

Summary for Human Health and Ecological Integrated Risk Assessment, South River and Upper Shenandoah

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FAQ from 2013-How is the RRM going to interface with the human health risk assessment and the adaptive management process?

1. Have now built a human health and well being model based on the RCRA HHRA.
2. Have integrated the HHWB and the Ecological Risk Assessment.
3. Now provides the inputs into the adaptive management model.



Objectives of HHRA +ERA integration

Assess risk to:

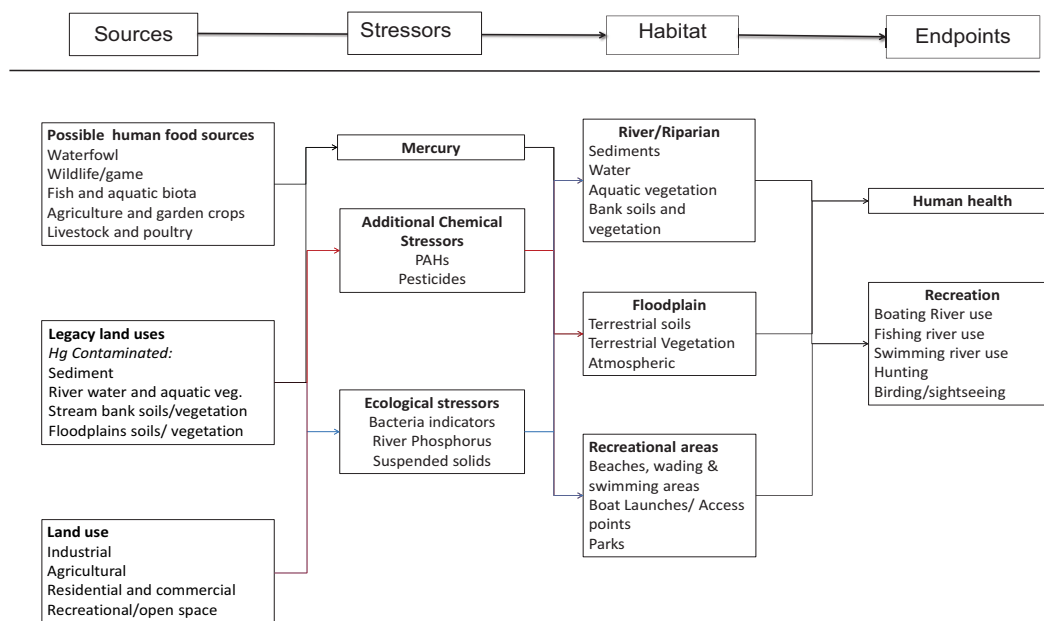
- Human health from mercury exposure via dietary sources
- Recreational activities in the South River watershed.

Incorporate all of the aspects of the current risk assessment programs into a single framework.

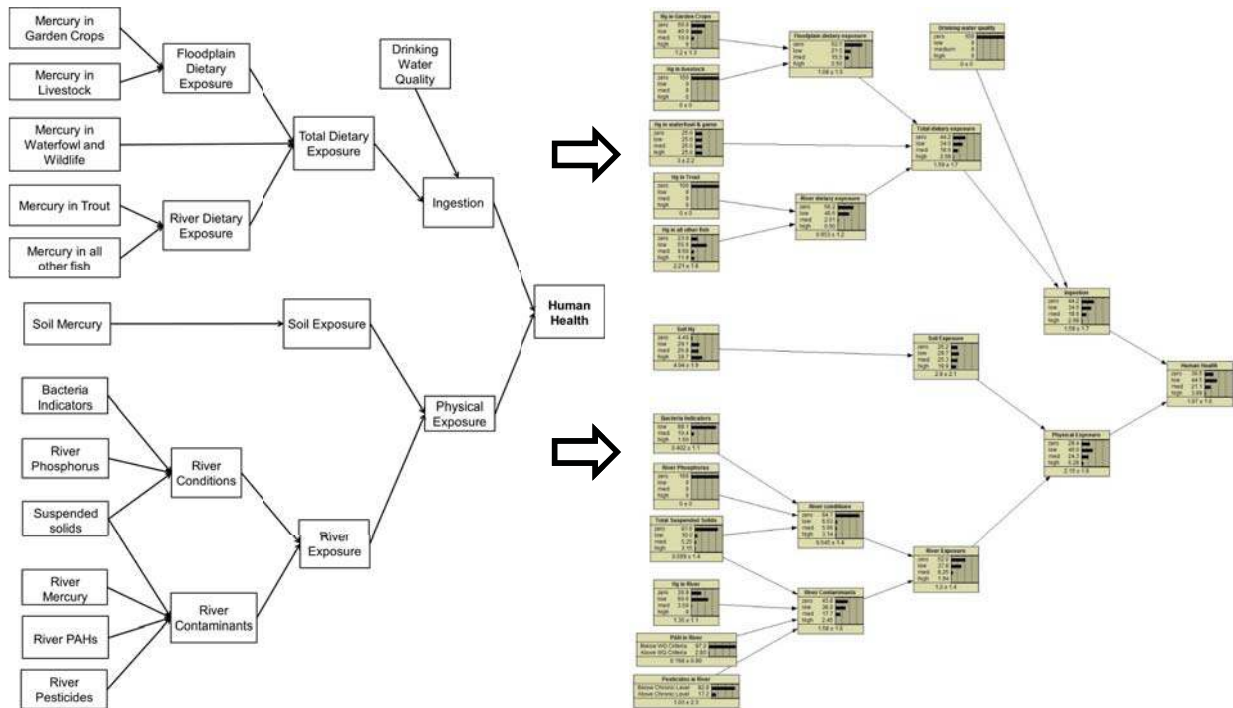
Maintain consistency /relevancy to RCRA HHRA and ACOE models

Conceptual model for HH and Well Being

South River RRM Human Health Conceptual Model



Conceptual Model is used to build Bayesian Network



Structure remains nearly the same.

Model parameterization 1

Input nodes are parameterized with
1. site specific data
2. criteria for evaluating data (ranking scheme)

Hg in Trout		
zero	96.3	
low	3.70	
med	0	
high	0	
0.074 ± 0.38		

Hg in all other fish		
zero	0.70	
low	26.6	
med	38.0	
high	34.7	
4.13 ± 1.6		

River dietary exposure		
zero	31.5	
low	57.0	
med	9.64	
high	1.87	
1.64 ± 1.3		

Region 5 Fish Fillet Hg (non-trout)		
	count	percent
Zero <0.2 mg/kg	4	0.7
Low 0.21-1.1 mg/kg	151	26.6
Med 1.2-2.8 mg/kg	216	38.0
High >2.9 mg/kg	197	34.7

Model parameterization 2

Hg in Trout	
zero	96.3
low	3.70
med	0
high	0
0.074 ± 0.38	

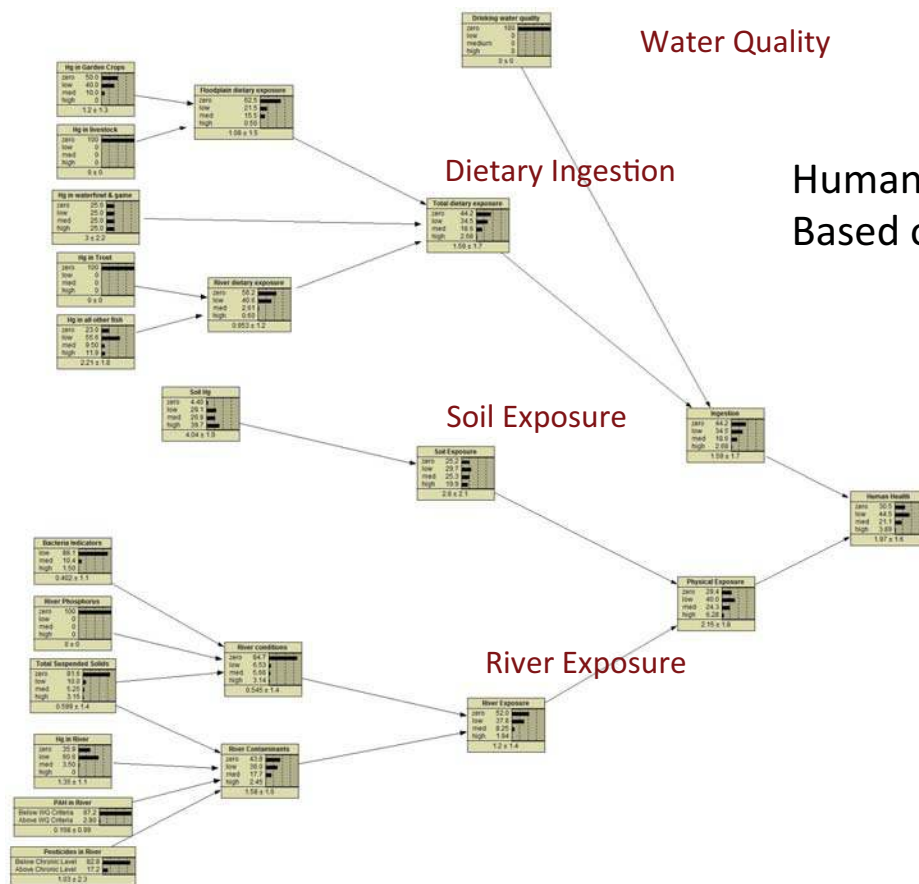
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Child nodes are based on conditional probabilities that reflect parent node interactions

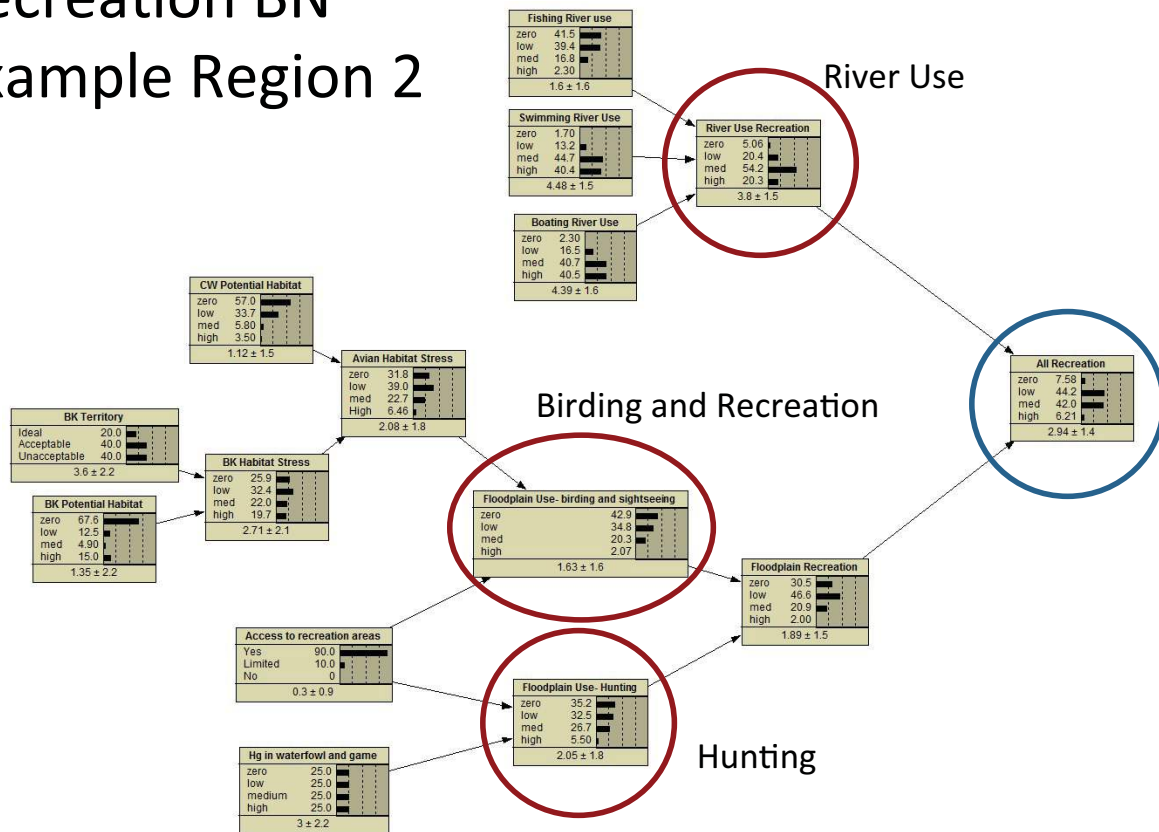
Conditional Probability Table (CPT)

Hg in all other fish	Hg in Trout	zero	low	med	high
zero	zero	100	0	0	0
zero	low	30	50	20	0
zero	med	5	15	75	5
zero	high	0	0	10	90
low	zero	50	50	0	0
low	low	20	60	20	0
low	med	0	15	80	5
low	high	0	0	10	90
med	zero	25	60	15	0
med	low	10	60	25	5
med	med	0	10	80	10
med	high	0	0	10	90
high	zero	25	60	10	5
high	low	10	60	20	10
high	med	0	0	80	20
high	high	0	0	0	100



Recreation BN

Example Region 2



Data

- 7 out of 13 input parameters shared with biotic and/or WQ model
- Shared parameters use same monitoring data but different ranking schemes (human specific criteria)
- 6 additional input parameters for human and/or terrestrial routes of exposure that were not considered in previous RRM.

HHRA

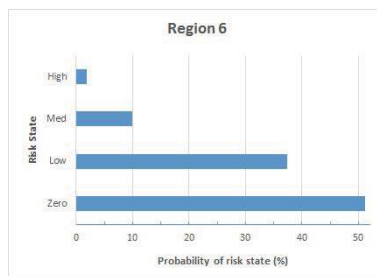
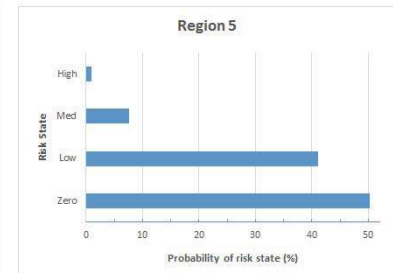
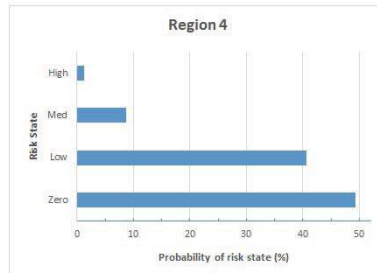
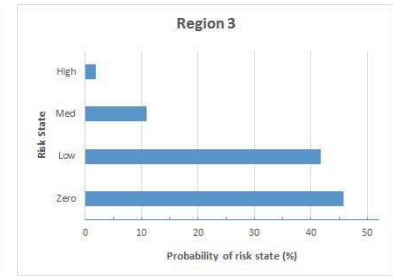
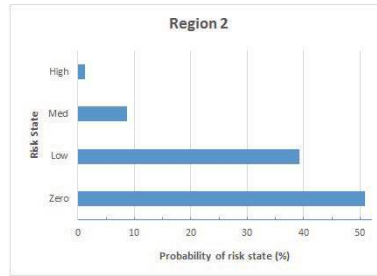
- Risk to human health from South River and SR floodplain from 2 main sources:
 1. Physical exposure- river, river sediments, and soils
 2. Dietary exposure- local foods and drinking water
- Multiple stressor risk assessment- mercury, PAHs, and organochlorine pesticides; fecal bacteria, total P and TSS in river water

Human Health User Scenarios

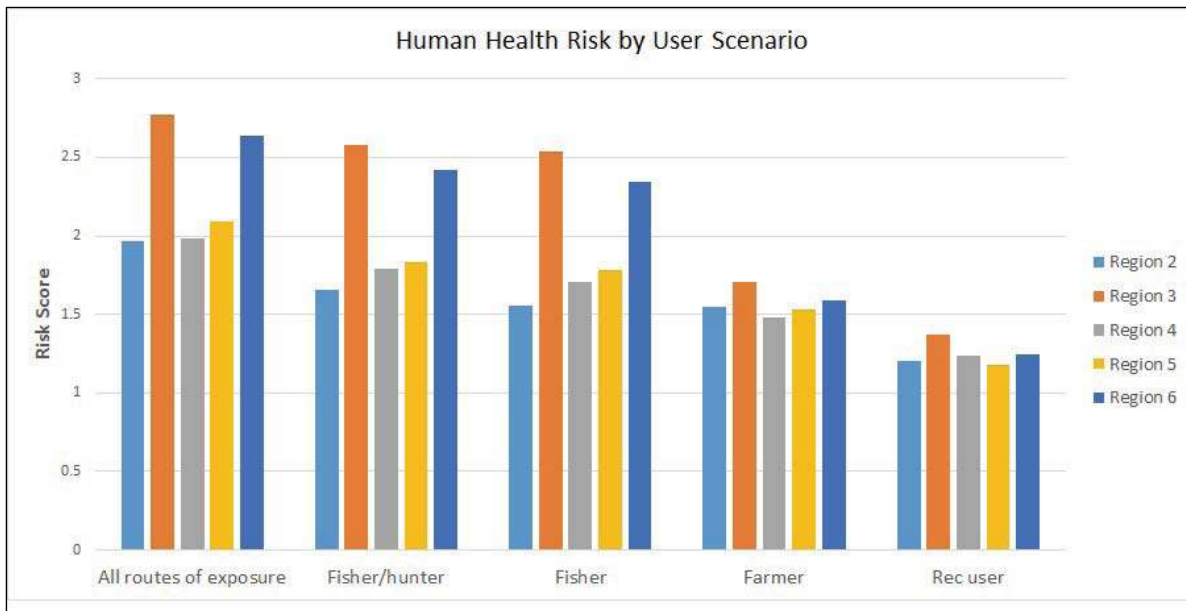
- User Scenarios reflect likely routes of exposure from dietary sources
- 4 User Groups are:
 - Fisher/Hunter (fish and game)
 - Fisher (fish)
 - Farmer (garden crops and livestock)
 - Recreational User (no dietary exposure)
- The approach is consistent with the RCRA human health risk assessment “future user” scenarios

All Routes Human Health Results Summary

- Human health risk generally low, consistent between risk regions
- Highest risk in Regions 3 and 6
- Lowest risk in Regions 2 and 4.
- Driven by these parameters:
 - Soil Mercury
 - Mercury in garden crops
 - Mercury in trout
 - Mercury in resident fish (non-trout)
 - Mercury in river water
 - Bacteria Indicators (fecal bacteria)



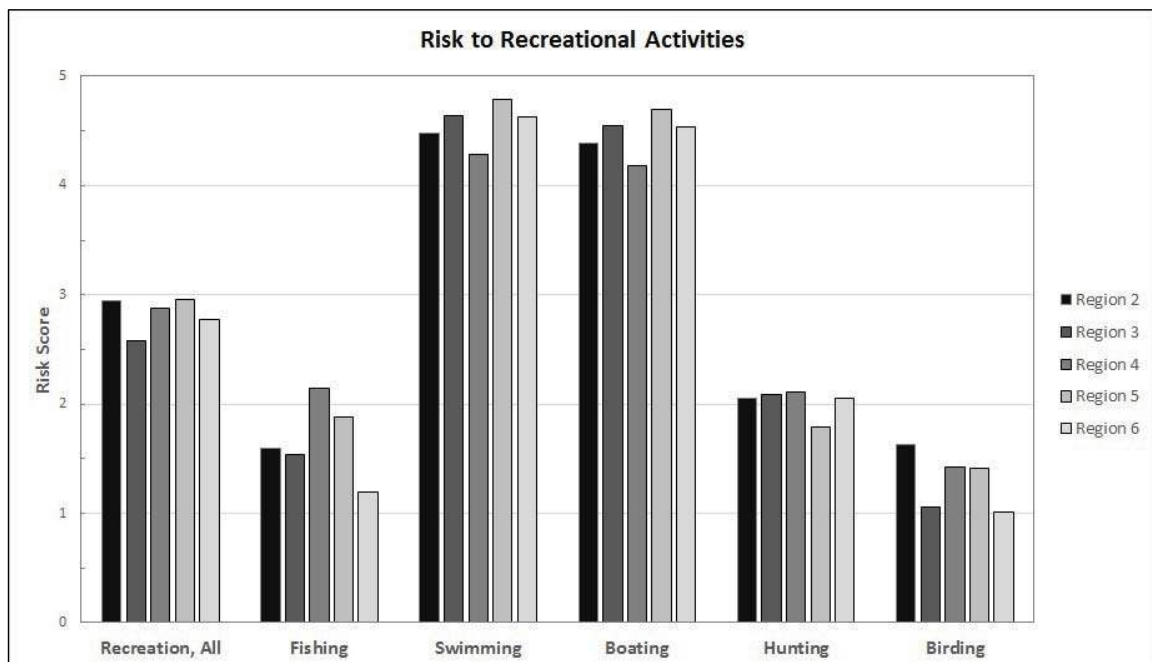
Health risk was also assessed for four generic user groups. User groups are defined by their dietary routes of exposure (consistent with RCRA HHRA approach).



Recreation

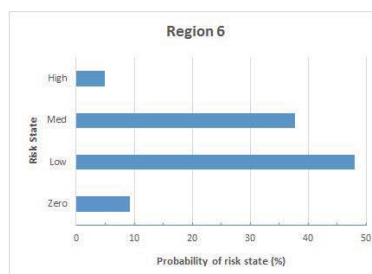
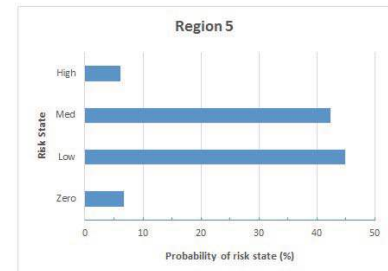
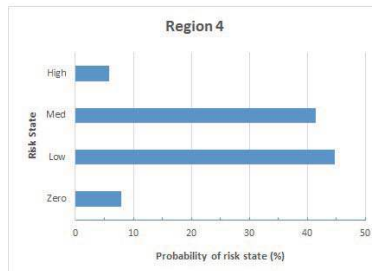
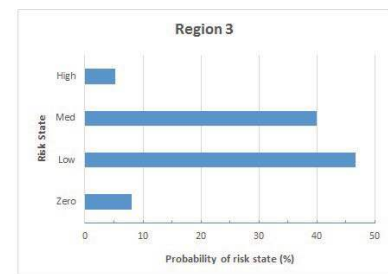
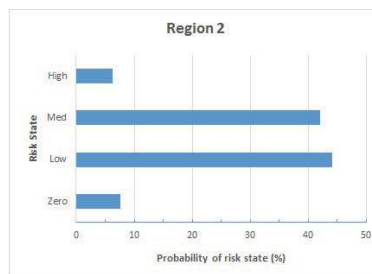
- Risk to recreation on SR floodplain and river
- Summarizes risk to 5 recreational activities:
 - Hunting
 - Birding/Sightseeing
 - Fishing (From WQ model)
 - Swimming (From WQ model)
 - Boating (From WQ model)

Risk to All Recreation is an aggregate of risk to 5 recreational activities on the South River and its floodplain:



Recreation Results Summary

- Generally low to medium risk
- Highest risk Region 2, 5
- Lowest risk in Region 6
- Important input parameters:*
 - Public access
 - Mercury in waterfowl and wildlife
 - River temperature



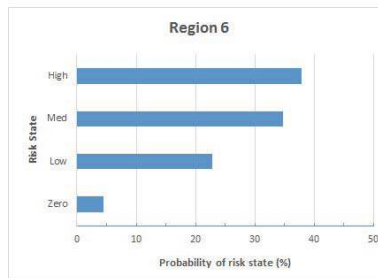
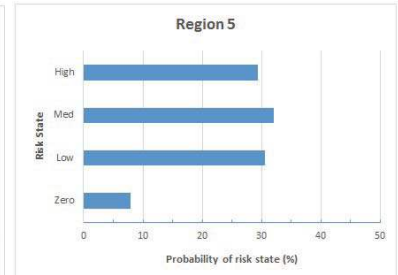
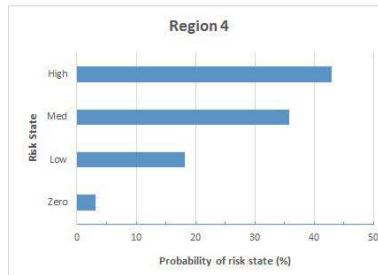
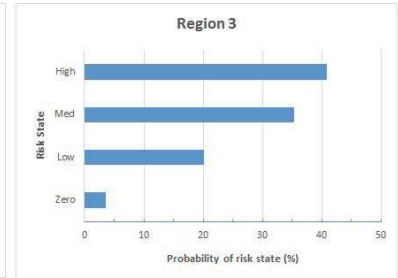
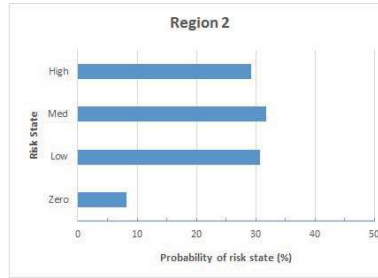
*from sensitivity analysis

Ecosystem Services Integrating HHRA-ERA

- Fully integrated model
- Risk to 4 main ecosystem services:
 - South River fishery
 - Recreation
 - Human health
 - Water quality
- Services can be equally weighted or prioritized in CPTs to reflect stakeholder goals/ values

Ecosystem Services Results Summary

- Integrates biotic, WQ, recreation, and human health models
- Considers 4 ecosystem services:
 - Fisheries
 - Recreation
 - Human health
 - Water quality
- Highest risk in Region 4
- Lowest risk in Regions 2 and 5
- Driven by these parameters:
 - Resident and non-resident fishery
 - Recreation
 - Water quality standards



Did we meet objectives?

- ✓ Assess risk to:
 - Human health from mercury exposure via dietary sources
 - Recreational activities in the South River watershed.
- ✓ Incorporate all of the aspects of the current risk assessment programs into a single framework.
- ✓ Maintain consistency /relevancy to RCRA HHRA and ACOE models

Next Steps

How does this fit with Adaptive Management Plan?

- Use integrated model to compare risk to biotic, WQ and human health
- Assess adaptive management strategies on all endpoints in **ONE** model
- Could be weighted to represent stakeholder or management priorities
- Could incorporate cost nodes and/or decision nodes (MCDA)
- Quantitative part of an Adaptive Management Process.

