

A Bayesian network based risk assessment for whirling disease on populations of Colorado River cutthroat trout in watersheds of the southwestern United States



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Overview

- I. Biology of whirling disease
- II. Study area
- III. Bayesian approach to ecological risk assessment
- IV. Assessment of whirling disease infection risk in Colorado River cutthroat trout



Colorado River cutthroat trout
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Whirling Disease

- * Infection of trout and salmon by *Myxobolus cerebralis*
- * Preferentially infects cartilage
 - * Axial deformities
 - * Neurological damage
 - * Tail-spinning behavior



Diseased rainbow trout
© Stephen Atkinson, Oregon State University



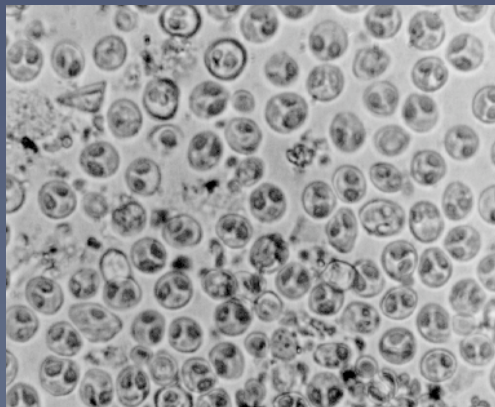
Myxobolus cerebralis
Triactinomyxon
(© Maria E Markiw, USGS)



Colorado Cutthroat Trout
(© FishEyeGuy Photography)



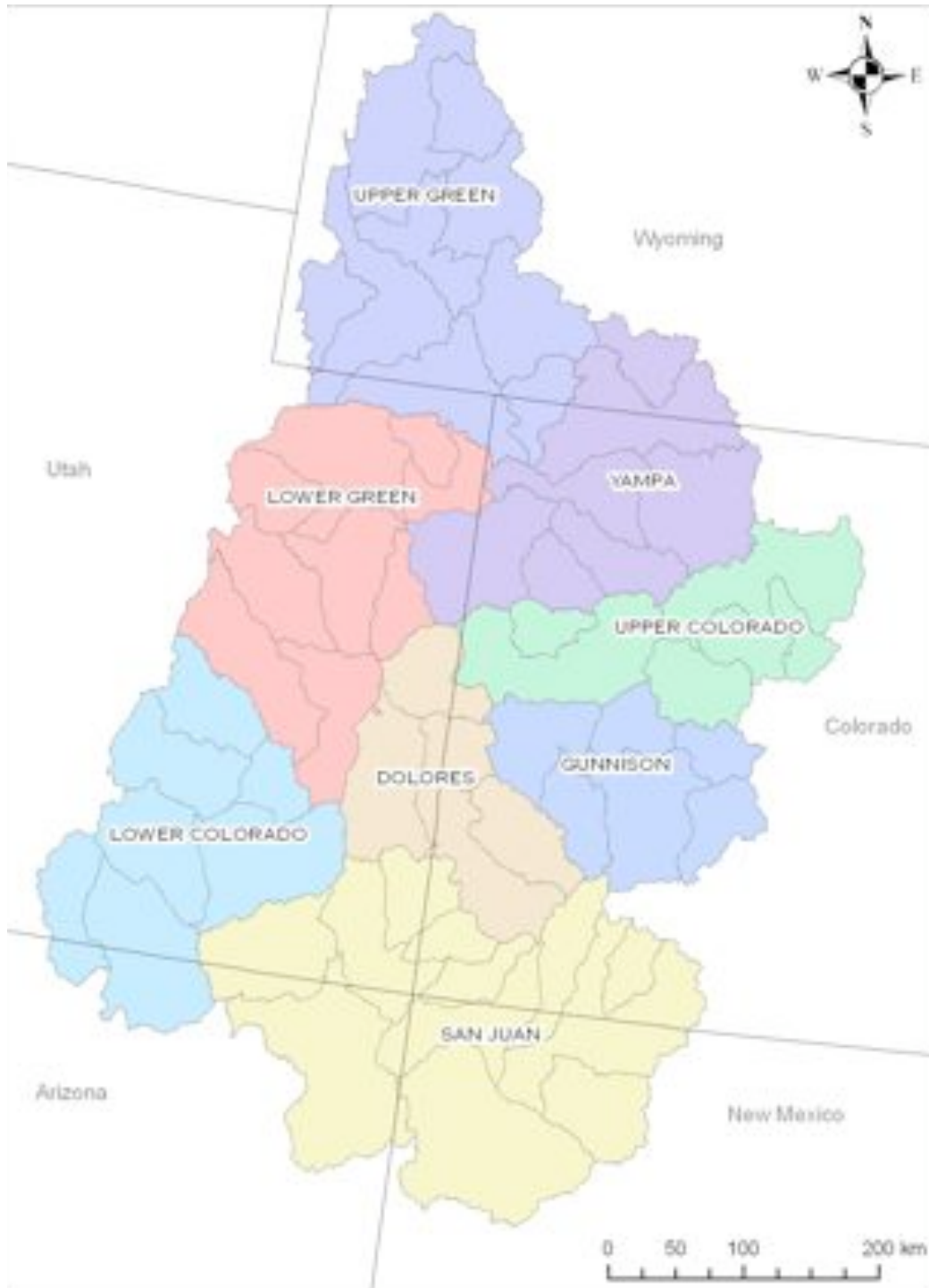
Tubificid worm host
(© D.L. Gustafson Montana State Univ.)



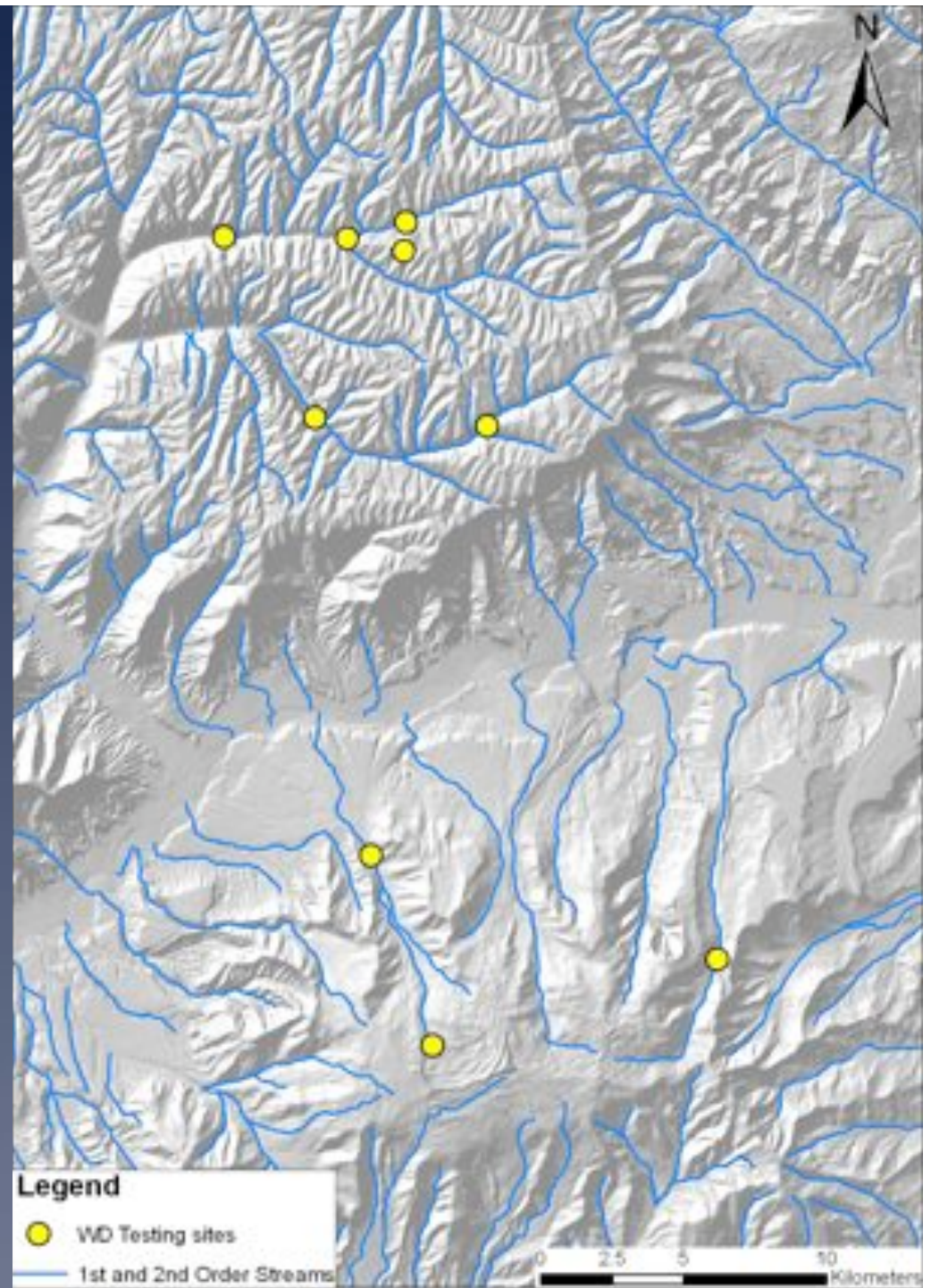
Myxobolus cerebralis spores
(© Maria E Markiw, USGS)



Geographic Management Units for Colorado Cutthroat Trout



Whirling Disease Testing



Factors Influencing Likelihood of Whirling Disease in Trout Population

1. Presence of secondary host (*Tubifex* sp.)
 - * Temperature
 - * Stream gradient
2. Connectedness to infected trout population
 - * Proximity to diseased populations
 - * Presence of barriers in stream channel
3. Ecological habits of Colorado cutthroat trout
 - * Presence of spawning & rearing areas
 - * Spatial overlap with rainbow trout

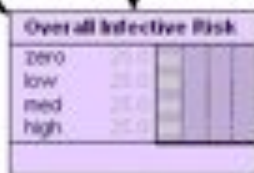
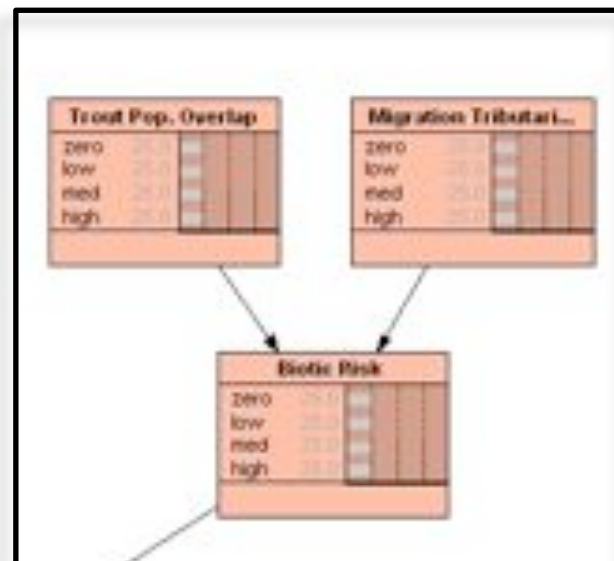
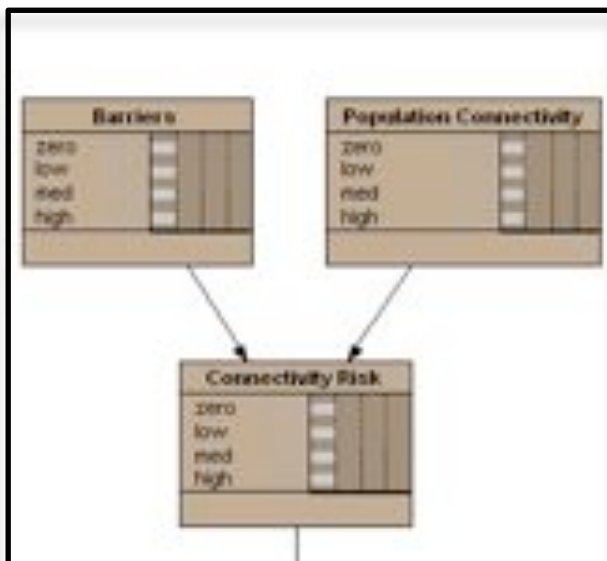
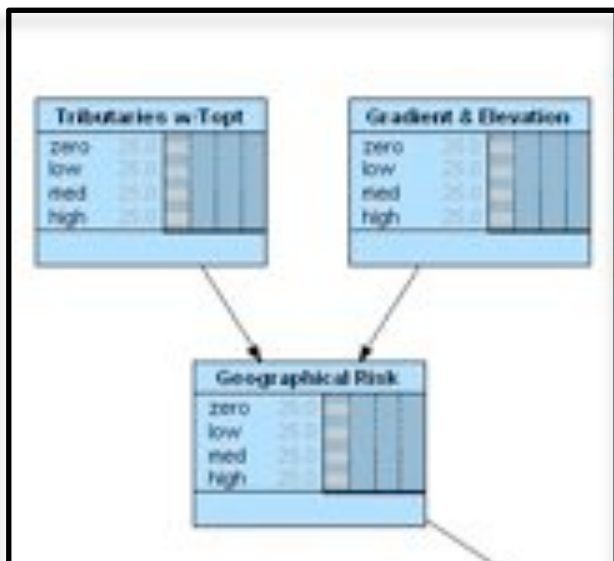
Bayesian Network Modeling for Ecological Risk Assessments

1. Can incorporate broad array of data types
2. Structure reflects causal pathways
3. Explicitly incorporate uncertainty
4. Sensitivity analysis can be used to identify influential variables
5. Easily updated

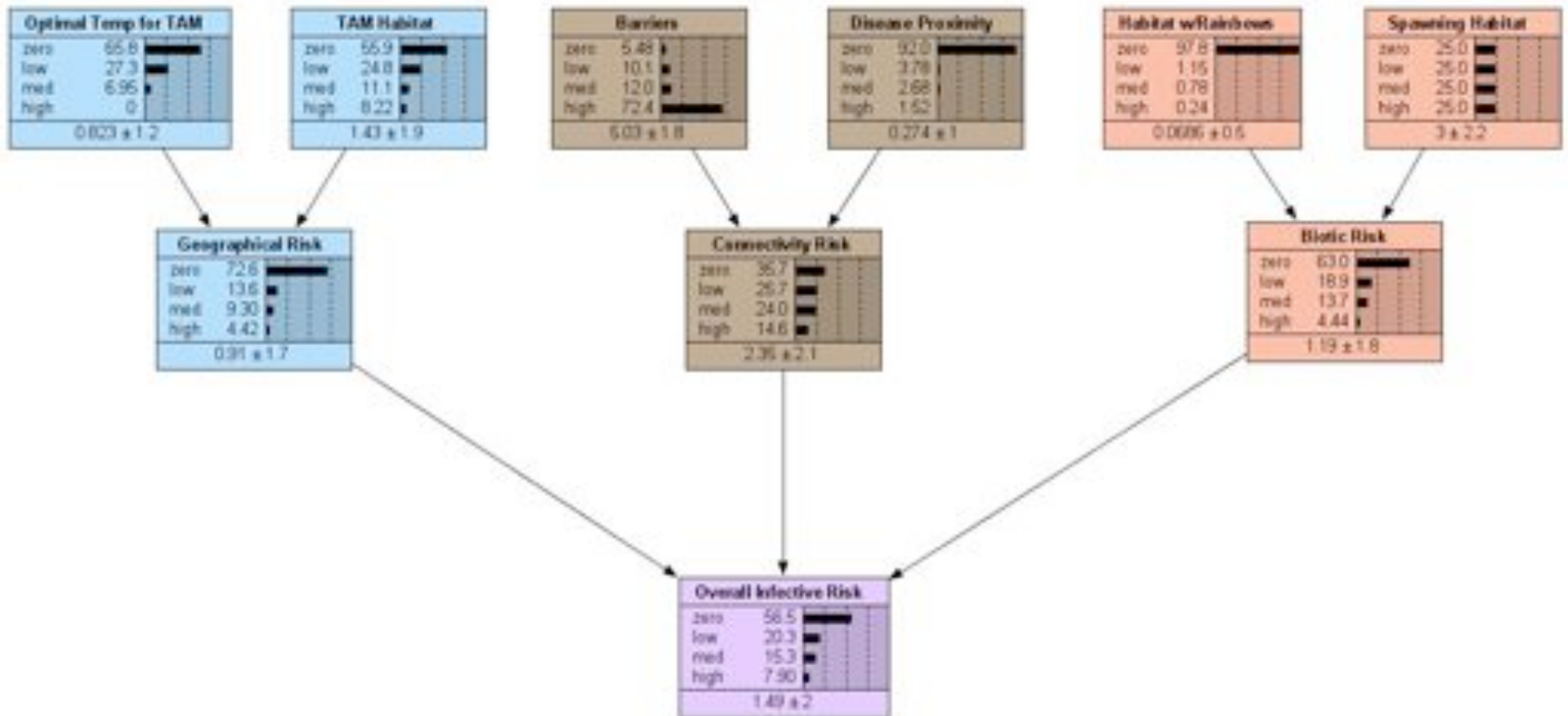
1. Presence of secondary host

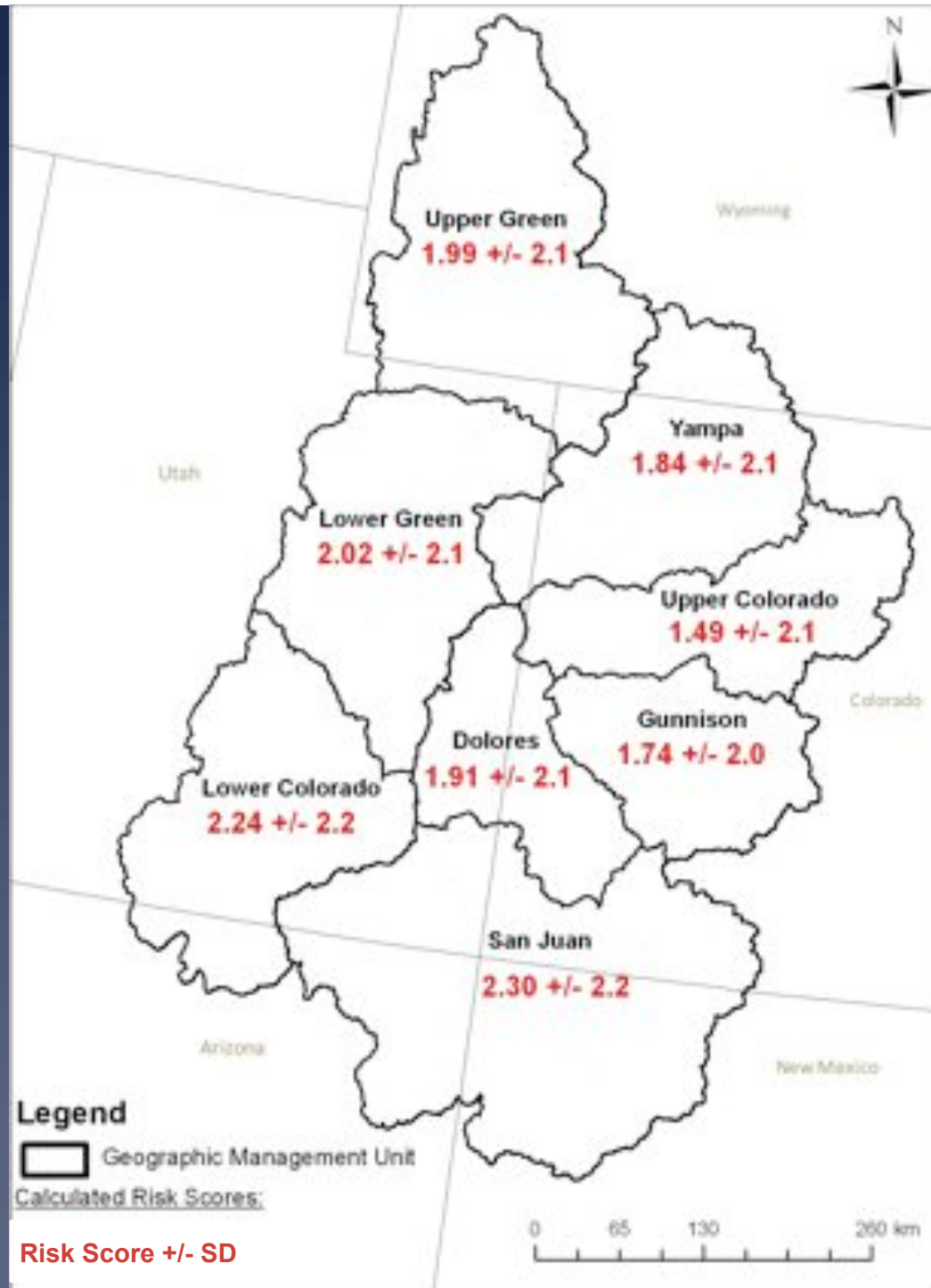
2. Connectedness to diseased fish

3. Ecological habits of Colorado cutthroat



Risk Assessment for Upper Colorado Management Region





Conclusions

- * Proximity to diseased populations was the parameter with the greatest influence on infection risk findings
- * Monitoring programs for disease detection were too narrowly focused for the regional scale being investigated
- * Lack of information on spawning & rearing behavior also contributed to uncertainty
- * Bayesian network approach allowed us to incorporate spatial structure and complexity of the environment into the risk assessment

Acknowledgements

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- * GIS datasets used:
 - * National Hydrography Dataset (USGS)
 - * National Elevation Dataset (USGS)



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