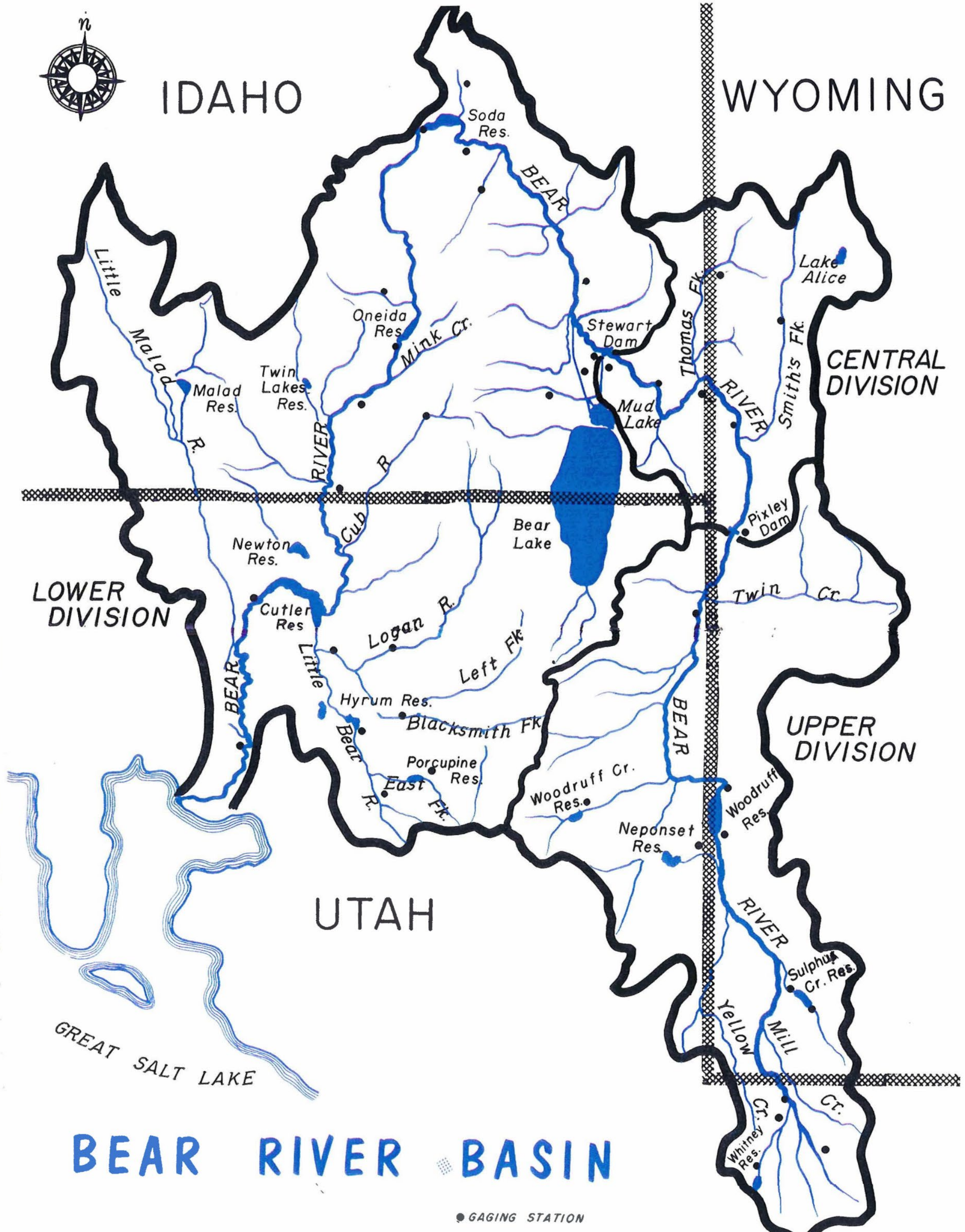
Optimizing barrier removal for human and environmental water use in the Bear River watershed

Greg Goodrum

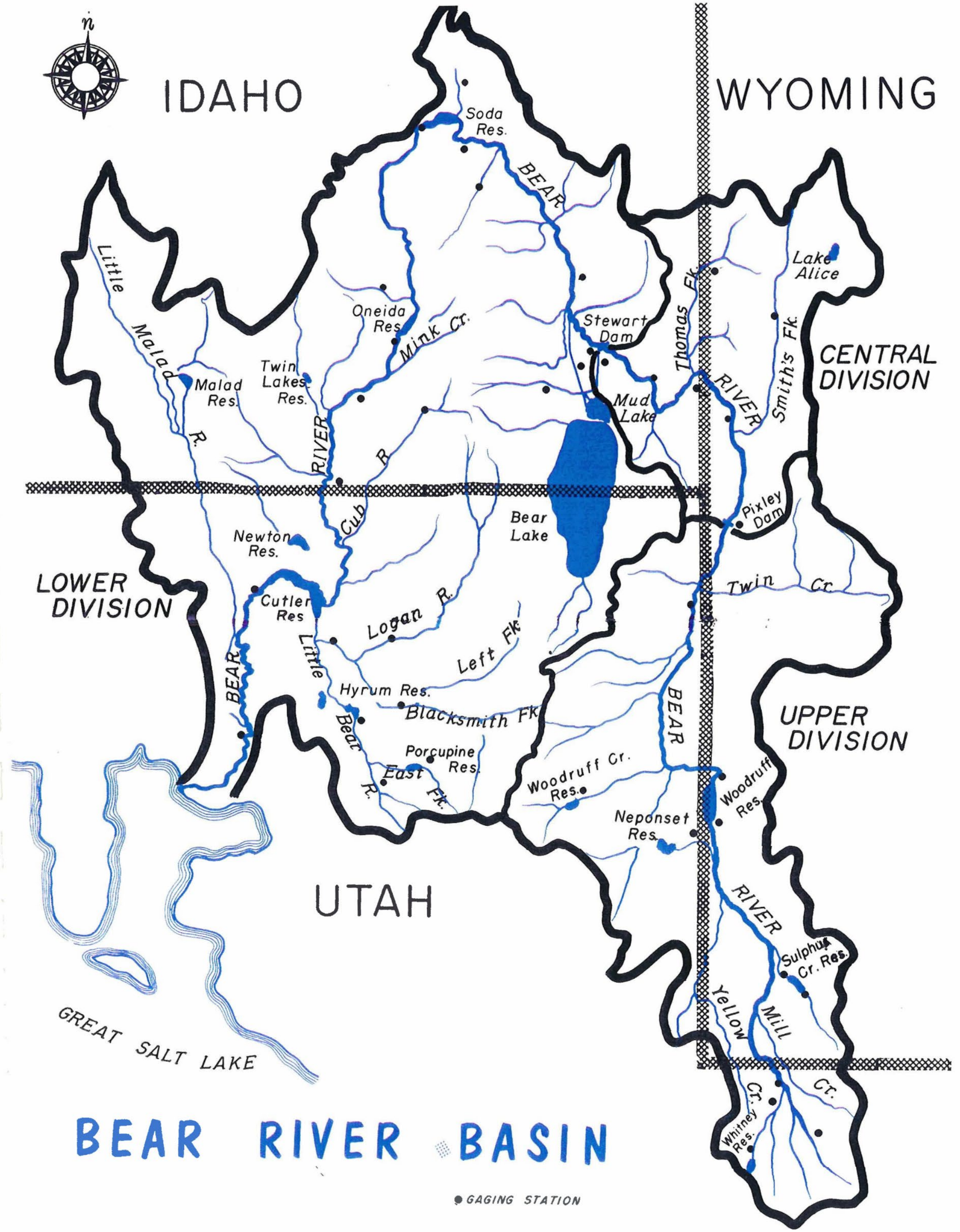
CEE 6410

10/26/2020

Human objectives

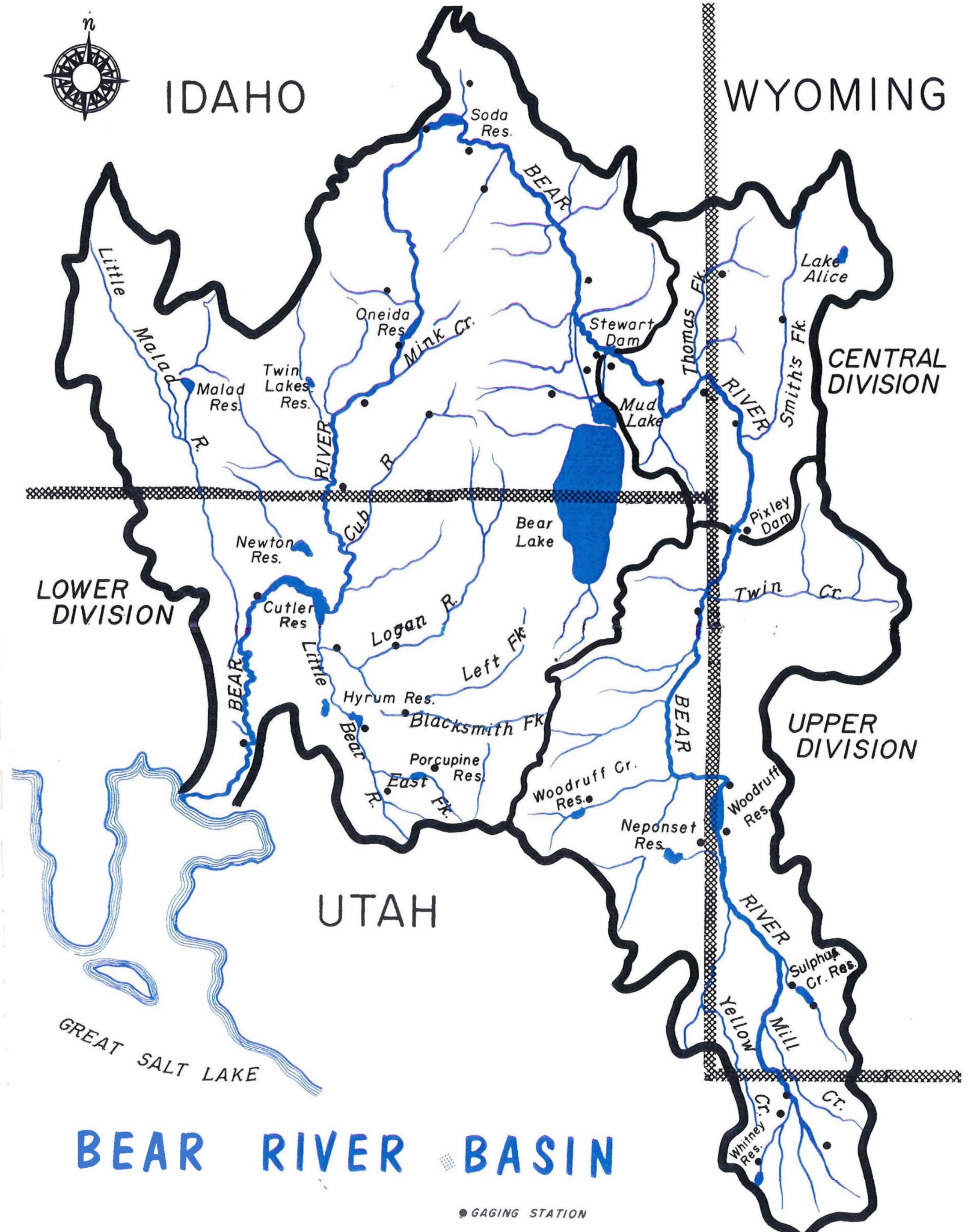


Environmental objectives



Bonneville Cutthroat Trout *Oncorhynchus clarki utah*

Bluehead Sucker *Catostomus discobolus*



Research question

- *How can we optimize barrier removal to increase connected aquatic habitat for fish and minimize water scarcity for people?*

- **Build on work from *Kraft, Rosenberg, and Null* (2019)**

Dual-objective model formulation

Obj 1: Maximize connected quality-weighted aquatic habitat

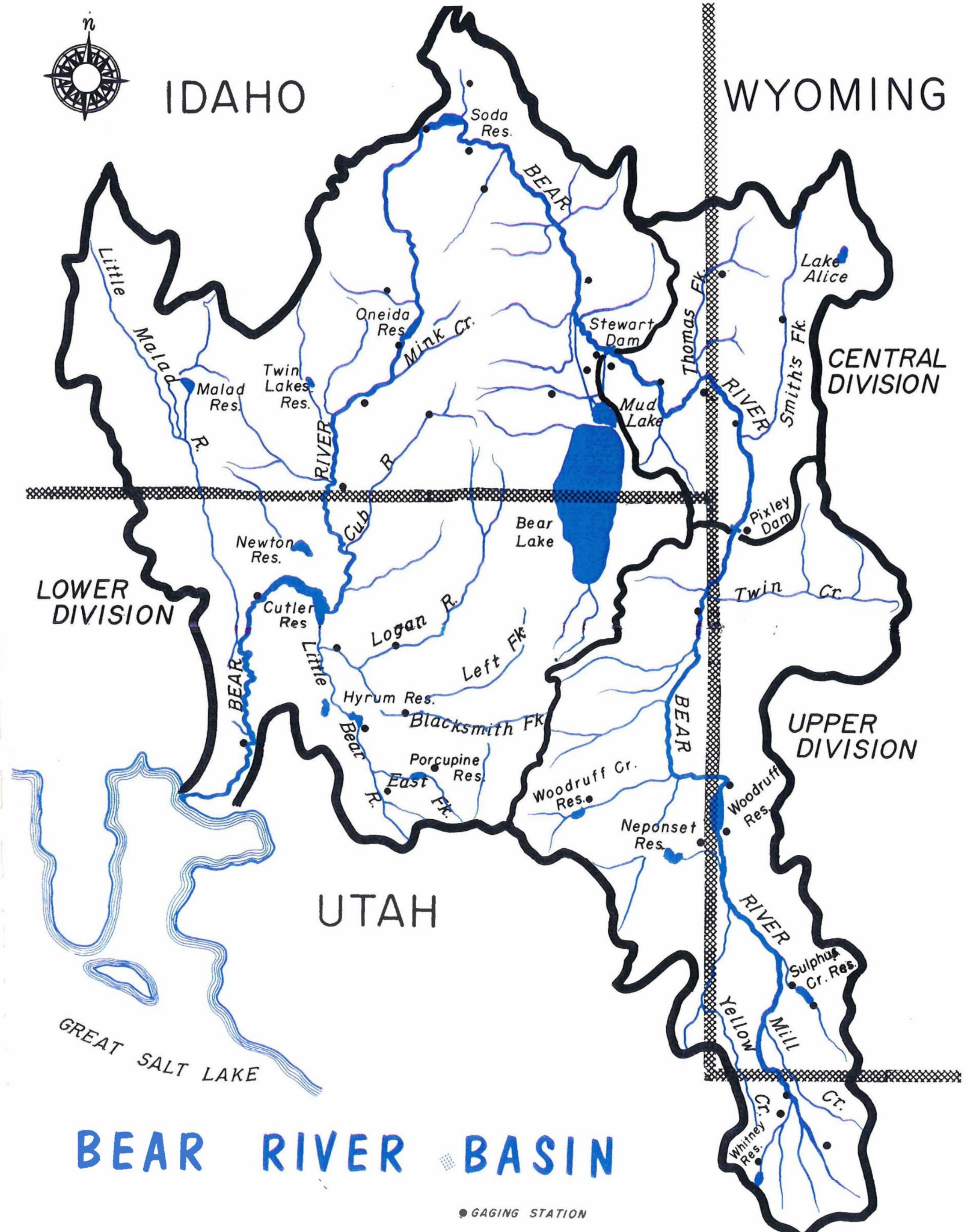
$$Max\colon Zhabitat = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\dfrac{H_i * H_j}{1 + L_{ij}} * CR_{ij} * P_i * P_j + \sum_i H_i^2}{H_L^2}$$

Obj 2: Minimize water scarcity

$$Min\colon Zscarcity = \sum_k \frac{C_k}{max(C_k)} * B_k$$

Combine using weighted sum method:

$$Maximize\ Z = (1 - w) * Zhabitat - (w * Zscarcity)$$



Model application

1. Apply formulation to Bear River watershed, compare results to *Kraft, Rosenberg, and Null* (2019)
2. Adapt formulation to use the Dendritic Connectivity Index

$$Maximize: Zhabitat = \sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij} * \frac{l_i}{L}\frac{l_j}{L} * 100 * CR_{ij}$$


Questions?