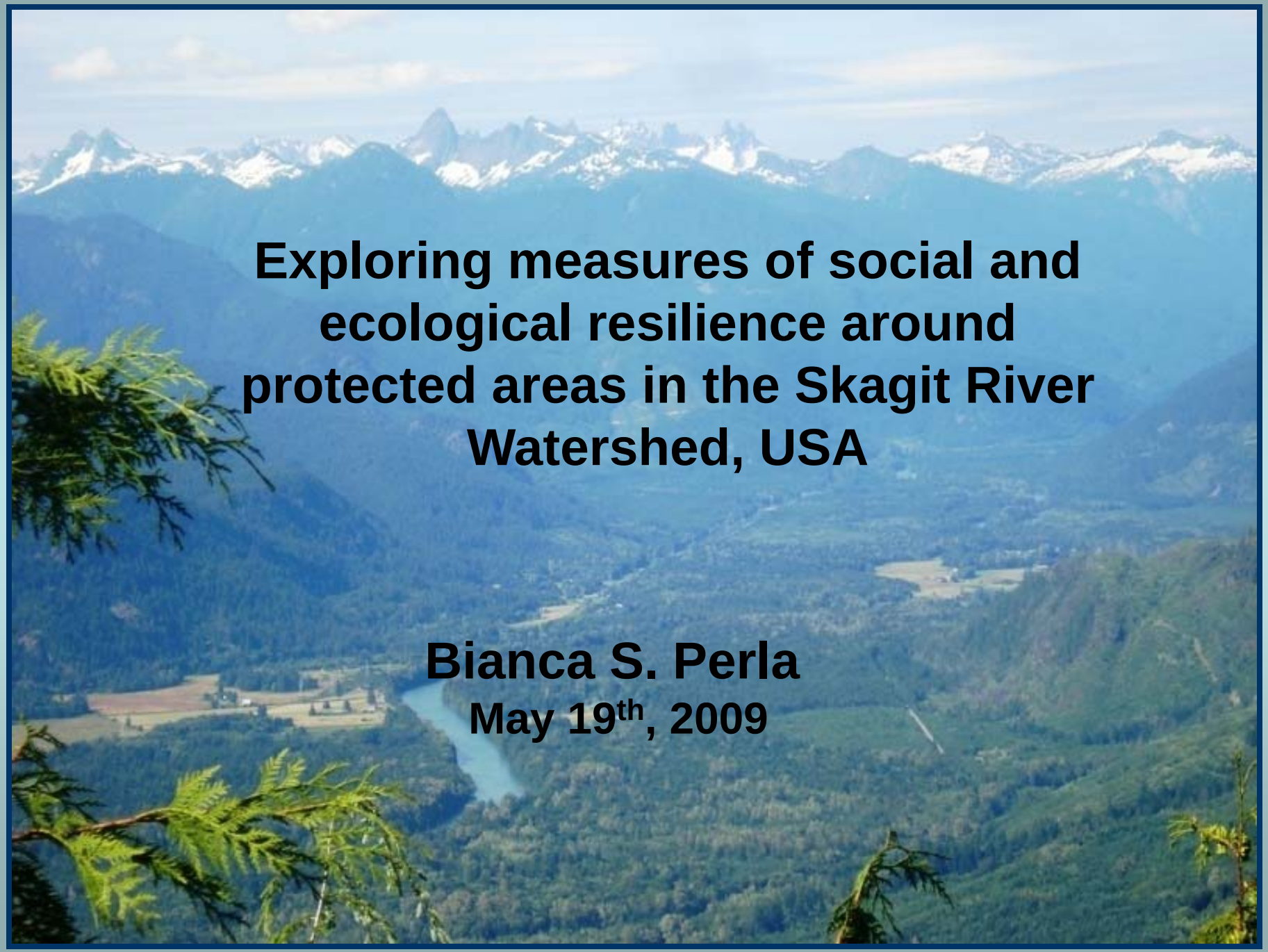


Exploring measures of social and ecological resilience around protected areas in the Skagit River Watershed, USA

Bianca S. Perla

May 19th, 2009

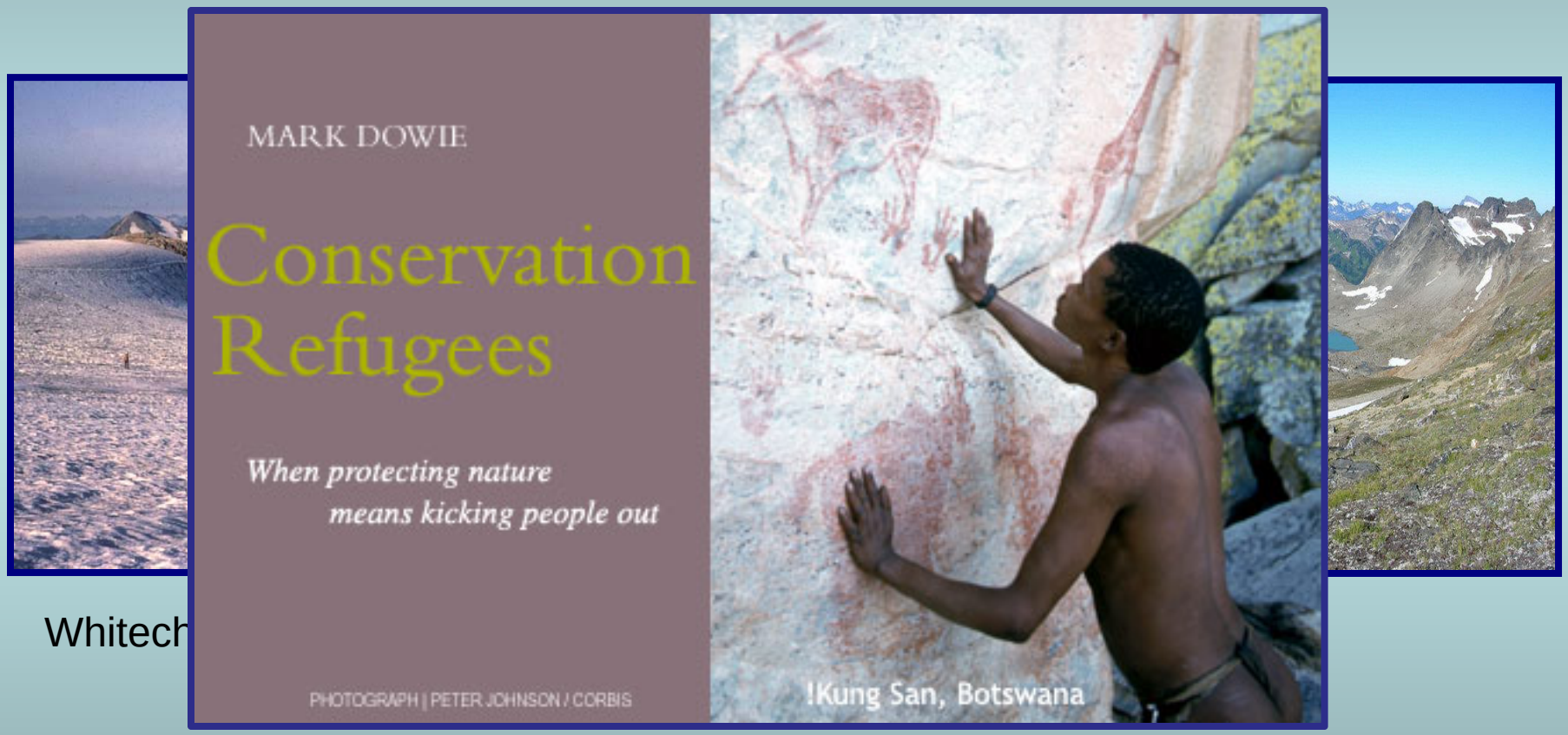
“There are two principles inherent in the very nature of things, recurring in some particular embodiments whatever field we explore—the spirit of change, and the spirit of conservation. There can be nothing real without both. Mere change without conservation is a passage from nothing to nothing…mere conservation without change cannot conserve. “

--Alfred North Whitehead

One major conservation challenge we face:

How do we manage linked social and ecological landscapes to incorporate change while maintaining sustainability?

Resilience= The ability of systems to absorb change while maintaining characteristic functions and feedbacks (Folke 2006).

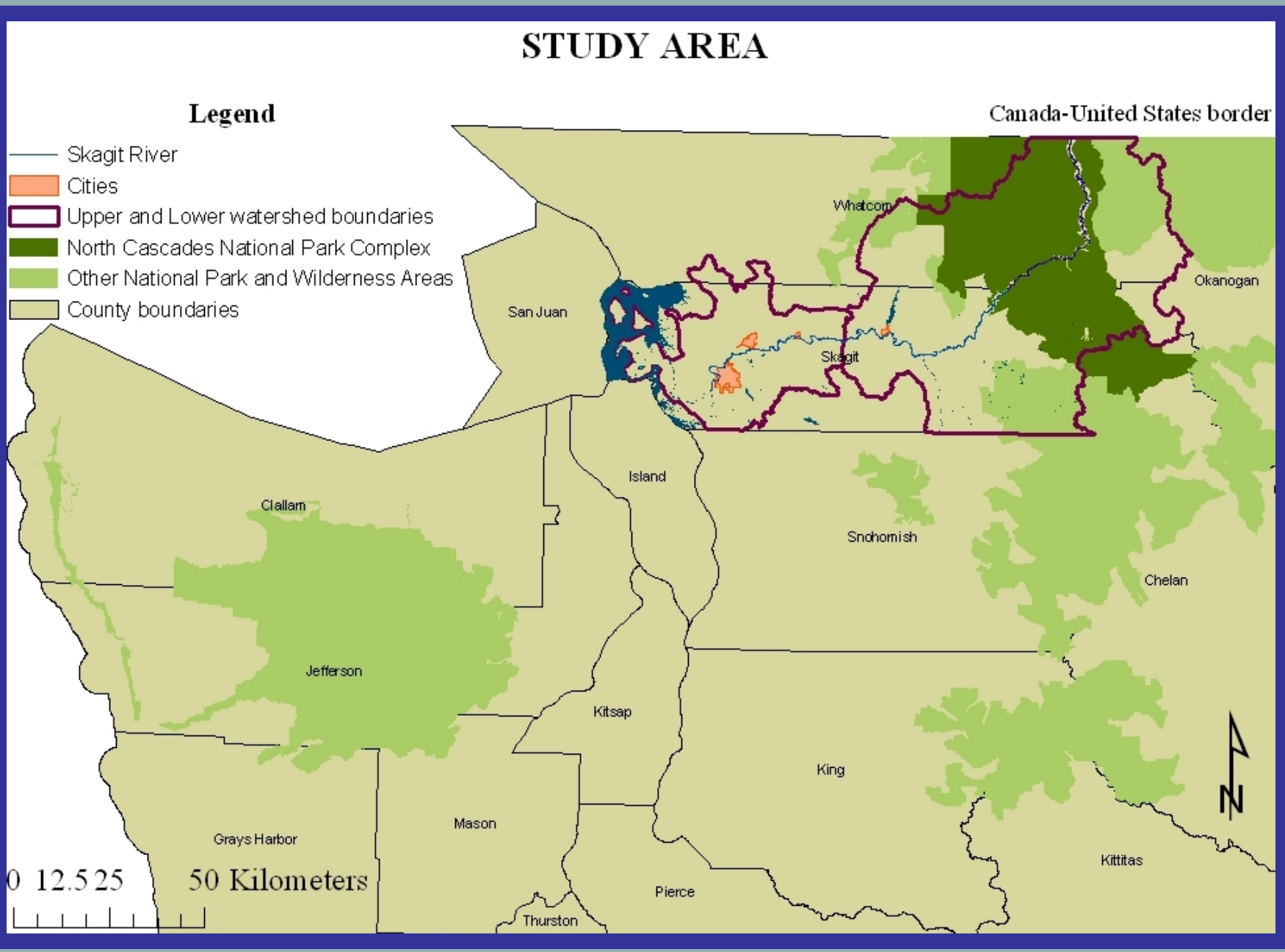


Whitech

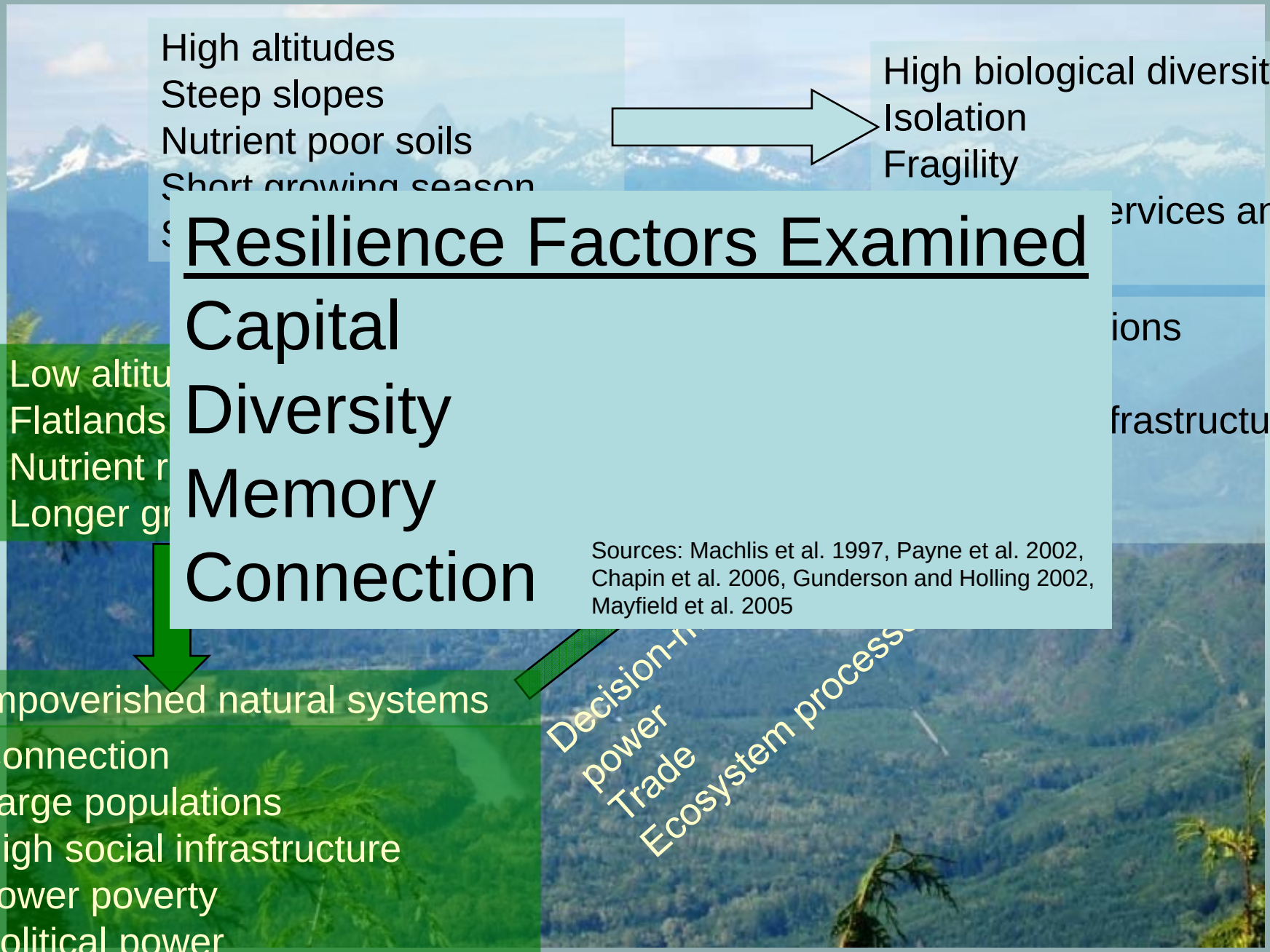
Courtesy:NC Glacier Climate Project 2008

GLOBAL RESEARCH QUESTION

What is the relevance of understanding social and ecological resilience in increasing the efficacy of protected areas?


STUDY AREA
Legend
Skagit River
Cities
Upper and Lower watershed boundaries
North Cascades National Park Complex
Other National Park and Wilderness Areas
County boundaries
Canada-United States border
Whatcom
Okanogan
San Juan
Skagit
Island
Clallam
Snohomish
Chelan
Jefferson
Kitsap
King
Mason
Grays Harbor
Kittitas
Pierce
Thurston
0 12.5 25 50 Kilometers
N

The mountain people hypothesis: Payne et al. 2002, Marsh 2004



PART I:

Do park and wilderness areas protect ecological resilience in the Skagit watershed?

Why riparian areas?

- Integral ecosystems in watersheds
- Sensitive to human activities
- Tightly tied to aquatic and upland ecosystems
- Experience frequent disturbance

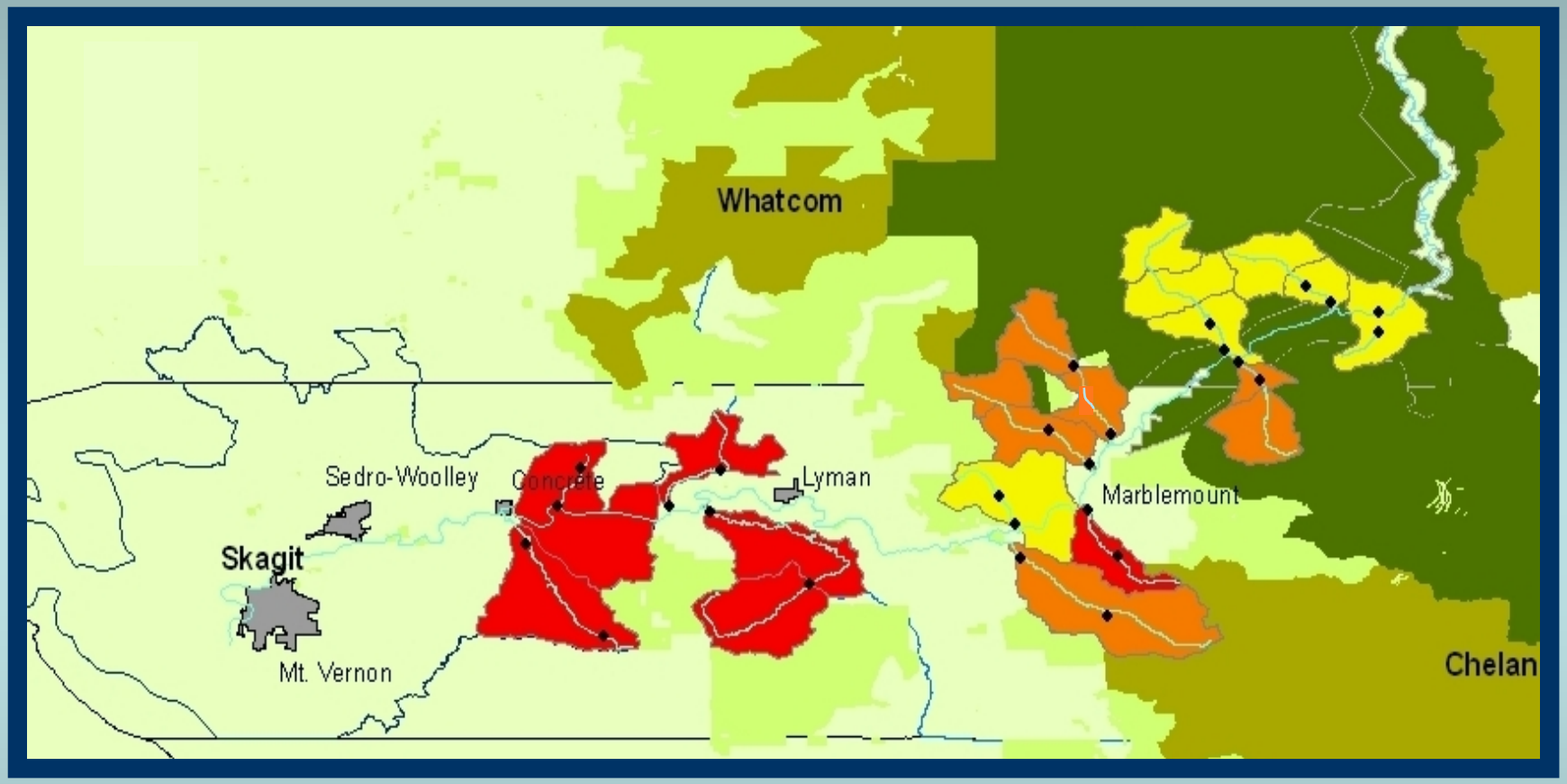
Functional Trait Richness (Fischer et al. 2007)

Provides options for adapting to change

Functional Trait Redundancy (Walker 1992)

Provides resistance to change

Riparian Study Sites



Cumulative Impact Level of Drainage

- High
- Medium
- Low

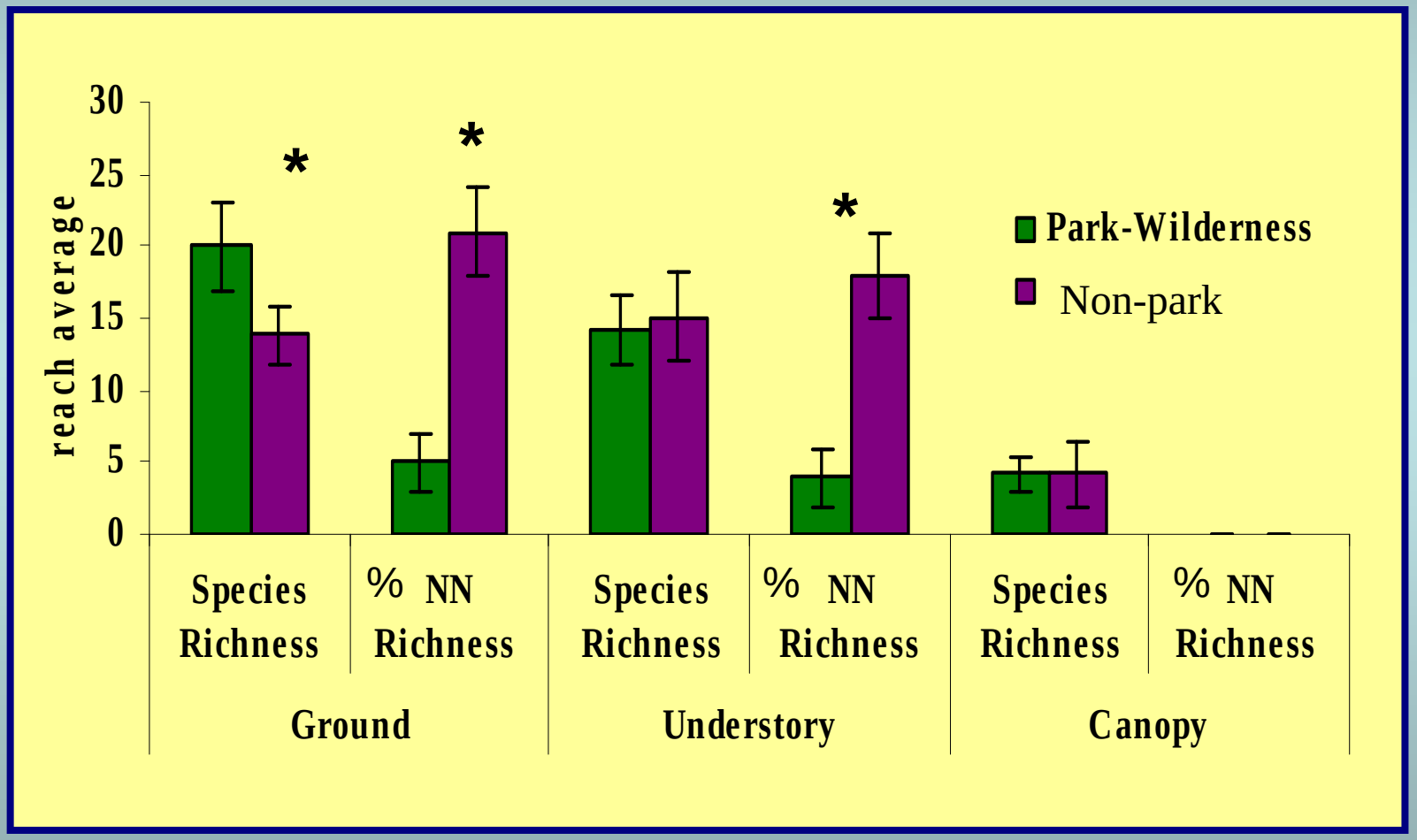
Protection Level

- North Cascades N P Complex
- Wilderness Areas USFS
- Other GAP 1,2 protected

HYPOTHESIS

River reaches in park/wilderness areas contain higher species richness and are more functionally diverse than non-park lands.

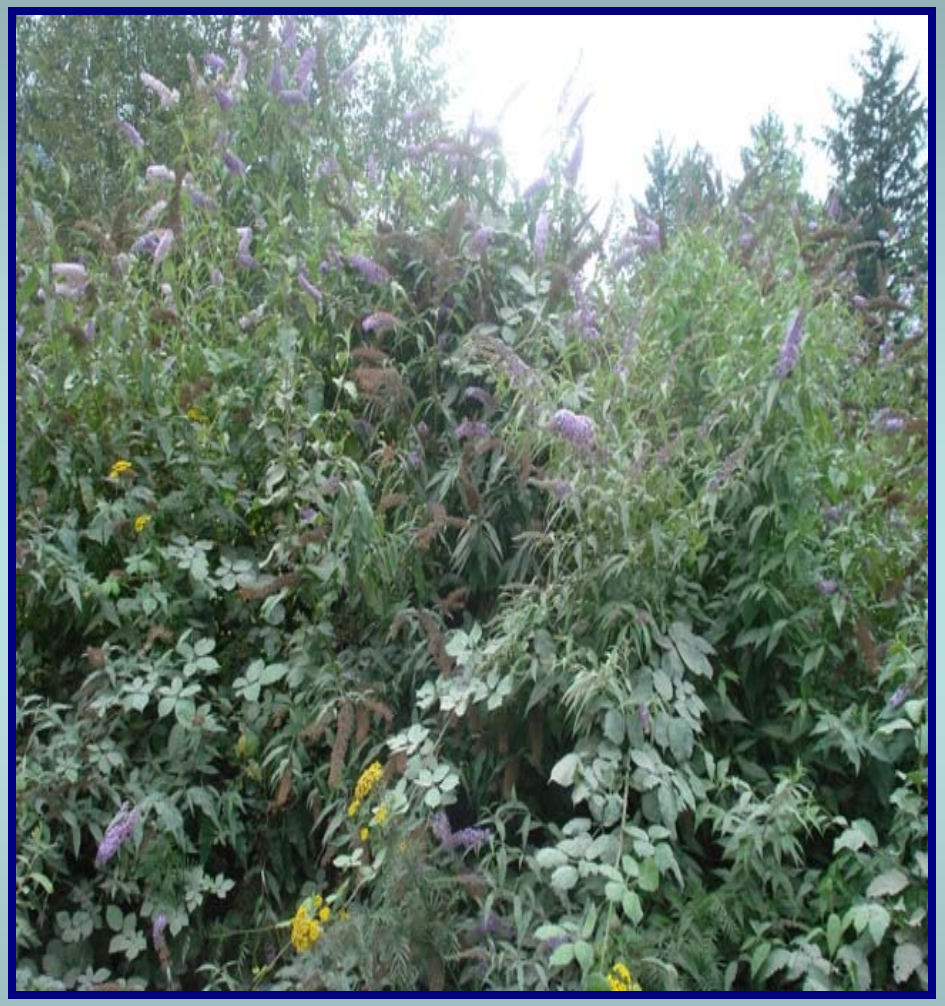
RESULTS:
Protection is associated with higher species richness and lower non-native richness



*= p<.05, General Linear Model: stand age, elevation co-variates; n=26

Upper Newhalem Creek

Muddy Creek



Vegetation Strata	Functional Richness	Functional Trait Redundancy **Park-wilderness Higher**	Functional Trait Redundancy **Non-park Higher**
Ground **Higher richness protected lands**	**Growth Habit**	***Evergreen, deciduous***	
	Growth Form	***Herb, subshrub***	
	Veg. Reprod.	***Rhizomatous***	
	Dispersal	***Gravity, propulsion***	
	Seed Size	***Medium (4-8 mm)***	
	Fruit Size	***Medium-small (4.1-8mm)***	
	Fruit Type	***Samara, berry, capsule***	
	Succession	***Mature, old-growth***	***Invasive, nitrogen fixer***
	Pollination	***Wind, water, Lepidoptera***	
	Wetland Status	***FAC-, FAC, FACU-***	
	Duration	***Perrennial***	***Biennial***
Undstory	**Growth Form**		***Graminoid***
	Seed Size		***Small (2.1-4mm)***
	Fruit Type		***Aggregate druplet, caryopsis***
	Succession	***Old-growth***	***Invasive, pioneer***
Canopy	**Growth Habit**	***Evergreen***	
	Veg. Reprod.	***Layering***	***Sprouting***
	Dispersal		***Wind***
	Flood Resp.	***Resister***	

χ^2>3.81 sequential bonferroni corrected p<.05 for all significant differences, n=26

CONCLUSION:
Protection is associated with higher ecological resilience for a wider array of ecosystem functions

Upper Illabot Creek-Protected

Upper Day Creek-Unprotected

MANAGEMENT IMPLICATIONS

What is the relevance of understanding ecological resilience in increasing the efficacy of protected area management?

- ✓ More attention to ground cover in riparian studies
- ✓ Functional trade-offs exist in riparian plant communities
- ✓ Functional trait redundancy can provide early warning signs of ecosystem change

Upper Skagit Watershed

Lower Skagit Watershed

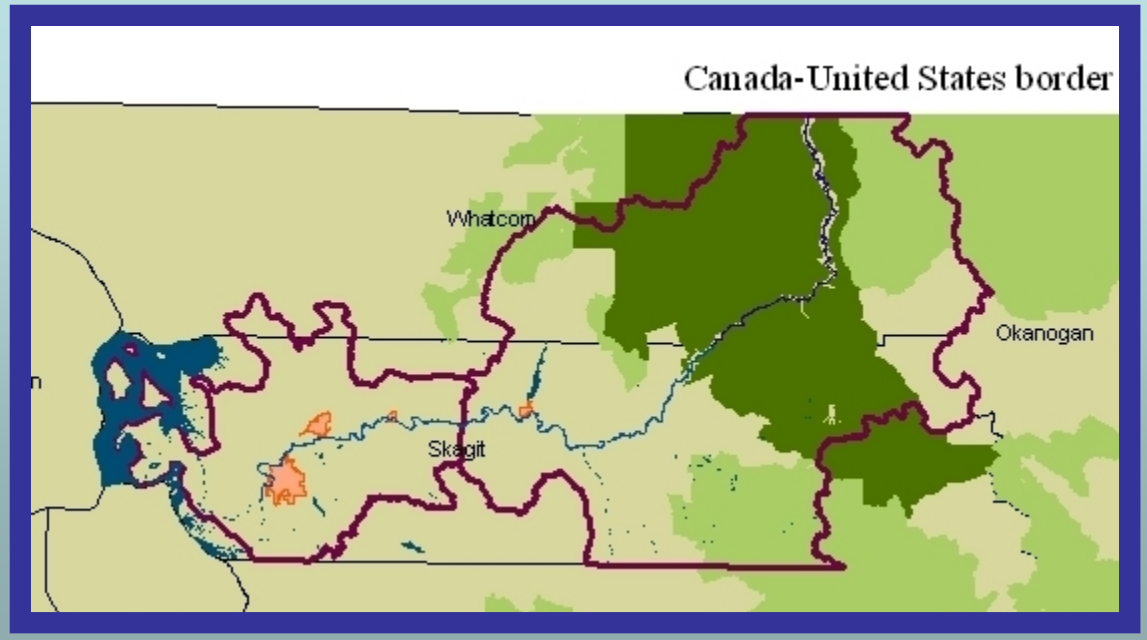
PART II:

How do protected areas influence social resilience?

HYPOTHESES

H1: Upper watershed and lower watershed communities will exhibit differences in social resilience to protection that reflect the landscape in which they exist.

H2: These differences will produce different social responses to protection that have ecological consequences.



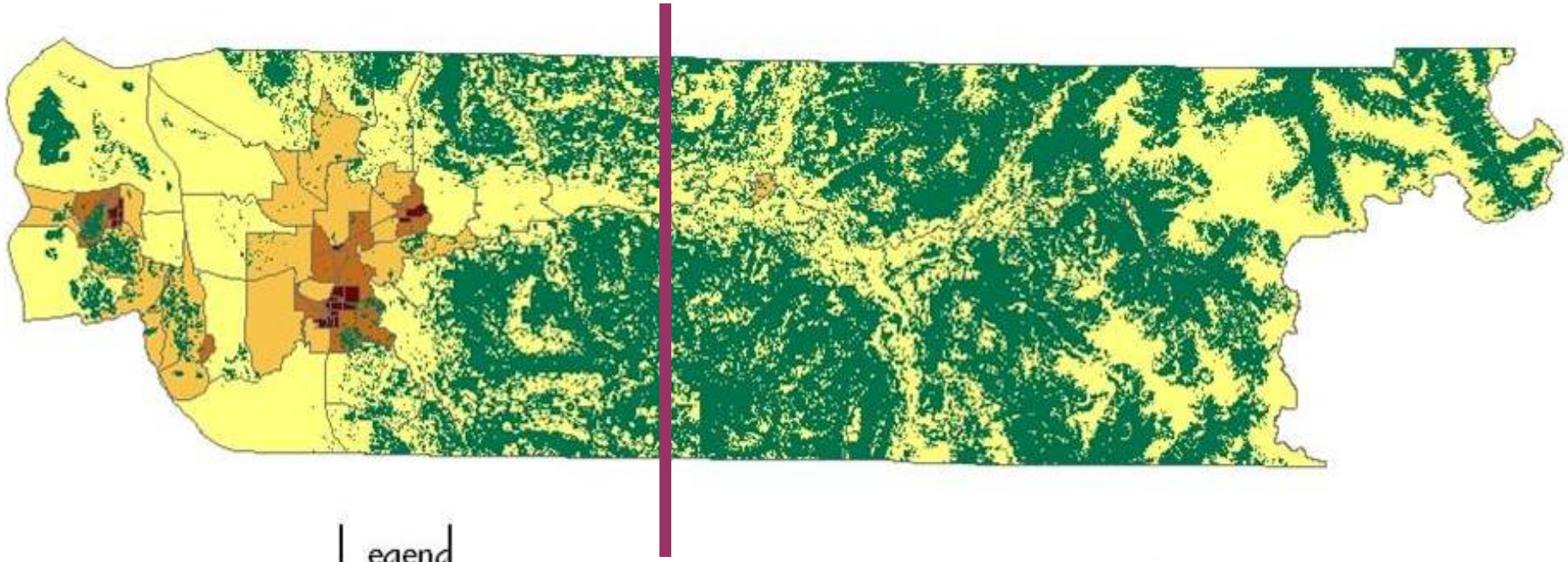
METHODS

Examination of quantitative social resilience indicators derived from census data, economic surveys, and parcel data (Machlis 1997)

Exploratory interviews of 30 local residents:

Exploratory interviews are recommended to help uncover causative factors, and contextual knowledge, and to supplement available quantitative information to provide a more complete picture of social dynamics (Jackson et al. 2004)

Forest Cover and Human Population Density in Skagit County



Legend

FOREST COVER

Coniferous Forest

Census Block Groups

Population Density(km2)

- 0-29
- 30-150
- 150-1000
- 1000-2000

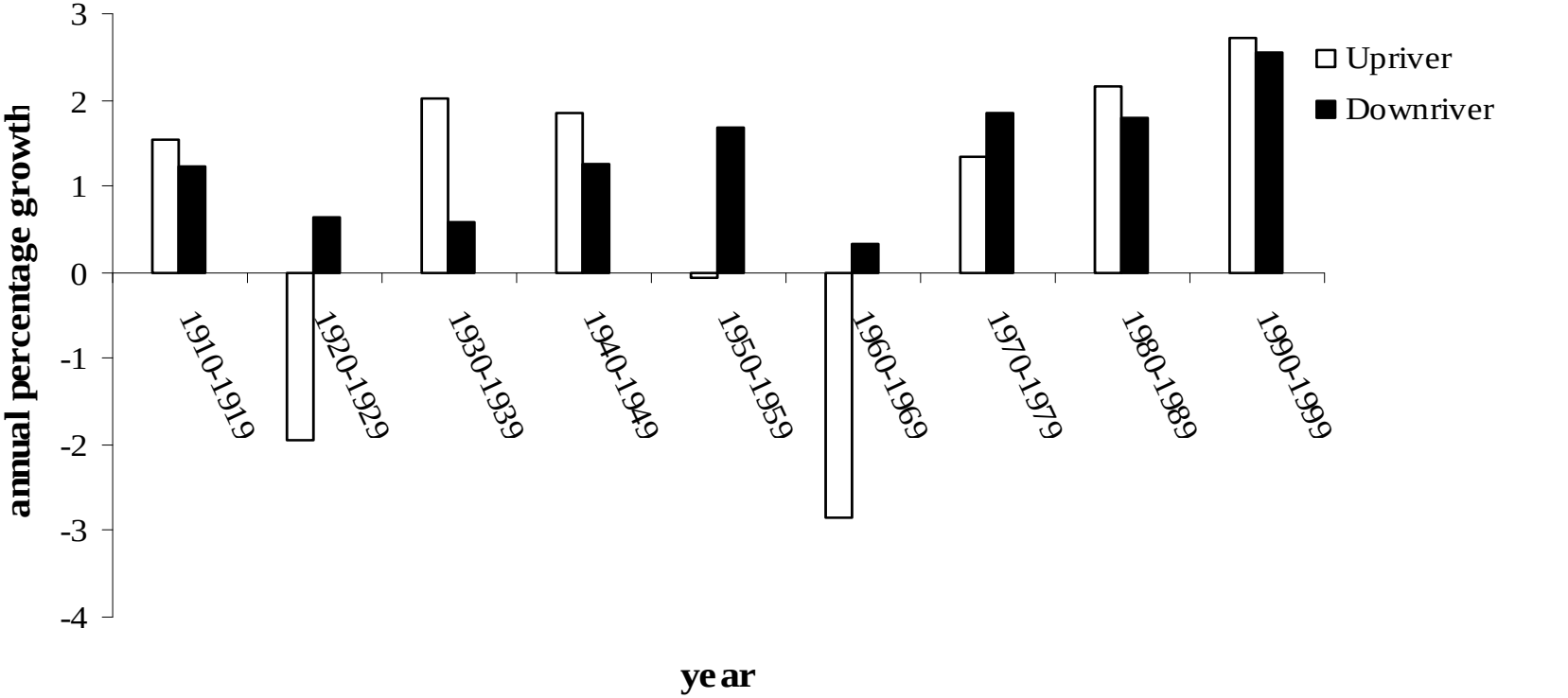
N

W E

S

0 5 10 20 Kilometers

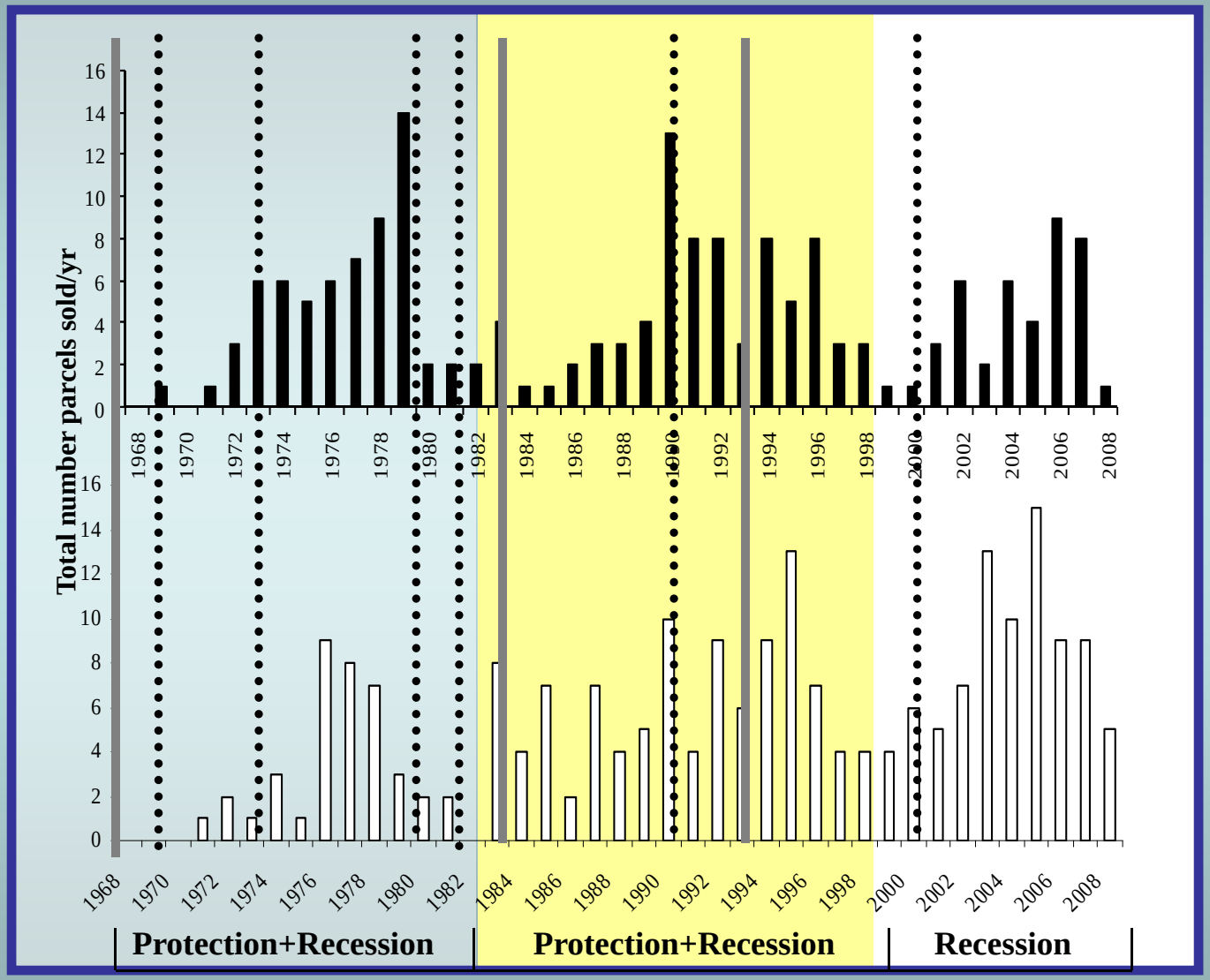
Are upper watershed communities less socially resilient than lower watershed communities?



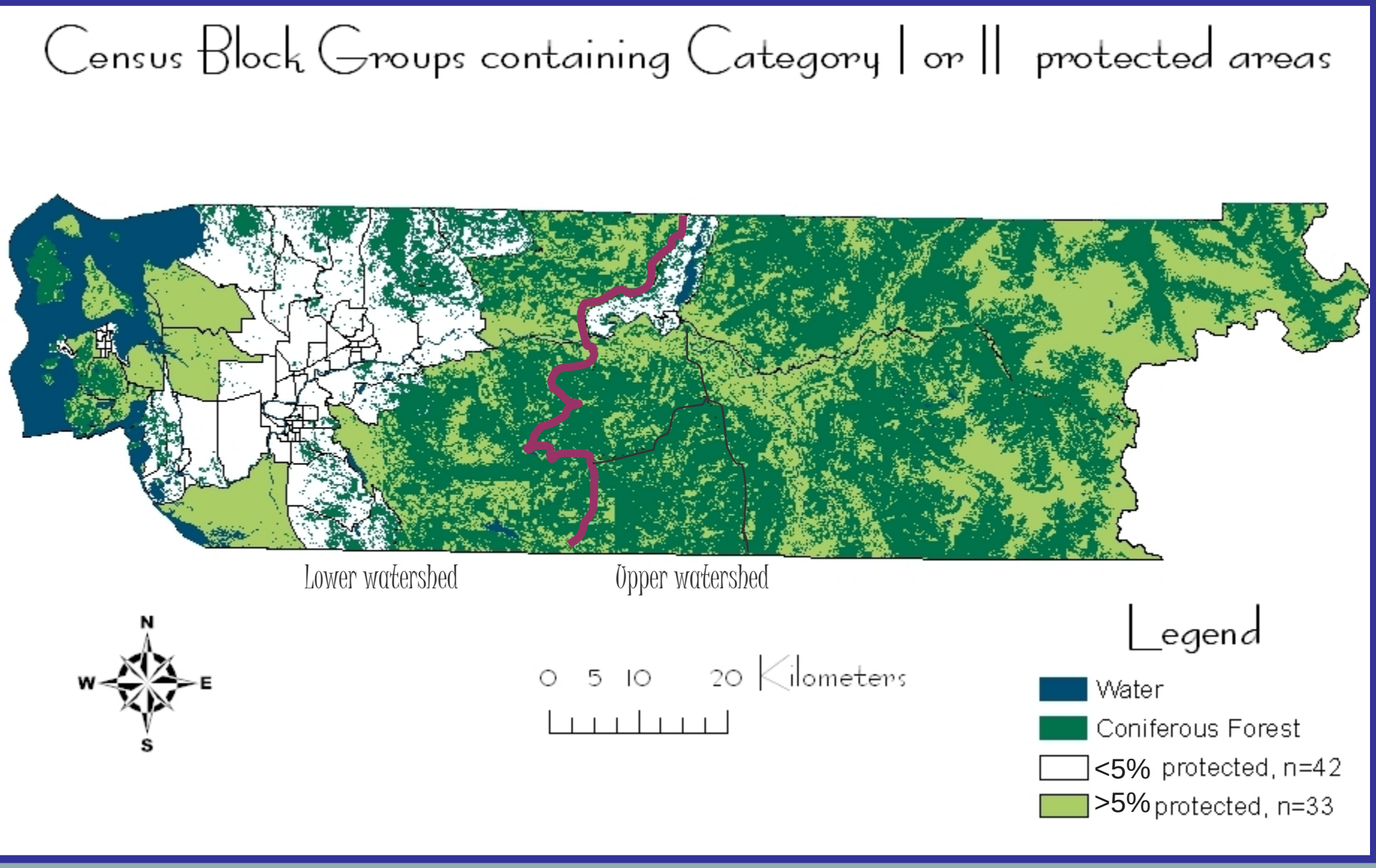
Does protection impact property turnover?

Upper watershed

Lower watershed



How much are social resilience differences associated with upland/lowland geography?



Geography affects protection response:

Upriver residents less socially resilient to protection:

Longer commute times than residents living near protected areas downstream (connection)
Higher population turnover (memory loss)
Higher poverty levels (low capital)

Downriver residents living near protected areas exhibit higher social resilience than upriver residents living near protected areas:

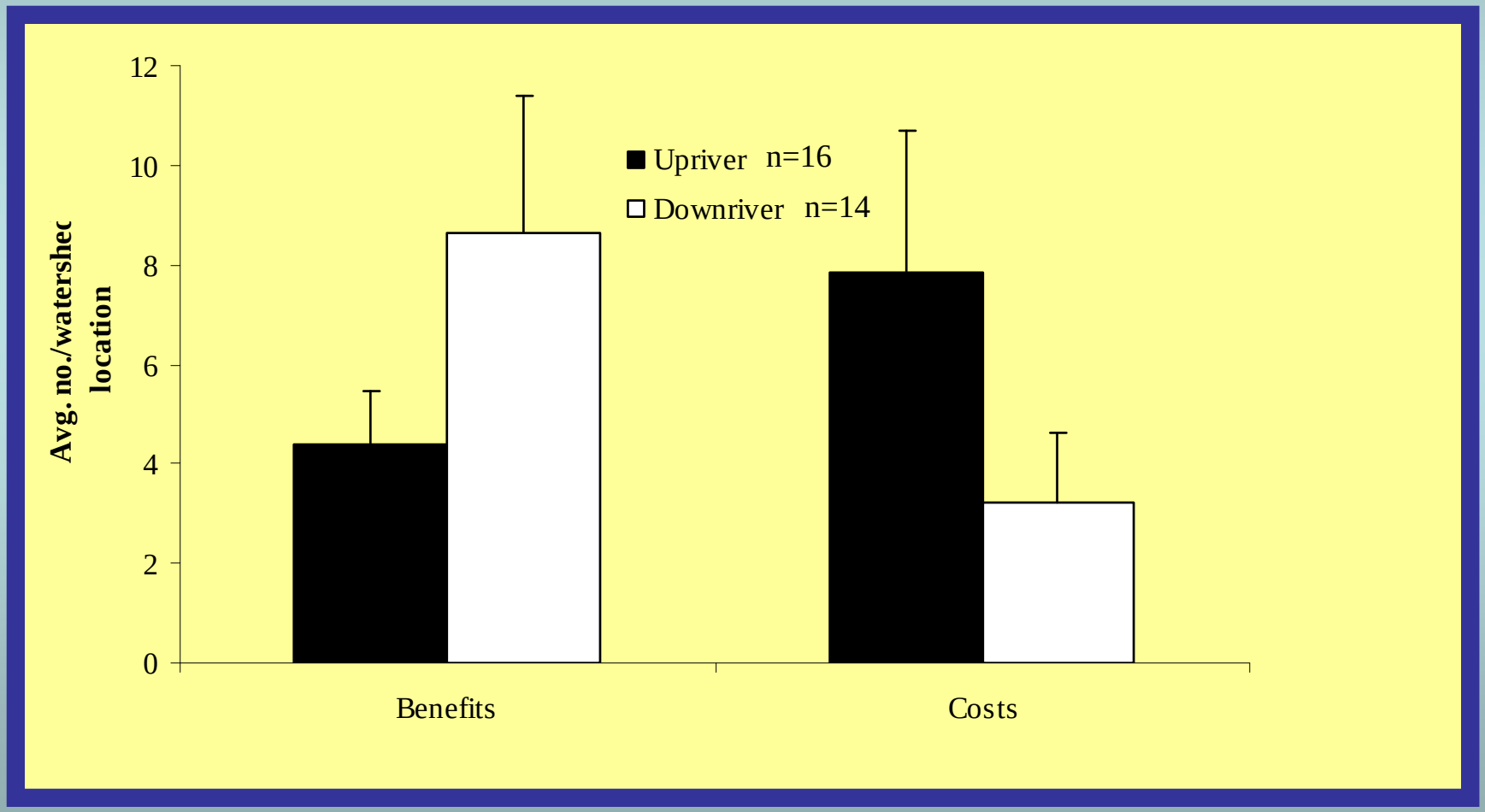
Higher education (connection)
Higher median income (high capital)
Higher household value (high capital)

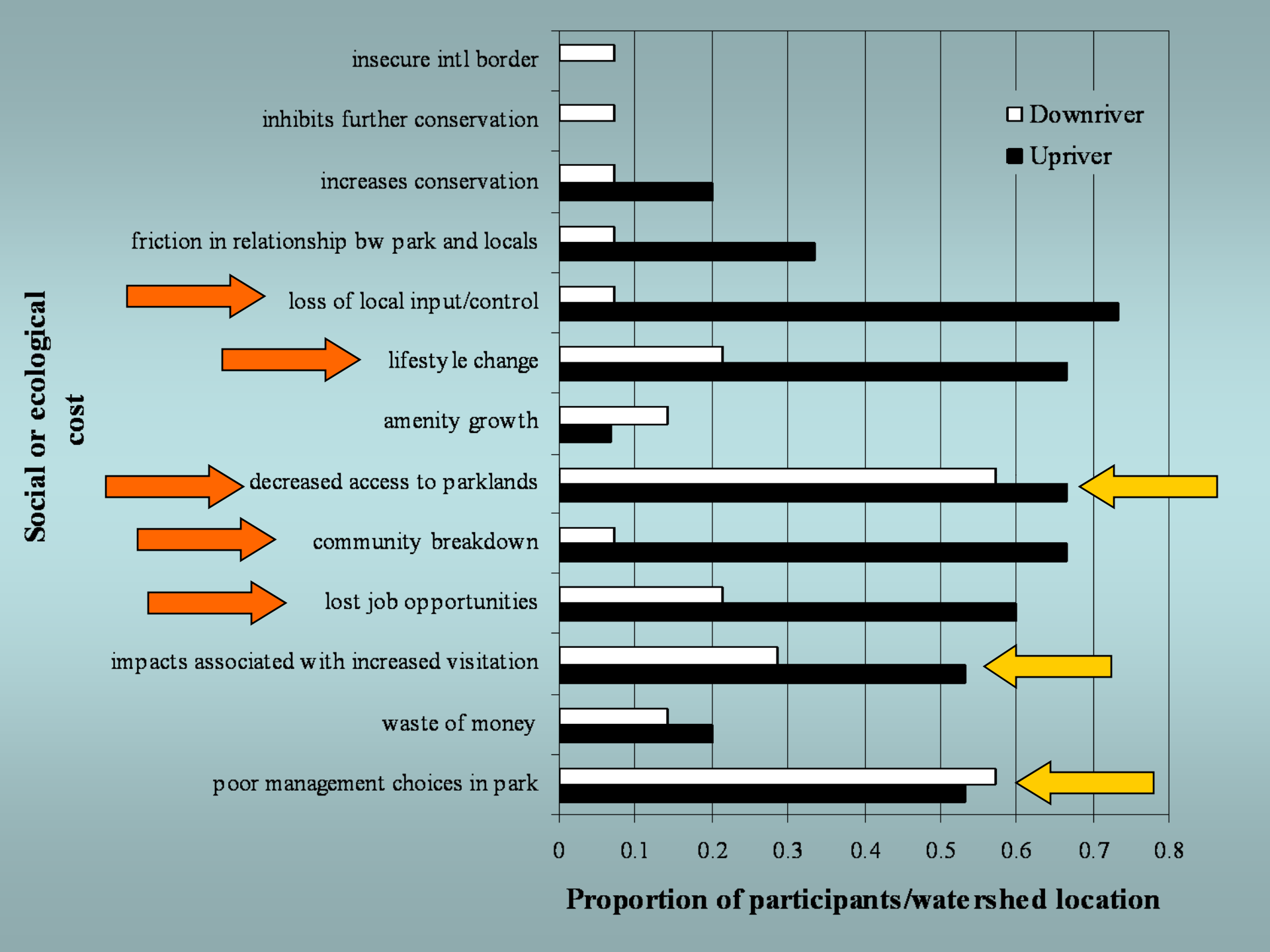
Different responses to protection:

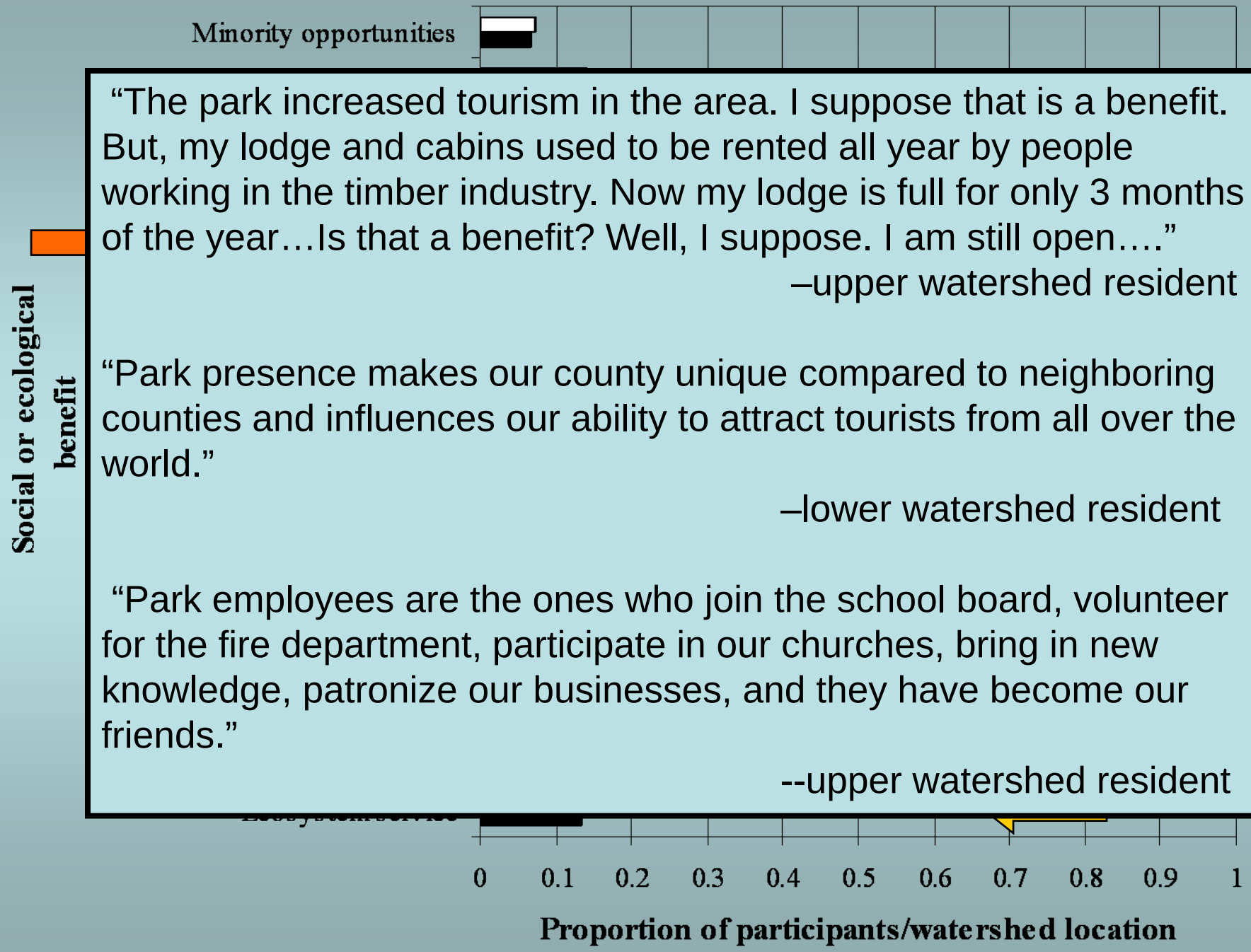
Higher retention rates near downriver protected areas
Lower retention rates near upriver protected areas

ANOVA, square-root transformed data, $p<.037$ for all

Resident Interviews:
Upper watershed residents perceive half as many park related benefits and more than twice as many costs compared to lower watershed residents




insecure intl border
inhibits further conservation
increases conservation
friction in relationship bw park and locals
loss of local input/control
lifestyle change
amenity growth
decreased access to parklands
community breakdown
lost job opportunities
impacts associated with increased visitation
waste of money
poor management choices in park
Downriver
Upriver
Social or ecological cost
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Proportion of participants/watershed location



"The park increased tourism in the area. I suppose that is a benefit. But, my lodge and cabins used to be rented all year by people working in the timber industry. Now my lodge is full for only 3 months of the year…Is that a benefit? Well, I suppose. I am still open…."

–upper watershed resident

"Park presence makes our county unique compared to neighboring counties and influences our ability to attract tourists from all over the world."

–lower watershed resident

"Park employees are the ones who join the school board, volunteer for the fire department, participate in our churches, bring in new knowledge, patronize our businesses, and they have become our friends."

--upper watershed resident

Conclusions

- ✓ **H1: Upper watershed and lower watershed socio-ecological systems differ in social and ecological resilience factors.**

- ✓ **H2: These differences create different responses to protection**

  in the form of:

  --land tenure turnover vs. retention

  --perceptions of park related benefits/costs

Management Implications

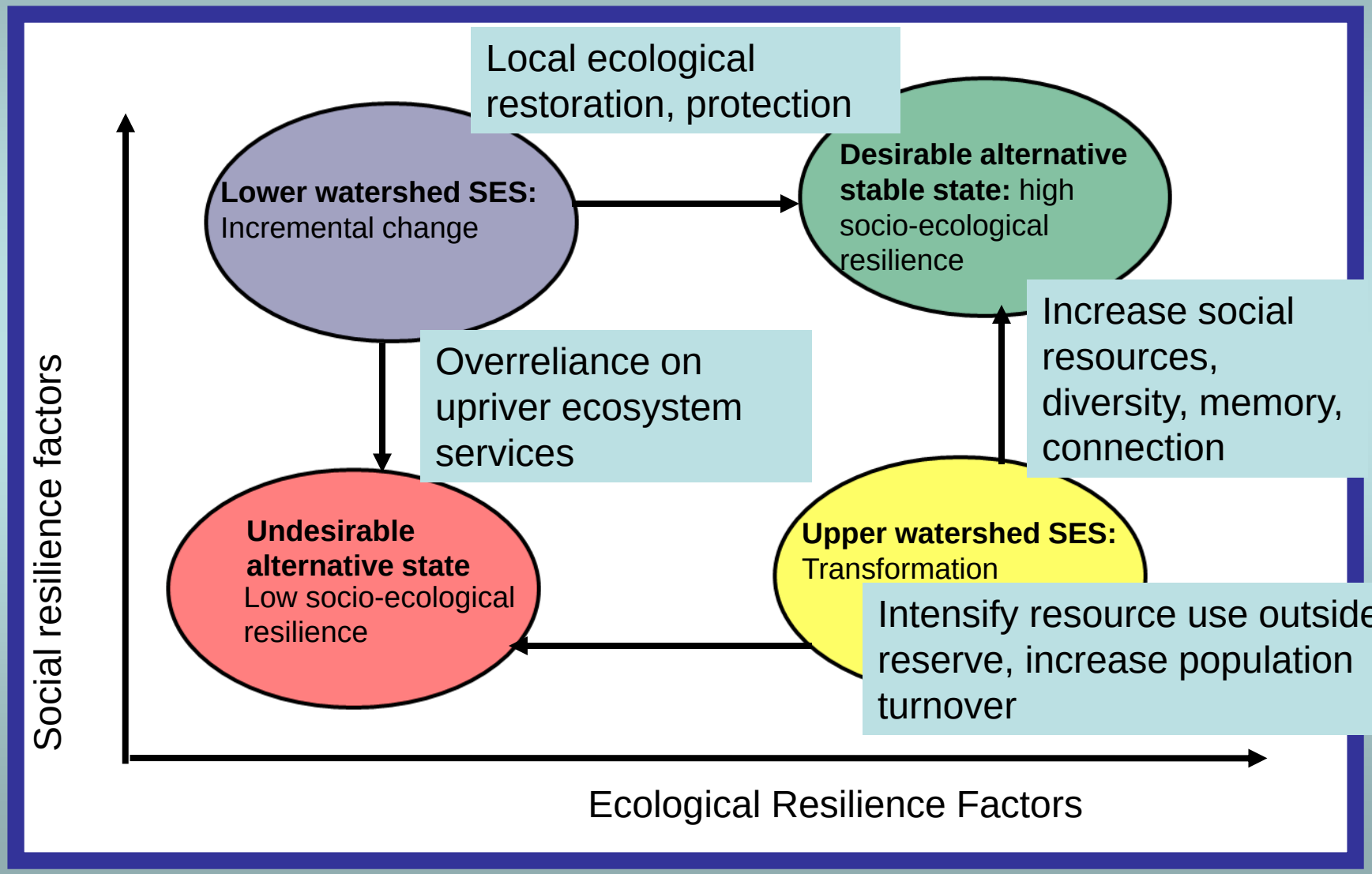
How a park impacts social resilience of a community can have ecological consequences:

Impact	Link	Ecological Consequence
Capital (income)	Land tenure turnover	Habitat fragmentation Memory: ecological knowledge lost
Diversity (park employee influx)	Increased support for conservation	More conservation, restoration actions
Connection (education, community breakdown)	Conservation ethic Conservation resistance	More conservation, restoration actions Conflicts, reduction in conservation efficiency

PART III:

Putting it all together

Socio-ecological resilience and adaptive management



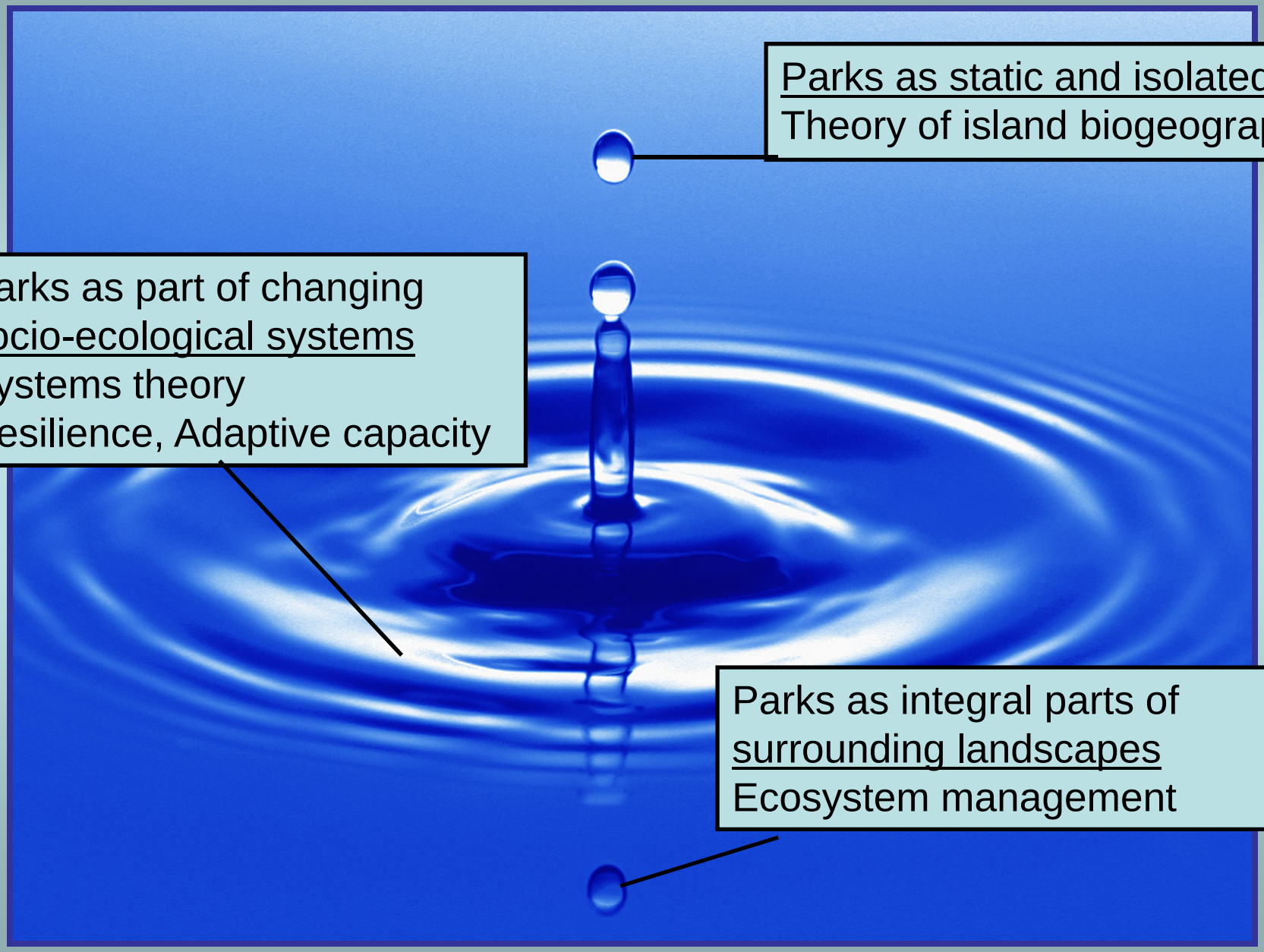
Relevance of resilience to watershed management

Systems with low values for resilience factors may be more vulnerable to changes: Check resilience factors of communities where conservation strategies are planned.

Social resilience affects ecological resilience: Increasing social resilience factor values in affected communities could prevent undesirable social and ecological outcomes.

Geography matters- geographic patterns are present in differences in social and ecological resilience factor values: Include social and ecological resilience factors on conservation planning maps.

Resilience helps us understand the ripples



Parks as static and isolated
Theory of island biogeography

Parks as part of changing
socio-ecological systems
Systems theory
Resilience, Adaptive capacity

Parks as integral parts of
surrounding landscapes
Ecosystem management

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