

Combining the Concepts of Eco-deficit and Sustainability Boundaries

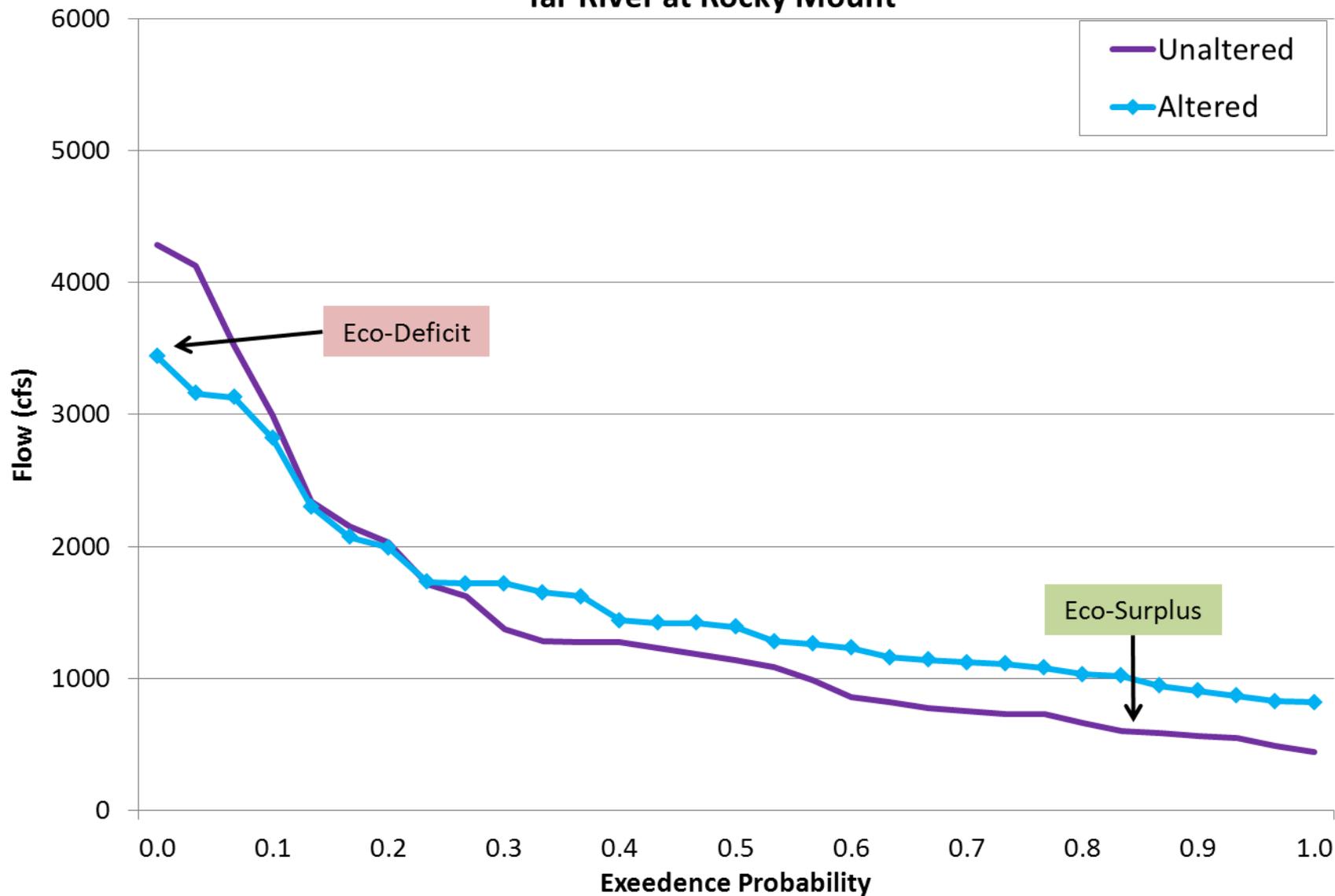
Ecological Flow Science Advisory Board
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Chris Goudreau, N.C. Wildlife Resources Commission

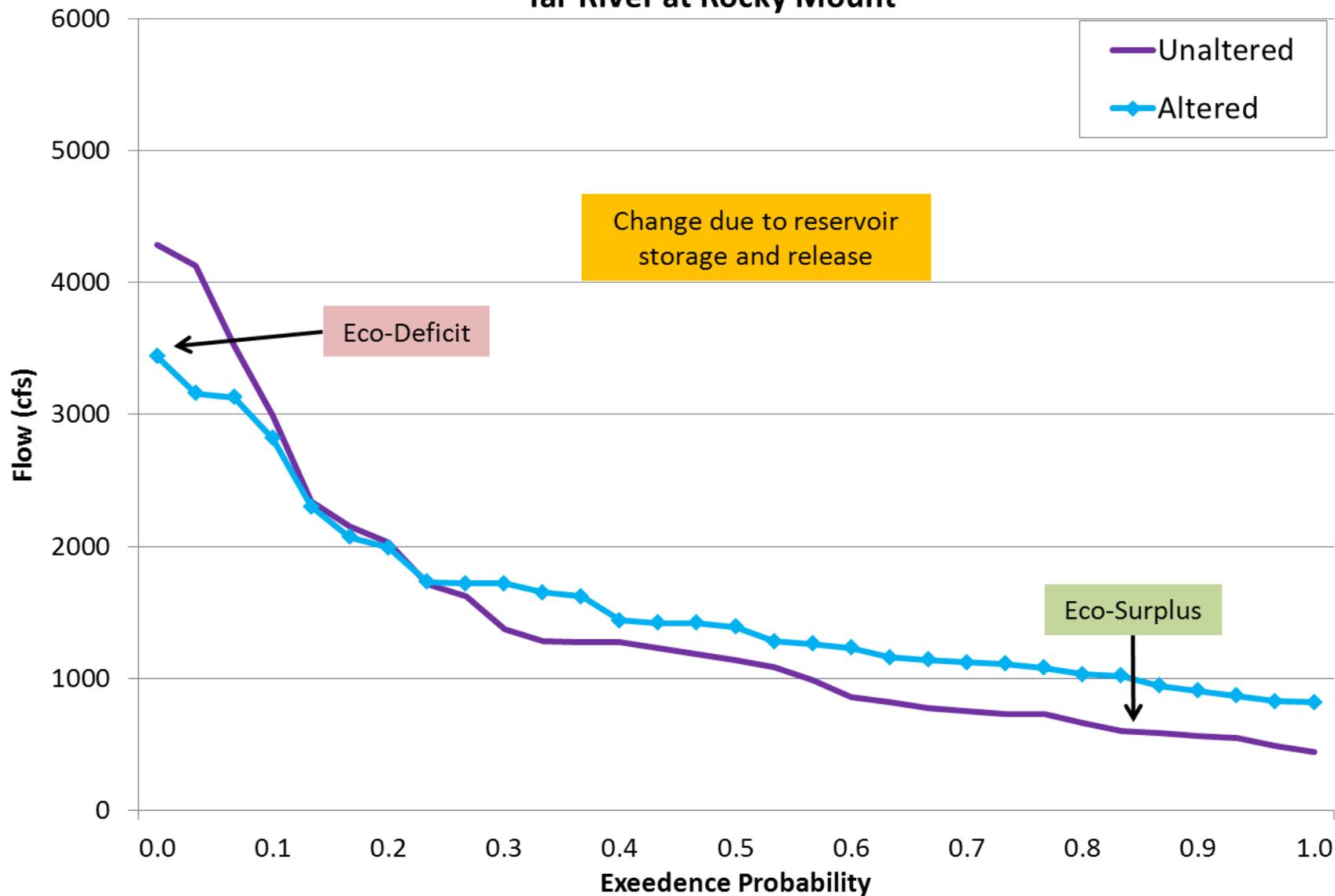
Eco-Deficit/Surplus

- Vogel et al. 2007
- Create a median flow duration curve of unaltered flows on an annual (seasonal, monthly) basis
- Do the same for altered flows
- Difference between the curves is termed “eco-surplus” or “eco-deficit”
 - It is really median flow surplus or deficit
- The focus is on changes in flow magnitude
 - Monthly curves also reflect aspects of timing
 - Duration, frequency and rate of change are not fully considered

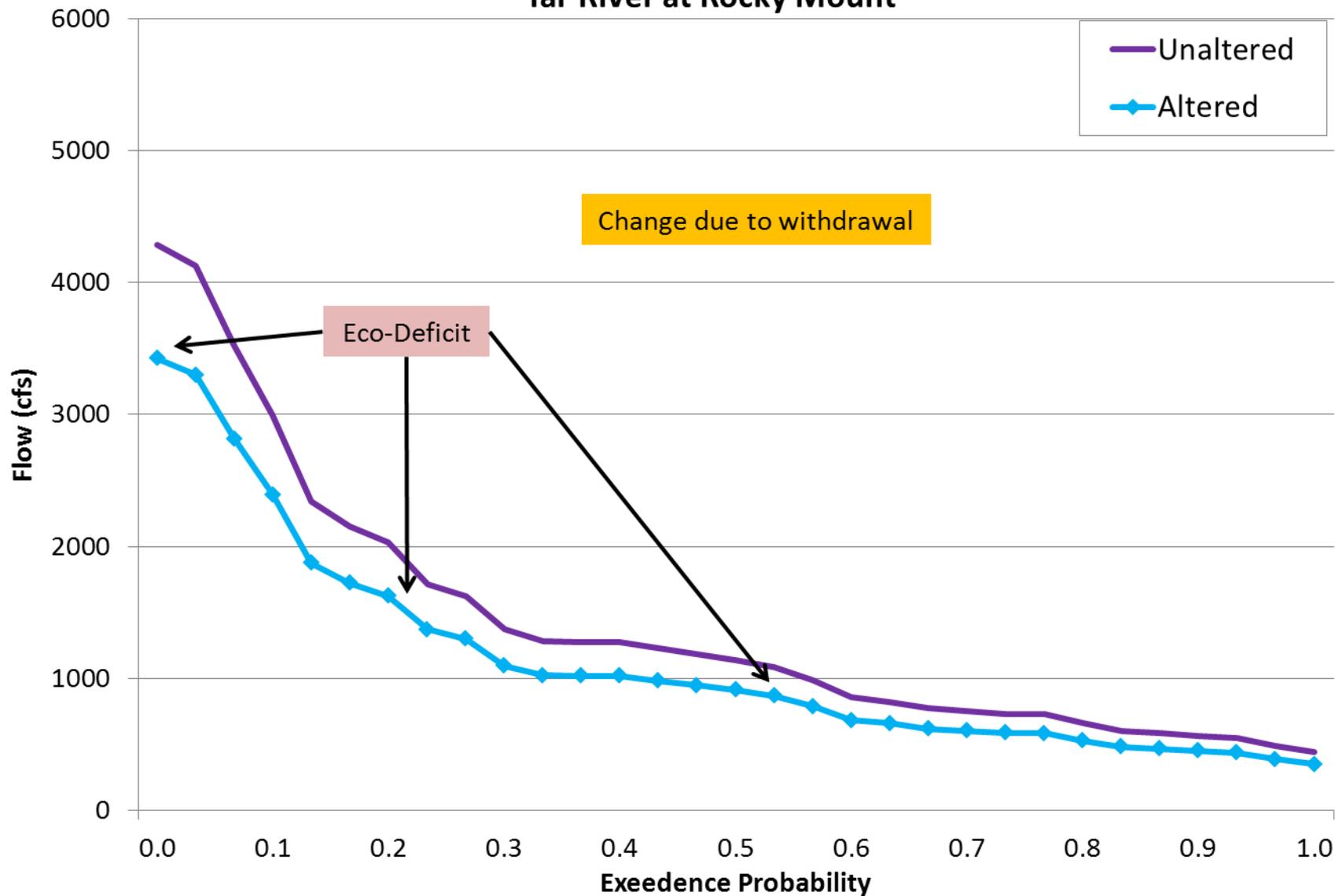
Example of Eco-Difference Flow Duration Curve - January Tar River at Rocky Mount



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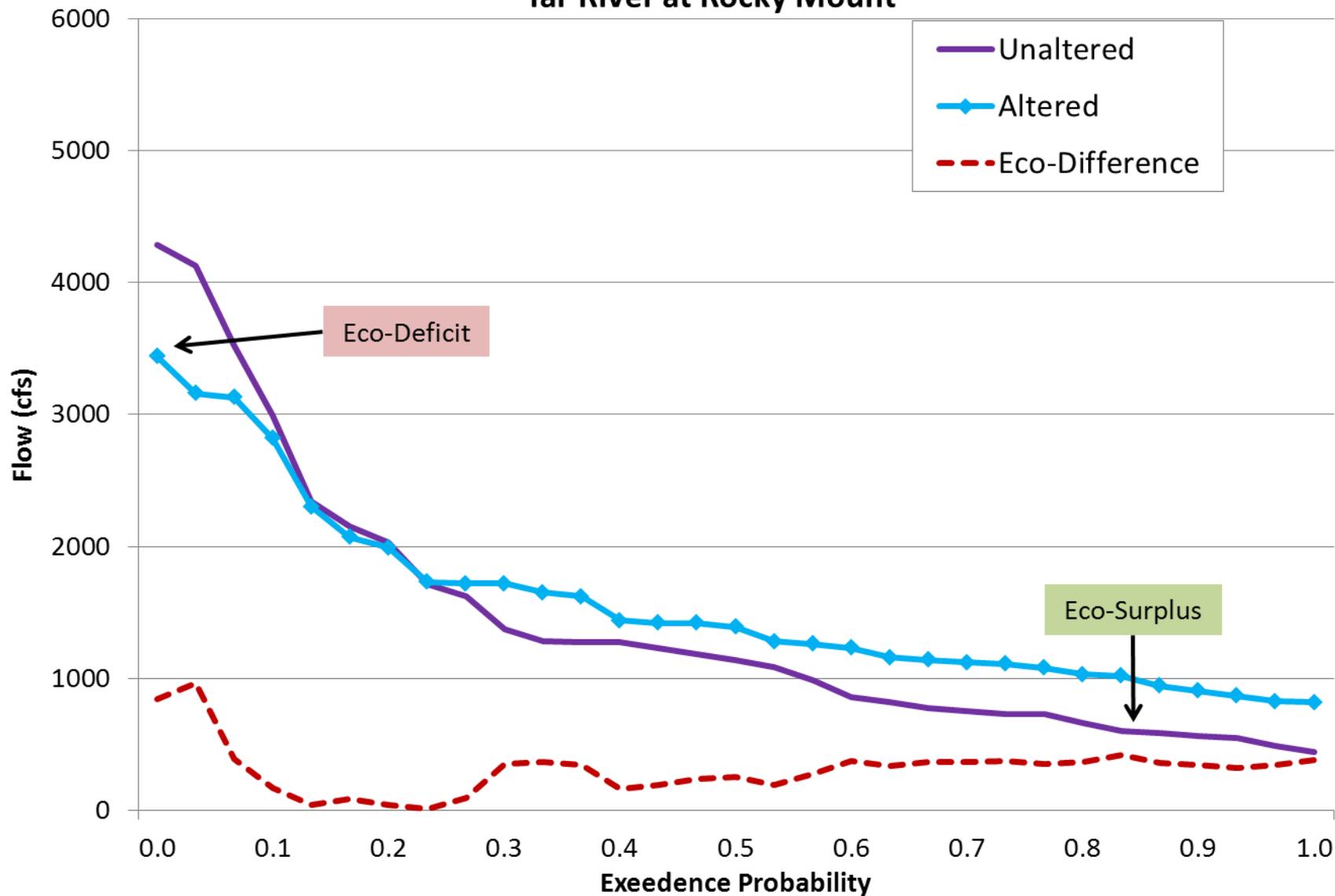
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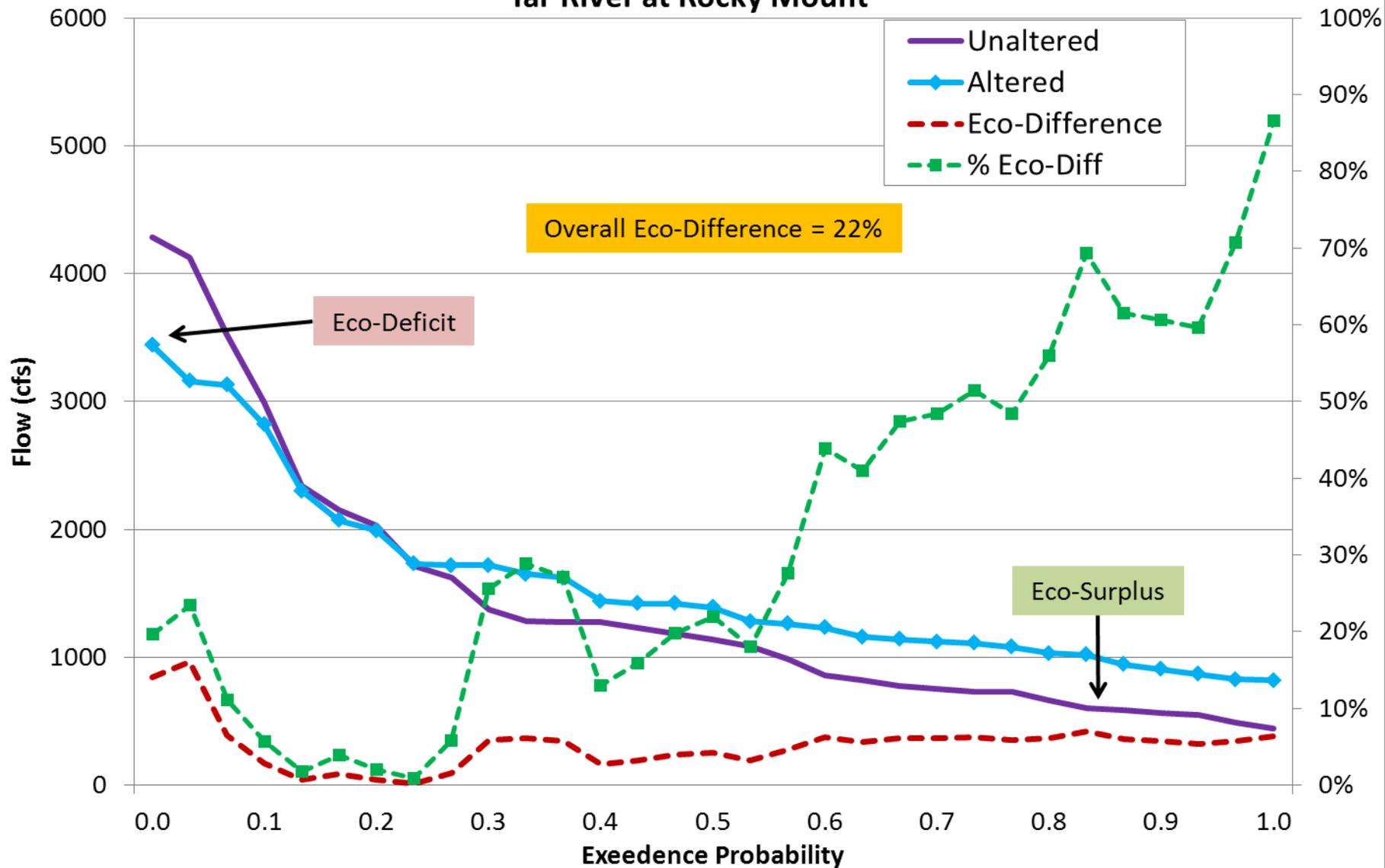
Eco-Deficit/Surplus

- “Eco-difference” is absolute value of “eco-surplus” or “eco-deficit”
- When calculated on an overall percentage basis, eco-difference gives measure of relative change from the unaltered condition

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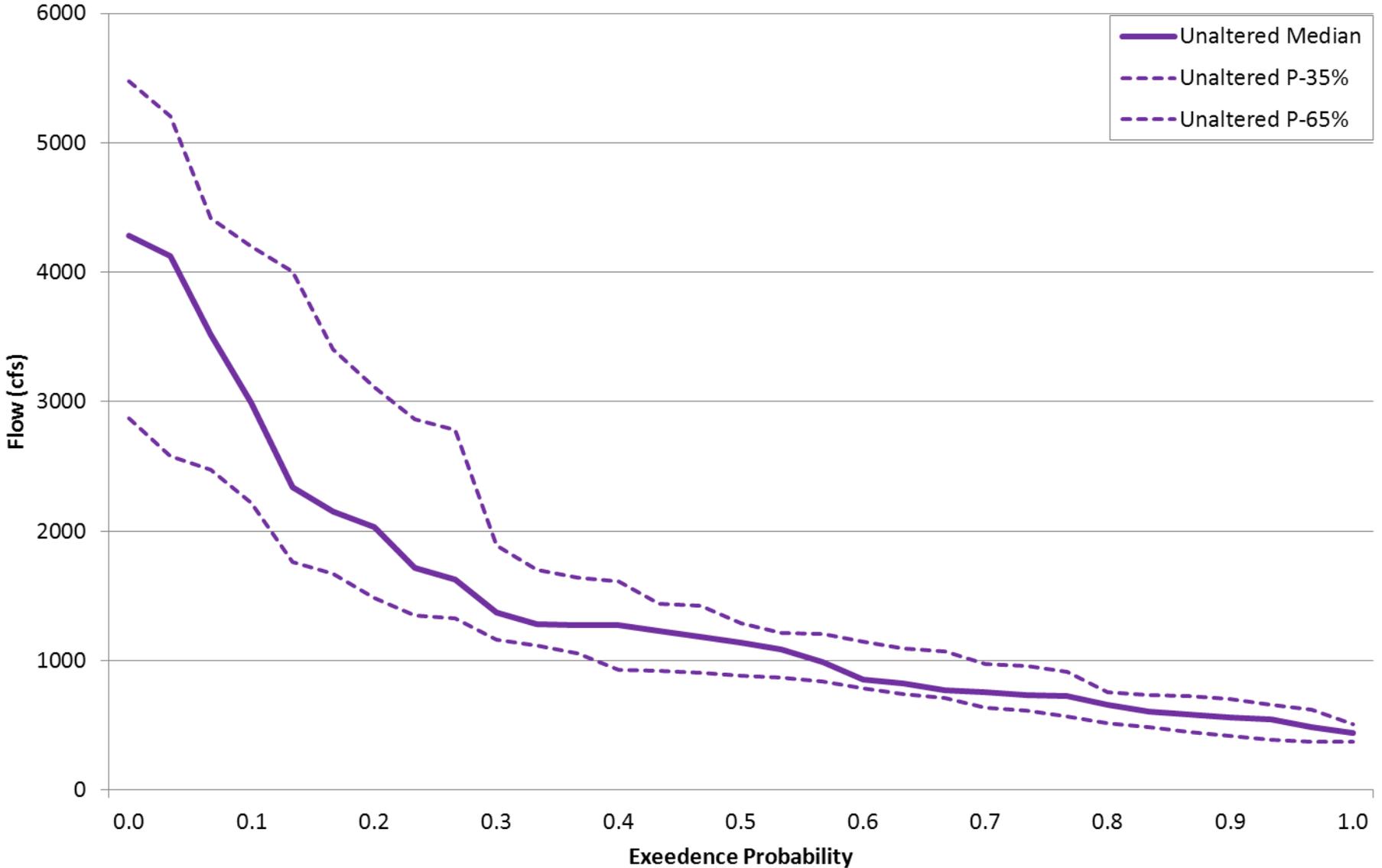
Sustainability Boundaries

- Richter et al. 2011
- Presumptive standard concept
- Deviation from inflow on a daily basis
 - Moderate protection: $\pm 11-20\%$
 - High protection: $\pm 0-10\%$
- Maintains inter- and intra-annual flow variability

Combining Concepts

- Median flow duration curves – because based on multiple data points, one can create a band of variability around the median
 - This is similar to the sustainability boundary
 - The width of the band should consider biological and management aspects
 - In following example, using 15%
- The Susquehanna Basin report (TNC 2010) used a similar approach

**Example of Eco-Difference
Flow Duration Curve - January
Tar River at Rocky Mount**

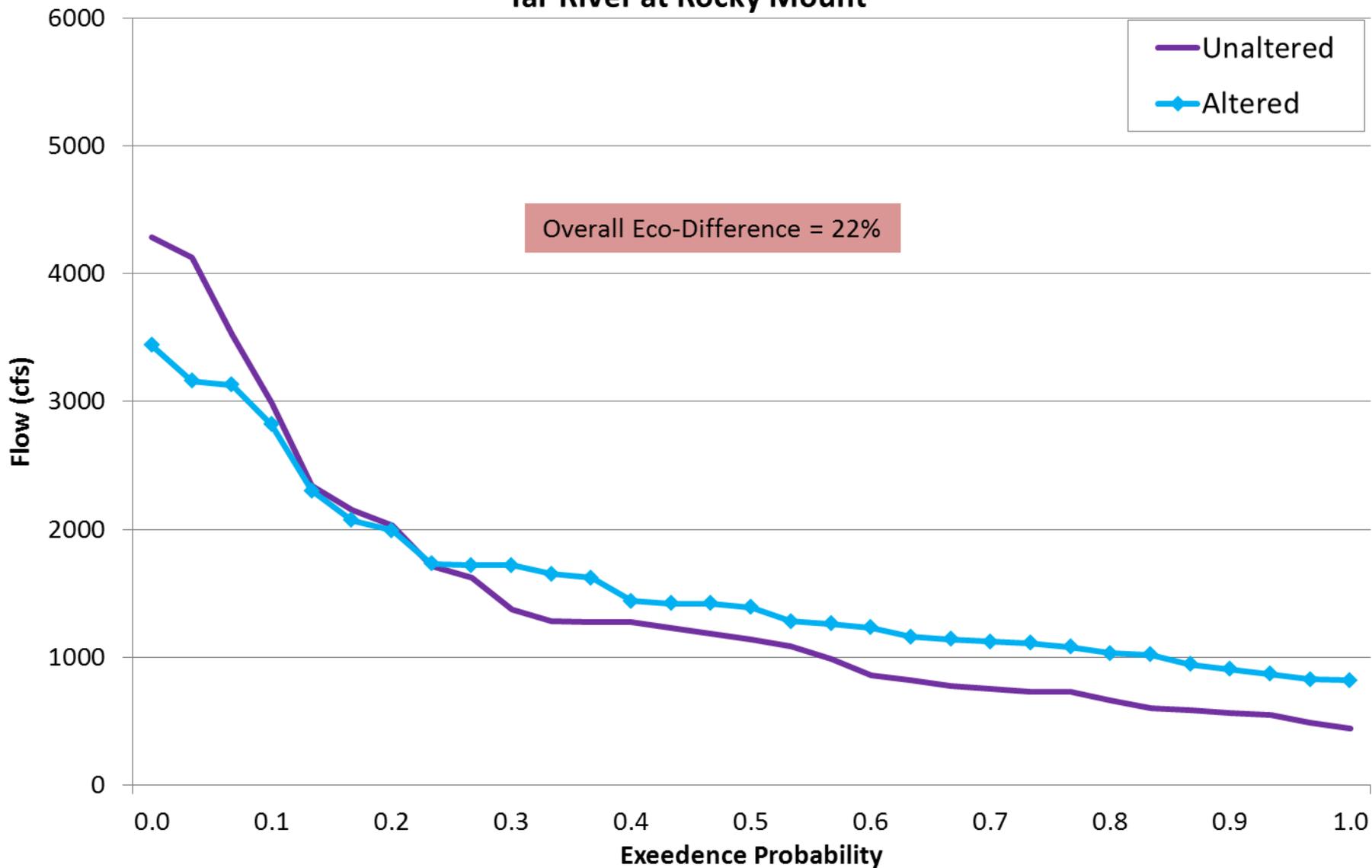


Use as a Planning Tool

Various ways to “trip the red flag”

1. Compare median altered to median unaltered (no band)
 - If eco-difference >15% 
 - This is comparing the overall difference between median FDCs
 - It does not trip if certain parts of the FDC exceed the threshold

Example of Eco-Difference Flow Duration Curve - January Tar River at Rocky Mount

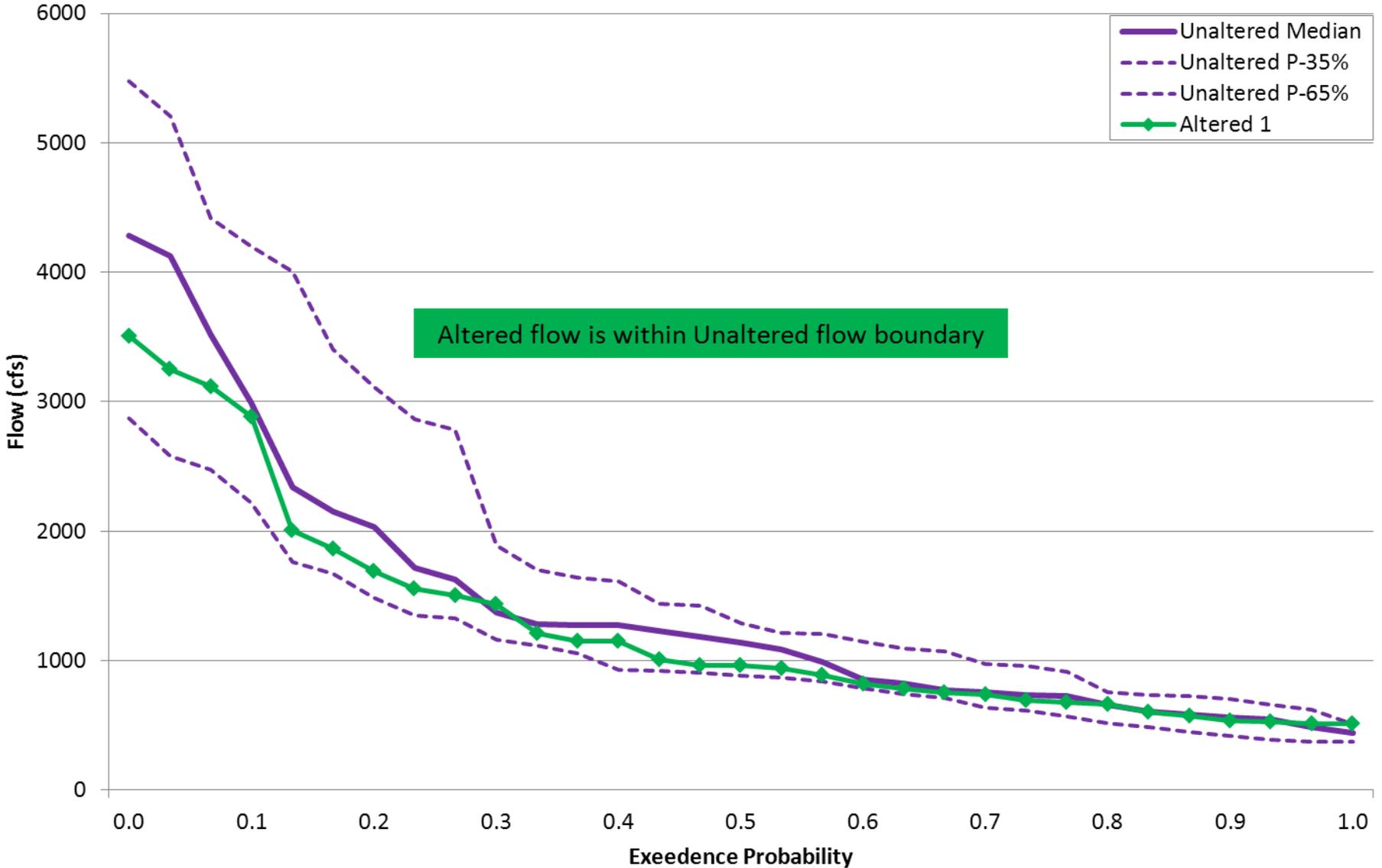


Use as a Planning Tool

Various ways to “trip the red flag”

2. Compare median altered FDC to the unaltered with band
 - If any part outside of band 
 - This is more stringent than option 1

Example of Eco-Difference Flow Duration Curve - January Tar River at Rocky Mount



Example of Eco-Difference
Flow Duration Curve - January
Tar River at Rocky Mount

