Pyramid Lake Paiute Tribe Climate Change Adaptation Planning

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October 2015

Great Basin LCC Webinar

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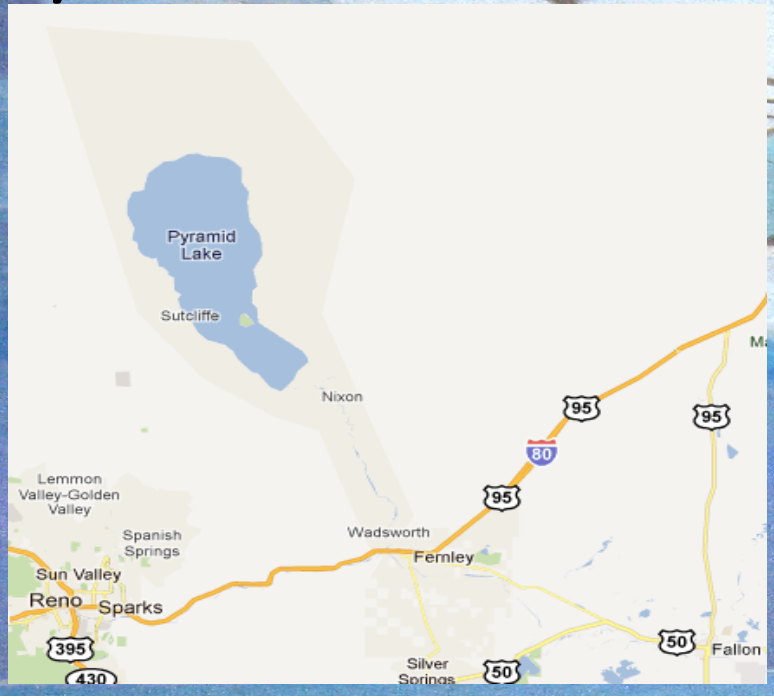
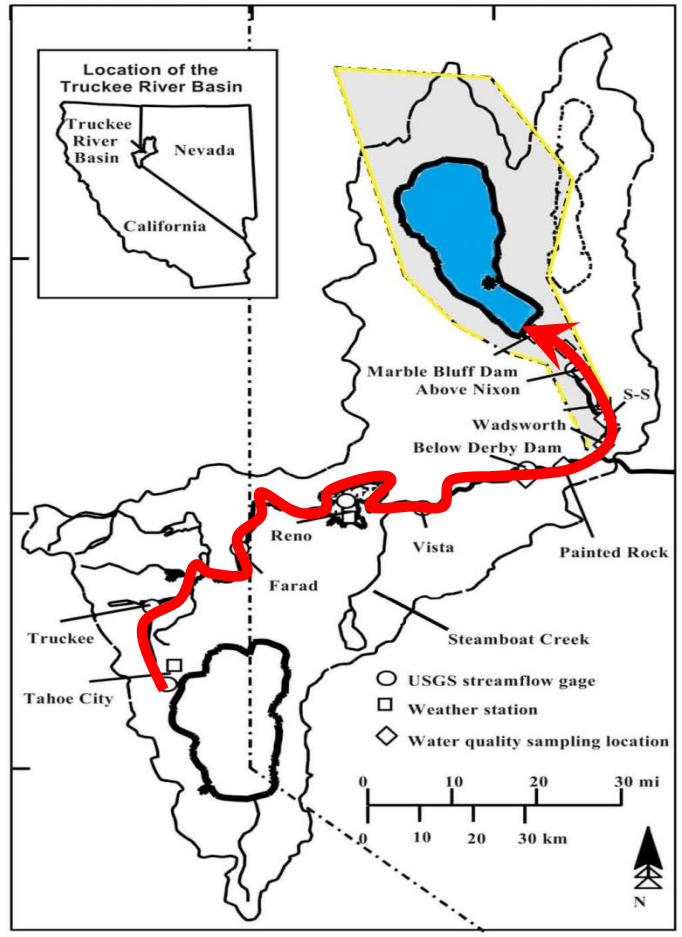


Characteristic	Value
Population	2,253
Housing Units	687
Total Area [acres]	475,000
Population Density [people/mi^2]	3

- Located 35 miles NE of Reno, NV
- Governed by Tribal Council (2 yr terms)
  - 8 council members
  - Tribal Chair
  - Tribal Vice-Chair
- 88% of members live on the reservation
  - 45% in Wadsworth
  - 15% in Sutcliffe
- 44% unemployment rate
- Majority is <35 yrs old
- Median age is 22 yrs old



Truckee River Basin (Warwick et al., 1999)

Pyramid Lake

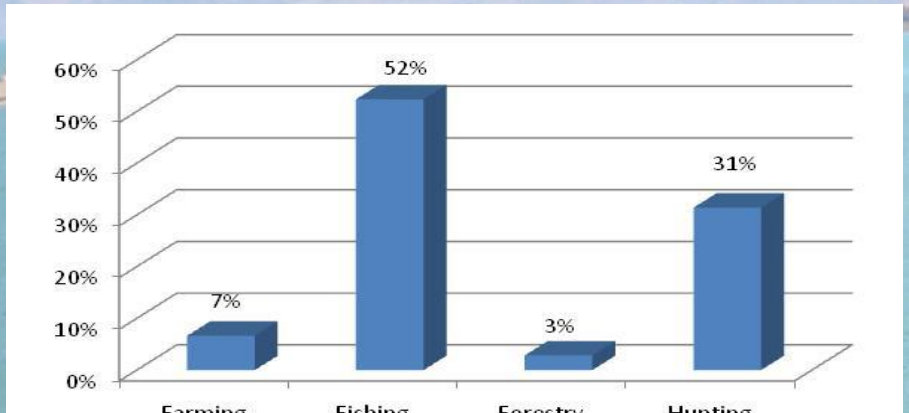
- Considered "*the most beautiful of North America's desert lakes*"
- Name comes from impressive tufa formations – Anaho Island, home to American White Pelicans
- Relic of pre-historic Lake Lahontan
  - 54 million acres, 900 ft deep, one of largest lakes on continent
- Requires 300,000 to 400,000 AF to Sustain Elevation
- Salinity is 1/6 of sea water
- Lake has no outlet and one inlet at its south ("endorheic lake")

Tribal Economy

- Mostly centered around fishing and recreational activities at Pyramid Lake
  - permit fees for fishing
  - day use and overnight camping


Lahontan Cutthroat Trout (LCT)

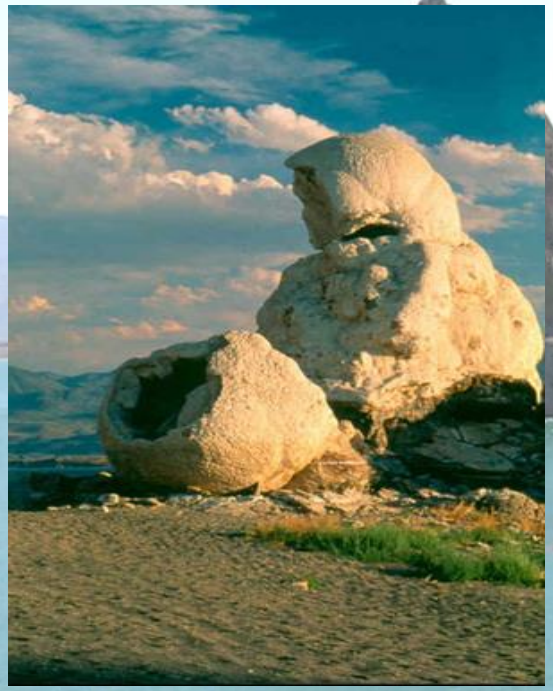

Fishermen sitting on ladders while fishing for LCT



Cultural Perspective

- Identity is bound in Cui-ui
  - Tribe's name is "*Kuyuidokado*" or cui-ui eaters
- Lake is "*Cui-ui Panunadu*", meaning fish in standing water
- Tufa formation of Anaho Island is"*Wono*" meaning cone-shaped basket
- Origin story is based on Stone Mother which resembles a woman with a basket whose tears for her children created

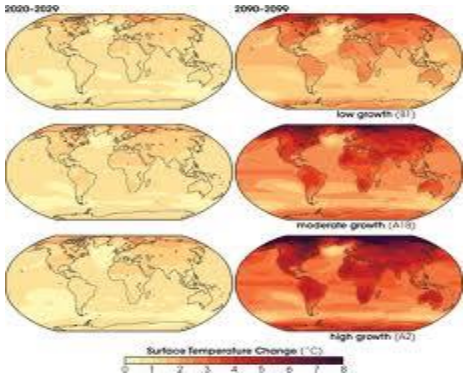
Cui-ui

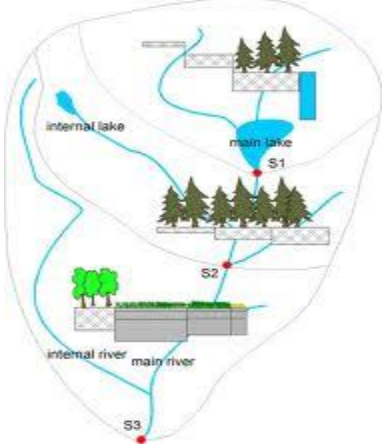


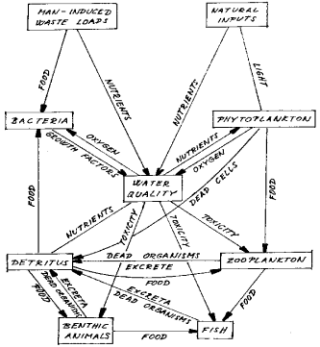
Objectives

- Understand tribal perceptions of climate change
- Describe the evolution of the Pyramid Lake Paiute Tribe water rights in the Truckee River
- Determine the climate change adaption potential of the Pyramid Lake Paiute Tribe through development of a conceptual framework for assessing vulnerability and resiliency

Typical Vulnerability Assessment







Climate Model

Biophysical system focused and Top-down

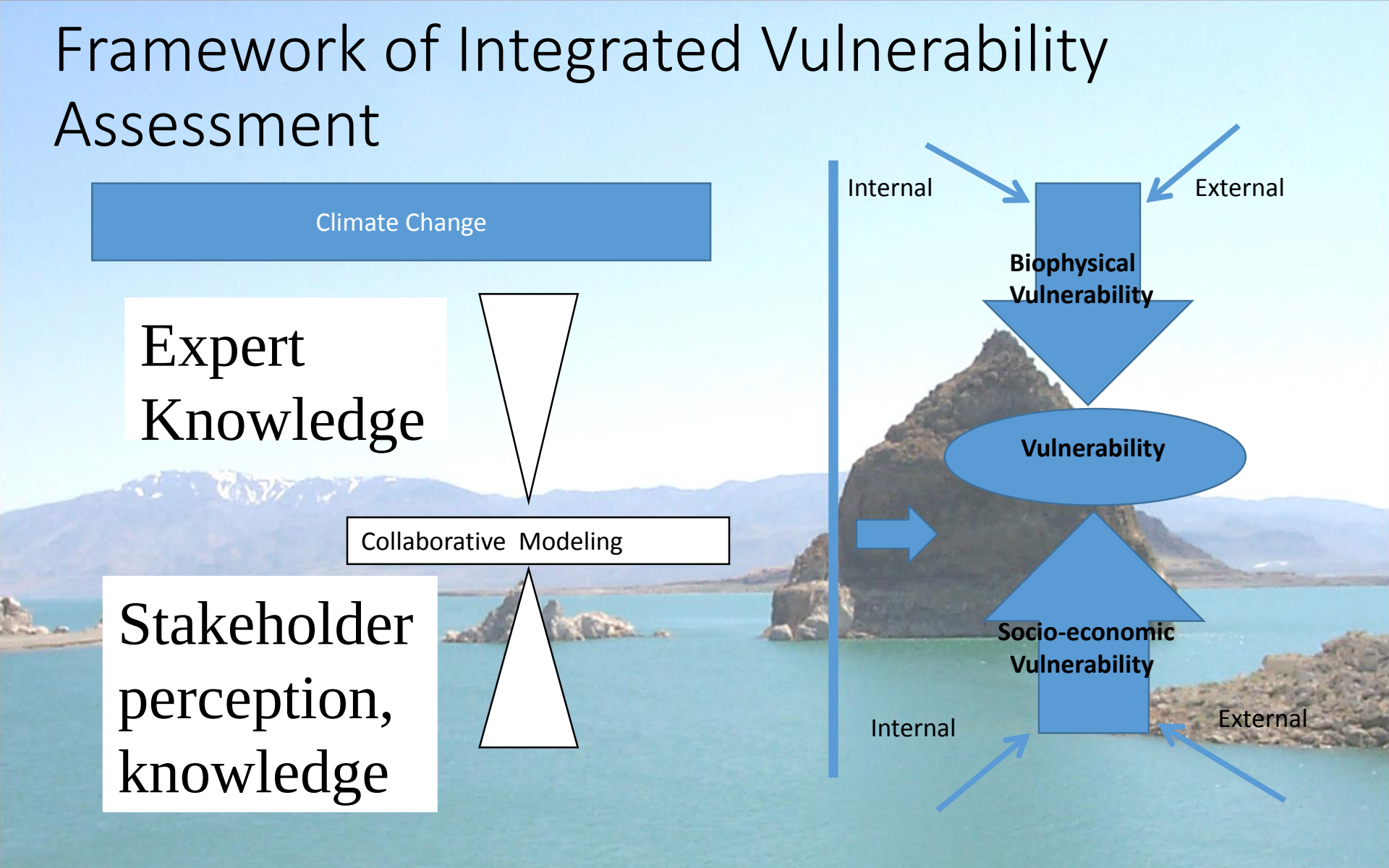
Watershed Model

Hydrodynamic/Water quality and Fisheries Model

Future Climate Change impacts

Climate Change Adaptation Planning

Framework of Integrated Vulnerability Assessment



Methods

- Literature Review
- Climate Change Surveys
- Interviews
  - Open-ended Questions: January 31-February 2, 2011
  - One-on-One Interview: May 17-20, 2011
- Power Analysis
- Focus Group Discussion
- Model Development
- Coupling of Human and Natural Systems

Climate Change Survey for Farmers and Ranchers in Nevada

Fallon, Nevada. Example of a Great Basin Curvilinear Petroglyph etched into a rock about 2-3000 yrs ago. The abstract form indicates that the artist had a sophisticated artistic sense. People who lived here fished and hunted in Lake Lahontan, which is now dry. (Source: http://www.jimpowers.com/ptrglph4.htm)

The purpose of this survey is to gather information on the perspectives Nevada ranchers and farmers regarding climate change. The reason that we are conducting this survey is to help researchers in our National Science Foundation-funded research project at UNLV, UNR and DRI, as well as natural resource managers in Nevada, better understand Nevada's ranchers and farmers' perceptions of climate change. This will aid researchers and managers in understanding how to best connect with Nevada ranching and farming communities regarding climate change. This is why this survey asks about your concerns, perceptions, and knowledge. The survey will take approximately 20 minutes to complete. The responses you provide are **very much appreciated**, and will be kept **confidential**. Should you have any concerns about the way the survey has been conducted, please contact Dr. William James Smith, Jr. at the School of Environmental and Public Affairs at UNLV at bill.smith@unlv.edu and (702) 895-4440, or contact the UNLV Institutional Review Board at OPRSHumansubjects@unlv.edu and (702) 895-2794. ***Thank you very much for your time and effort during this busy holiday season!***

Demographic Information

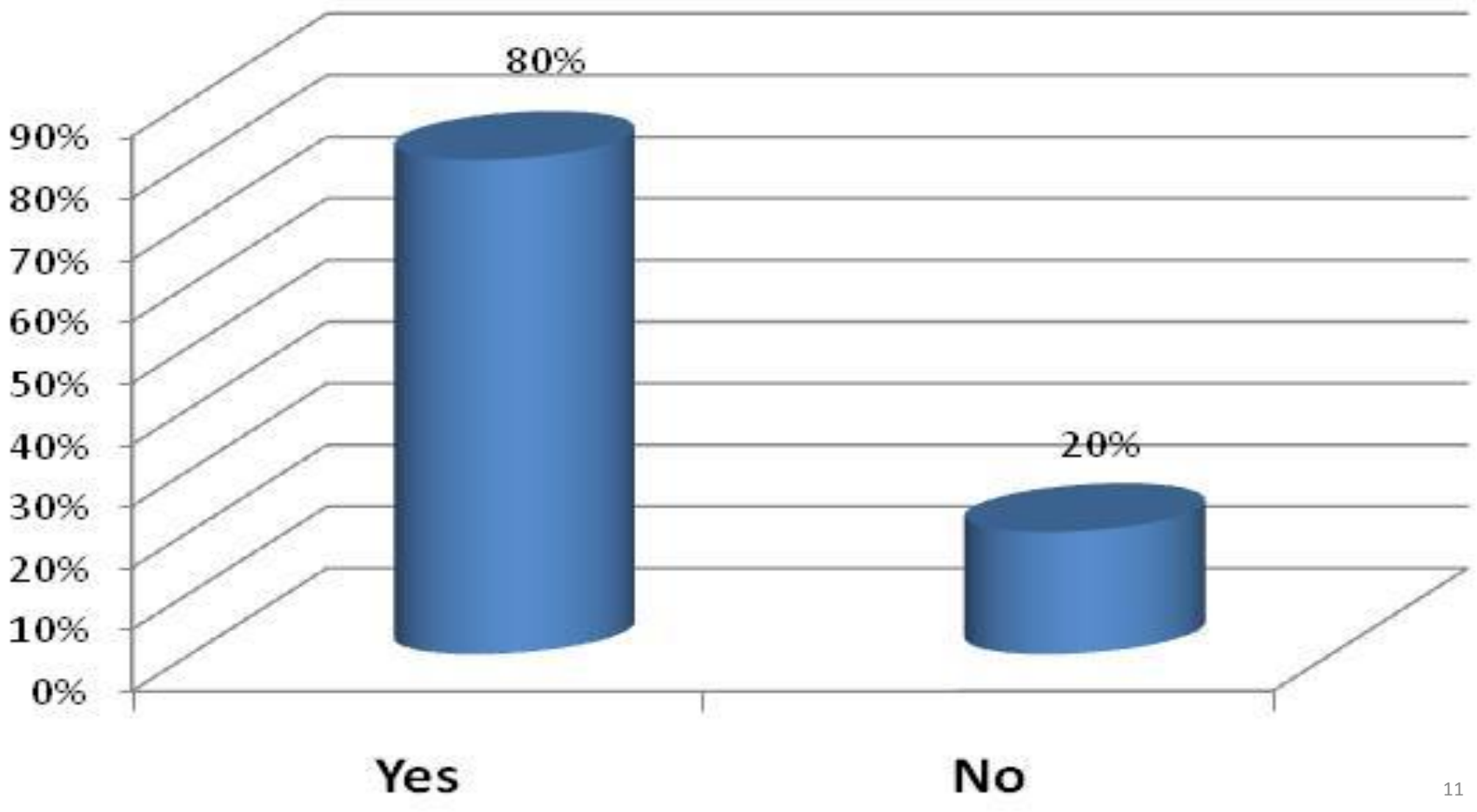
This section assesses the participant's basic demographic information.

1. Age _____
2. Gender
   - ☐ Female
   - ☐ Male

Survey techs cont.: House-to-house by NA undergrad and pow-wow

Attended NA EM meetings around NV

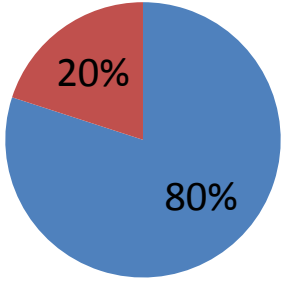
Awareness of Climate Change

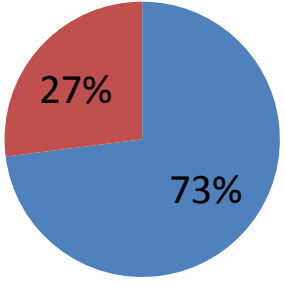


PLPT Climate Change Perspectives

Surveys with tribal members indicated

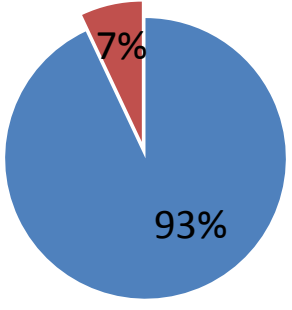
80% were aware of climate change and observed changes in their environment





73% believed climate change is happening and humans play a role in climate change

93% expressed their priority for climate change action at the national level (Gautam et al. 2013)



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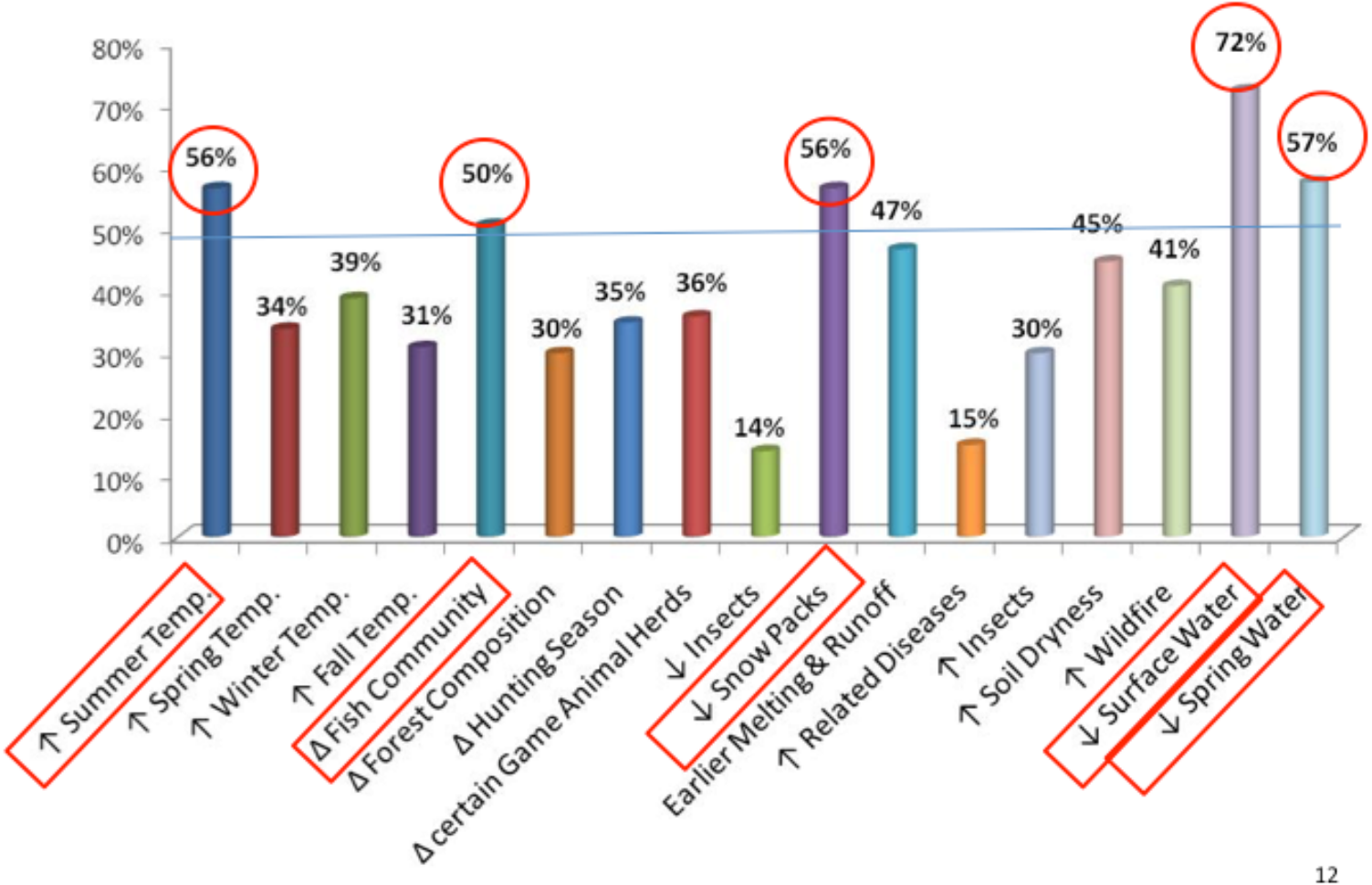
Observed Environmental Changes



Interviews

Key Themes
Local Context
Livelihood assets: Capacity and vulnerability
Social or intrinsic Vulnerability
Sensitivity and exposure
Adaptive capacity
Future: Challenges and vulnerabilities

Socio-economic Vulnerability

Internal Factors

- Education and employment
- Climate Change perceptions
- Institutional capacity
- Technology
- Physical Capacity
- Economic resources and financial capital
- Social capital
- Natural capital

External Factors

- Federal support and entitlement
- Power relation and legal stressor
- Job opportunity and migration

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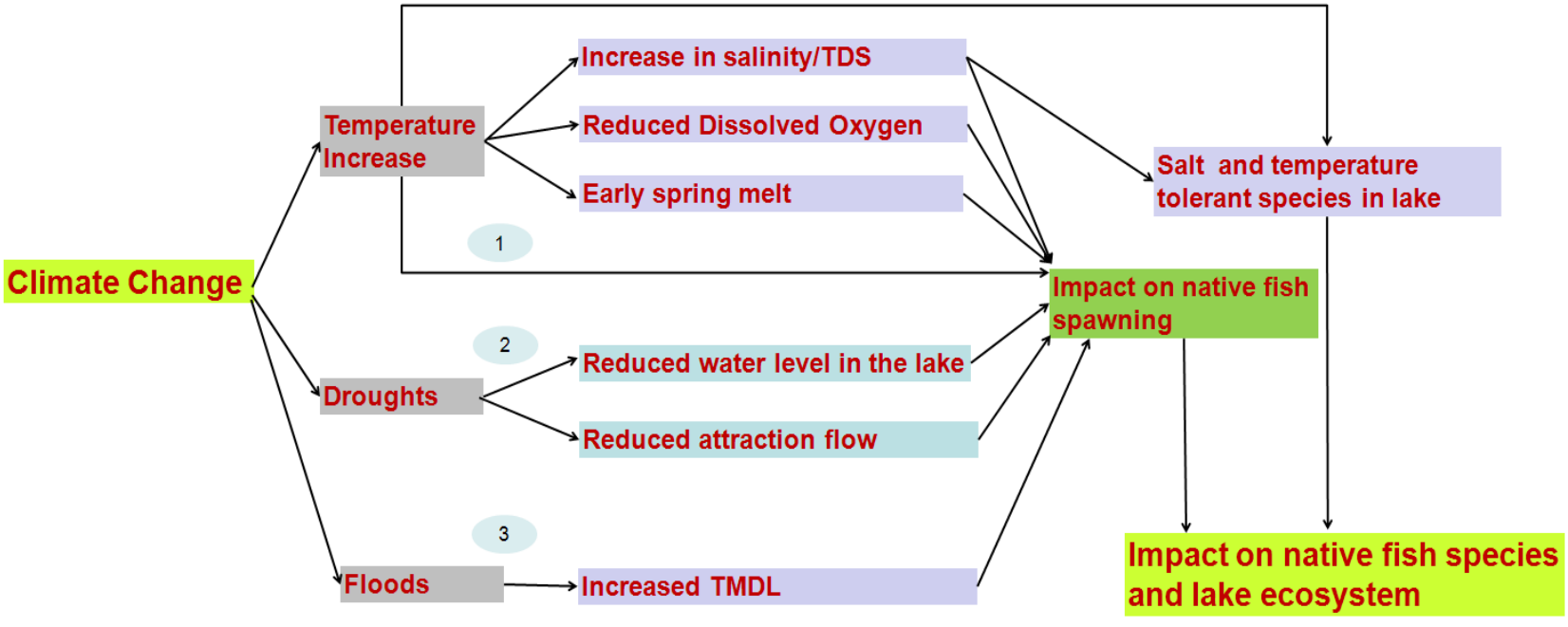
Focus Group

Expert Cognitive Map



Expert Cognitive map based on literature review

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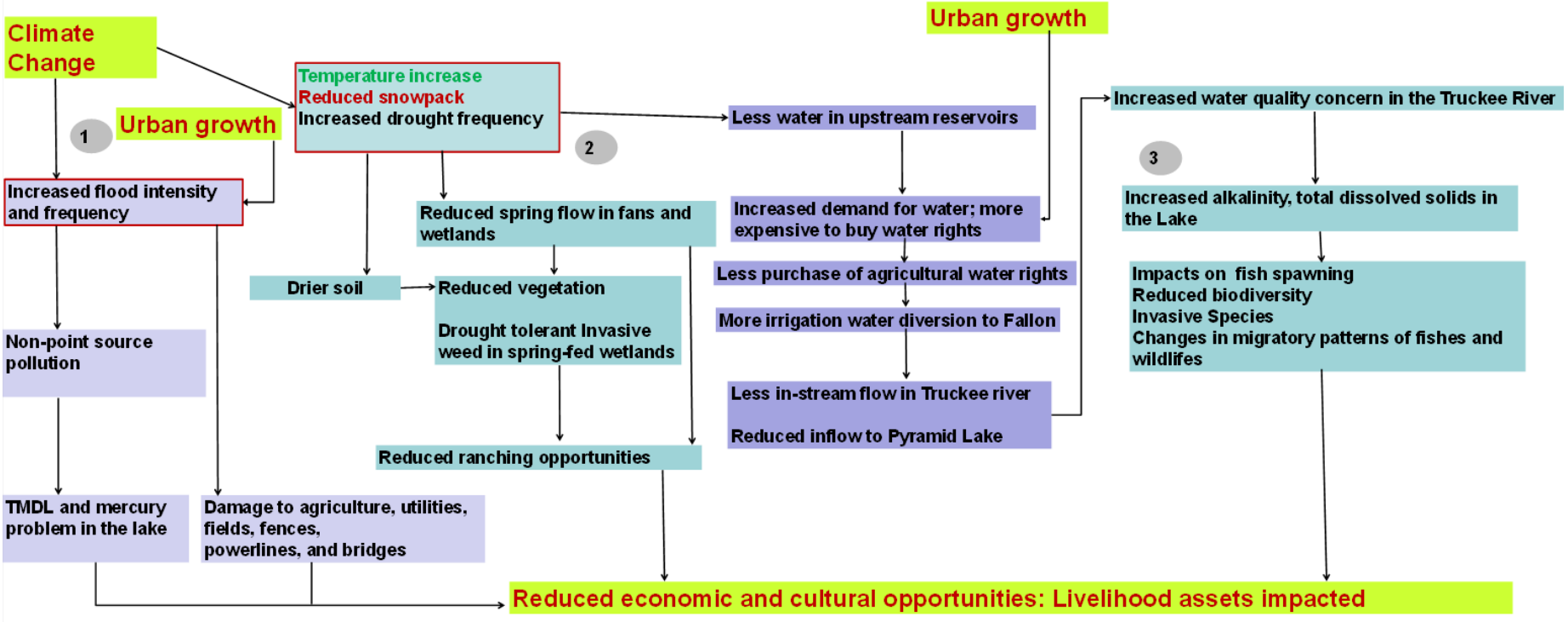
Tribal Cognitive Map



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Workshops and Presentations

Project Kickoff Meeting
Nov. 2012

National Congress of American Indians
June 2013

Climate Change Planning Workshop
Sept. 2013

Nevada Water Resources Association
Nov. 2013

Great Basin Consortium
Dec. 2013

Scenario Discussion
Aug. 2014

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Climate Change Workshop

Two-day Workshop with tribal members held September 25-26, 2013 at the Nixon Gym:

- About 20 participants
- Discussion of our research
- Presentations on management plans for cui-ui, rangelands & pelicans at Anaho Island
- Participatory exercises

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Participatory exercises

Participants were asked to consider:

- Environmental, water & ecological challenges facing Pyramid Lake
- Management alternatives and solutions to these challenges

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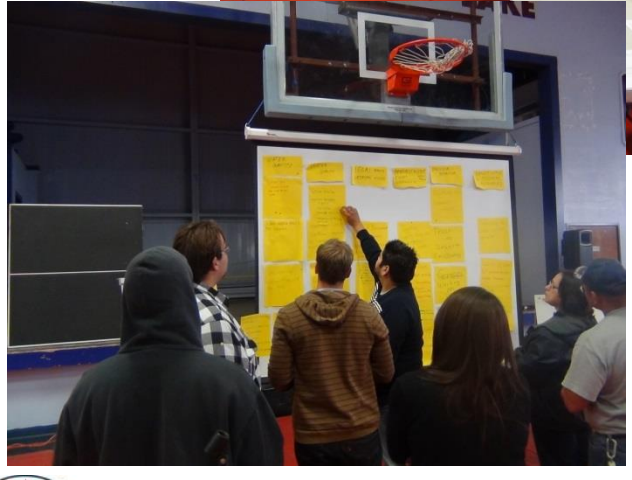
Participatory exercises

- Participants wrote all possible issues on large Post-it notes
- Read each note out loud and collectively decided on emerging categories
- Everyone voted with “dot stickers” to assign priority



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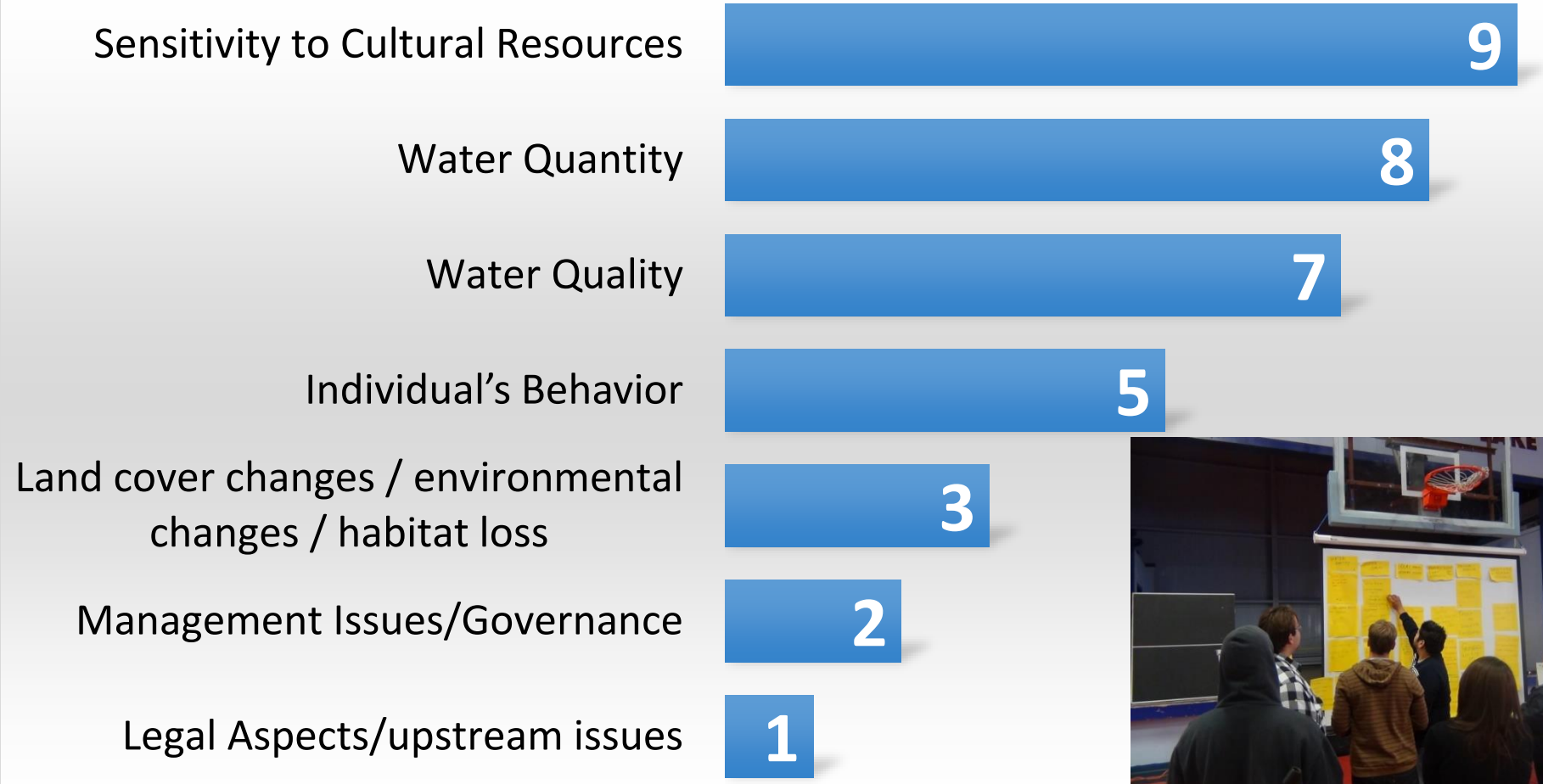
Categories of challenges



Ecological indicators

Water Quantity

- Lake level
- Snow pack
- Spring flow rate & duration
- Water table height
- Upstream reservoir storage

Water Quality

- Water temperature
- Dissolved oxygen
- Concentration of calcium carbonate
- Total dissolved solids
- Nutrients
- Cyanotoxins (blue/green algae)

Land cover, environmental changes / habitat loss

- Bird count / wildlife census
- Botanical census
- Annual migration count of Cui-ui
- Benthic surveys
- CREEL - count of fishing (Stations)
- Particulate matter / aerosols

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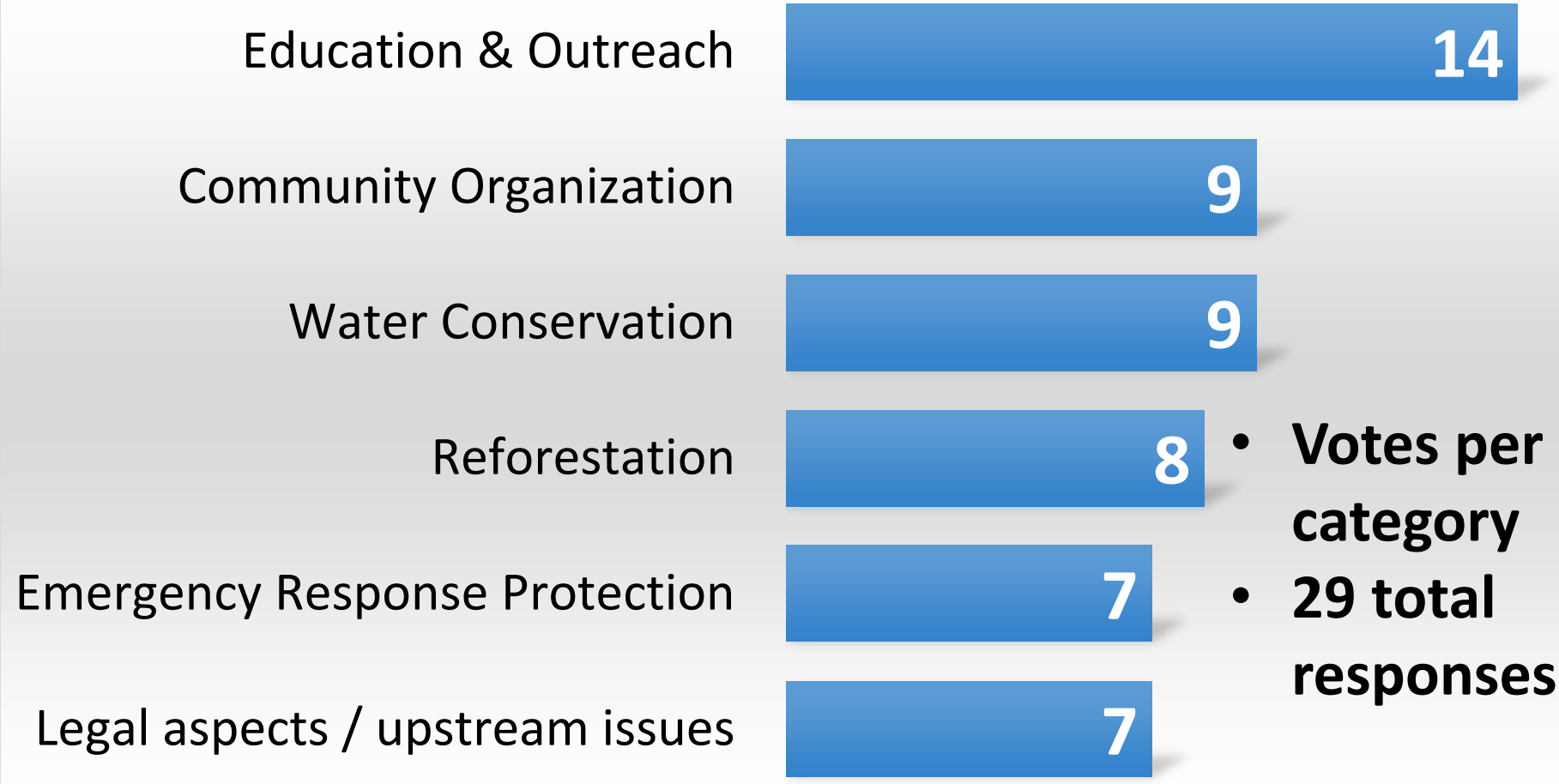
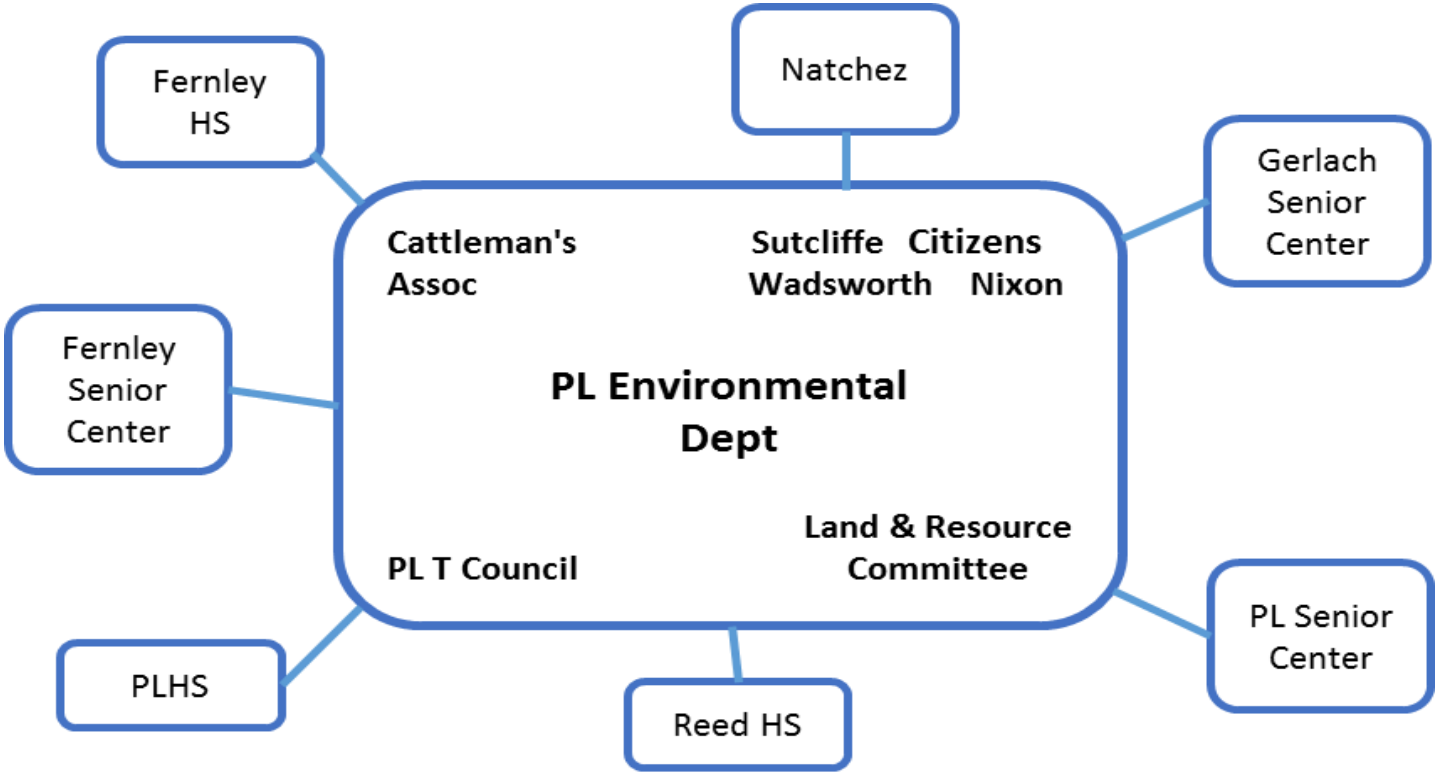
Management Alternatives & Solutions



- **Votes per category**
- **29 total responses**

Community Network



Participant's Diagram from 2013 Workshop (Solution #28)

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Adaptation Recommendations

1. Manage Stampede Reservoir releases at convenient times for cui-ui spawning
2. Increase irrigation efficiency which will reduce water demand and follow soil conservation practices which will improve water quality.
3. Revisit Operations of Marble Bluff Dam to adapt to changes the hydrologic regime of the river
4. Revisit hatchery operations to adapt to changes in fish populations.

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Adaptation Recommendations

5. Maintain and enhance efforts to restore the natural riparian habitat of the Truckee River
6. Adapted urban planning and residential outdoor landscaping to promote water harvesting of storm runoff, reduce erosion, enhance water quality, water for community gardens.
7. Integrated comprehensive Emergency Response Plan (for mitigation of chemical pollution and sediment pollution upstream)

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Adaptation Recommendations

8. Monitoring environmental indicators is important.
9. Outreach: Engage schools and the community. Teach the value of environmental and cultural resources,, and the opportunities to face today's challenges, as well as the role of the youth.
10. Establish tribal led reservation-wide initiatives to increase education of global change and protecting the environment. Involve high schools and senior centers.

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Tribal Support for Adaptation

- Developing an effective adaptation plan requires buy-in and support from tribal government and community (pass a tribal resolution which supports the development of adaptation plan)

- Three-day course in October 2013 at DRI hosted by the Institute for Tribal Environmental Professionals (ITEP)

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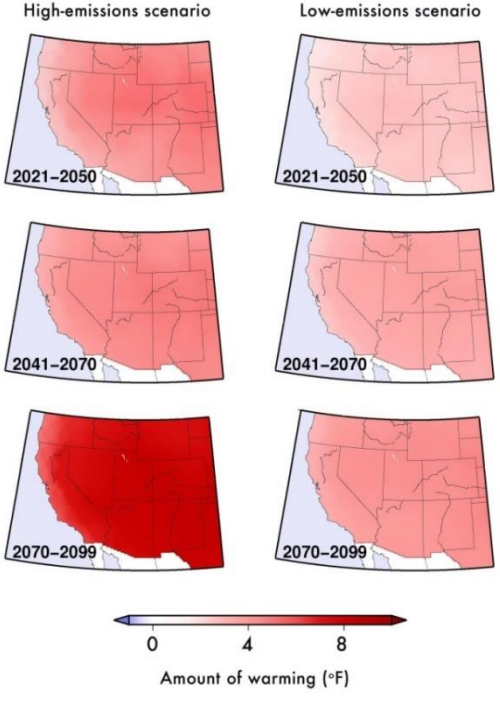
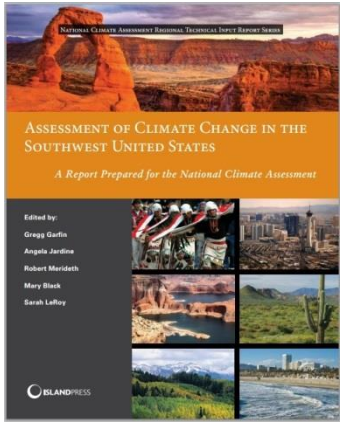
Climate Projections for US Southwest

Temperature change (°F)



Temp. increase of 3 to 9°F

Southwest Climate Change Assessment Report



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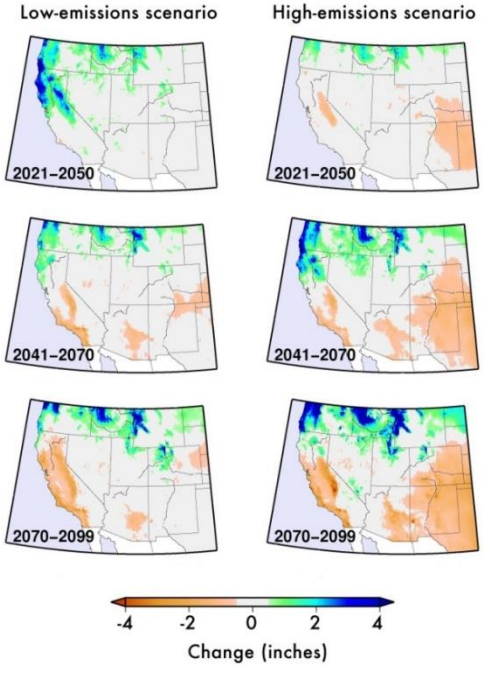
Precipitation change (in.)



2 in. decrease to 2 in. increase

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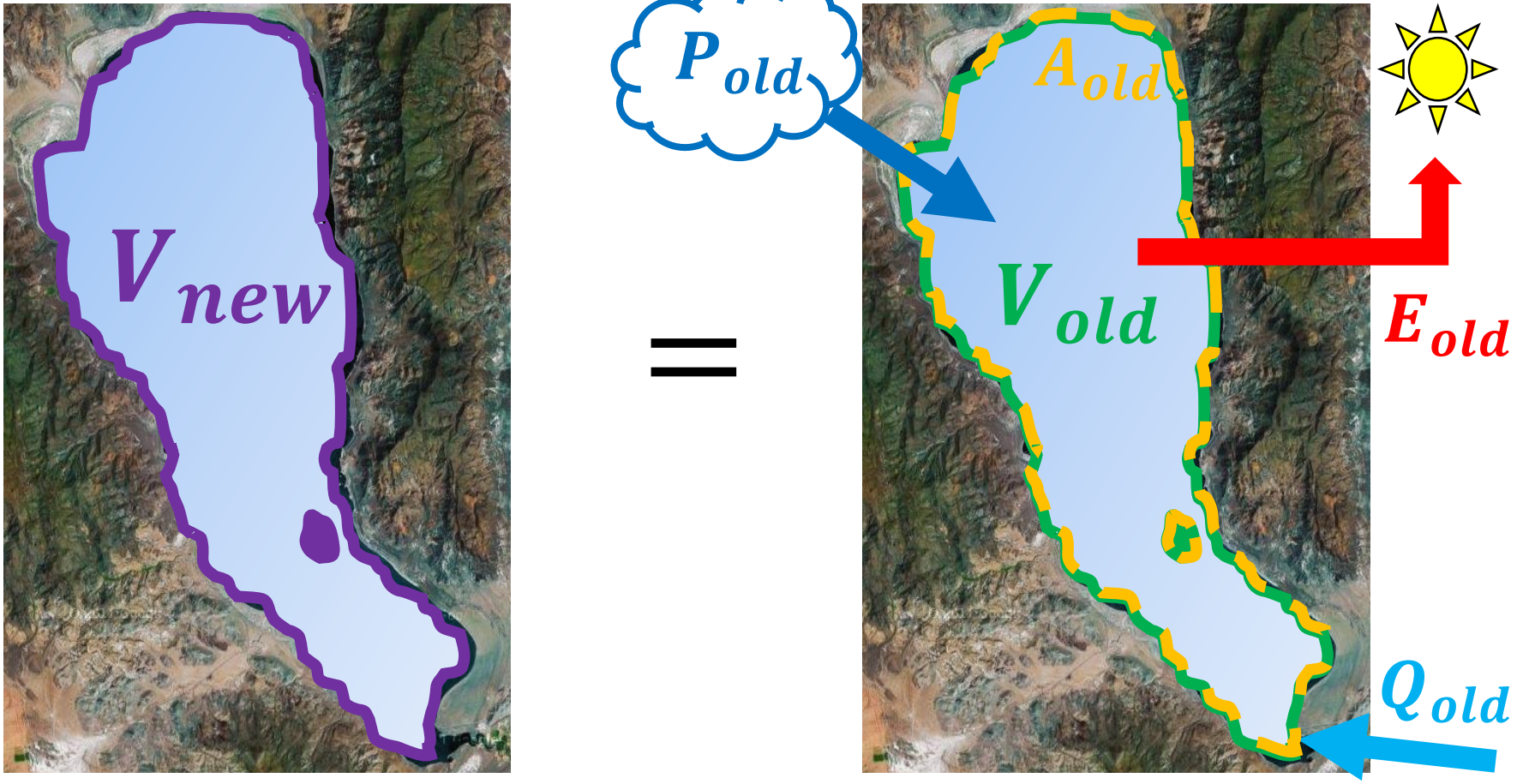
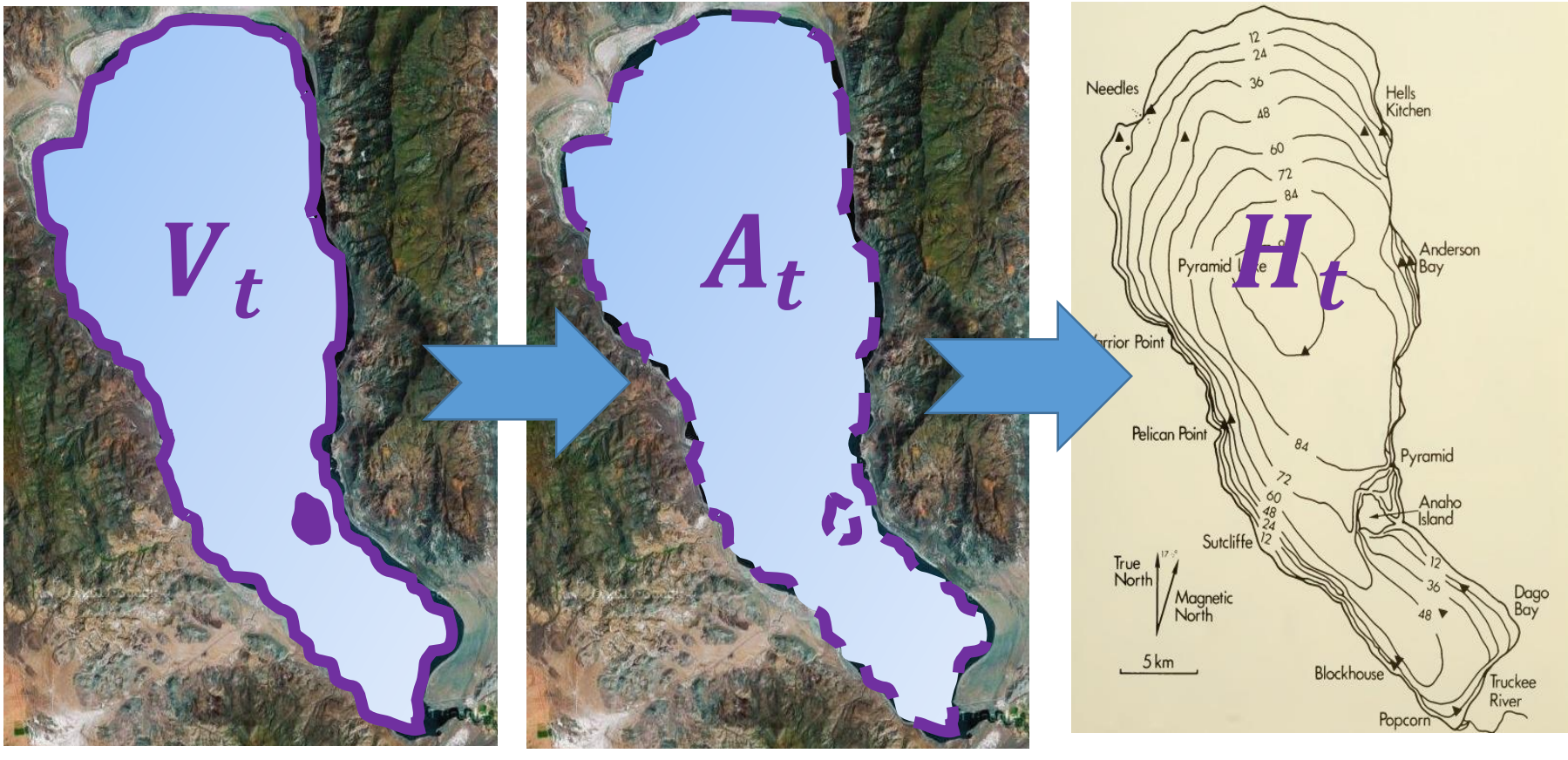
$$V_t = V_{t-1} + (Q_{t-1} \times T) + (A_{t-1} \times P_{t-1} \times T) - (A_{t-1} \times E_{t-1} \times T)$$

Current time step (t)

Previous time step (t-1)



Model outputs for surface area (A_t) and elevation (H_t) can be inferred from volume (V_t) using lake bathymetry



Lake Elevation Climate Scenarios

- Hypothetical future climate scenarios were developed for the model up to the year 2100 in order to simulate:
  - Decreasing Truckee River flows into the lake
  - Increasing Temperature
  - Decreasing Precipitation
- These are hypothetical scenarios which use modified historical records of river flow.

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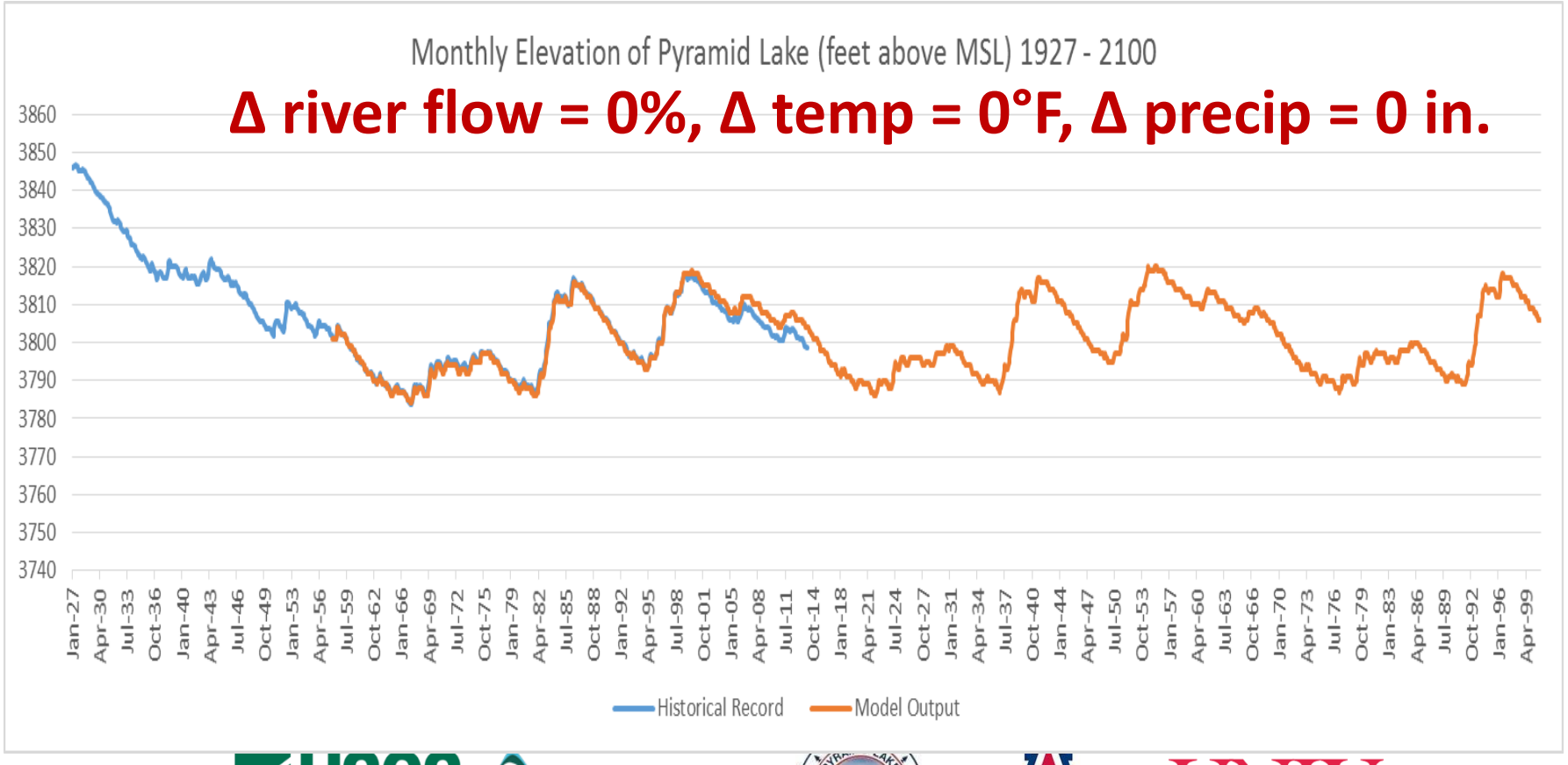
Lake Elevation Climate Scenarios

Scenario	Change in River flow ΔQ	Change in Temperature Δθ	Change in Precipitation ΔP
0) No change	0	0	0
1) Decrease river flow by 5%	-5%	-	-
2) Increase river flow by 5%	+5%	-	-
3) 2°F temp. increase by 2100	-	+2°F	-
4) 1 inch precip. decrease by 2100	-	-	-1 inch
5) Combined scenarios 2-4	-5%	-1 inch	+2°F

No Changes in flow, temp, precip



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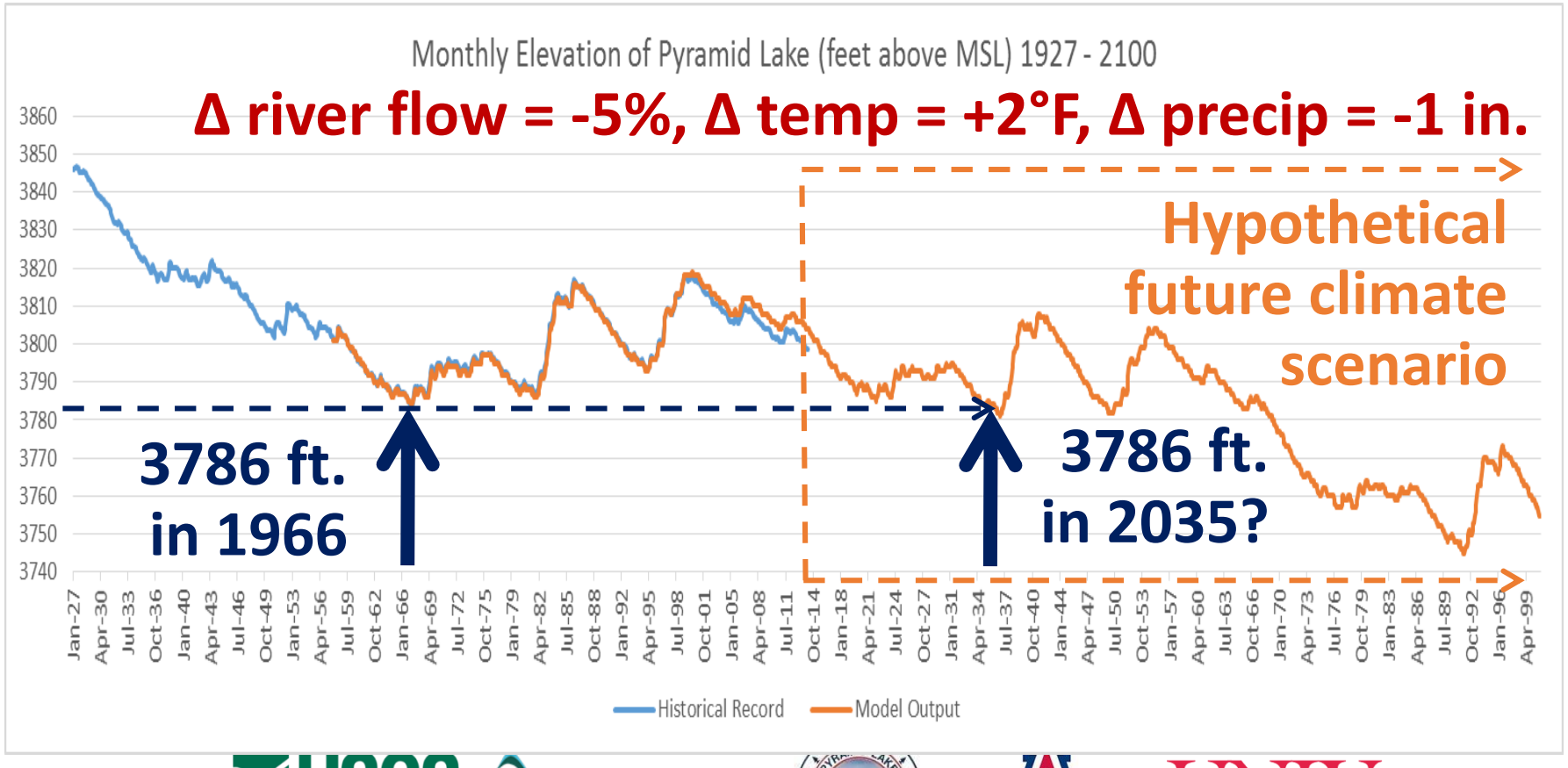
↓river flow, ↑ temp and ↓ precip



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Future of Cui-ui & LCT?

Δ flow = ?5%, Δ temp = +2°F, Δ precip = -1 in.

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Conclusions

- PLPT's vulnerability to climate change is tied to a **cultural and economic dependence on Pyramid Lake**
- **External socio-economic factors** influence adaptive capacity and amplify potential impacts
- The sustenance of Pyramid Lake ecosystem is extremely important for **economic, spiritual, and cultural** reasons and this is reflected in the fact that cui-ui, the lake, and people are considered the three central components of tribal identity.
- **Climatic and non-climatic impacts threaten** the endangered cui-ui fish by decreasing water quantity and quality.

Conclusions

- An **integrated analysis** that **merges biophysical and socioeconomic vulnerabilities** using model driven (top–down) and local perception-knowledge driven (bottom–up) is needed to precisely quantify these impacts and uncertainties.
- Despite limited economic opportunities and dwindling federal support, PLPT's adaptive capacity is strengthened by **sustainability-based values**, **technical capacity** for natural resource management, **proactive initiatives** for invasive-species control, strong **external scientific networks**, and a remarkable **awareness of climate change**.
- Like many tribes, PLPT would benefit from **increased federal funding** for tribal climate change programs, and its resilience would be enhanced by selective **sustainable economic development** that is sensitive to the relatively unique context of PLPT.

Next Steps

- Assess Feasibility of Adaptation Strategies
- Develop and Implement Tribal Climate Change Adaptation Plan
- Continue Hydrologic Analysis and Scenario Planning using the model

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Thank you!

For more information:

http://nativeadaptation.arizona.edu/

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