Work with what is there for better outputs, lower inputs. (5) **Urban areas should manage 3 flows** (a) sewage; (b) urban storm water, and (c), using floodways, relatively clean water passed through to downstream irrigation and small storage for ag use and for aquifer recharge, and augmentation credits. (People love the off-road child-safe paths. Creates real estate values; higher property tax base from this huge amenity.) Good introduction to Green Infrastructure for local governments: Trust for Public Land: https://www.tpl.org/sites/default/files/cloud.tpl.org/pubs/water_building_green_infrastructure.PDF. More and more cities are defending their water supplies, increasingly using water rates as well as bonding. (See Trust for Public Land: Watershed Protection: Making the Case <https://www.tpl.org/how-we-work/research/watershed-protection-making-case#sm.0016t3cpt1du7f2gvzs2c5um3f25t> and Land and Water Publications <https://www.tpl.org/how-we-work/research/land-water-publications#sm.0016t3cpt1du7f2gvzs2c5um3f25t>. And Earth Economics: <http://www.earthconomics.org/urbangi>. Remember: Riverine flood Hazard Mitigation for cities pays back 7 to 1; be sure your local governments know! See Multi-Hazard Mitigation Council: https://cdn.ymaws.com/www.nibs.org/resource/resmgr/docs/NIBS_MitigationSaves_Interim.pdf. (Often called “Mitigation Saves 2.0”.)

Finally: keeping score: (1) <http://columbiaclimatelaw.com/resources/climate-deregulation-tracker/> and <https://blogs.ei.columbia.edu/2017/01/25/tracking-the-undoing-of-climate-change-measures/> (2) <https://eelp.law.harvard.edu/2018/07/tracking-the-trackers/> and <https://eelp.law.harvard.edu/our-trackers/>; (3) <https://www.brookings.edu/interactives/tracking-deregulation-in-the-trump-era/>; (4) <https://policyintegrity.org/deregulation-roundup>

So, if you are a professional in the many areas of water, are you pushed into meeting only local obsolete standards rather than serving the real public interest? Can you help raise the bar for professional sign-offs? A great help: Mitigation Saves 2.0, National Institute of Building Sciences, 2017, <https://www.nibs.org/page/mitigationsaves>. Fiscal conservatism in truth includes saving \$7 for every \$1 spent on riverine flooding mitigation. And, people love what they think are recreational paths, but are actually floodways. Think what your organization could do if not spending over and over on predictable losses.