Reflections on WOTUS:
When is no number ($B) better than some number?

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Evolution of WOTUS

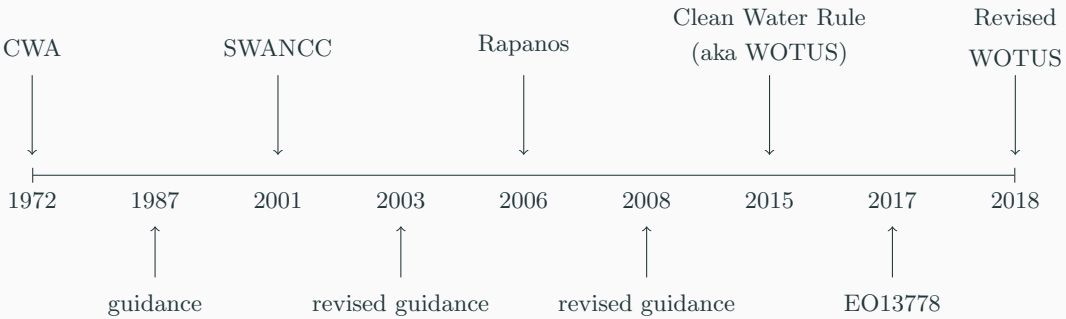
- CRS (2018):

  https://fas.org/sgp/crs/misc/R45424.pdf

  — "...the Clean Water Act, redefined 'navigable waters' to include 'the waters of the United States, including the territorial seas.' Disputes over that phrase have been ongoing ever since..."
  — [Insert history of expanding and contracting scope of jurisdiction here.]
  — "...observers disagree on whether the latest proposed definition correctly calibrates the scope of federal jurisdiction to regulate water pollution."

- In 'econ world:' $\max_x [B(x) - C(x)]$, where x is point on gradient of connectivity.
- In the real world: disputes about this determination center on legislative intent, judicial review, and agency authority.

WOTUS timeline



Evolution of (foregone) benefits analyses

year	studies/ obs	emrg/fstd [$/acre]	market extent	state resp.	total [10^6/yr]
2015	10/22	.06/.005	blend	0	306
2017	0/0	$B*	NA	NA	$B*
2018	17/38	.03/.05	state	.02-.28	1.6-17

" * It should be noted that not all benefit categories are fully quantified. $B is a stand-in for the unquantified benefits... "

$B = *no number*

(Foregone benefits for "Step 1" only, 3% discount rate.)

Views from the outside and inside

- Boyle et al. (2017) "...discrepancy between the 2015 and 2017 RIAs from the same government agencies serves as a call to action for an agency-research community partnership..."
- Boyle and Kotchen (2018) "The agency should be calling for more—not less—external advice on economics..."
- Simpson (2018) "...important that economic analysis... be more than just 'policy-based evidence-making,' as I feared was becoming the case..."
- Sullivan et al. (2019) "In relying more upon case law than science, the proposed rule would remove protection for millions of stream miles and acres of wetlands..."

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⇒ My view: "Call to action" for more external independent RIAs + more research on evidence and prediction for policy. (But how to incentivize such work?)

Challenges for economic analysis posed by WOTUS

1. *Uncertain baseline:* Connectivity, risks, what would states do?
   USEPA (2018 p 35-46).
   `https://www.eenews.net/stories/1060117957`

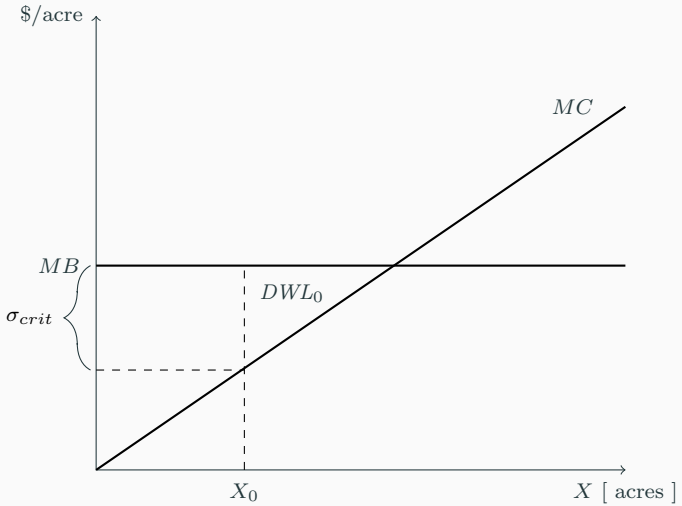
2. *Environmental federalism:* Local versus centralized regulatory control.
   Oates and Schwab (1988), Oates (2001), Sigman (2003), Banzhaf and Chupp (2012)

3. *Standards of evidence for policy:* How to judge internal and external validity for applications to policy? (I.e., How good is 'good enough for government work?')

   a. What is the half-life of non-market valuation studies?
      USEPA (2017) said 'short,' Boyle et al. (2017) said 'long.'

   b. What is the half-distance of non-market valuation studies?

No number vs. *some number*



No number vs. *some number*

- Consider an unbiased estimator: $\widehat{MB} = MB + \sigma$ or $MB - \sigma$, each with $p = 0.5$.
- Regulator will choose X such that $\widehat{MB} = MC(X)$.
- If σ is $<$ ($>$) than σ_{crit}, then use of the estimator will $\downarrow$ ($\uparrow$) *DWL*.
- A biased low estimator, if its σ is sufficiently small, can decrease *DWL*.
- If σ sufficiently high, then $\widehat{MB} = MC\,(X_0)$—i.e., *no number*—may be optimal.
- Note that σ_{crit} depends on MB and MC curves, not a feature of the estimator. Statistical significance $\neq$ economic significance.

Benefit transfer steps

1. Screen all available study estimates for internal and external validity.
2. Transfer study estimates to policy cases.

   But how? Consider two extremes:

   Plan A: Transfer only to identical policy cases. May be very precise for covered cases, but many policy cases may be left uncovered.

   Plan B: Transfer to all policy cases. May be very imprecise for many cases due to long distance extrapolation, but all policy cases covered.

Evidence for policy

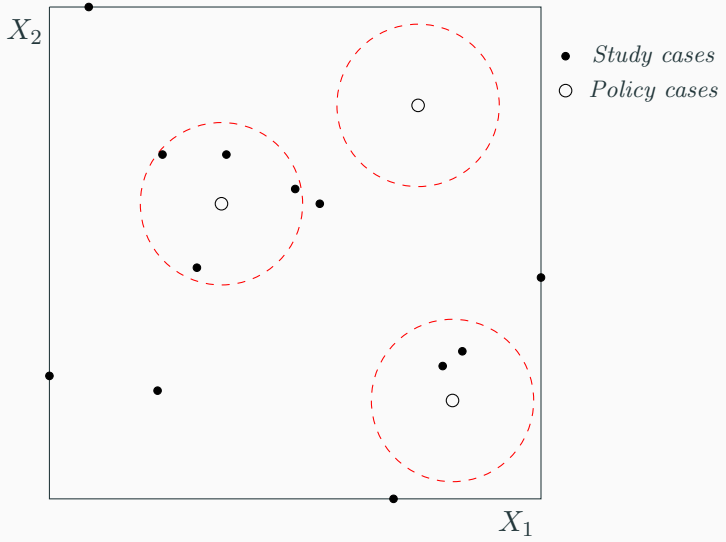
Proposition:

Along a vector between study case i and policy case j, there is some finite transfer distance beyond which the decrease in precision outweighs the increase in accuracy.

Re-frame "good enough for government work" as a well-defined optimization problem on a case-by-case basis:

"Is this study good enough for government work?"	$\Rightarrow$	"What is the optimal transfer distance for the available set of study cases given the set of policy cases?"

Illustration in two dimensions



Evidence for policy

- Standard approach is expert judgment. (BT step 1: screen studies...)
- Another possible approach: Merge BT steps 1 and 2 by using cross-validation to estimate optimal transfer distance.
  - Transfer each study estimate to all other study cases.
  - For each cross comparison measure the transfer error, e, and transfer distance in observed attribute space, d.
  - Use the $e\,(d)$ association to determine optimal transfer distance (which may encompass only a subset of the policy cases) accounting for both precision and accuracy of the estimated total benefits.

Take-home messages

- If our predictive models have high error rates, even if they are unbiased, then *no number* can be better than *some number*.
- WOTUS "serves as a call to action..." to
  1. "...produce relevant and credible information on benefit and cost measures for environmental policies." (Boyle et al. 2017)
  2. Develop a systematic approach for delineating the *no-some* boundary that can: (a) be applied on a case-by-case basis, and (b) help to prioritize new non-market valuation research (me, now).

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$\Rightarrow$ These actions should help to make *no number* clearly inferior more often.