Education Outreach

Elena Sparrow, Katie Spellman, Christa Mulder, Rebecca Finger, Mary Beth Leigh, Glenn Juday, Jan Dawe, Zach Meyers, Martha Kopplin, Kenji Yoshikawa, Jill Johnstone, Terry Chapin, Teresa Hollingsworth, Christine Villano, Knut Kieland

EO Activities/Programs

Science Integration with the Arts and Humanities

- **In Times of Change (ITOC) –** Mary Beth Leigh

- **One Tree K-20 STEAM Education -** Jan Dawe, Zachary Meyer, Glenn Juday

One Tree K-20 STEAM Education

Jan Dawe, Zachary Meyer, Glenn Juday

Art acts as a bridge or "hook" in to OneTree's STEM (science, technology, engineering, and math) activities

Learning is broader and deeper with STE**A**M

EO Activities/Programs

- **Science Fair/Symposiums –**Coordination and judging, mentoring
- **Research Experience for Undergraduates**
- **Permafrost/Active Layer Monitoring Project-** Kenji Yoshikawa & Elena Sparrow

Yoshikawa, K. **Permafrost in Our Time**.
e-version on the following web site:
http://issuu.com/permafrostbook

EO Activities/Programs

- **GK-12 Changing Alaska Science Education** (CASE) program- 2013 CASE fellow Rebecca Finger at Lathrop High School
- **Dangerous Ice: Changing ice conditions on the Tanana River, Fairbanks.** Schneider, W.S., K. Brewster, K. Kielland and Chas Jones. 2013. Oral History Program, Rasmuson Library and the Institute of Arctic Biology, University of Alaska Fairbanks, 66 pages.

EO Activities/Programs

- **Professional development Workshops- Teachers**

  - Fairbanks 13 educators from Haines, Juneau, Koyuk, Nenana, North Pole, Shageluk, Valdez and Wasilla

Basic GLOBE Measurement Protocols

- Cloud
- Temperature
- Precipitation

- MUC
- Qualitative Land Cover Sampling
- Quantitative Land Cover Sampling
- Manual Mapping

Budburst
Green-up/green-down

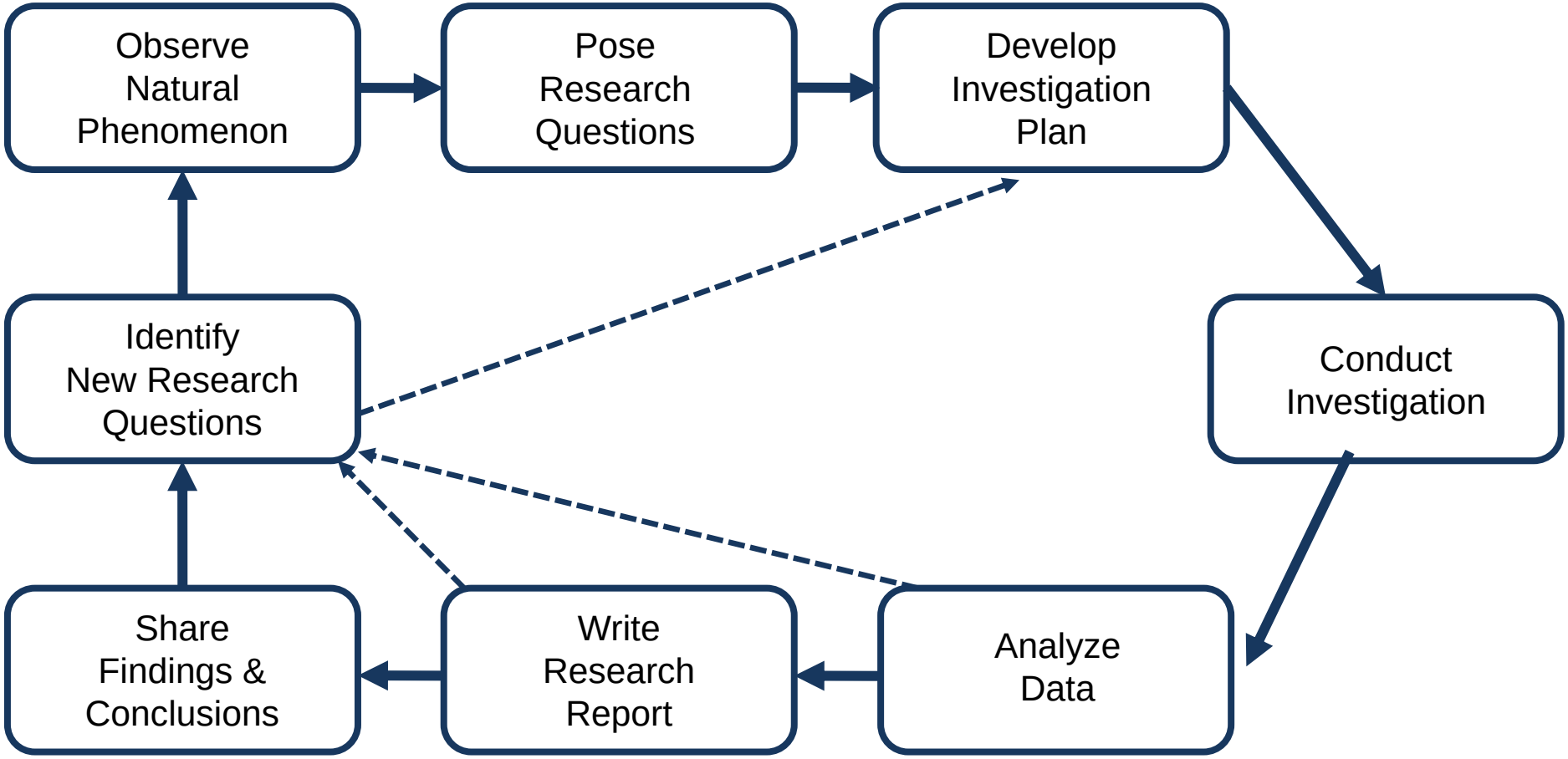
- Transparency
- Temperature
- pH
- Conductivity
- Salinity

- Field Characterization
- Bulk Density
- pH
- Temperature
- Gravimetric Moisture

www.globe.gov

GLOBE Seasons and Biomes Professional Development
Face-to-face Workshop Model

	Monday	Tuesday	Wednesday	Thursday	Friday
Science Content and Process	Introduction and setting the stage	Atmosphere	Phenology -Budburst -Green Up -Green Down	Hydrology -Transparency -Temperature -Dissolved O_2 -Electrical conductivity -pH	Ice Seasonality -Freeze Up -Break Up Frost Tube
GLOBE Model for Student Scientific Research	Observation	Asking a question	Data collection and preliminary analysis	Design and conduct an investigation – Putting it all together	
Best Teaching Practices in Science					
Earth/ecosystem includes Human Dimension					
Workshop assessment and program implementation planning for classrooms					



Legend

Primary Pathways

Additional Pathways

Bonanza Creek
Long-Term Ecological Research


Bonanza Creek
LTER
Bonanza Creek
Long-Term Ecological Research

EO Activities/Programs

- **Professional development Workshops-Teachers**

  - Philippines: 40 educators from 7 schools from all over the Philippines.

  - Portugal at Univ. of Coimbra Sparrow among presenters at the Polar Educators International PD Workshop for 30 educators

EO Activities

- **Development of Teacher Leaders/Trainers**
  - multiplier effect
  - Teacher award

temporary version
November 2009

Seasons In My Biome

created by Markus Eugster
markus.eugster@schule-uzwil.ch

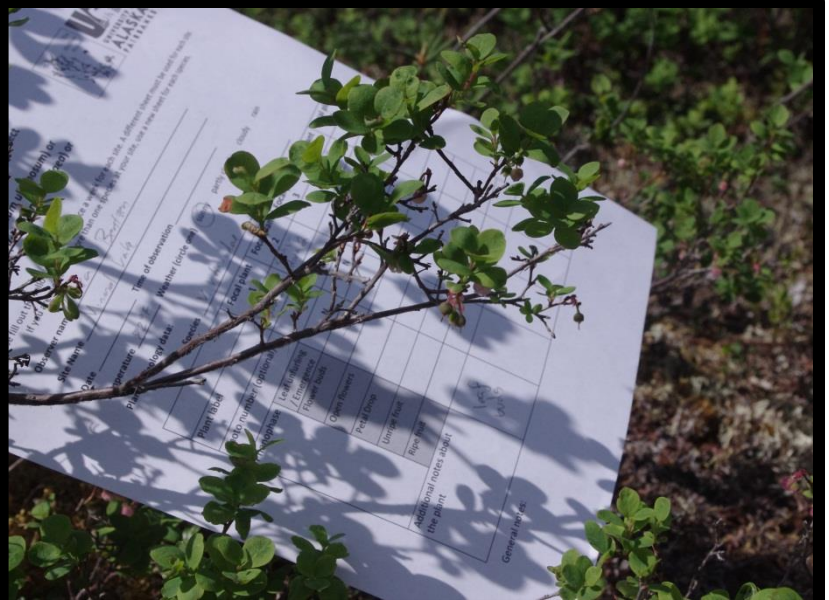
EO Activities

- **Summer Research Experience/Internship-** Upward Bound High School Students

2013 BNZ Research Experience for Teachers

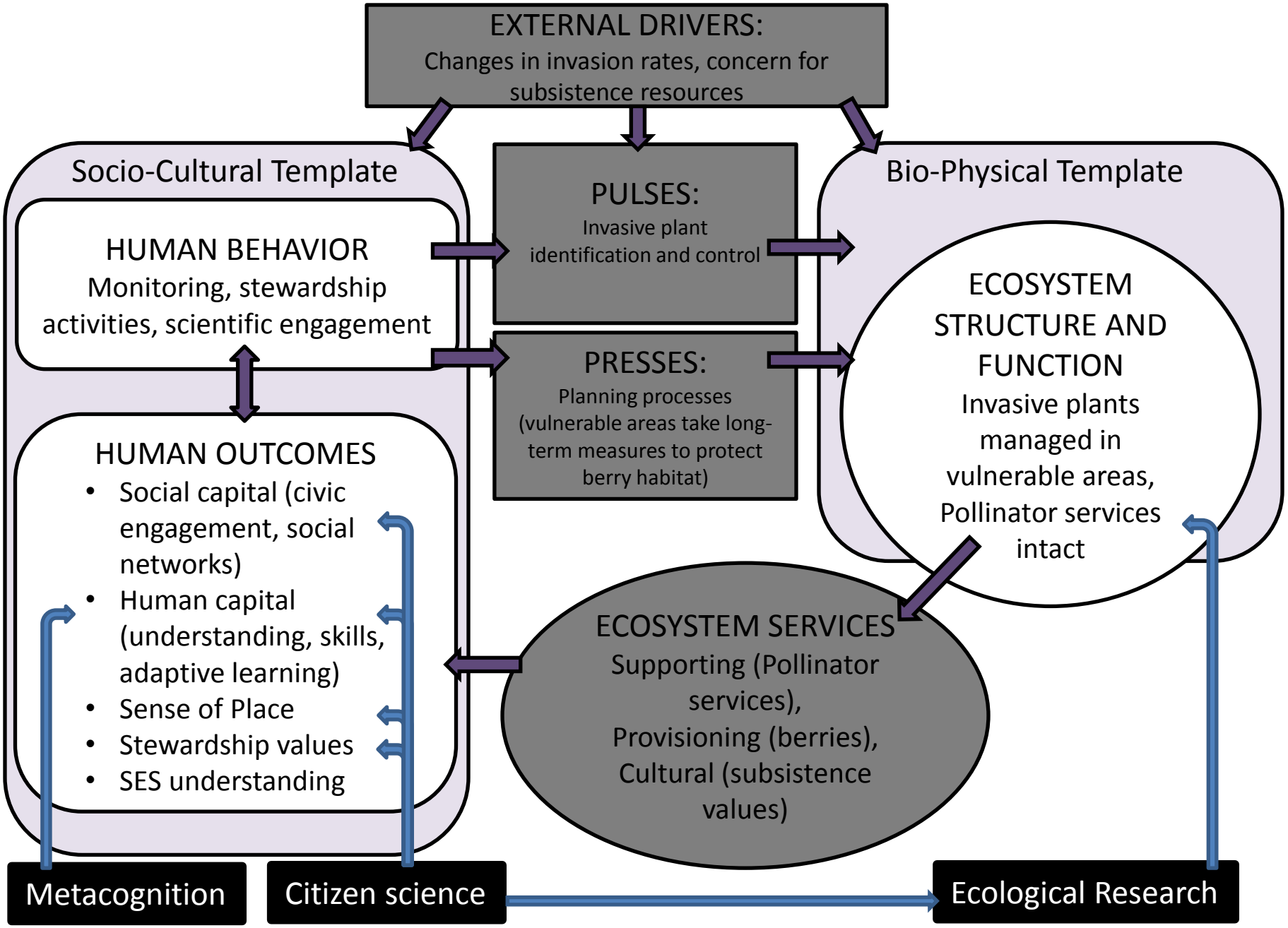
- Marcy Kuntz, Pearl Creek Elementary
- Mulder Lab field work
- Extended research into classroom
- Student-Scientist Symposium

Integrating Ecology and Education Research in the Melibee Project



Key Learning Tools:

- Ecological Research
  - observational
  - experimental
  - historical phenology
- Citizen Science
  - current phenology
  - public participation in science
- Education Research
  - experimental



Adapted from LTER Social-Ecological Research Framework (Collins et al. 2011)

Melibee Citizen Science

Learning ecology content and process skills

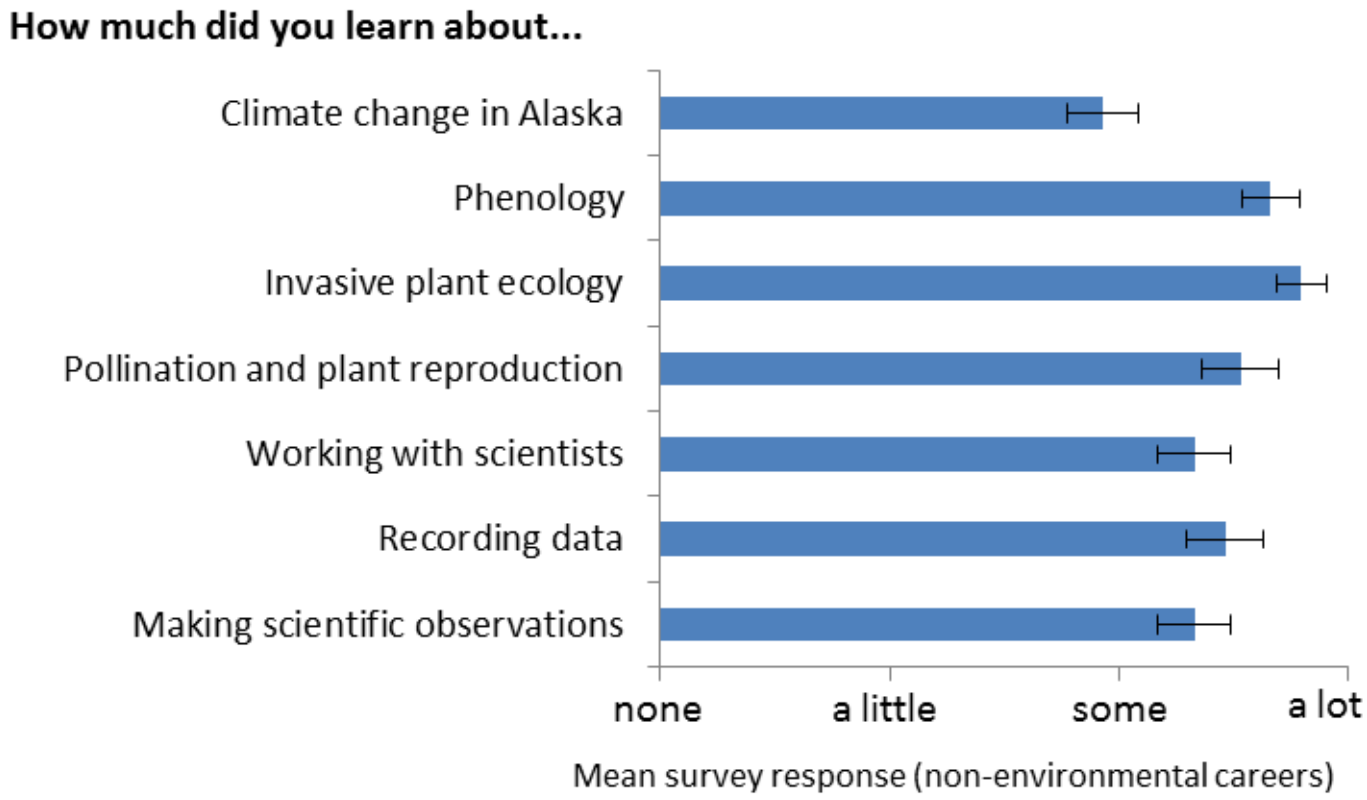


Figure 1. Learning reported by volunteers who were not engaged in environmental careers that occurred as a result of participation in the Melibee Project phenology monitoring program on key concepts and science process skills on key concepts and science process skills.

Changes in Activity Frequency

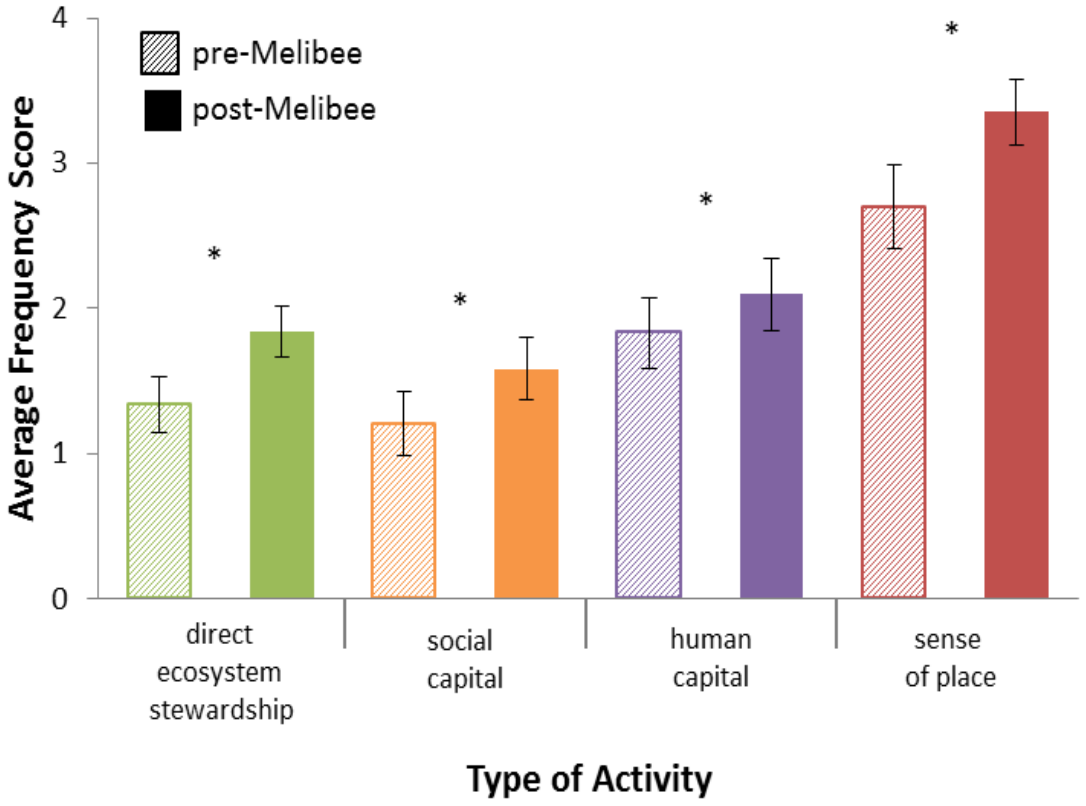
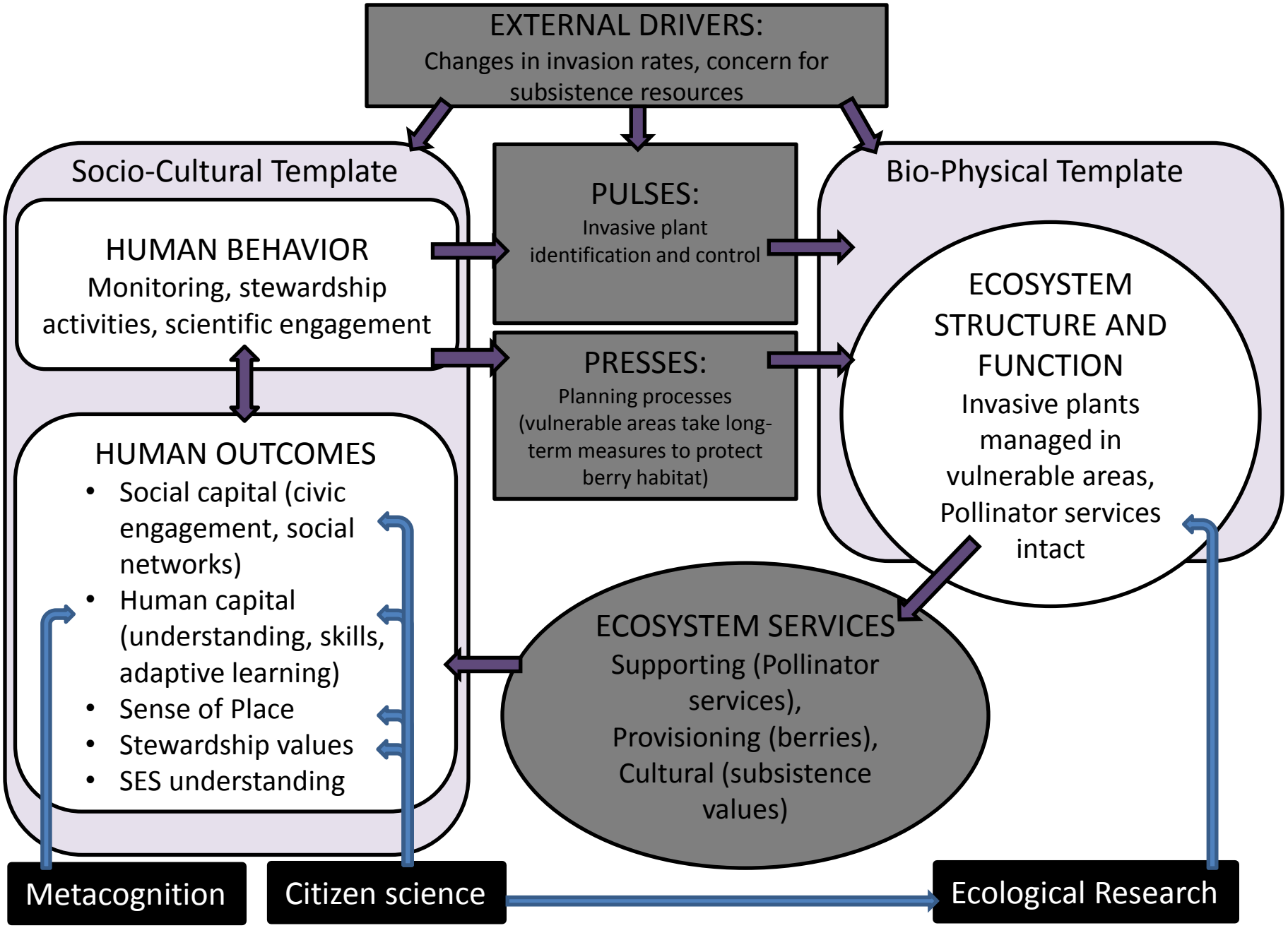


Figure 2. Average self-reported activity frequency scores in different outcome categories for volunteers before (pre-) and after (post-) their participation in the Melibee Project Citizen Science Program. Statistical differences between pre- and post- Melibee activity frequency (tested using two-tailed t-tests) is indicated by * ($p<0.05$).



Adapted from LTER Social-Ecological Research Framework (Collins et al. 2011)

Key characteristics of resilient and adaptive thinkers prepared to address climate change issues in social-ecological systems:

Thinking Skill	Theoretical Backing
ability to interpret and apply new scientific information	Carpenter 2002, Fazey et al. 2007
ability to think critically to solve complex problems	Chapin et al. 2010
ability to envision multiple scenarios and prioritize most probable outcomes	Kofinas 2010
Ability to view problems within a social-ecological system context	Chapin et al. 2010
ability to think about future events or future desired ecological states and anticipate the consequences of present actions	Ascher 2009, Tschakert et al. 2010, Tidball & Krasny 2011
ability to make bold decisions in the face of uncertainty	MEA 2005, Fazey et al. 2007, Chapin et al. 2010

Metacognition may help…

Strategy for improving resilience thinking skills?

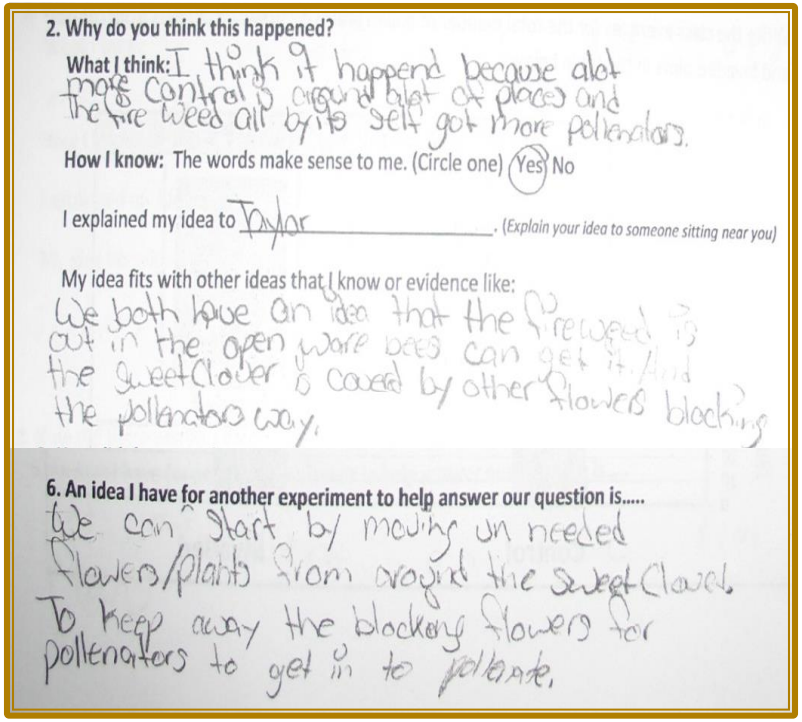
Using Melibee ecological research as a context for learning…

Research Questions:

1. Do metacognitive learning interventions improve student metacognitive ability?
2. Do metacognitive learning interventions affect student ability to perform "resilience thinking" tasks?
3. Does the effect of the intervention vary with student ability level?

Experimental Methods

- Metacognitive intervention experiment with 108 7th graders (6 weeks)
  - Treatment groups:
    - Inquiry learning
    - Metacognitive inquiry learning
- 3 Standards Based Assessments proficiency levels
  - Advanced, Proficient, Below
- Pre-, Post- and Delayed Post-Assessments:
  - Metacognitive skill survey (Sandi-Urena 2008)
  - "Resilience Thinking" written assessment
- Interviews with 24 students



2. Why do you think this happened?

What I think: I think it happend because alot more control is around that at places and the fire weed all by its self got more pollenators.

How I know: The words make sense to me. (Circle one) (Yes) No

I explained my idea to Taylor. (Explain your idea to someone sitting near you)

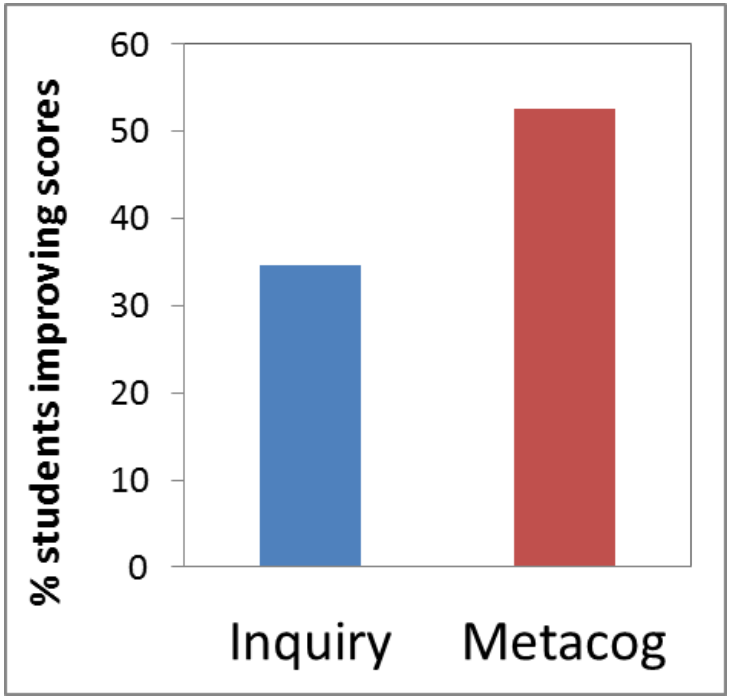
My idea fits with other ideas that I know or evidence like:

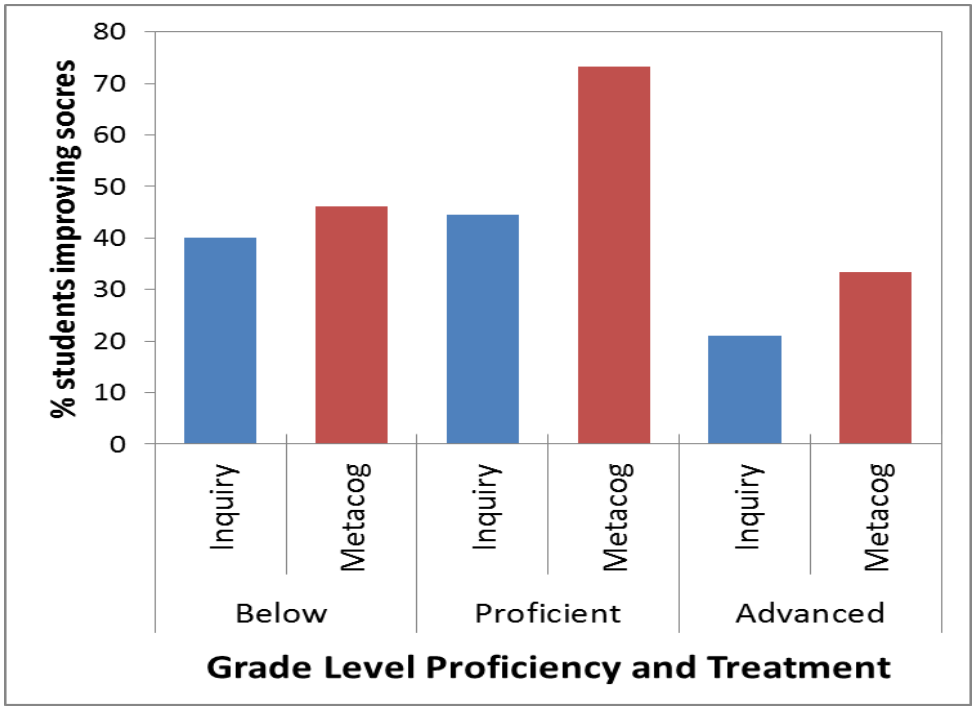
We both have an idea that the fireweed is out in the open where bees can get it. And the sweetClover is caused by other flowers blocking the pollenators way.

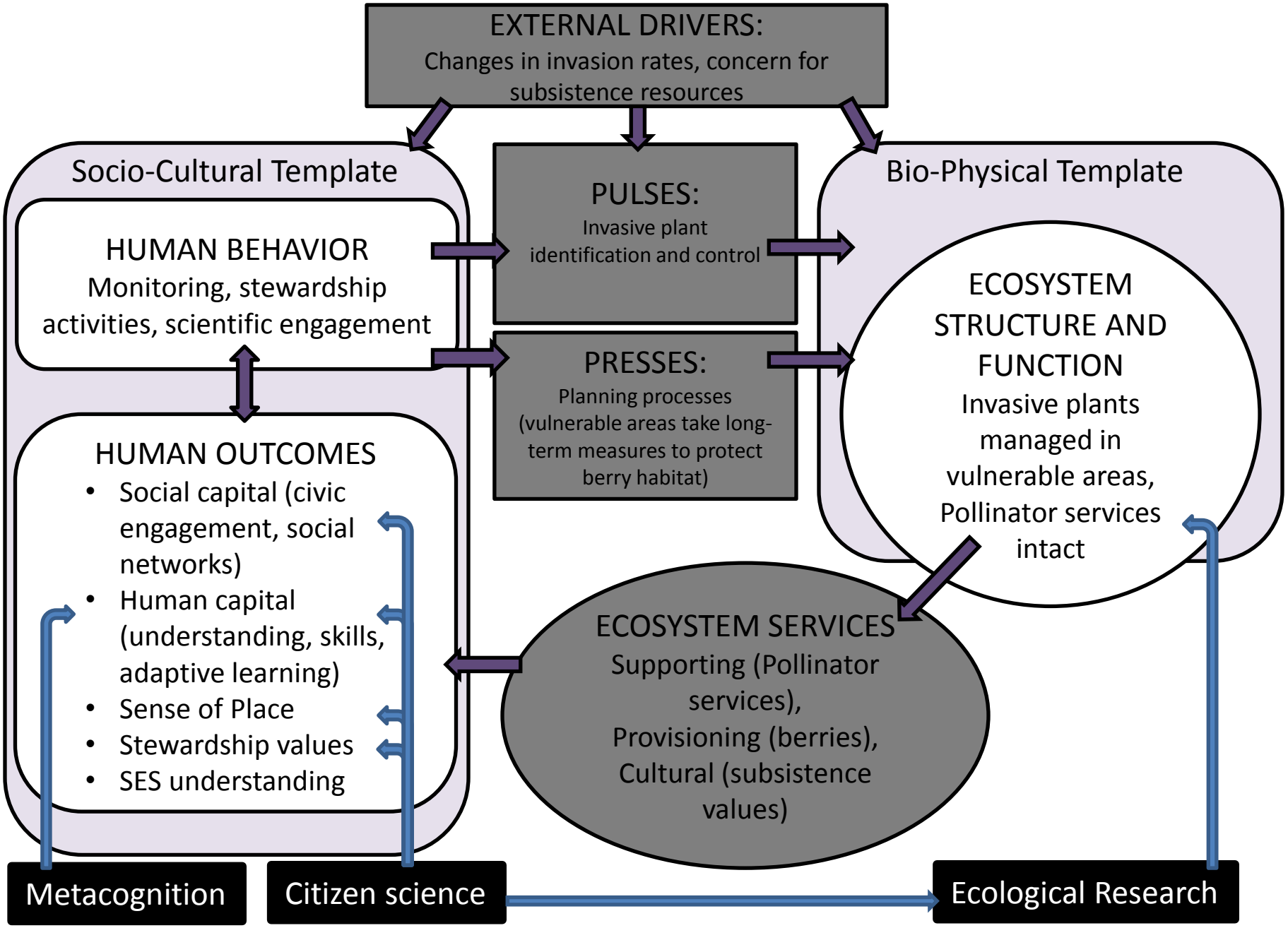
6. An idea I have for another experiment to help answer our question is.....

We can start by moving un needed flowers/plants from around the sweetClover. To keep away the blocking flowers for pollenators to get in to pollenate.

Change in Resilience Thinking Written Assessment Scores







Adapted from LTER Social-Ecological Research Framework (Collins et al. 2011)

Bethel Invasive Plants and Melibee Training Workshop, April 2013

Berry Picking, Ester Dome 1984

Berry Picking, Bonanza Creek 2013