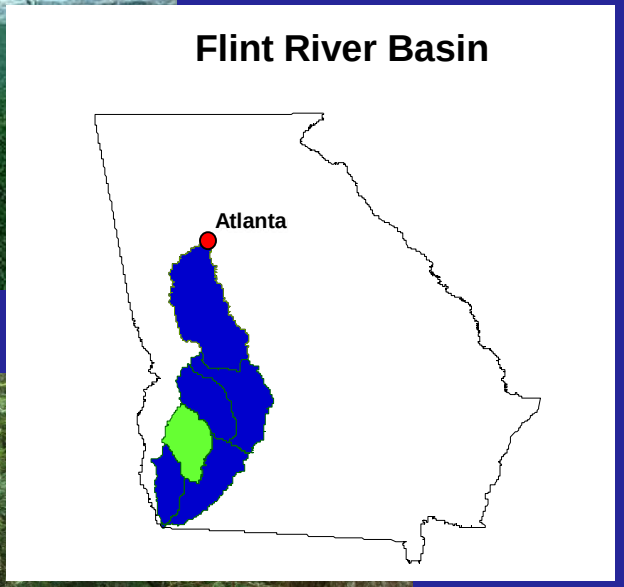
MANAGING WATER USE AND MUSSELS POPULATIONS IN A SOUTHEASTERN US RIVER

Jane Q. Student
FW 599

Water Resource Management Issues in the Southeast



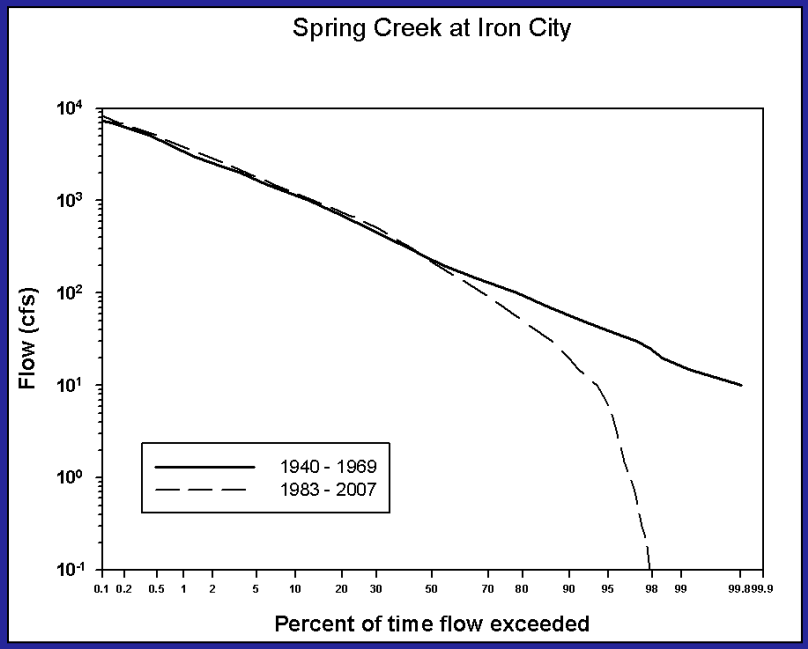
- Agricultural irrigation
- Increasing urbanization
- Climate change
- Flow standards
- Water allocation
- Spring Creek

Streamflows in Spring Creek

Extensive agricultural irrigation
1975 - present

Pre-irrigation (<1974) vs post-irrigation

Changes in flow exceedance



R. Jackson and K Rugel

Unionid Diversity in Spring Creek

- 28 of 31 historically known species are extant
- 5 Federally protected species
- 4 State protected species
- 8 endemic species

Gulf Moccasinshell

Shinyrayed Pocketbook

THE PROBLEM

Conserve/Recover listed mussels

Water for irrigation

- **Local economies**
- **Increasing need**

<u>Decision context</u>: water withdrawal from Spring Creek Basin

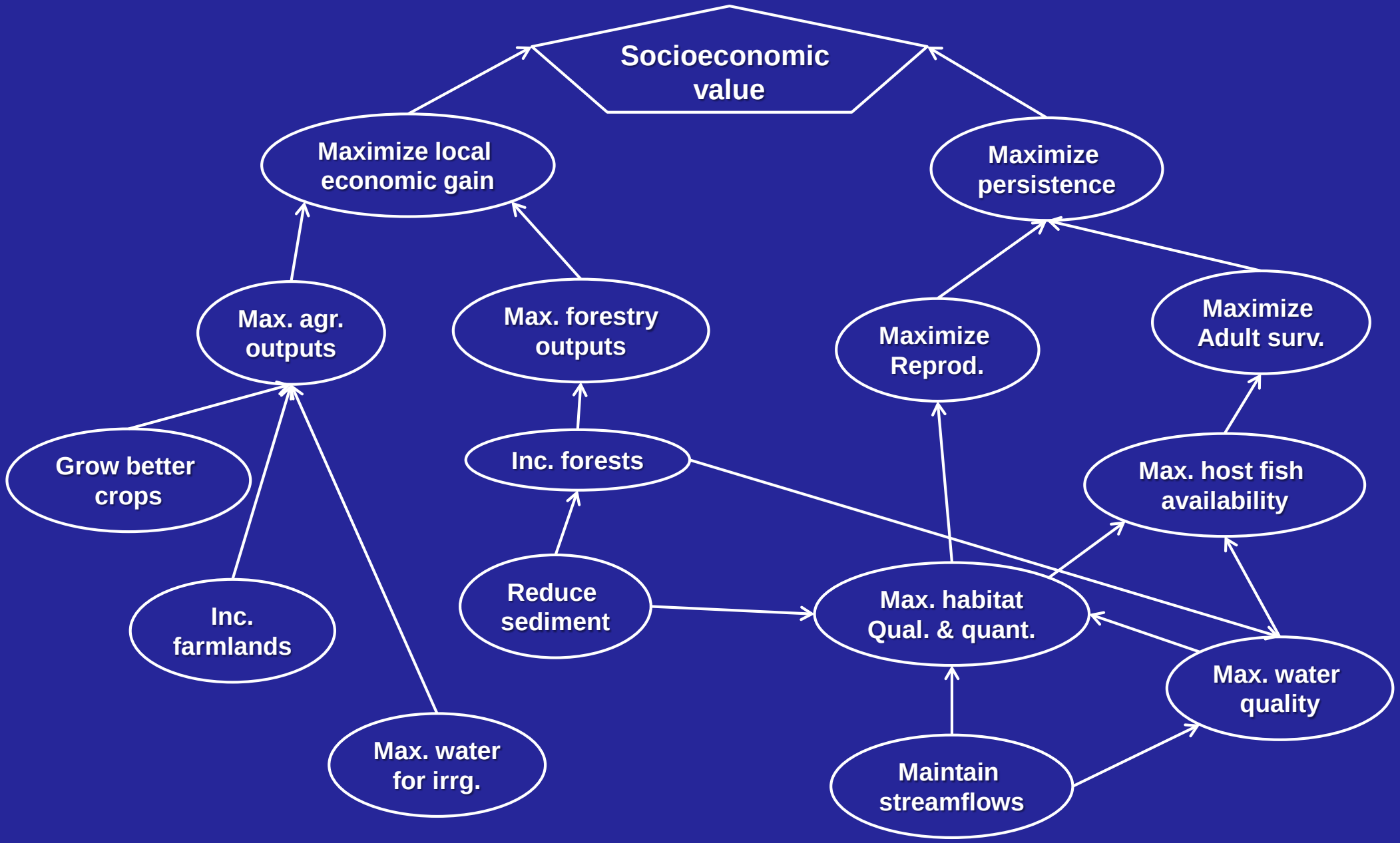
Hamiota subangulata

Pleurobema pyriforme

Medionidus penicillatus

Decision makers and stakeholders

Objectives network



Decision alternatives

EPD permitting authority

WRD very limited authority

FWS authority through ESA (jeopardy)

Three decision alternatives

- increase water withdrawal by 10%
- maintain current levels of water use
- decrease water withdrawal by 10%

Valuation of outcomes
Additive ranked outcomes

Probability of persistence		Water withdrawal decision		Socioeconomic value
Outcome	Rank	Outcome	Rank	
<25 years	1	Increase	3	4
25-75 years	2	Increase	3	5
>75 years	3	Increase	3	6
<25 years	1	Status quo	2	3
25-75 years	2	Status quo	2	4
>75 years	3	Status quo	2	5
<25 years	1	Decrease	1	2
25-75 years	2	Decrease	1	3
>75 years	3	Decrease	1	4

Modeling Approach I

Spatial dimensions:
Focused on distribution of all 5 species--lowest 47 km of Spring Creek

Time horizon:
100 years from present

Shinyrayed Pocketbook

Modeled *Hamiota subangulata* only: assumed other mussel species respond similarly

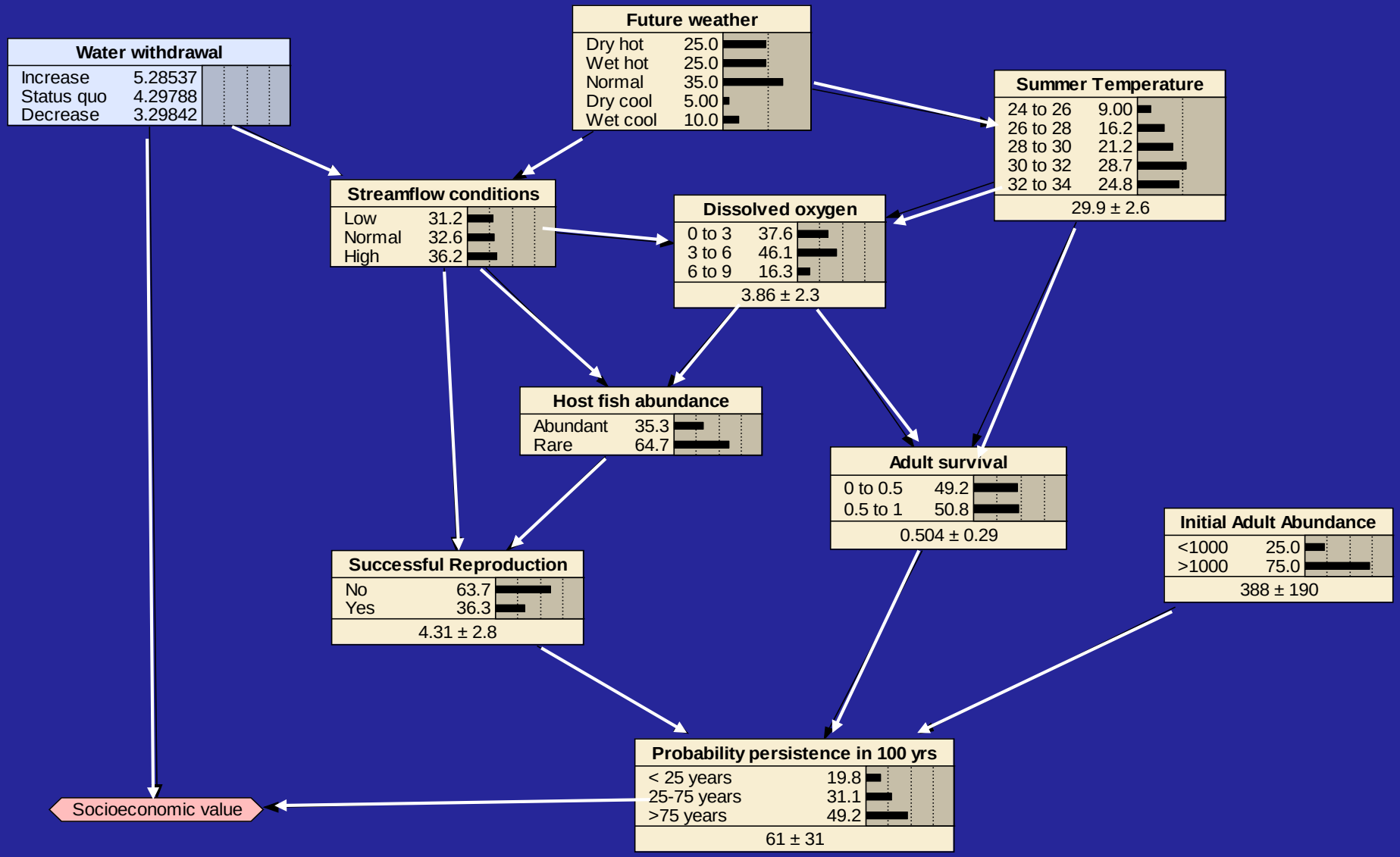
Modeling Approach II

Influence diagram

Parameterized: expert opinion

- **3 experts**
- **averaged values across experts**

Mussel conservation influence diagram



Modeling results

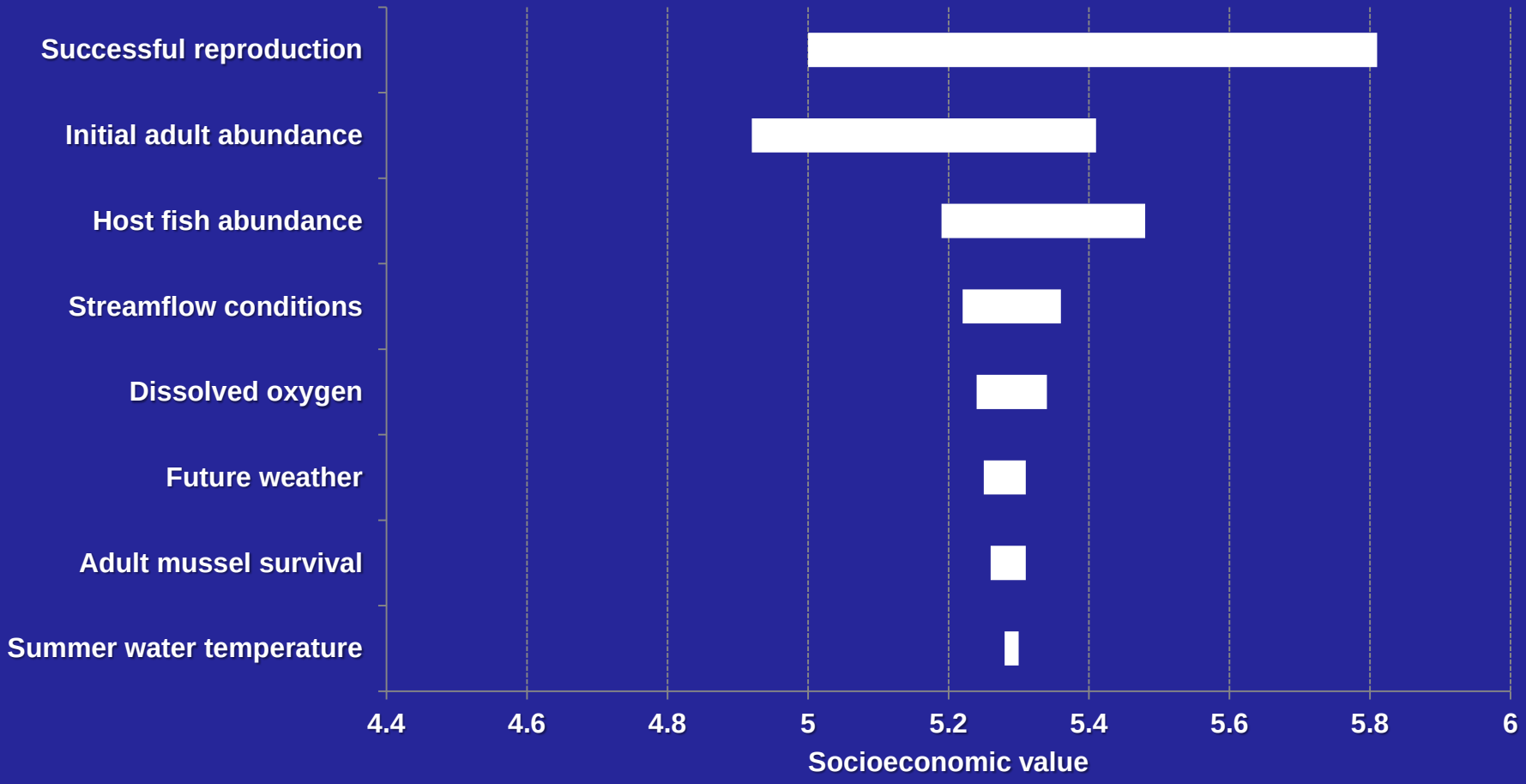
Optimal decision:

Increase water withdrawal 10%

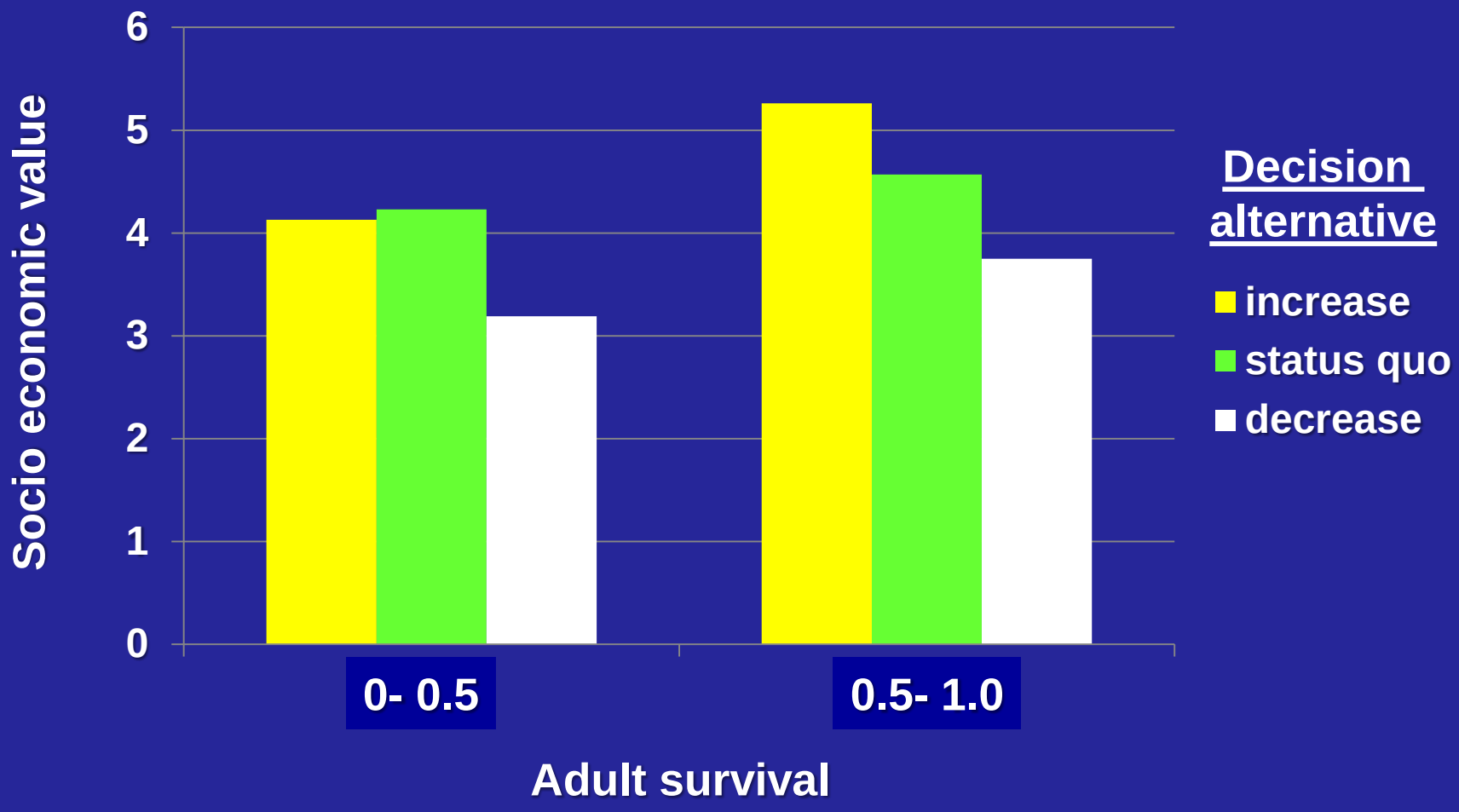
Expected socieconomic value 5.28 (88% of maximum)

Estimated probability persistence > 75 years, 49.2%

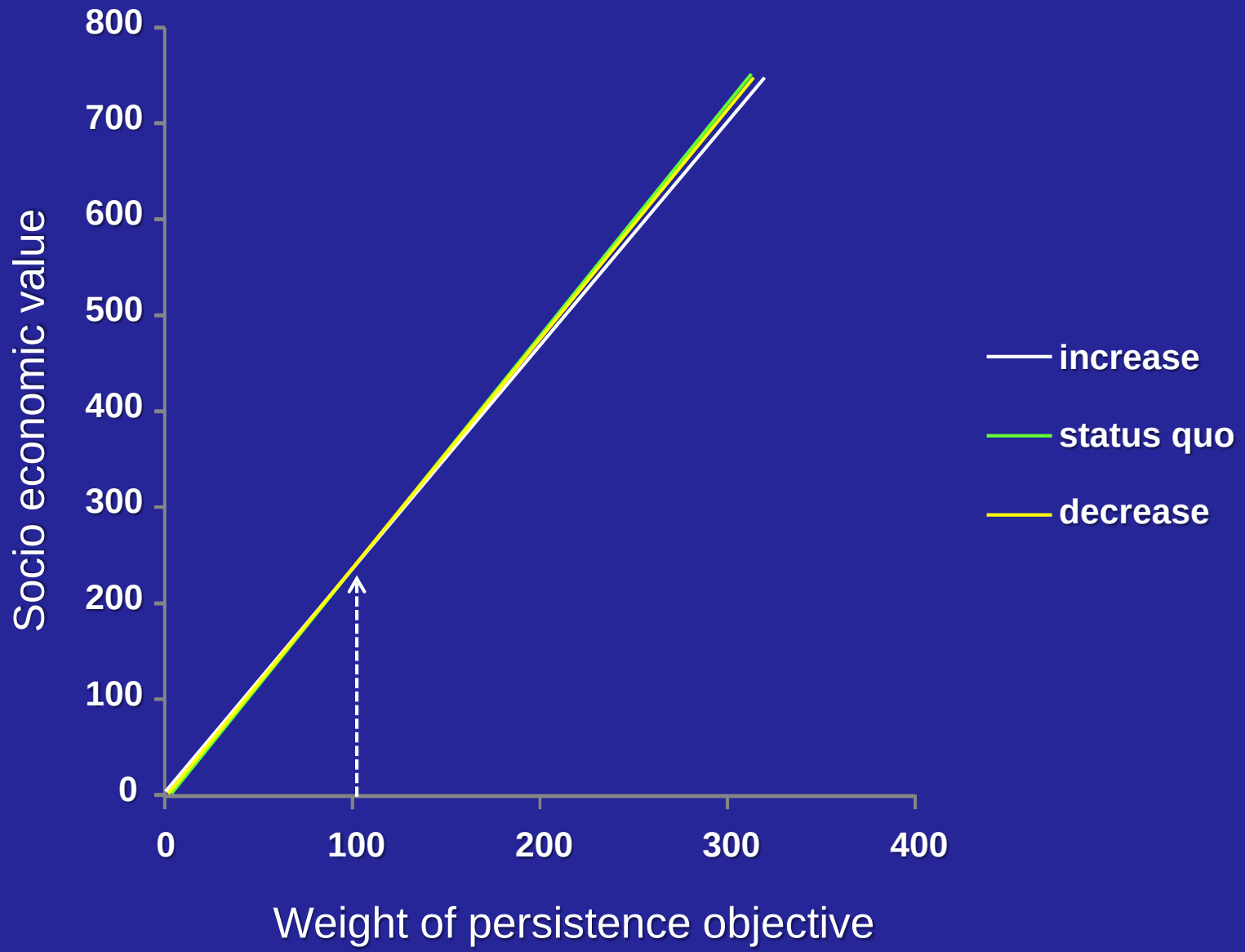
One way sensitivity analysis



Response profile



Indifference curve



Conclusion and next steps

Optimal decision: increase water use 10%

Survival > 75% low, model may be inadequate

Key uncertainty- adult survival, monitoring

Lessons learned

Too much reliance on expert opinion

-data needed

Decision alternatives too coarse

- degrees of water use
- others??

Alternative objective valuation

- constraints rather than multiple objectives