

Planning for Conservation and Management as Climate Changes



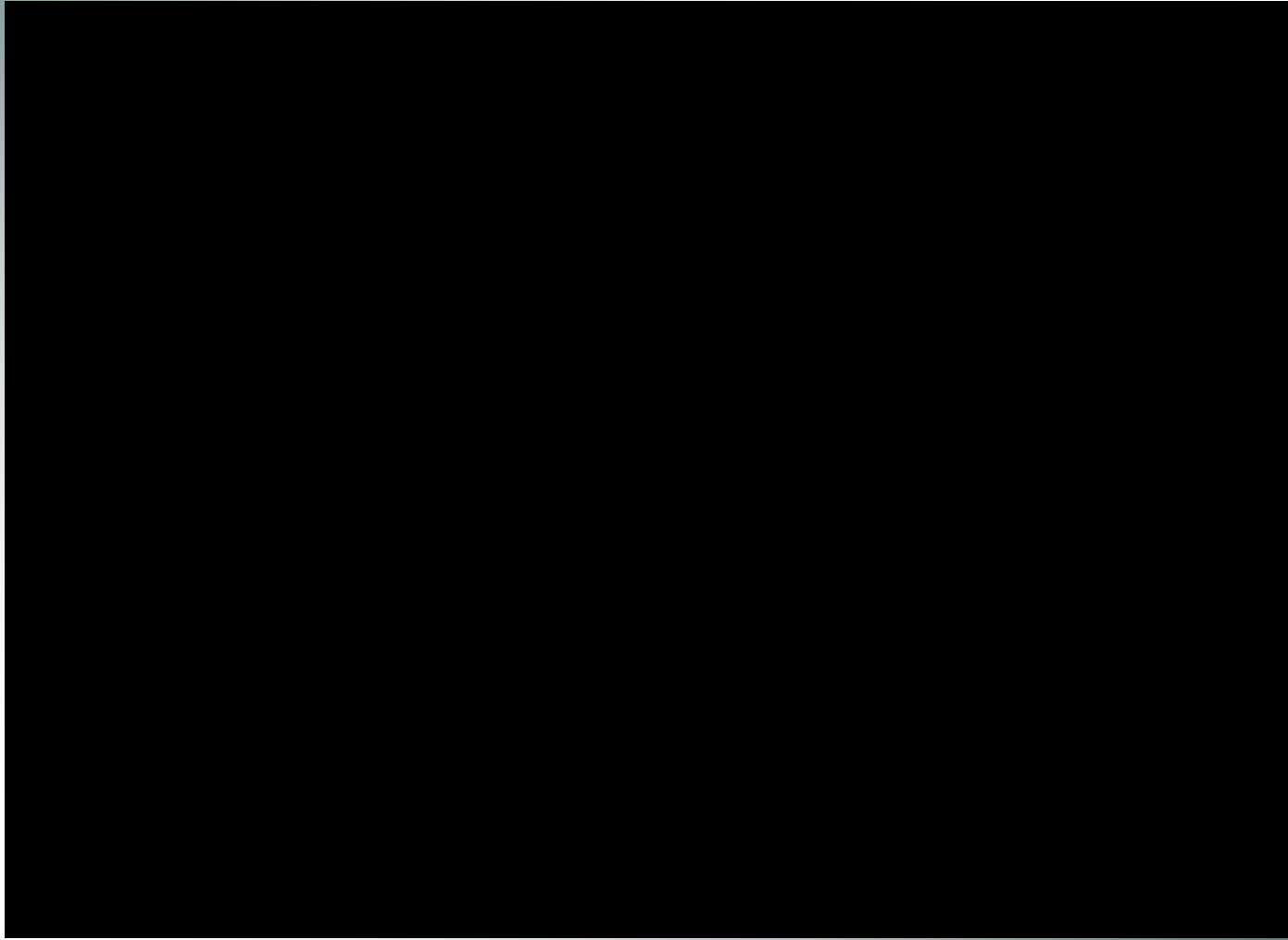
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traveler.sunset.com/new_mexico/

www.westerntrout.org

C. Allen

Adapt, Move, or Go Extinct?



Managing for Climate Change

"5 R + 1 framework"

Resistance	Hold Back the Tide
Resilience	Decrease Stressors
Response	Conserve for all Extremes
Realign	Conserve for New Reality
Reduce	Mitigate Greenhouse Gases
Triage	Prioritize Action

Adapted from Millar et al. 2007, Ecological Applications and U.S. CCSP SAP 4.4 2008

General Principles of Adaptation

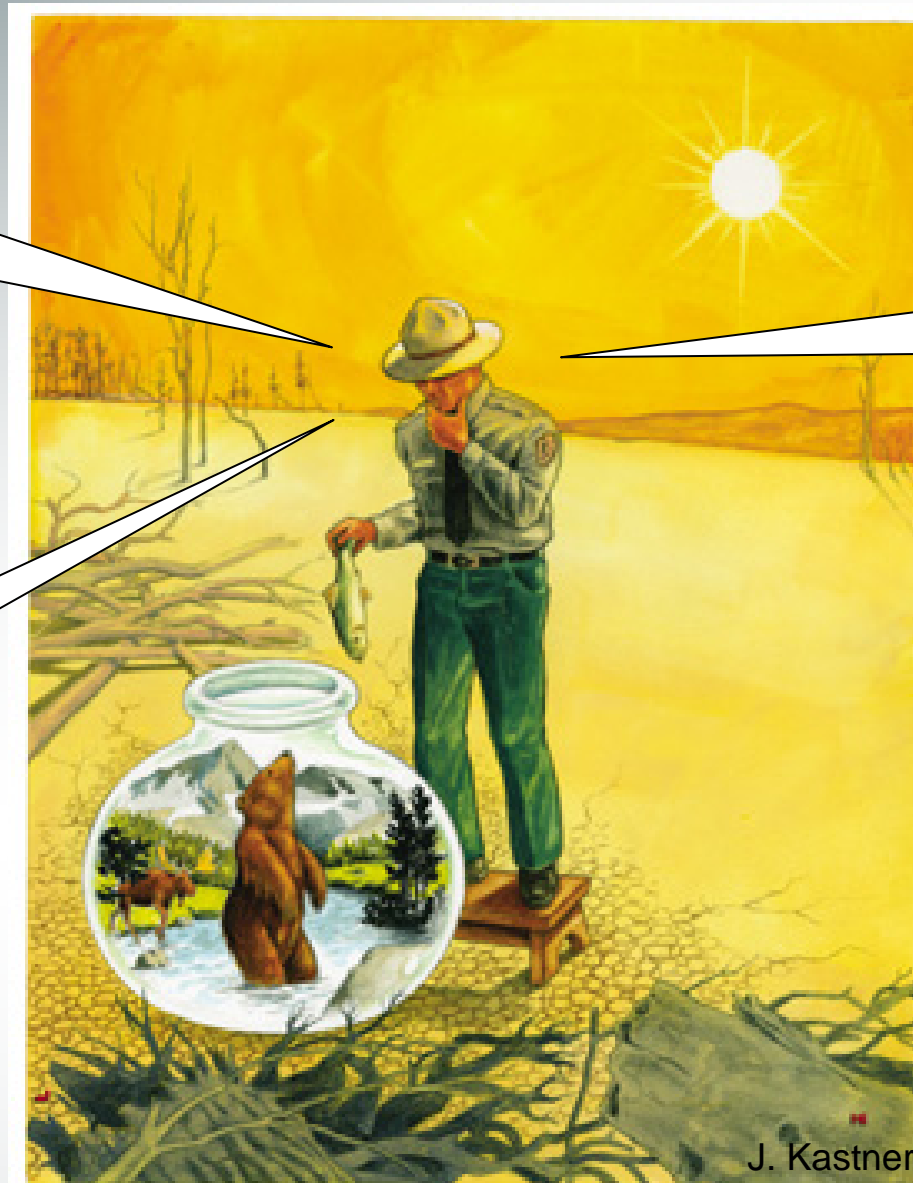
1. Reduce non-climate stressors
2. Manage for ecological function and protection of biological diversity
3. Establish buffer zones and connectivity
4. Implement “proactive” management strategies
5. Increase monitoring and facilitate management under uncertainty

Implications for Management

How to make applicable to my system?

Where to begin?

Uncertainty?
Complexity?



J. Kastner

Climate Change Adaptation for Conservation Working Group

CONVENED BY: Wildlife Conservation Society
National Center for Ecological Analysis + Synthesis (NCEAS)
Center for Large Landscape Conservation

GOAL: Develop a *participatory and iterative* process for generating adaptation strategies that are:

Proactive

Place-based

Overcome “uncertainty paralysis”



Adaptation planning phase

Select conservation target and
Define management objective

Build
conceptual
model

Assess
climate
change
impacts

Identify
future
climate
scenarios

Repeat for:

- more information
- more targets
- more objectives

ID info. needs

Identify intervention points
and management actions

ID info.
needs

Evaluate actions

ID info. needs

Implementation and efficacy evaluation phase

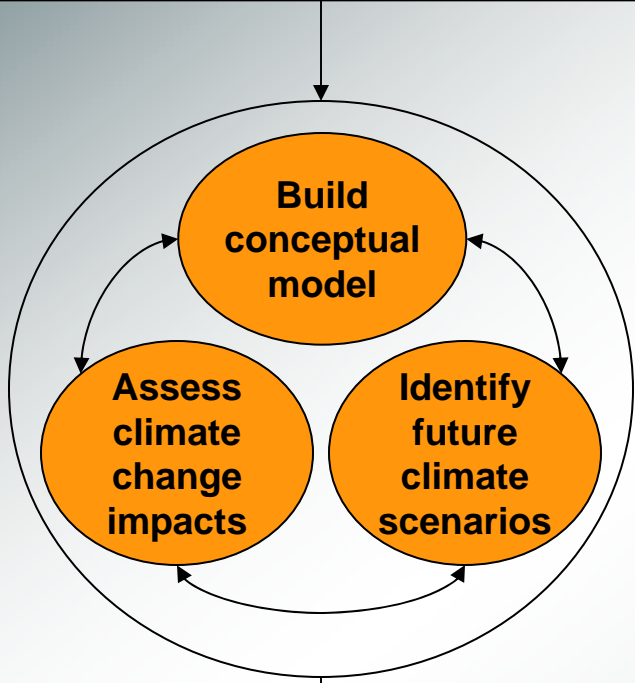
Monitor and
evaluate action
plan efficacy

Implement
action plan

Develop
action plan

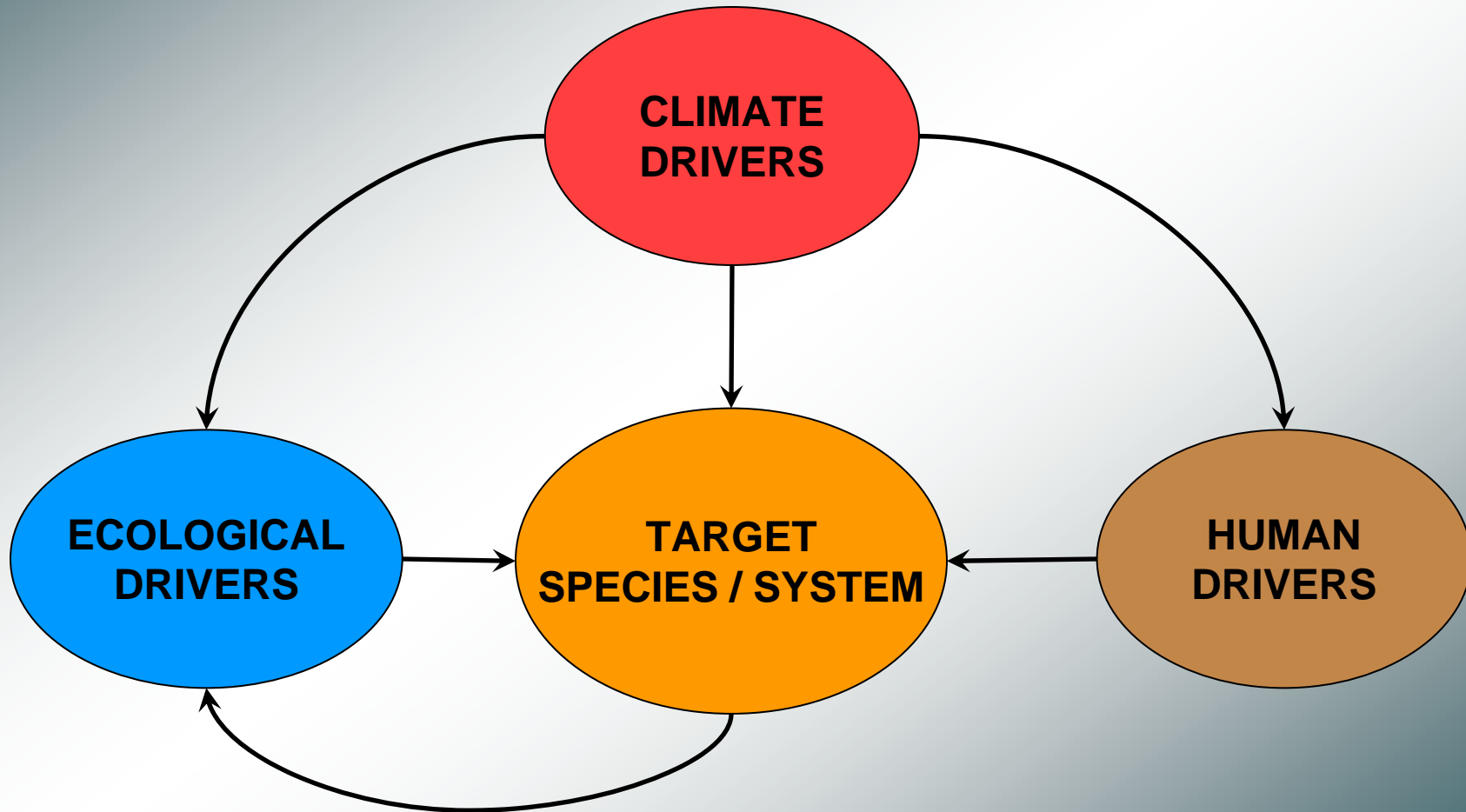
Cross et al, *in review*

**Select conservation target
and
Define management objective**

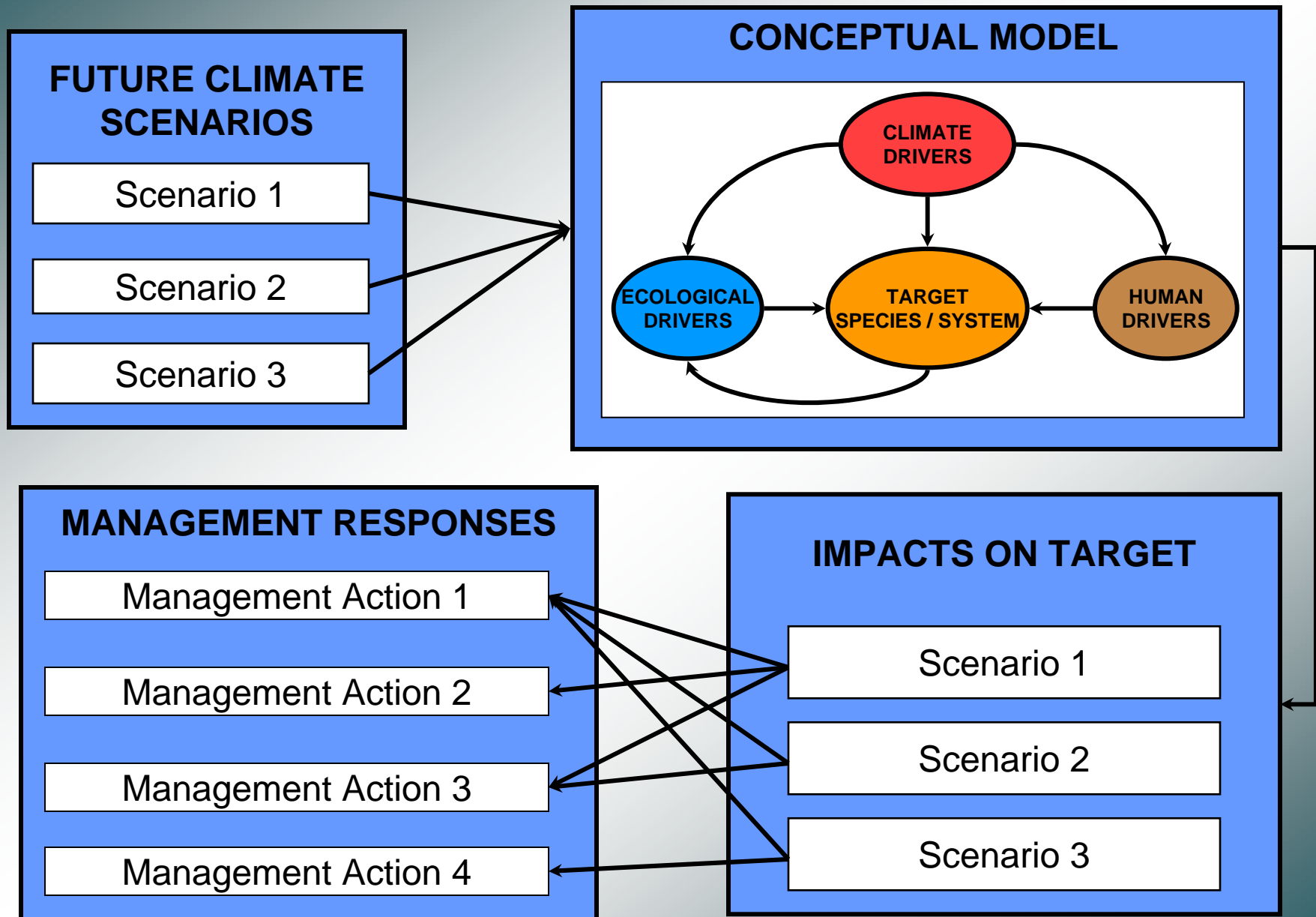


**Identify intervention points
and management actions**

Climate Change Adaptation Planning



Climate Change Adaptation Planning



A Real World Example

Greater Yellowstone Ecosystem



Select Target + Define Management Objective

**Yellowstone River flows
(ecological process)**

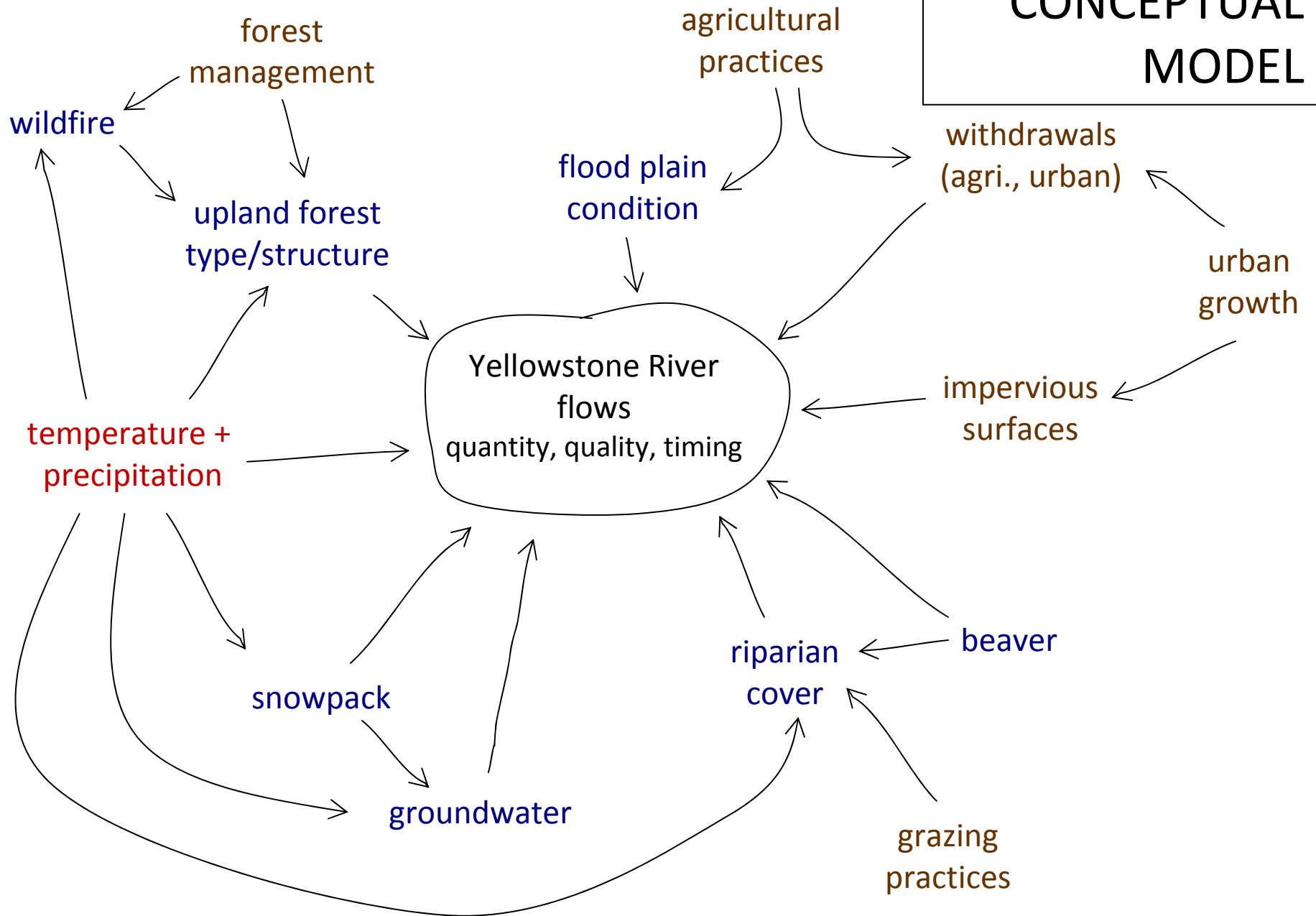


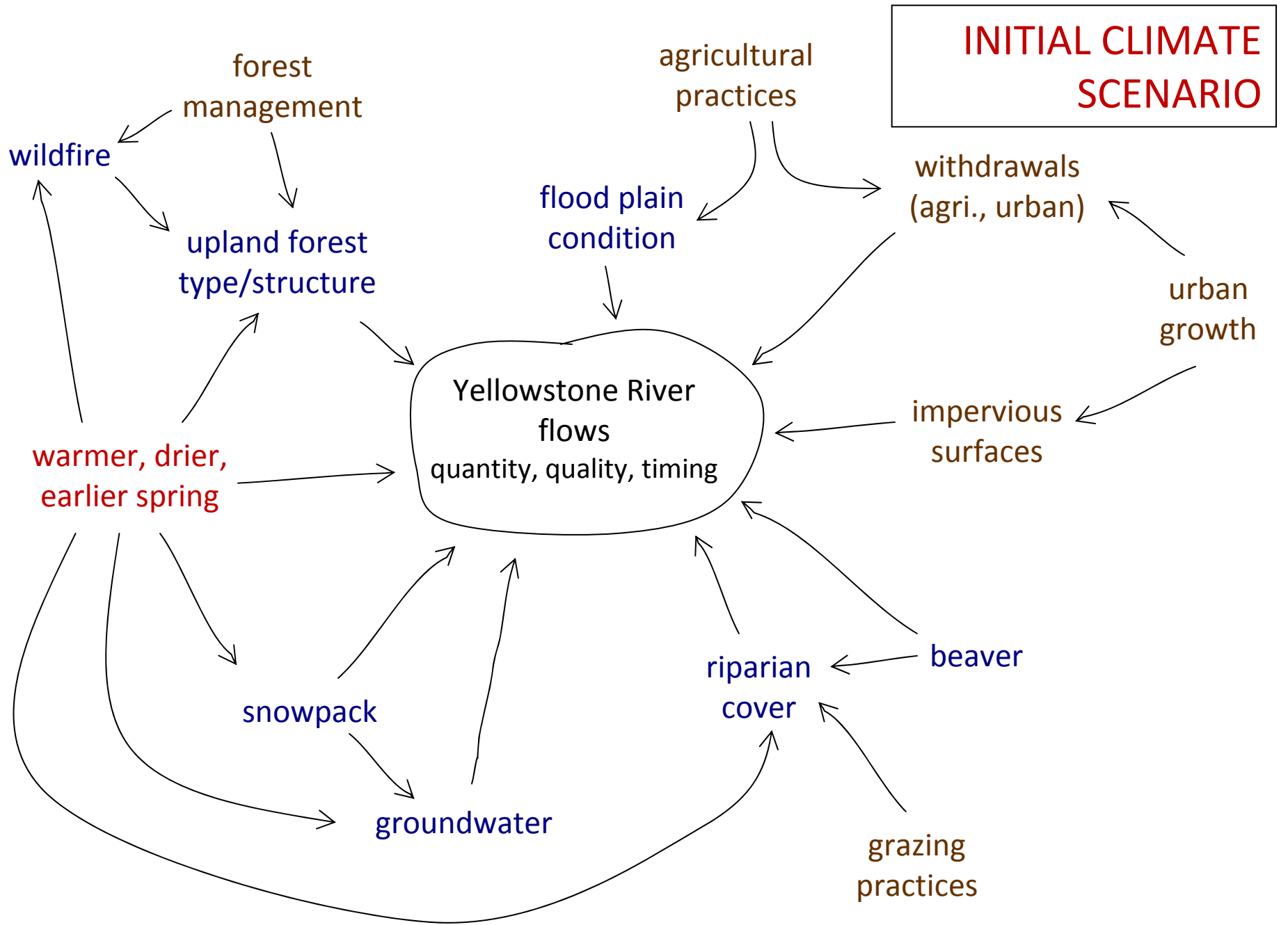
**To maintain
Yellowstone
cutthroat trout**



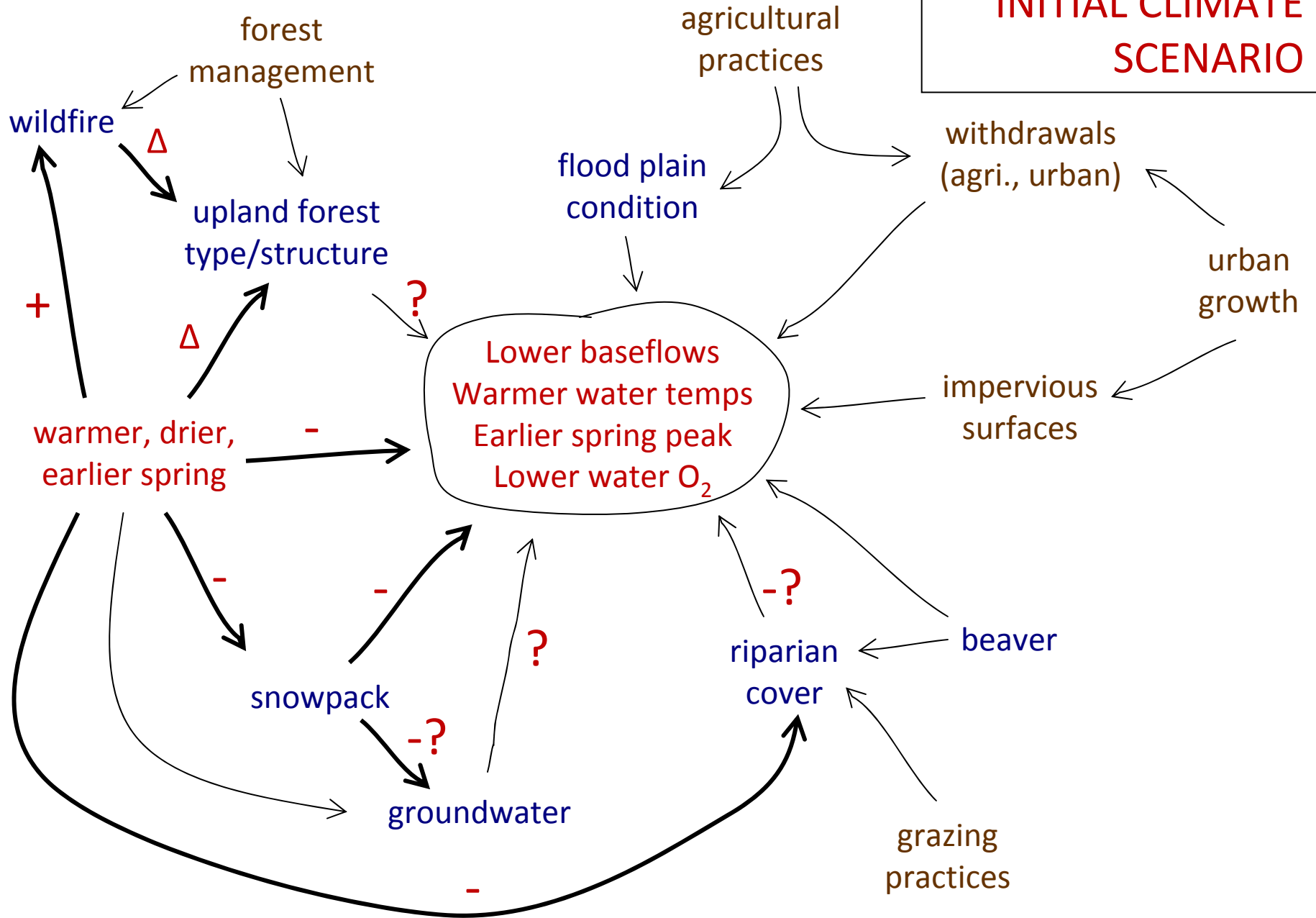
Cross et al, *in review*

CONCEPTUAL MODEL

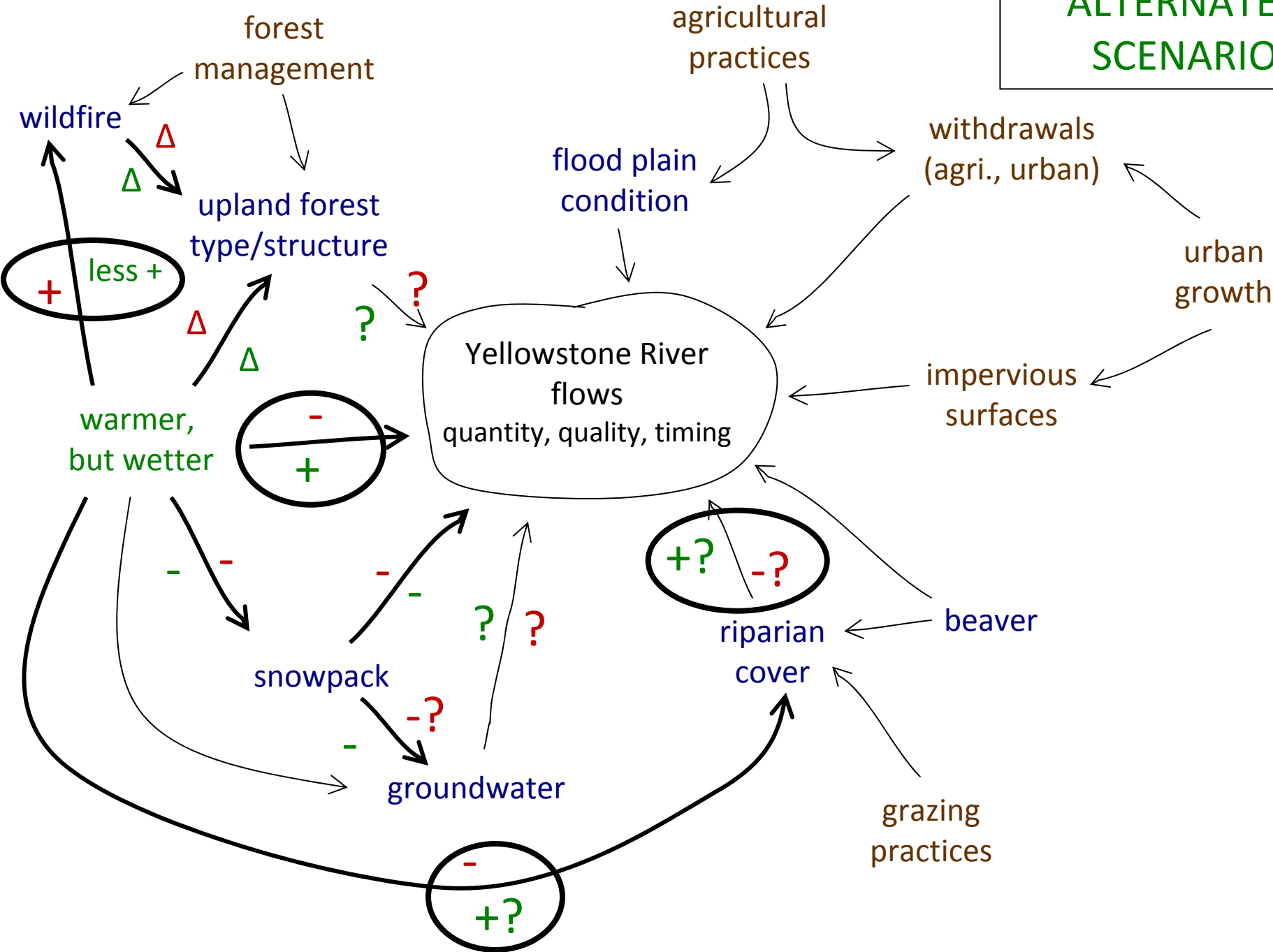




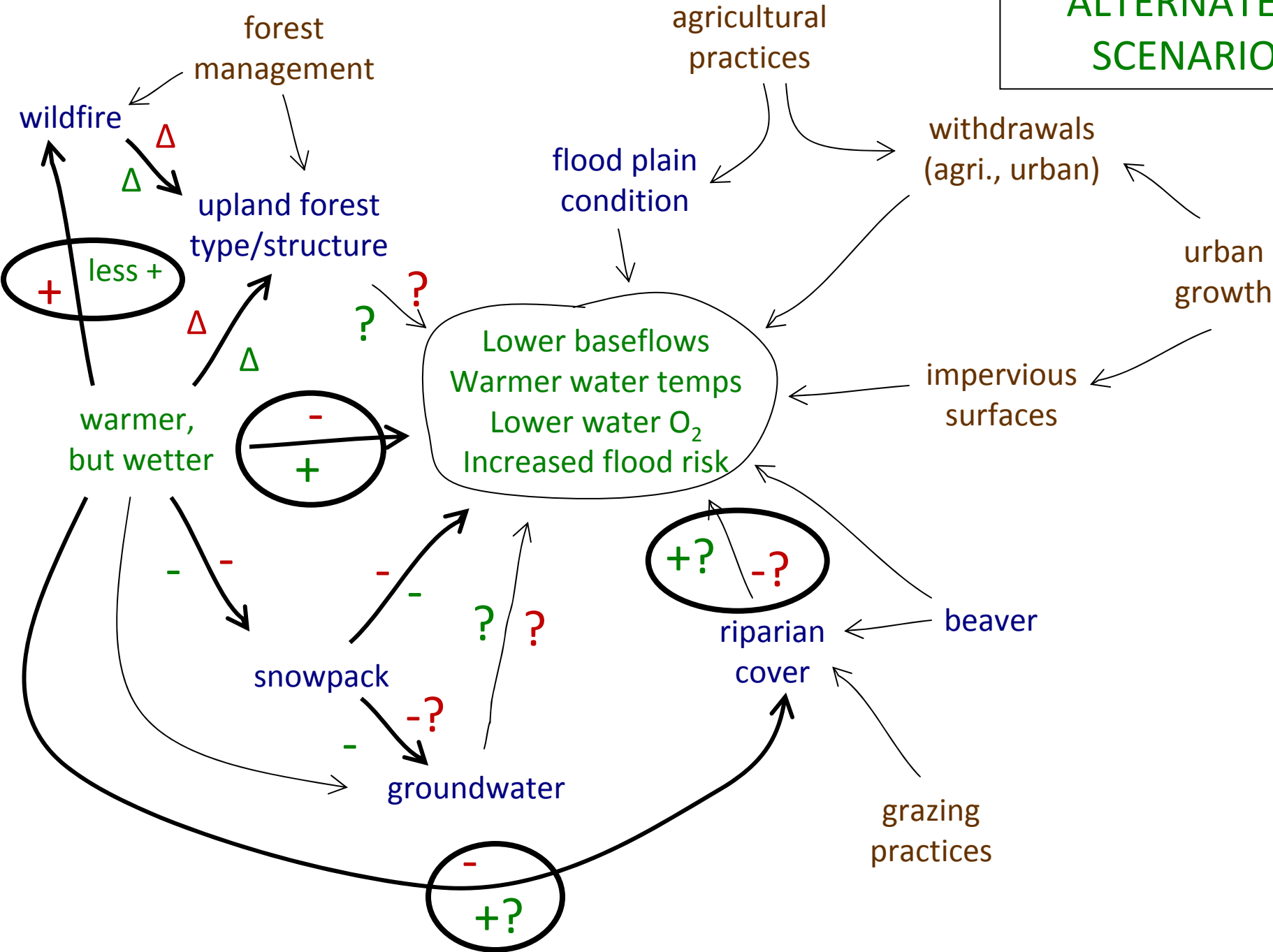
INITIAL CLIMATE SCENARIO



ALTERNATE SCENARIO



ALTERNATE SCENARIO



Climate Scenario: Increased T Net drying

SCENARIO 1 - Yellowstone R. - 2020-2030 - ↑ pop growth watershed

↳ assumptions about change in certain factors

stream engineering
↑ CO₂
flood/irrigation

Other drivers
groundwater withdrawals
springs, springs, creeks
geothermal
fences & incentives
instream diversions
ex/antenn growth
grazing

*NEED: - feedbacks to instream flows
(budget, outflow) → intervention points for instream flows (mopit)
long-term action → scenario(s) for actions to pursue
- no change in mgmt
- no ill or neg links
- feasible
→ evaluate synergies w/ other goals, e.g. connectivity

PRELIM ASSESSMENT

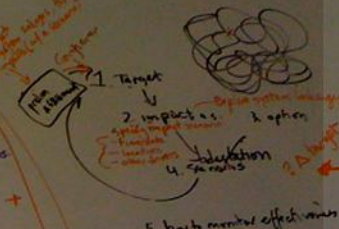
- Define coarse CC trends
- pick a good target (good = linked to water, not possible to CC)
- pick boundaries (geography, time scale, other trends/inputs)
- Brainstorm (system components, linkages)
- coarse CC trend effects on target (direct, indirect, feedbacks)
- ID intervention pts

cloud seeding

(culverts) roads (use)

- ⊖ SNOW PACK (early melt)
- ⊖ SOIL MOISTURE (upland)
- ? SOIL MOISTURE (riparian)
- + HYDROGRAPH
- EARLIER PEAK
- ⊖ LOWER BASEFLOW
- LONGER BASEFLOW
- ⊕ VARIABILITY, FLOOD PEAKS, SEVERITY
- ⊕ IN FIRE REGIMES

- ⊕ WATER T₀ (higher peak, earlier peak)
- ⊖ DISSOLVED O₂
- ⊖ GROUND WATER
- ⊖ RUNOFF (pulses, variability)
- EROSION, INCISION
- RELATIONAL STRAIN (D) (RIPARIAN)
- ⊕ SEDIMENTATION
- ⊖ WATER QUALITY (nutrients, chemicals)



INSTREAM FLOWS (main stem)

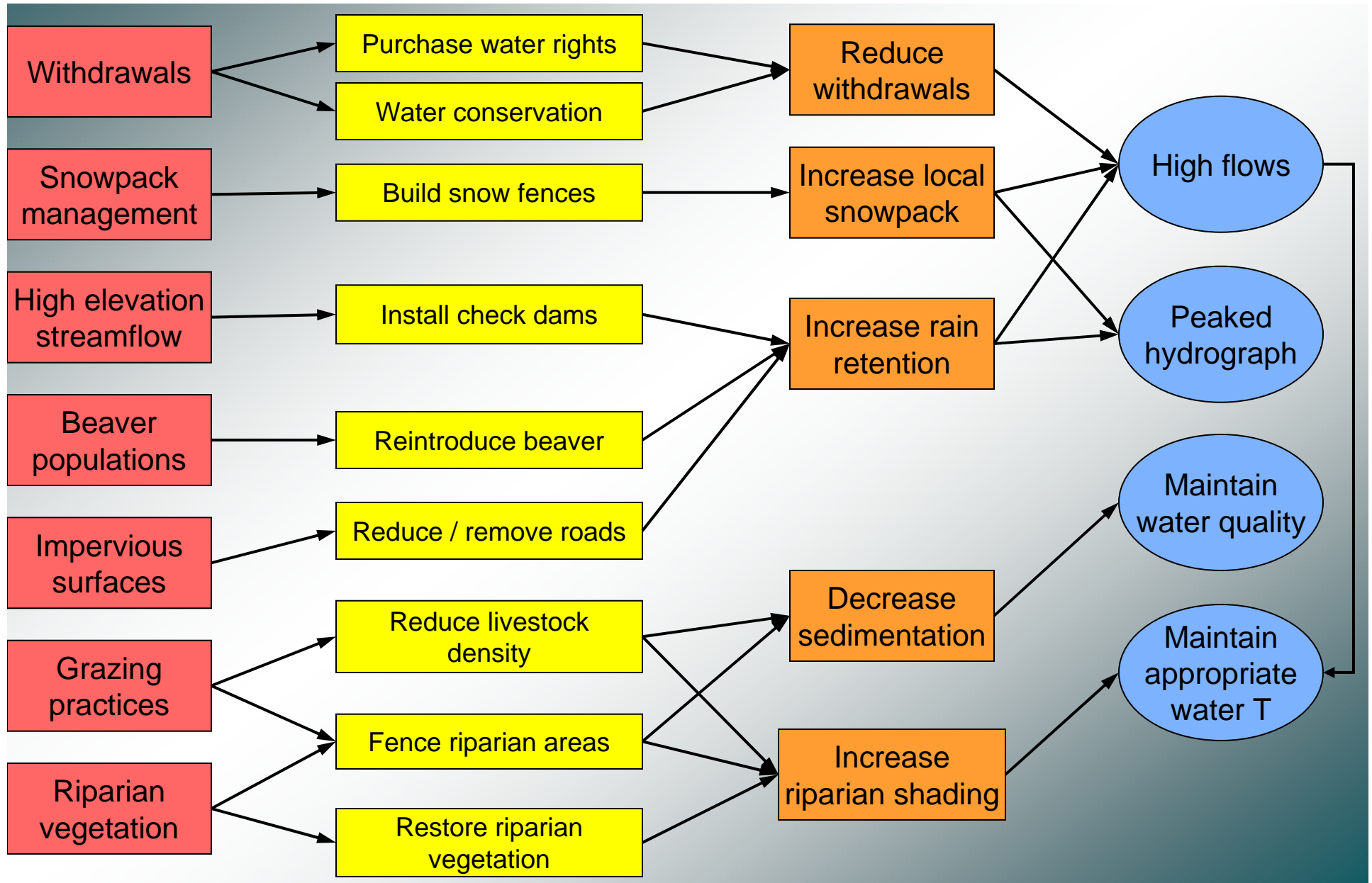
- base flow (specify where to take action)
- variability
- pulse flows
- quality

Needs a hydrologist, a species target

Define new targets → what if key info missing?

For Initial Climate Scenario

Intervention Points → Potential Actions → Desired Responses



Targets for this workshop

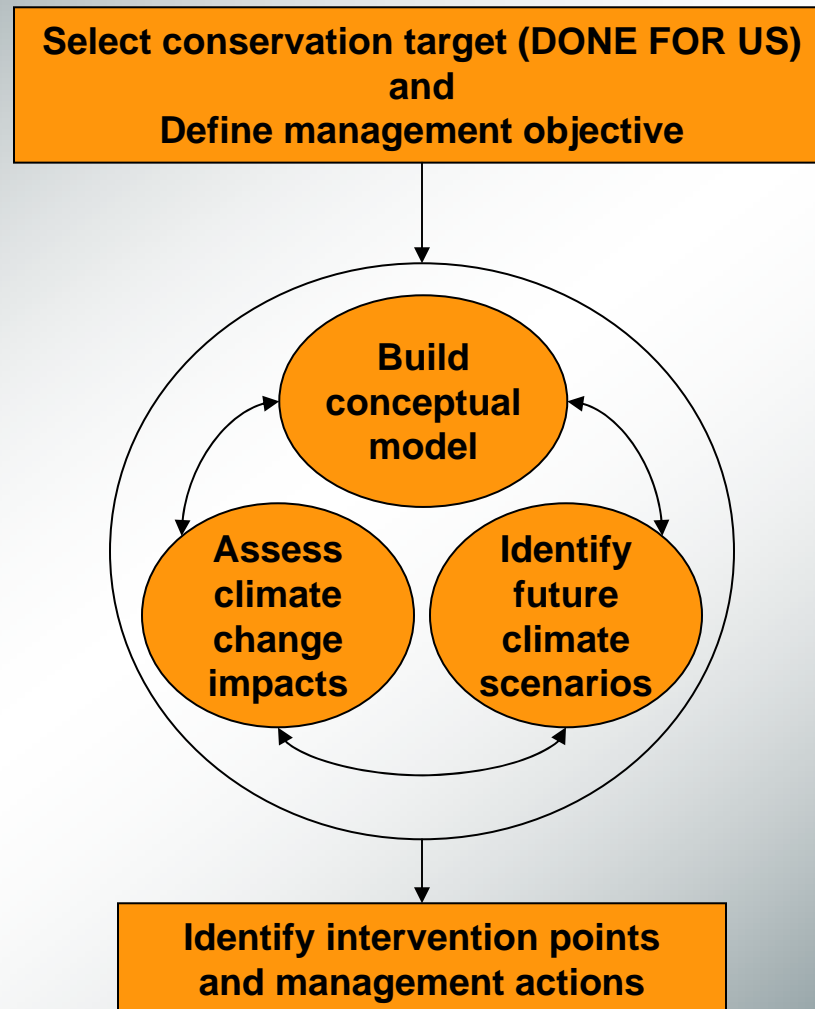
1. In-stream flows



2. Fire



Goal for breakout sessions



QUESTIONS?