Adaptive Management in the TRRP: Progress, Challenges and Opportunities

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<with thanks to all TRRP scientists!>

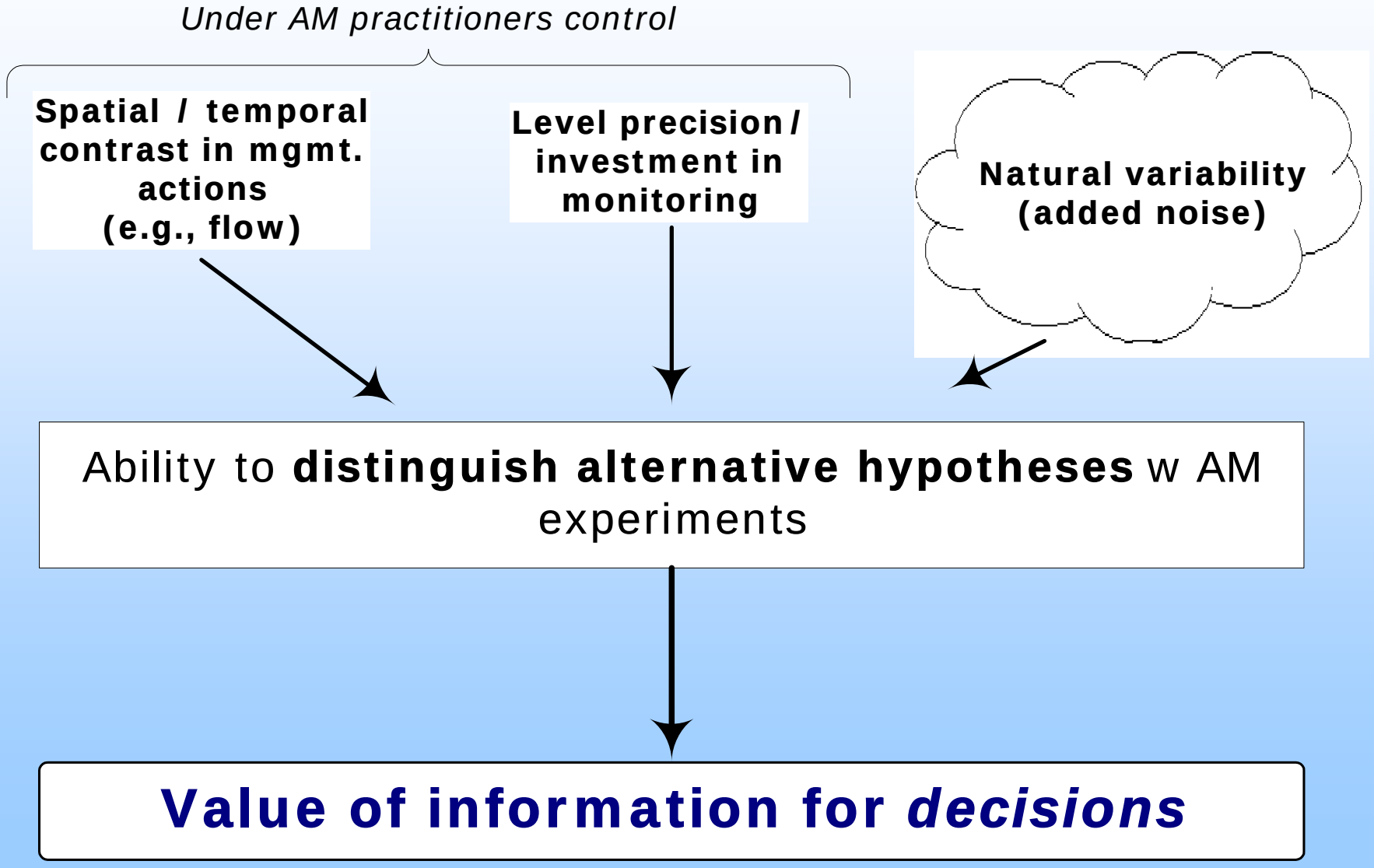
Outline

- Critical AM concepts
- What we can learn from an AM experiment in BC
- Time-Space scales of AM in the Trinity
- Ideas for improving the Program’s AM

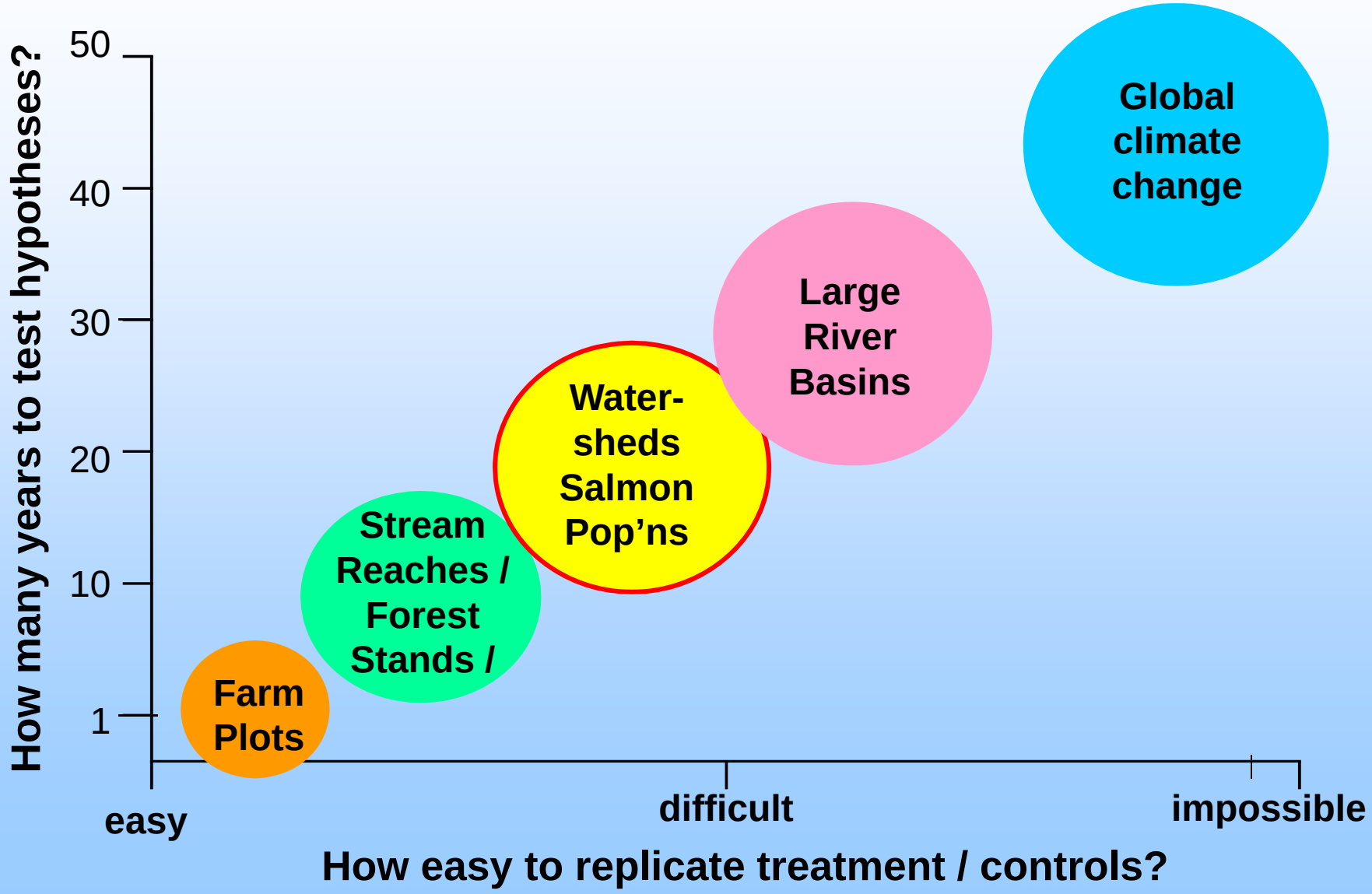
Adaptive management is:

a systematic, rigorous approach
for learning
by designing
management actions
as experiments

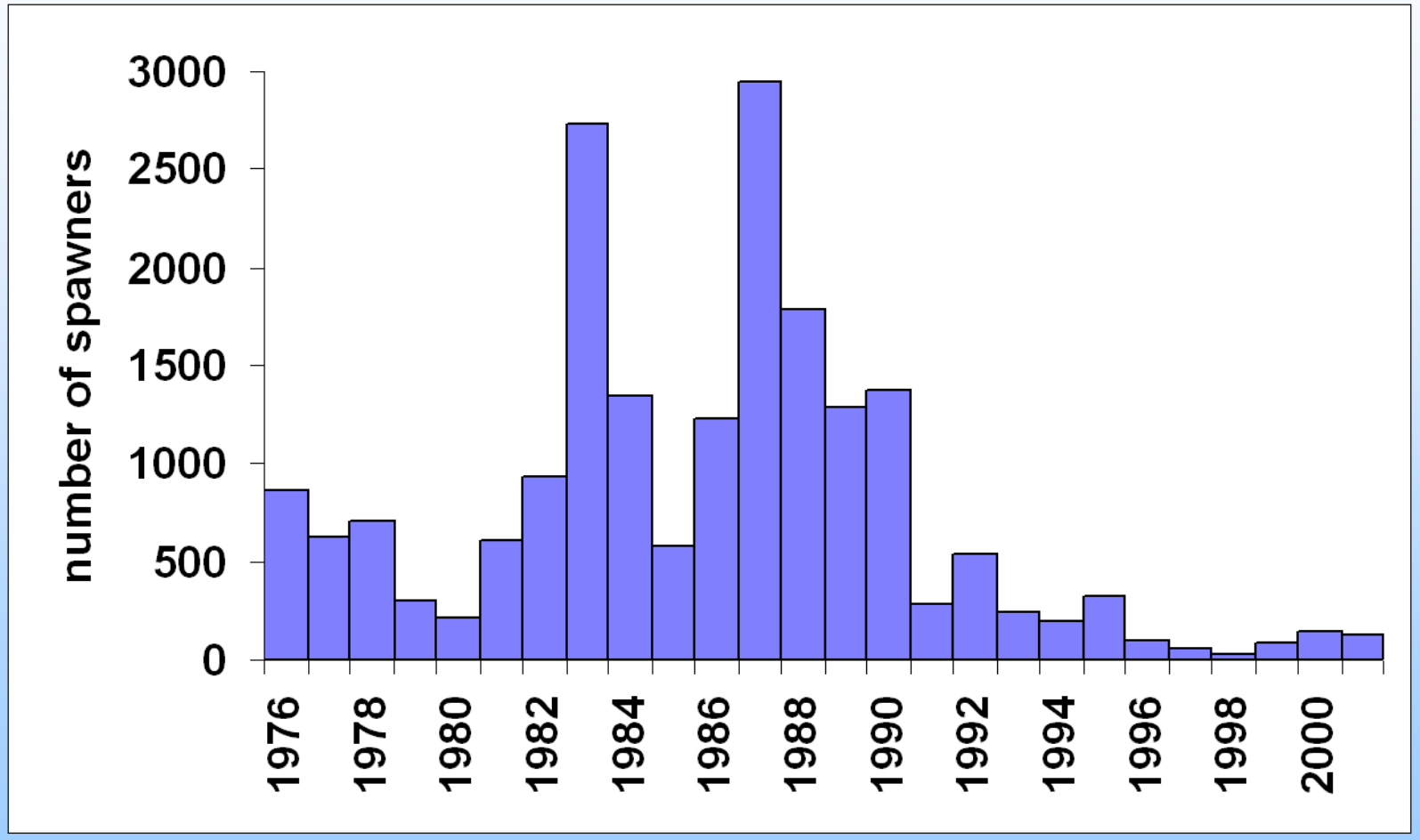
Learning is a function of what practitioner can and cannot control



Feasibility of AM Experiments



AM example: Keogh River steelhead



BC Watershed Restoration Program (WRP)

Keough River AM Actions

Adding instream structures

Adding nutrients

McCubbing and Ward 2000

Staircase design to maximize contrast

Year

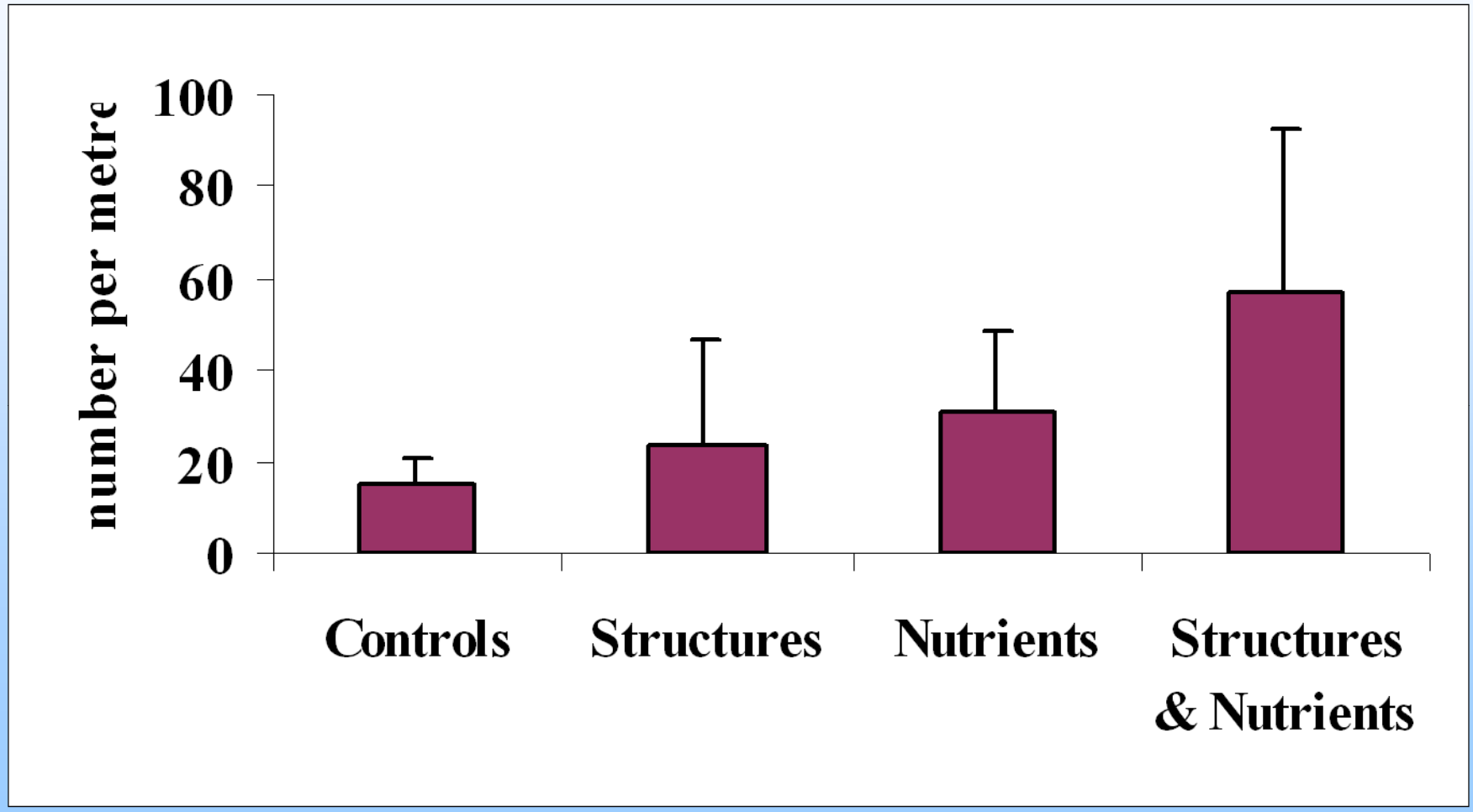
Site	1	2	3	4	5
1		s	s	fs	fs
2		s	fs	fs	fs
3		f	fs	fs	fs
4		f	f	fs	fs
5			fs	fs	fs
6				fs	fs
7					

Waukwass (control watershed)

	= no treatment
f	= fertilized
s	= structures
fs	= fertilized + structures

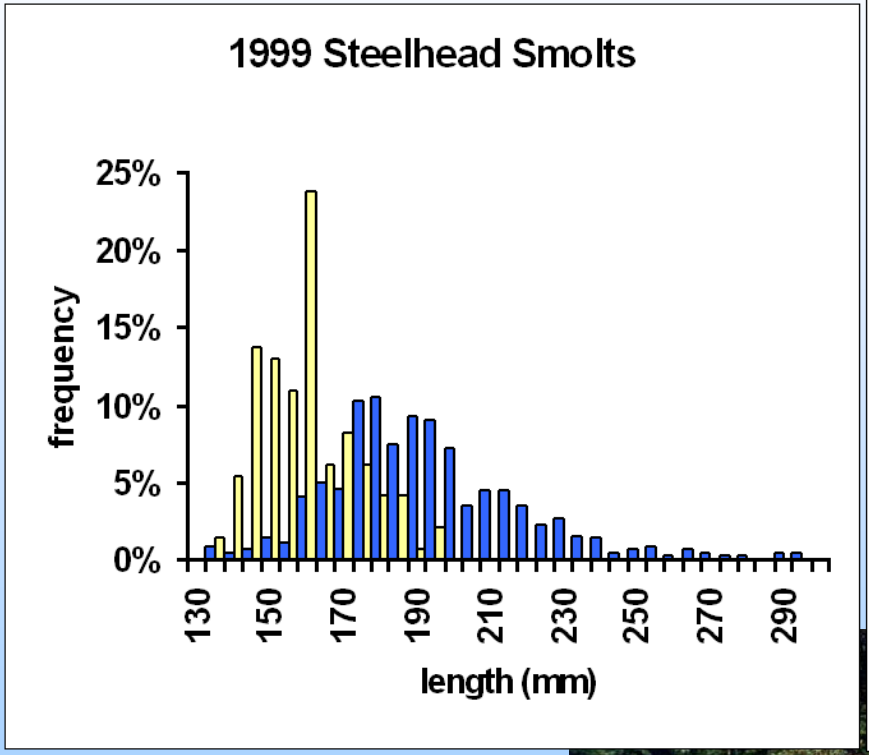
McCubbing and Ward 2000

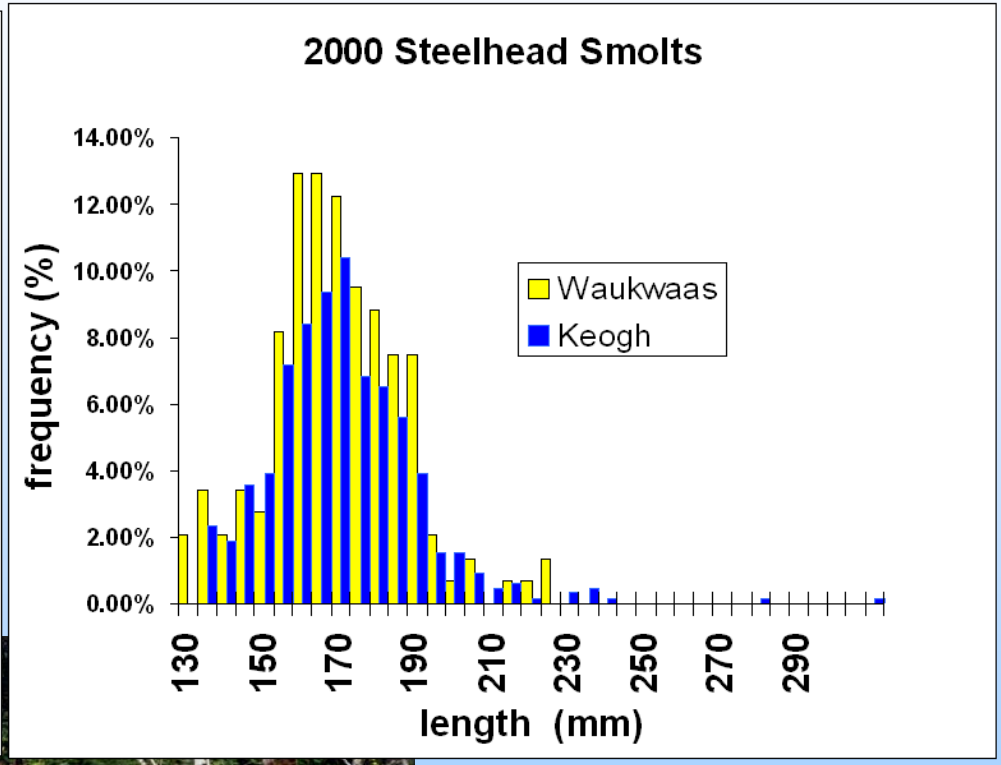
Response 1: Steelhead Parr / meter in Treatment and Control Habitats



McCubbing and Ward 2000

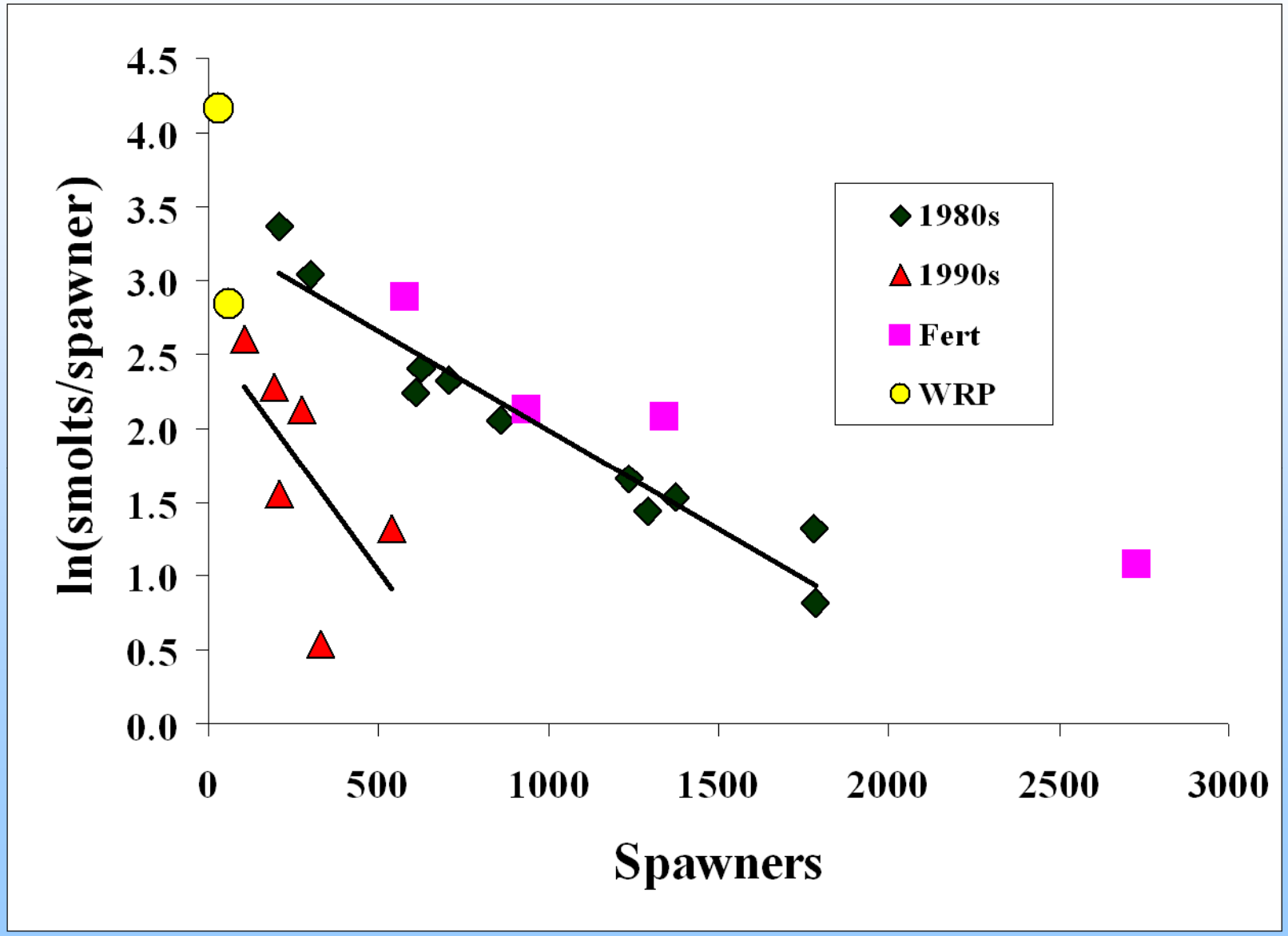
Response 2: Steelhead smolt length frequency in Keogh and Waukwaas





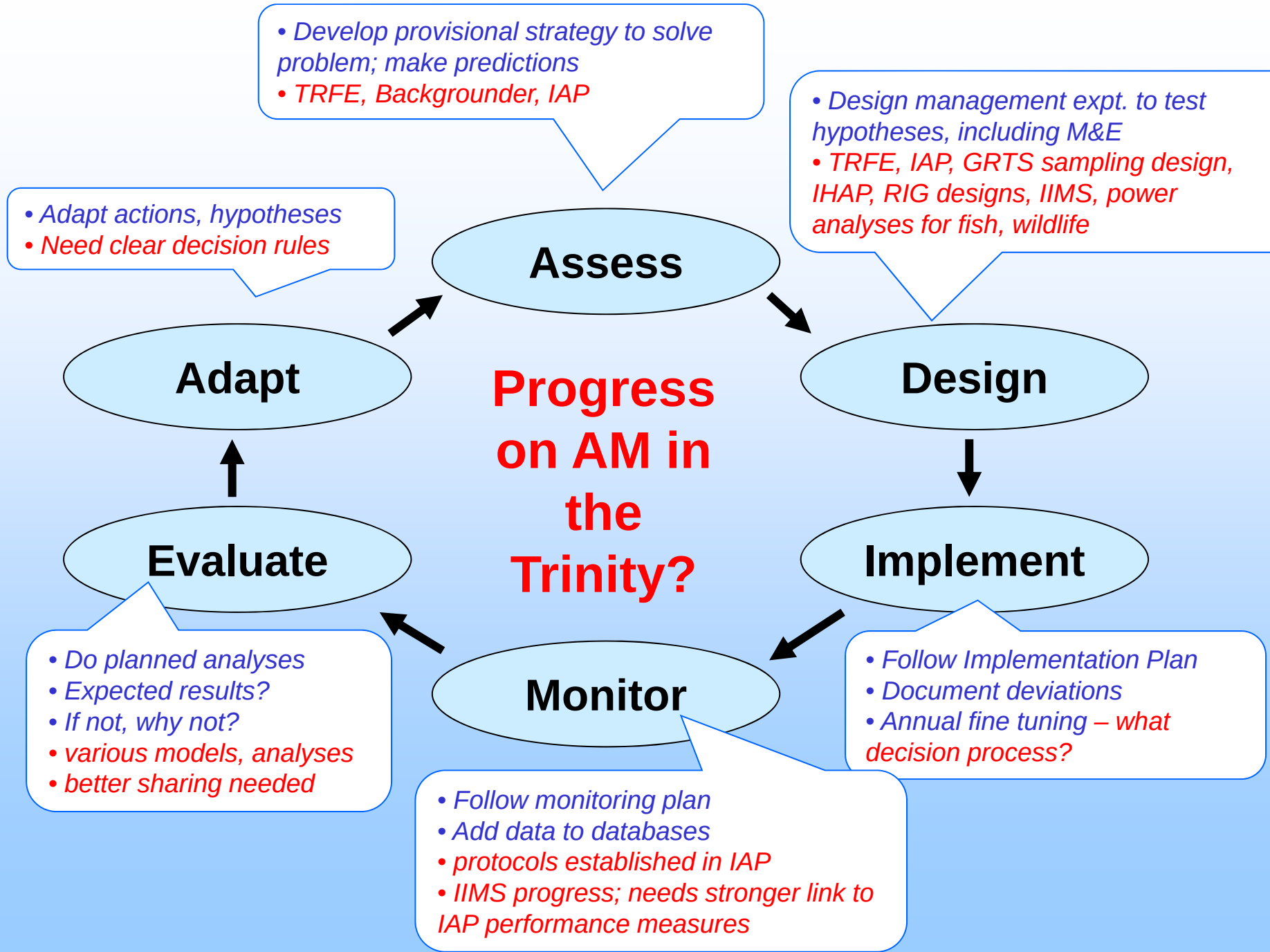
McCubbing and Ward 2000

Response 3: Survival benefits at low spawner densities

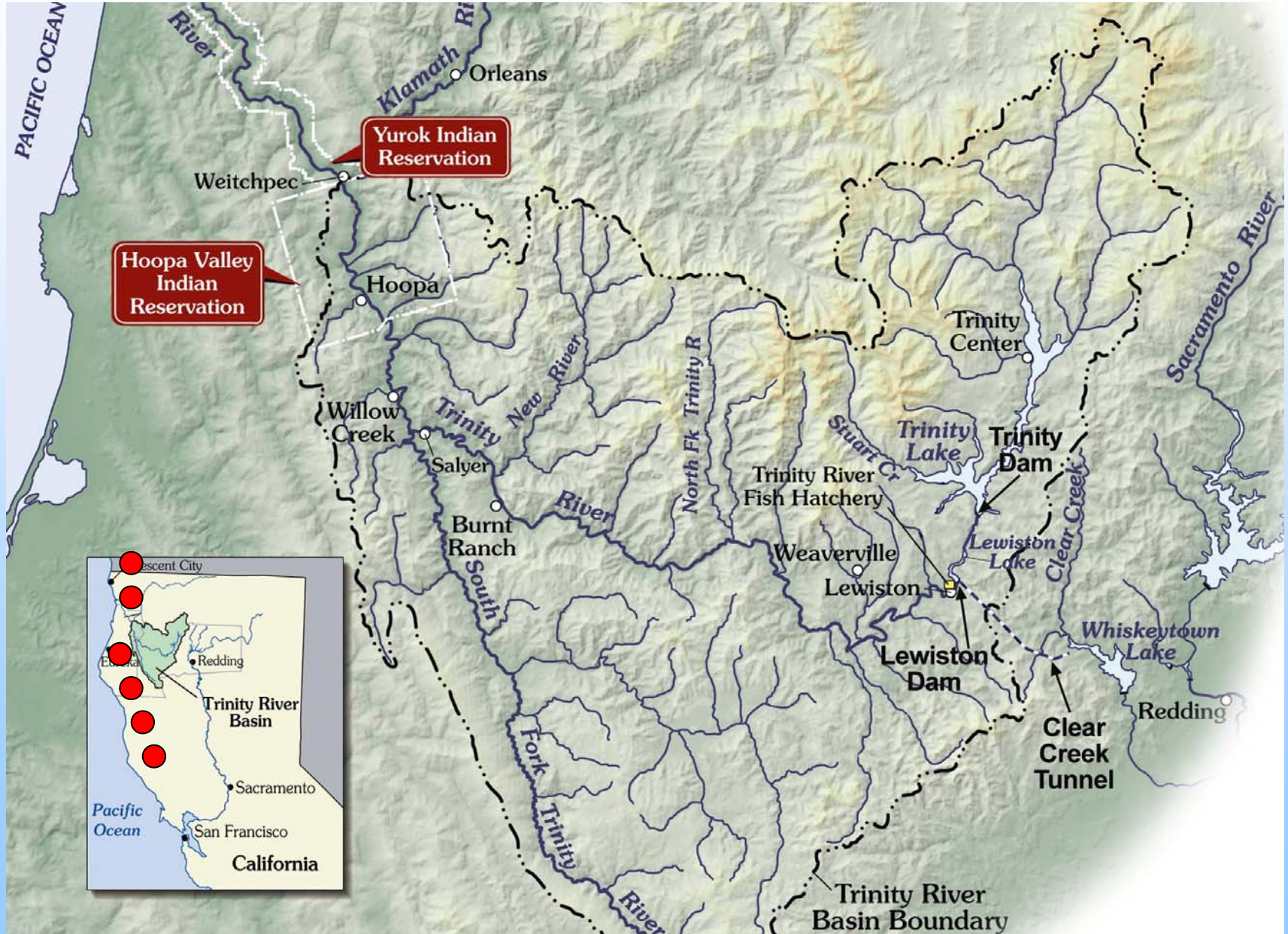


Key features of Keogh AM experiment

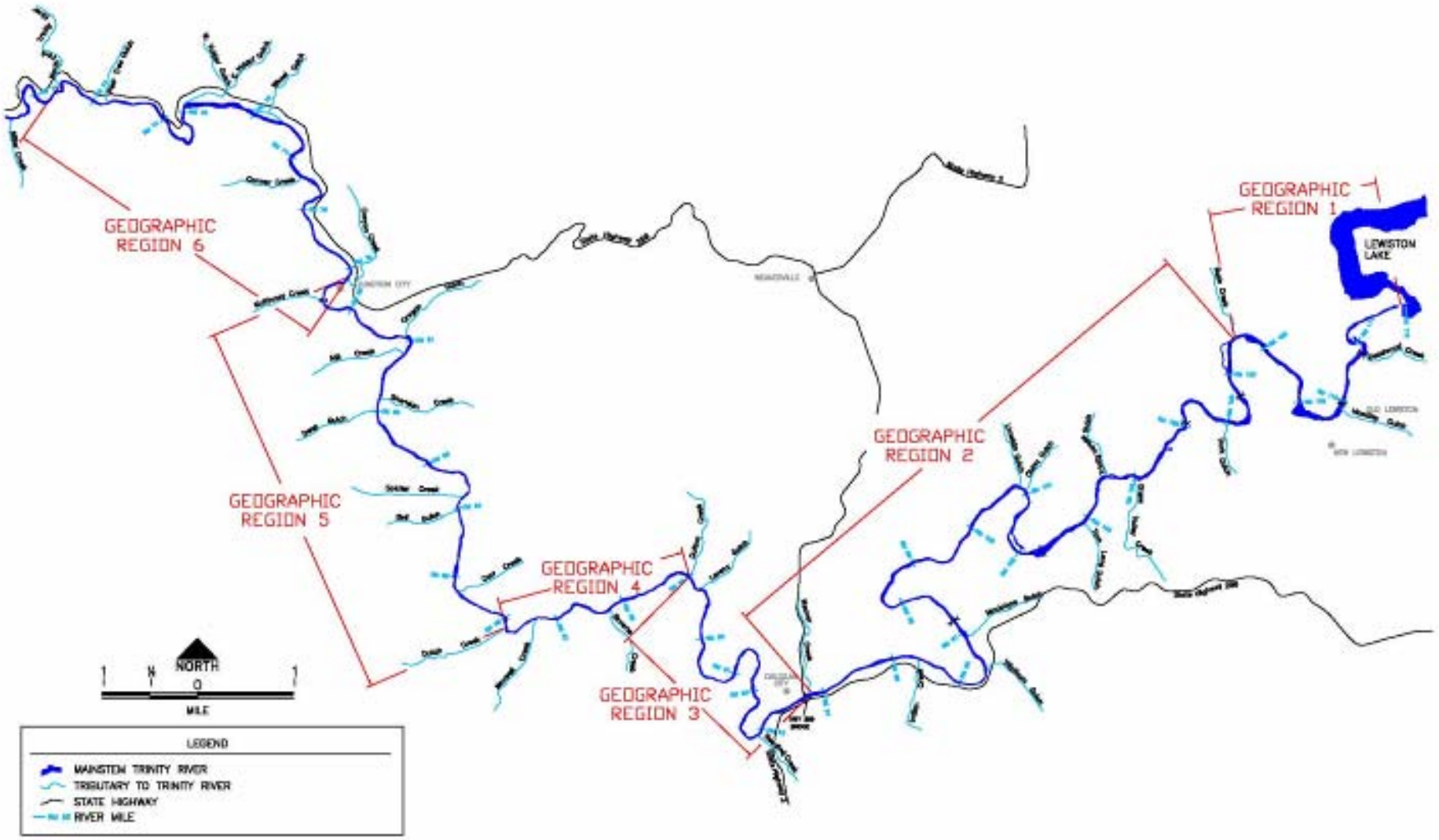
- **Strong contrast** in treatments both spatially (watershed and reach scales) and over time
- **Consistent methods** of measuring habitat, spawners, smolts over 3 decades
- **Outcomes:**
  - Demonstrated benefit of habitat actions for freshwater production, but very poor ocean survival (1-2%) leaves stock precarious
  - Now using hatcheries to recover steelhead, but hatchery smolts/spawner << wild
  - Coho are doing OK


• Develop provisional strategy to solve problem; make predictions
• TRFE, Backgrounder, IAP
• Design management expt. to test hypotheses, including M&E
• TRFE, IAP, GRTS sampling design, IHAP, RIG designs, IIMS, power analyses for fish, wildlife
• Adapt actions, hypotheses
• Need clear decision rules
Assess
Design
Adapt
Progress on AM in the Trinity?
Implement
Evaluate
Monitor
• Do planned analyses
• Expected results?
• If not, why not?
• various models, analyses
• better sharing needed
• Follow Implementation Plan
• Document deviations
• Annual fine tuning – what decision process?
• Follow monitoring plan
• Add data to databases
• protocols established in IAP
• IIMS progress; needs stronger link to IAP performance measures

Scale 1: The Trinity River Watershed

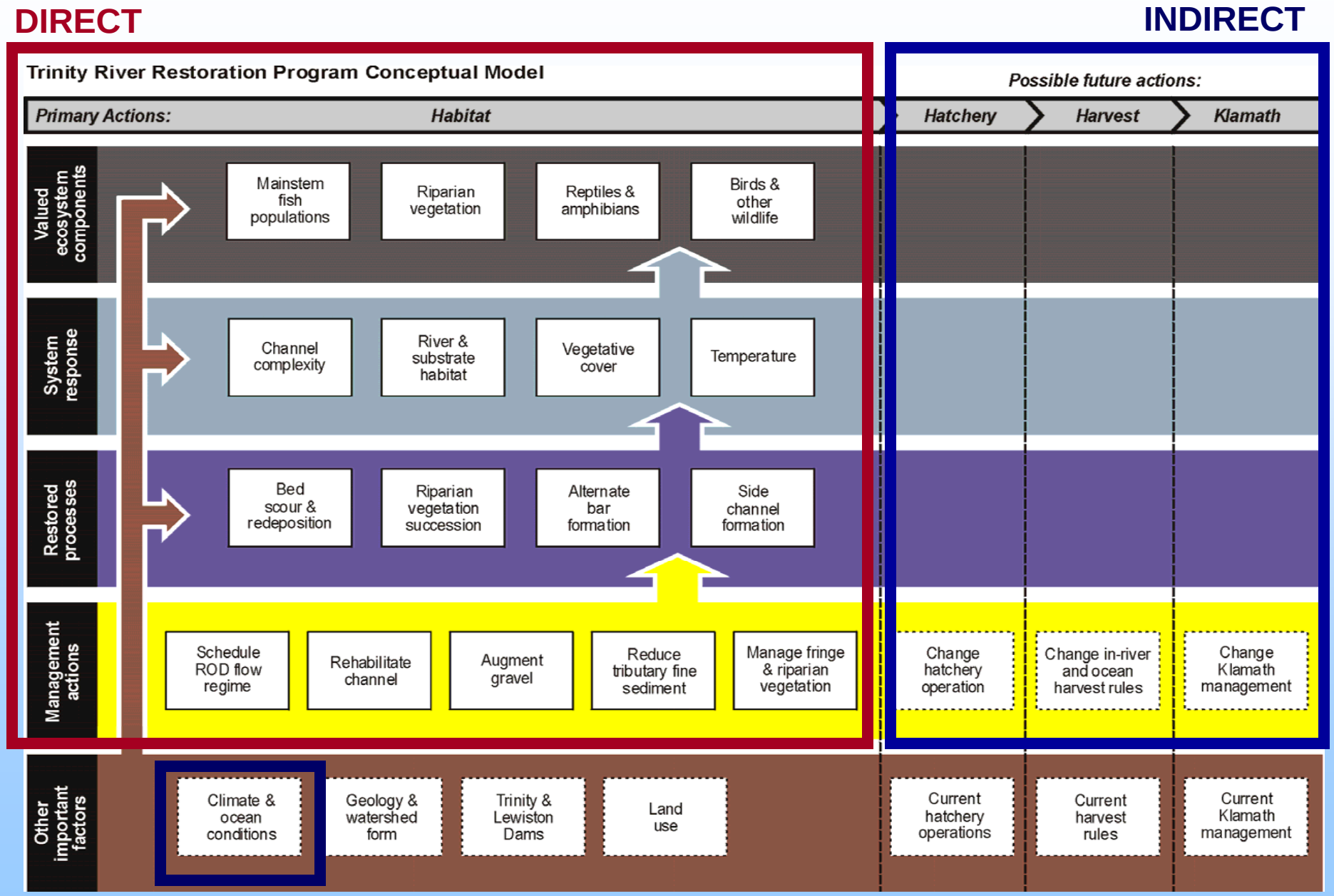


Scale 2: Top 40 Miles

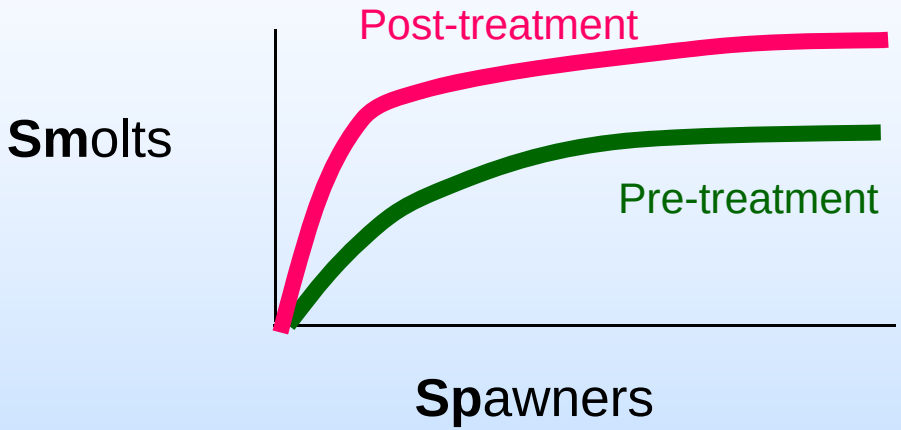


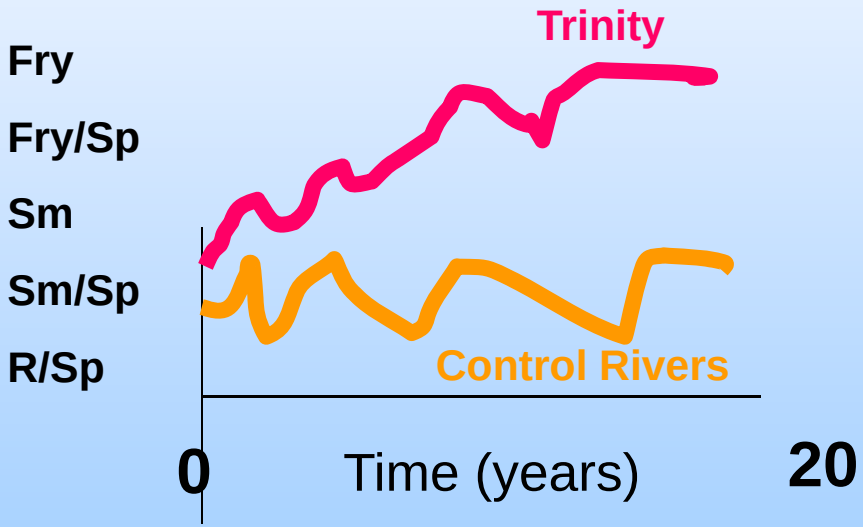
Trinity River Geographic Regions

Testing Program Hypotheses



What will analyses show in 2020? 2030?

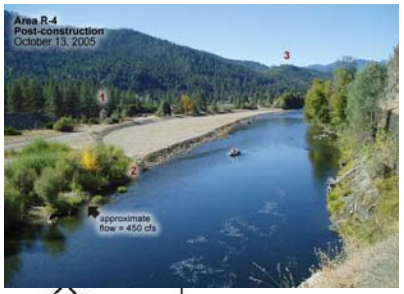




e.g. $\text{Ln } (R/Sp)_{j,t} = a_j + b(Sp)_{j,t} + c(WY)_{j,t} + d(HAB)_{j,t} + \ldots$

j=rivers; t=years

Scale 3: Channel Rehab and 'Control' Sites



CANYON CREEK SUITE (N=4)

HOCKER FLAT (N=1)

GEOGRAPHIC REGION 6

GEOGRAPHIC REGION 5

GEOGRAPHIC REGION 4

GEOGRAPHIC REGION 3

GEOGRAPHIC REGION 2

GEOGRAPHIC REGION 1

LEWISTON LAKE

LEWISTON 4 & DARK GULCH (N=8)

INDIAN CREEK (N=3)

NORTH

1 ½ 0 1

MILE

LEGEND

- MAINSTEM TRINITY RIVER
- TRIBUTARY TO TRINITY RIVER
- STATE HIGHWAY

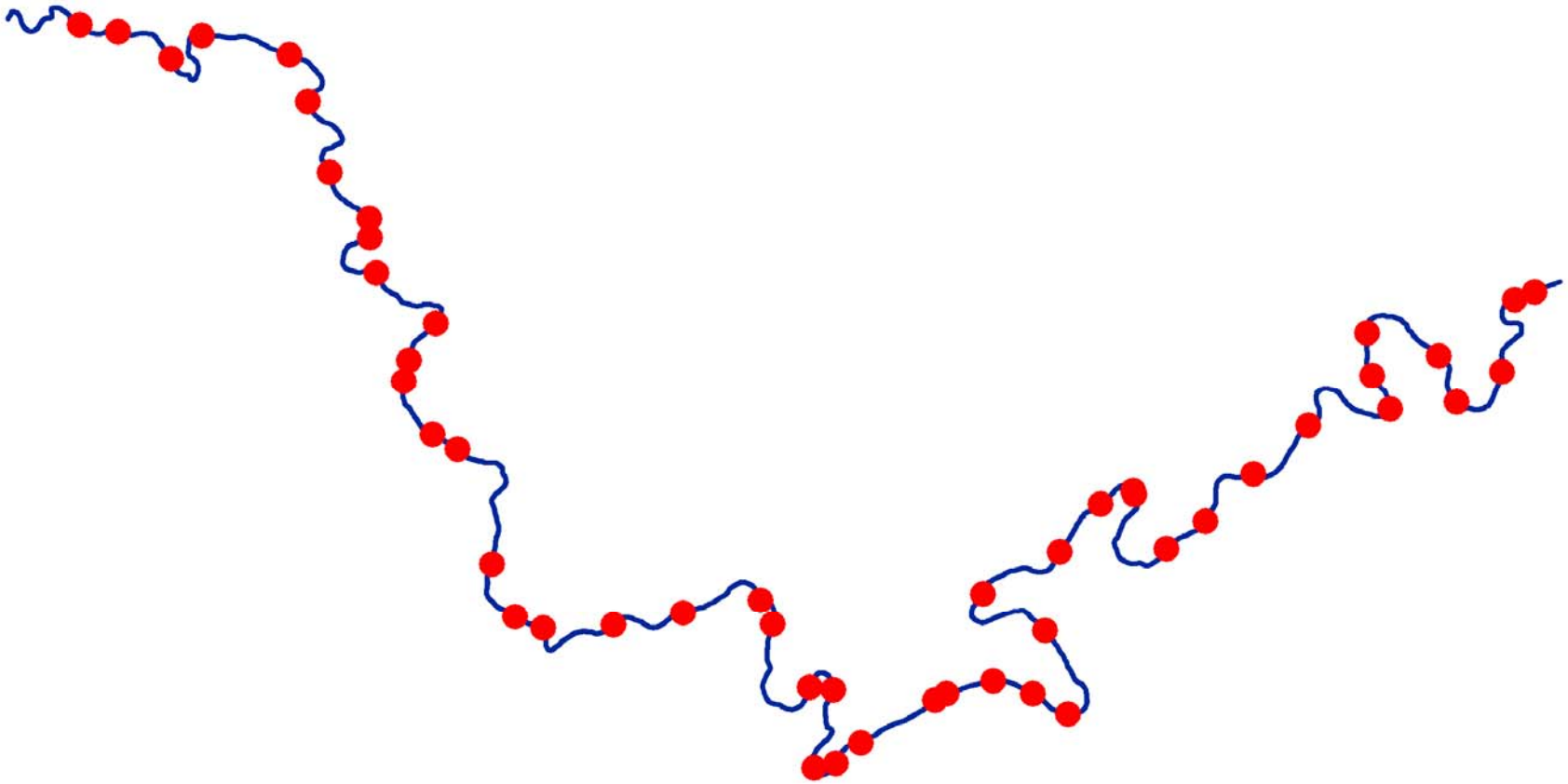
BANK REHABILITATION PROJECTS

- 2005 IMPLEMENTATION
- 2006 IMPLEMENTATION
- 2007 IMPLEMENTATION
- RIVER MILE

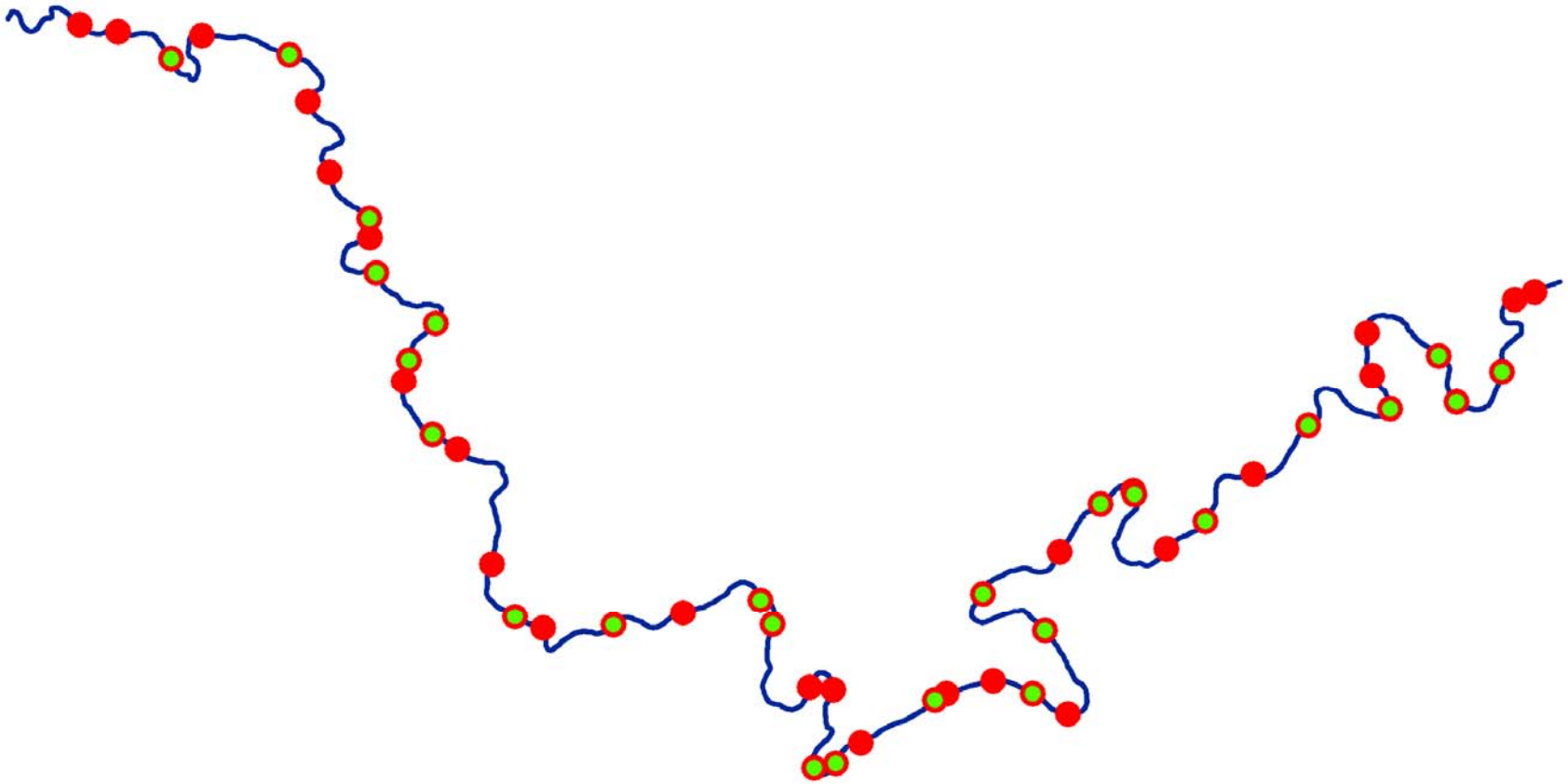
Trinity River Channel Rehabilitation Sites

Progress on system-wide sampling design (When? Where? Co-location?)

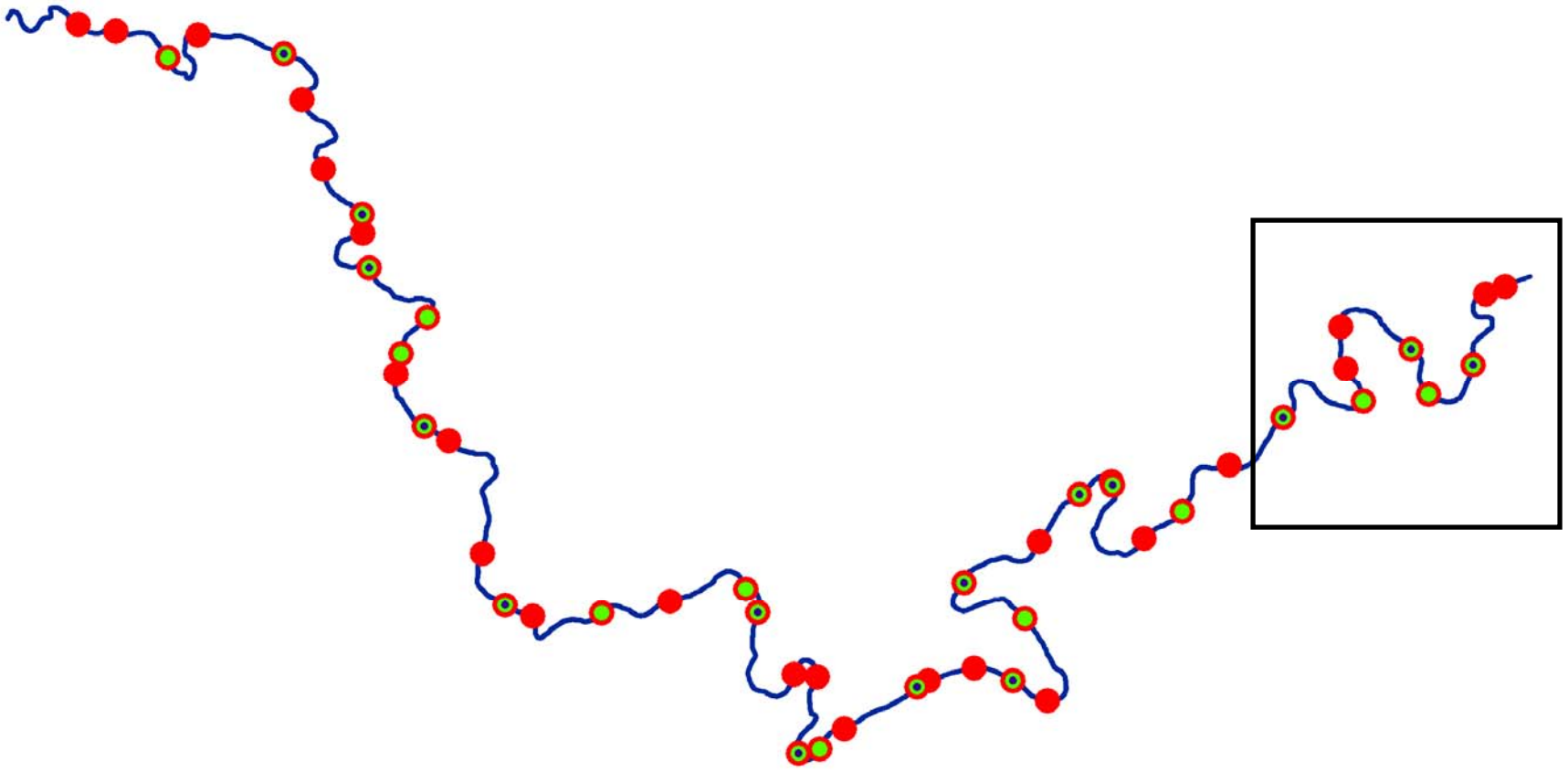
Protocol 1 - GRTS selected sampling (50 sites)

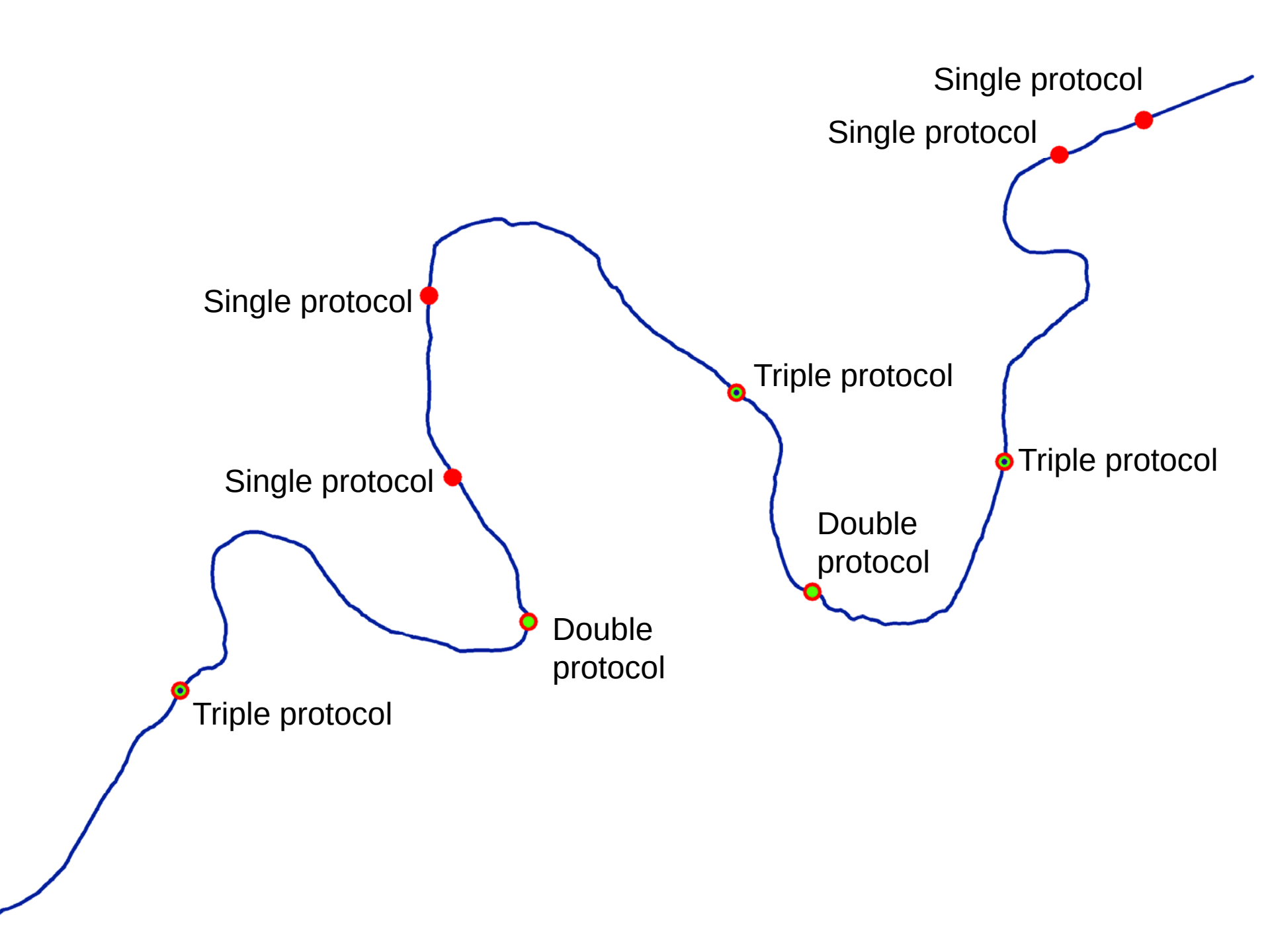


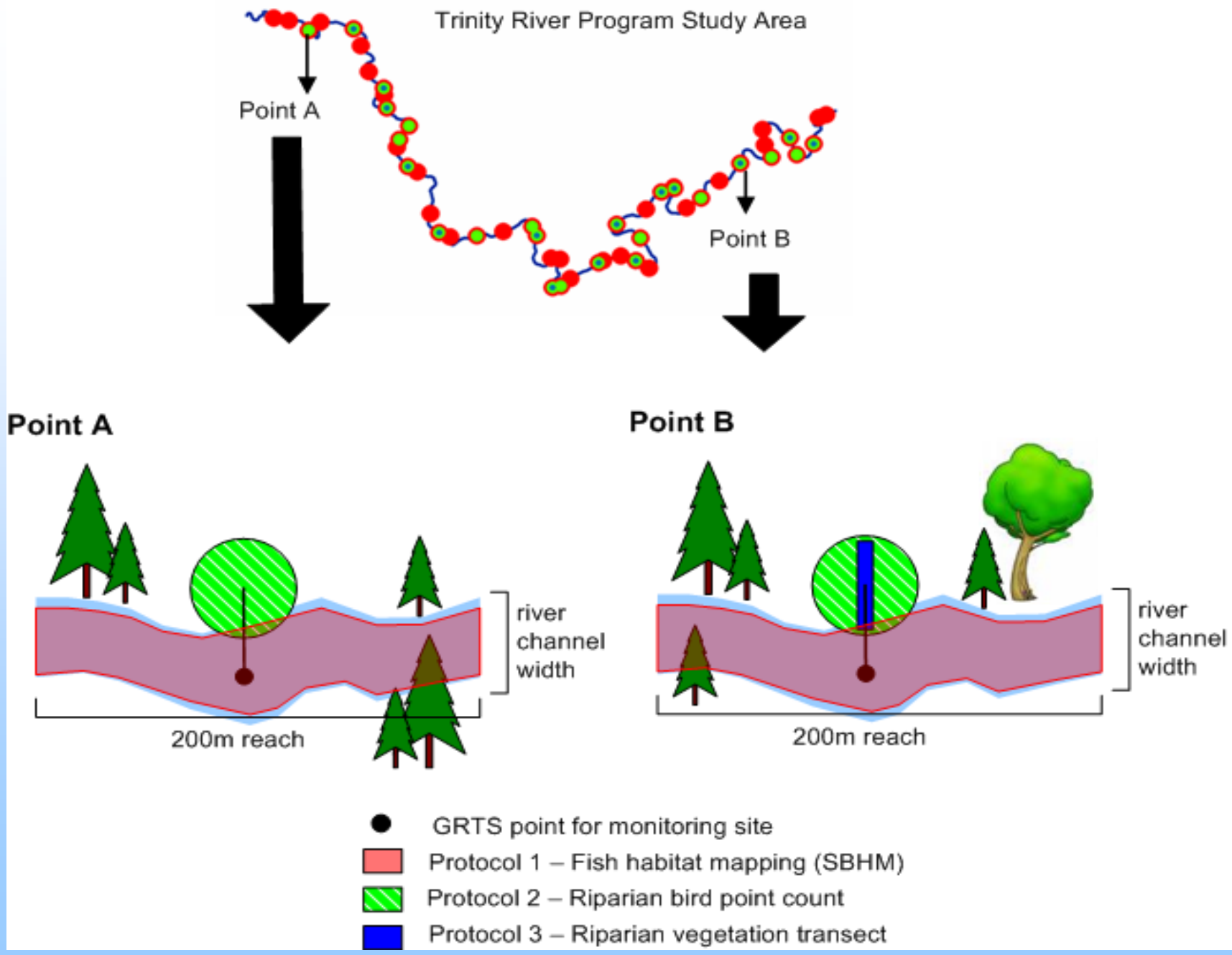
Protocol 2 - GRTS selected sampling (25 sites - green)
overlapped with Protocol 1 sites



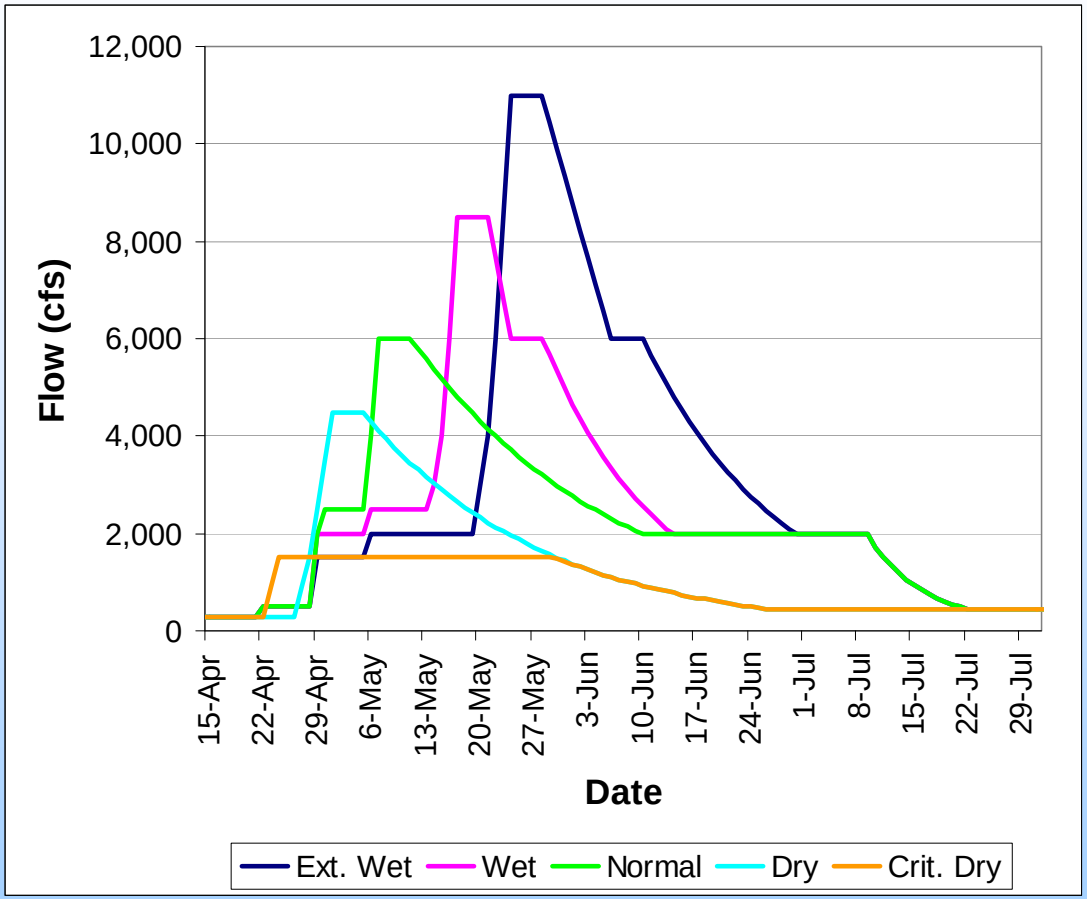
Protocol 3 - GRTS selected sampling (15 sites - black)
overlapped with Protocol 1 & 2 sites




Single protocol
Single protocol
Single protocol
Triple protocol
Triple protocol
Single protocol
Double protocol
Double protocol
Triple protocol

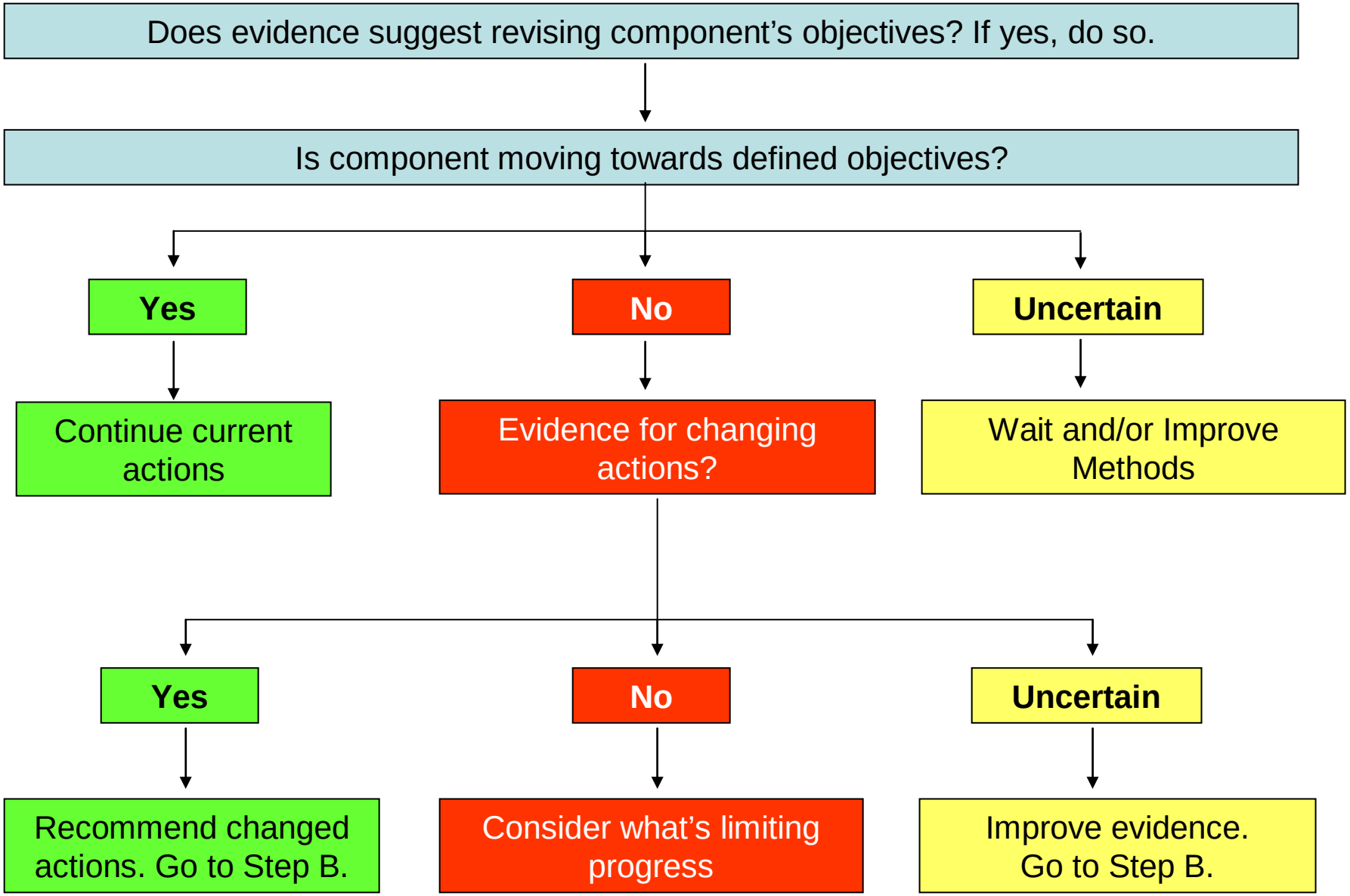

Trinity River Program Study Area
Point A
Point B
Point A
river
channel
width
200m reach
Point B
river
channel
width
200m reach
GRTS point for monitoring site
Protocol 1 – Fish habitat mapping (SBHM)
Protocol 2 – Riparian bird point count
Protocol 3 – Riparian vegetation transect

Scale 4: Annual Flow and Sediment Actions



Annual AM decisions involve evaluations both within and across domains

A. Individual Component Level (evaluated by component leads)



B. Whole system level (inter-disciplinary evaluation)

B1. Examine rationales for all proposed changes in actions

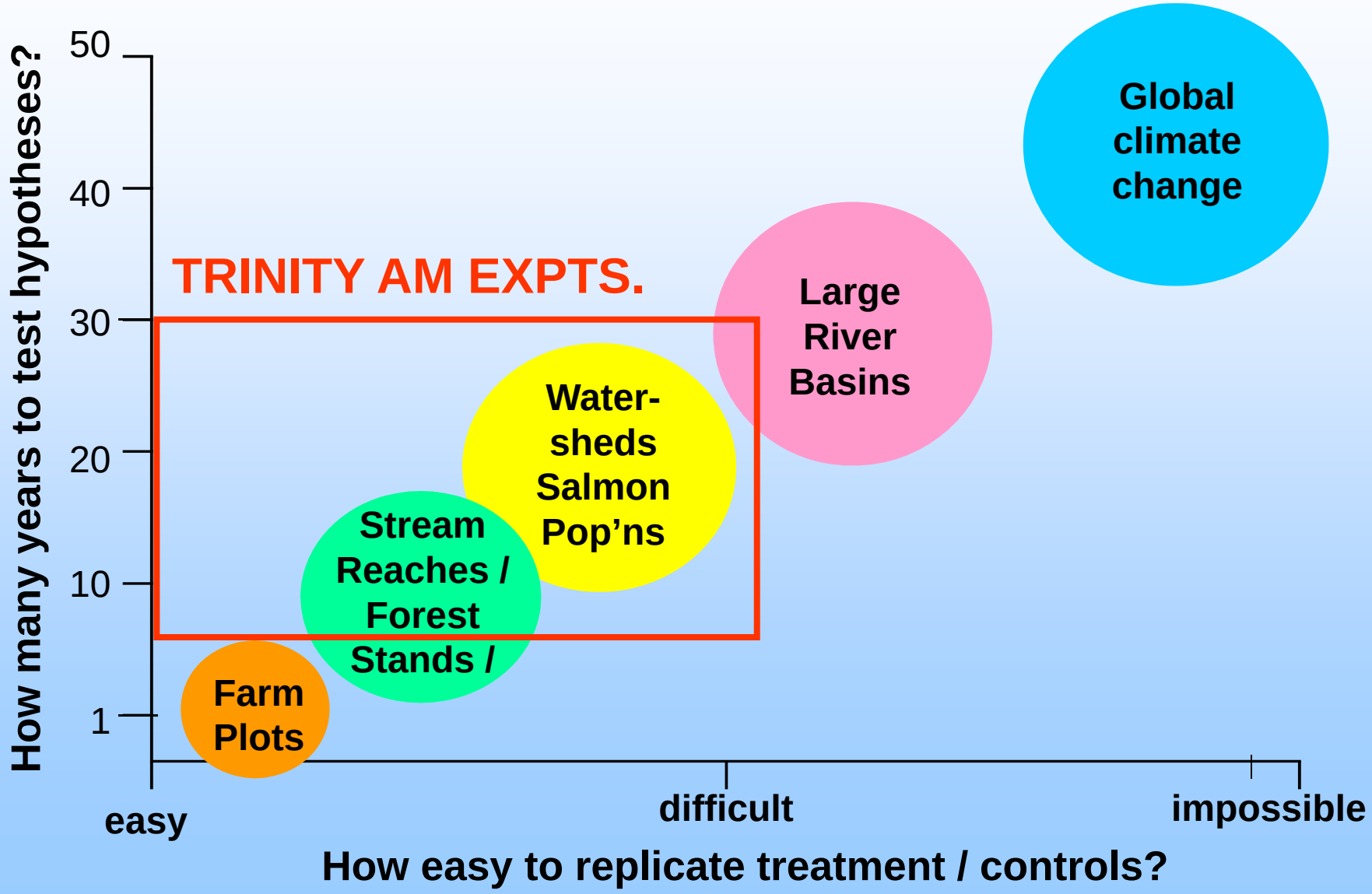
B2. Is each proposed action change:

1) consistent with TRRP strategy (and not confound its evaluation)?
2) supportive of other components (won't undermine them)?
3) addressing factors most limiting fish production in short term (1-2 yrs)?
4) addressing factors most limiting fish production in long term (10 yrs)?

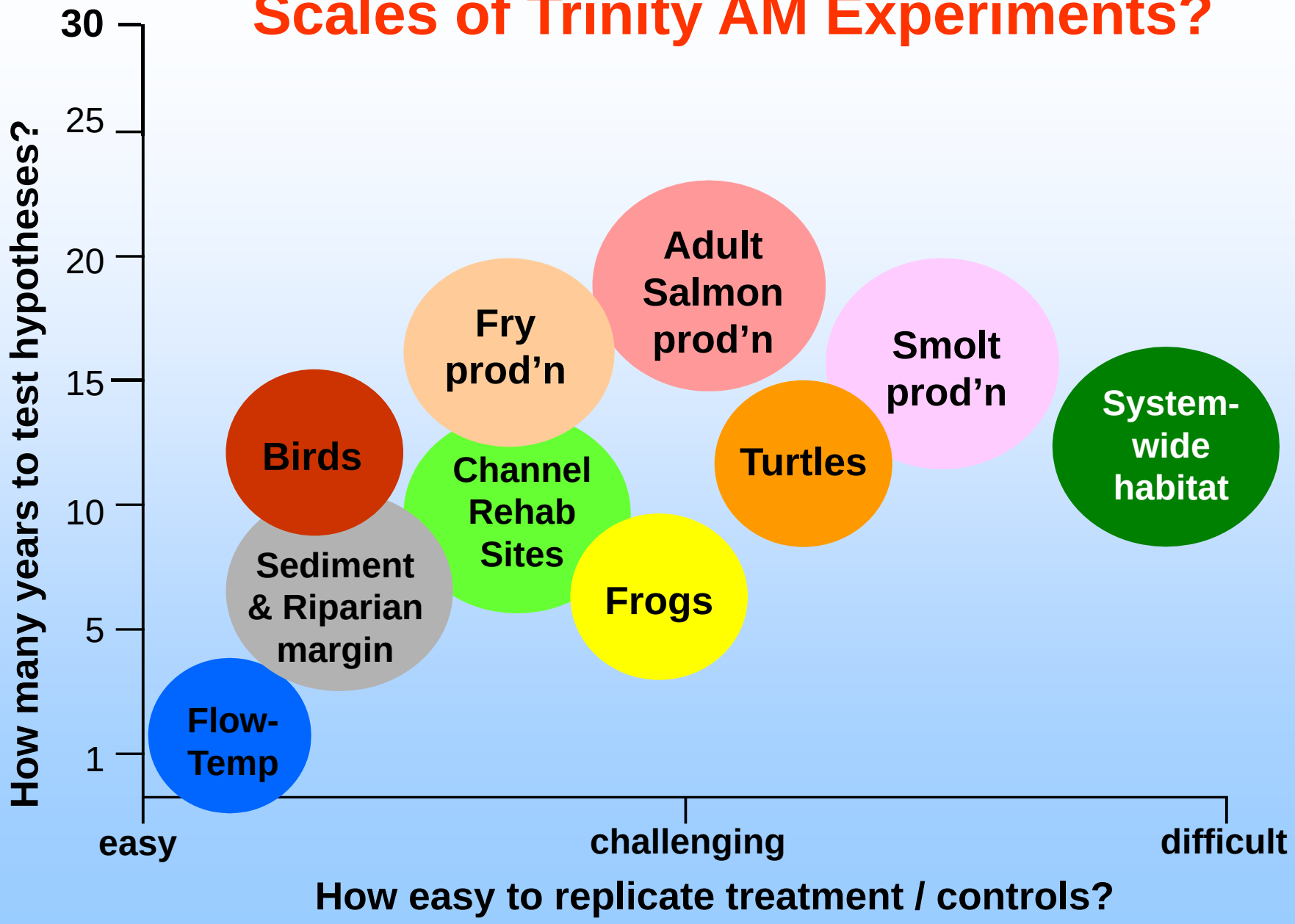
B3. Score proposed actions vs 4 criteria & assess tradeoffs

Converge to action plan for next year

Feasibility of AM Experiments



Scales of Trinity AM Experiments?



What will we know in 2015, 2020, 2030?

Weaverville, CA

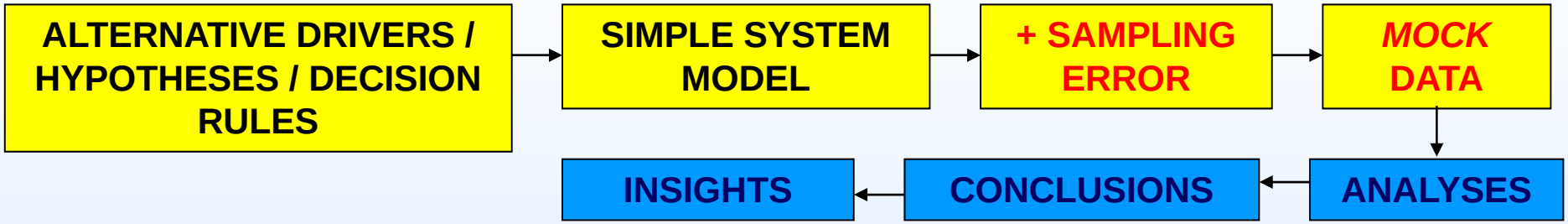
Image © 2006 DigitalGlobe
Image © 2006 MDA EarthSat

Google

Pointer 40°46'50.84" N 122°55'41.15" W elev 3179 ft Streaming 100% Eye alt 48085 ft

Mock Reports on TRRP (2015, 2020, 2030)

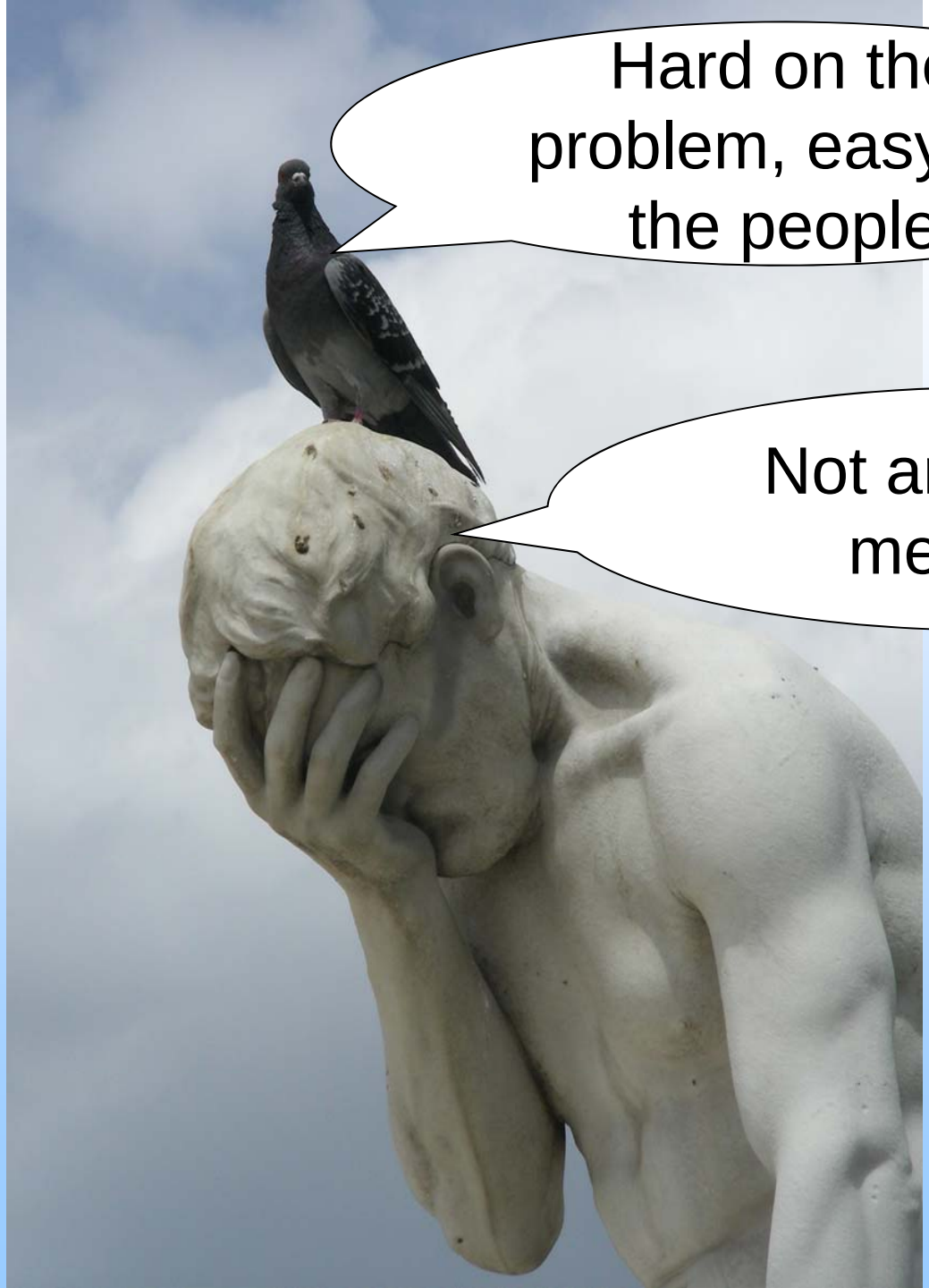
Simulate / rapid prototype the whole experiment



1. climate / water year scenarios →
2. amount of contrast in flow and habitat response →
3. effectiveness in producing habitat →
4. response of fish/wildlife to habitat (incl. confounding factors) →
5. sampling error in estimating performance measures →
6. "mock data" →
7. analyze mock data as you would real data →
8. write up mock report & draw conclusions for key decisions in 2015, 2020, 2030, using specified decision rules
9. Gain insights on feasibility of hypothesis tests, decisions
   - Re-examine methods, priorities, contrast

Conclusions

- Excellent progress in AM at multiple scales
- Long term success will require:
  - **strong contrasts** at each scale (incl. other rivers)
  - **consistent monitoring** over 2 decades
  - clear decision rules (short & long term)
- Do mock reports now for 2015, 2020, 2030:
  - gain insights
  - build partnerships
  - revise sampling / analytical approaches


Hard on the problem, easy on the people
Not another IAP meeting…

IAP Sampling Framework