Using a systems approach to retrospective regulatory review: quantifying economic impact and potential risk reduction due to cumulative regulatory actions in an agricultural watershed in Washington

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USDA Office of the Chief Economist

The views and analyses presented here are those of the authors and not necessarily those of USDA.
Importance of retrospective analysis – why this is a good case study

- Balancing benefits and costs is an integral part of our regulatory system.
- In the case of balancing the benefits and costs of actions pertaining to the protection of threatened or endangered species, there are few opportunities to consider costs. One is the economic analysis of Critical Habitat designations.
- With respect to PNW salmonid species, the EA for the CH designation epitomized ex-ante analysis. Now, following agency consultations, it is clear an ex-post analysis would generate very different cost and benefit estimates.
Endangered Species Regulatory Actions?

1. Propose to list a species.
2. Finalize a listing.
3. Propose a critical habitat designation with proposed Regulatory Impact Analysis (PRIA).
4. Finalize a critical habitat designation, in consideration of economic impacts with final RIA (FRIA).
5. Consultation with agencies.
6. Services issue Biological Opinions (BiOps) that define “reasonable and prudent” measures and alternatives to prevent adverse modification of the critical habitat.
7. Review their listing status every 5 years.
When might EO 13563 retrospective analysis be useful for ESA actions?

Goal: simplify and harmonize rules across agencies in order to reduce costs through retrospective review.

- When there has been a significant change in science or economic impacts due to unanticipated circumstances.
- When there are cumulative impacts from other agency(ies)’ actions.
- When there is significant public participation in the issues governed by the original rulemaking.
- When there is already an ongoing review process.
NMFS lists and Designates Critical habitat For 13 ESUs of Pacific salmon and steelhead in WA, OR and ID
Final Critical Habitat designated; no incremental economic costs estimated Feb. 16, 2000

NAHB challenge CH designation due to inadequate consideration of economic impacts June 2000

NMFS rescinds CH designation; new EA to support CH Mar. 8, 2002

EPA send NMFS Biological Effects Determinations for WA Toxics pesticides 2002 - 2004

NMFS issues new proposed rule designating CH; new EA Dec. 14, 2004

NMFS conducts status review of MCS; 71-68 vote that spp should remain threatened v no longer listed June 2005

Middle Columbia Steelhead DPS listed as threatened Mar. 25, 1999

Washington Toxics sues EPA for failure to consult with Services on impact of 54 pesticides on salmon Jan. 30, 2001

Washington Toxics court orders EPA to consult with Services; injunctive relief requested until completion of consultation July 2, 2002

EPA and USDA submit economic analyses on impact of no-spray buffers as injunctive relief Aug. 13, 2003

WA Toxics court orders no-spray buffers Jan. 22, 2004

NMFS issues final rule designating CH; new EA Sept. 2, 2005
2005 Final Economic Analysis for Designation of Critical Habitat*

- Estimated Economic Impacts for 13 Activity Types:
  - Hydropower Dams
  - Non-hydropower Dams
  - Federal land management
  - Federal land management (wilderness)
  - Grazing
  - Transportation Projects
  - Utility Projects
  - Sand & Gravel Operations
  - Instream Activities
  - Dredging
  - Residential & Commercial Development
  - NPDES Activities
  - Pesticides

Final Economic Analysis of Critical Habitat Designation for 12 West Coast Salmon and Steelhead ESUs, August 2005, Northwest Fisheries Science Center, National Oceanographic and Atmospheric Administration, Seattle, WA http://www.nwr.noaa.gov/habitat/critical_habitat_in_the_nw/2005_northwest_salmon_and_steelhead_designations.html
Economic impact* due to pesticide restrictions

From the low and high economic impact scenarios calculated for 5 digit HUCs in Yakima in the Final Economic Analysis of Critical Habitat Designation for 12 West Coast Salmon and Steelhead ESUs, August 2005. See slide 8 for complete citation.
Map produced using data from Washington State Department of Agriculture 2011 GIS database available at: http://agr.wa.gov/pestfert/natresources/aglanduse.aspx as in previous slide
Map produced using GIS data for Middle Columbia Steelhead critical habitat from National Marine Fisheries Service’ Northwest Region available at:
http://www.nwr.noaa.gov/1salmon/salmon/esa/crithab/CHGISpage.html
Map produced using GIS data for Middle Columbia Steelhead critical habitat from National Marine Fisheries Service' Northwest Region available at:

http://www.nwr.noaa.gov/1salmon/salmonesacrithab/CHGISpage.html
Middle Columbia Steelhead Life History

**Anadromous Form of Species**
- Steelhead
  - Fry
  - Fingerling Juvenile
  - Smolt
  - Oceanic Adult

**Resident Form of Species**
- Rainbow Trout
  - Egg
  - Kelt - Reconditioned
  - Spawning Adult
  - Jacks – Adults returning to Freshwater for maturation
<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>April</th>
<th>May</th>
<th>June</th>
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<td>Kelt Migration</td>
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**Yakima Basin Salmon Presence**
Limiting Factor

- Floodplain Connectivity
- Channel Structure
- Riparian Areas LWD
- Altered Hydrology
- Degraded Water Quality
- Altered Sediment Routing
- Impaired Fish Passage

Management Action

- Stream flow regulation - irrigation
- Withdrawal Irrigation/Hydropower
- Water Storage/diversions
- Conveyance irrigation return flow
- Floodplain constriction
- Forest harvest, roads, fire suppression
- Livestock grazing
- Streamside recreation

2009 Yakima Steelhead Recovery Plan; Extracted from the 2005 Recovery Plan with Updates; Yakima Basin Fish and Wildlife Recovery Board. www.ybfwrb.org
# Pesticide Application by Season

<table>
<thead>
<tr>
<th>Codling Moth Horticultural Pest</th>
<th>Delayed Dormant</th>
<th>Pre Pink</th>
<th>Pink</th>
<th>Bloom</th>
<th>Petal Fall</th>
<th>After Bloom</th>
<th>Spring Summer</th>
<th>Pre-harvest</th>
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<td>Pheromone</td>
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<td>Acetamiprid/ Petroleum oil</td>
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<td>Petroleum Oil</td>
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<td>Azinphos methyl</td>
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<td>Phosmet</td>
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</table>

Percent of apple crop treated, National Agricultural Statistics Service Chemical Use Surveys, 1990 to 2009

WA Codling Moth Pest Control

Percent of apple crop treated using pesticides included in WA Toxics (red) and subject to 60 or 300 ft buffers and newer pesticides (other colors). Red circle highlights older, less expensive pesticides; green – newer products.
### Pesticide Application by Season

**Cutworms** | Delayed Dormant | Pre Pink | Pink | Bloom | Petal Fall | After Bloom | Spring Summer | Pre-harvest
---|---|---|---|---|---|---|---|---
Chlorpyrifos | 4 | | | | | | | |
Endosulfon | 4 | 4 | | | | 4 | | |
Indoxacarb | | | | | | | | |
Methoxyfenozide | | | | | | | | |

**Apple Maggot Horticultural Pest** | Delayed Dormant | Pre Pink | Pink | Bloom | Petal Fall | After Bloom | Spring Summer | Pre-harvest
---|---|---|---|---|---|---|---|---
Acetamiprid | | | | | | | | |
Azinphos methyl | | | | | | | | |
Phosmet | | | | | | | | |
Based on court injunction, NMFS assumed for all pesticides:
- a buffer of 60 feet for ground application
- a buffer of 300 feet for aerial application
- Around “salmon supporting waters”
- Buffer assumed to be land retirement

Range:
- High Cost (H) = all applications are aerial (300 ft)
- Low Cost (L) = all applications are ground (60 ft)

(Per acre costs)$_{ij}$ = (net revenue)$_{j}$ ÷ (acres)$_{j}$ for
- huc $i$ = Yakima watersheds and
- crop $j$ = orchards, vegetables, grains

Total Cost$_{H \text{ or } L}$ = $\sum_{ij}$ (per acre costs)$_{ij}$ $\times$ buffer$_{H \text{ or } L}$
### NMFS Economic Analysis – Entire Middle Columbia ESU

<table>
<thead>
<tr>
<th>2003 Prices</th>
<th>Orchards/ Vineyards</th>
<th>Row Crops</th>
<th>Small Grains</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td># acres in 60 ft buffer</td>
<td>764</td>
<td>482</td>
<td></td>
<td>2615</td>
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<tr>
<td># acres in 300 ft buffer</td>
<td>3685</td>
<td>2363</td>
<td></td>
<td>13404</td>
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<tr>
<td>Gross $/acre</td>
<td>$4817</td>
<td>$1449</td>
<td>$173</td>
<td>$173</td>
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<tr>
<td>Gross revenue 60 ft buffer</td>
<td>$3,524,510</td>
<td>$699,838</td>
<td>$436,358</td>
<td>$4,660,707</td>
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<tr>
<td>Gross revenue 300 ft buffer</td>
<td>$16,998,100</td>
<td>$3,430,635</td>
<td>$2,234,339</td>
<td>$22,663,073</td>
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<tr>
<td>Net revenue 60 ft buffer</td>
<td>$176,226</td>
<td>$34,992</td>
<td>$21,818</td>
<td>$233,035</td>
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<tr>
<td>Net revenue 300 ft buffer</td>
<td>$849,905</td>
<td>$171,352</td>
<td>$111,717</td>
<td>$1,133,154</td>
</tr>
</tbody>
</table>

*Draft Economic Analysis of Critical Habitat Designation for 13 Pacific Salmon and O. mykiss ESUs. 2004. NOAA Northwest Fisheries Center, Seattle WA*
300 foot buffer Salmon Critical Habitat

What’s Changed (i)?

Then: “Salmon-supporting waters” was interpreted by NMFS to mean actual waters that actually were occupied by the listed species.

Now: Pesticide applications are restricted in the BiOps to include all waters in the watershed connected to critical habitat, such as agricultural ditches or man-made conveyances.
Map produced using GIS data for Middle Columbia Steelhead critical habitat from National Marine Fisheries Service' Northwest Region available at: http://www.nwr.noaa.gov/1salmon/salmesa/crith/CHGISpage.html


Stream (blue)
Critical Habitat (red)
Ditch (gold)
What’s Changed (ii)?

Then: Buffers were 60 ft to 300 ft
Now: Buffers are adjustable depending on concentration, but range from 25ft to 1000ft
300 and 1000 foot buffer Streams and Ditches
Do those changes matter?

- Based on BiOps, assume:
  - a buffer of 25 feet for ground application (we do 60 feet)
  - a buffer of 1000 feet for aerial application
  - Around ALL WATERS

- Range:
  - High Cost (H) = all applications are aerial (1000 ft)
  - Low Cost (L) = all applications are ground (60 ft)

- \((\text{Per acre costs})_i = (\text{net revenue})_j \div (\text{acres})_j\) for
  - huc \(i =\) Yakima watersheds and
  - crop \(j =\) orchards, vegetables, grains

- Total Cost \(_{H \text{ or } L} = \sum_{ij} (\text{per acre costs})_{ij} \times \text{buffer}_{H \text{ or } L}\)
## Comparison 2005 and 2013

<table>
<thead>
<tr>
<th>Watershed</th>
<th>2005 Acres</th>
<th>2005 Dollars</th>
<th>2013 Acres ¹</th>
<th>2005 Dollars ²</th>
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<tbody>
<tr>
<td>203</td>
<td></td>
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<tr>
<td>Low 60 ft buffer</td>
<td>165</td>
<td>$102,035</td>
<td>1,192</td>
<td>$848,230</td>
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<tr>
<td>High 300 ft/1000 ft (2013)</td>
<td>817</td>
<td>$457,931</td>
<td>16,209</td>
<td>$11,132,549</td>
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<tr>
<td>301</td>
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<tr>
<td>Low 60 ft buffer</td>
<td>187</td>
<td>$170,653</td>
<td>1035</td>
<td>$732,234</td>
</tr>
<tr>
<td>High 300 ft/1000 ft (2013)</td>
<td>1,039</td>
<td>$755,506</td>
<td>14,072</td>
<td>$9,226,634</td>
</tr>
</tbody>
</table>

¹ 2013 Acres are acres of agricultural land uses within 60 ft (low) or 1000 ft (high) buffers of streams and ditches. Acres of crop types calculated using 2011 National Agricultural Statistics Service Cropland Data Layer for WA.

² 2005 Dollars estimated using average WA net operational dollar for orchards, row crops and field crops.
Trends

- Since the 2005 BiOps, salmonid population is increasing and acres under production is decreasing even absent the application restrictions.
- What does this imply?
  - Salmonid populations are rebounding due to other habitat restoration efforts
  - General farming trend to fewer operations due to increased competition and higher management costs
- If so, does a pesticide ban policy really make sense for this CH?
Other management options to limit adverse modification due to pesticide use

- Restrict pesticide applications (lower aggregate risk to species --- not simply each pesticide separately)
- Change spatial distribution of crops
- Habitat restoration (planting vegetative buffers / shade trees / minimizing sediment deposition)
- Conservation reserve (permanent easements --- essentially assumed in earlier methodology)
Last question --- does this seem to matter much?

- February 21, 2013 the 4th Circuit found that....
- NMFS did not meet the "economically feasible" requirement as detailed by the ESA.
- "Under the Fisheries Service's reading, the economic feasibility requirement becomes simply a limitation that the reasonable and prudent alternative be economically possible, without any need for discussion," according to the opinion. "We cannot agree with this position, as it effectively reads out the explicit requirement . . . that the agency evaluate its reasonable and prudent alternative recommendation for, among other things, economic and technological feasibility."
Emphasis Added

“...We cannot agree with this position, as it effectively reads out the explicit requirement of Regulation 402.02 that the agency evaluate its reasonable and prudent alternative recommendation for, among other things, economic and technological feasibility. Moreover, economic feasibility becomes especially relevant when recommending uniform buffers because, as the Pesticide Manufacturers point out, pesticide applications would be prohibited within 500 feet (for ground applications) and 1,000 feet (for aerial applications) of any waterway that is connected, directly or indirectly, at any time of the year, to any water body in which salmonids might be found at some point. Such a broad prohibition readily calls for some analysis of its economic and technical feasibility...”