TREES, STREAMFLOWS, AND WILDFIRES: DO WE HAVE THE RIGHT MIX?

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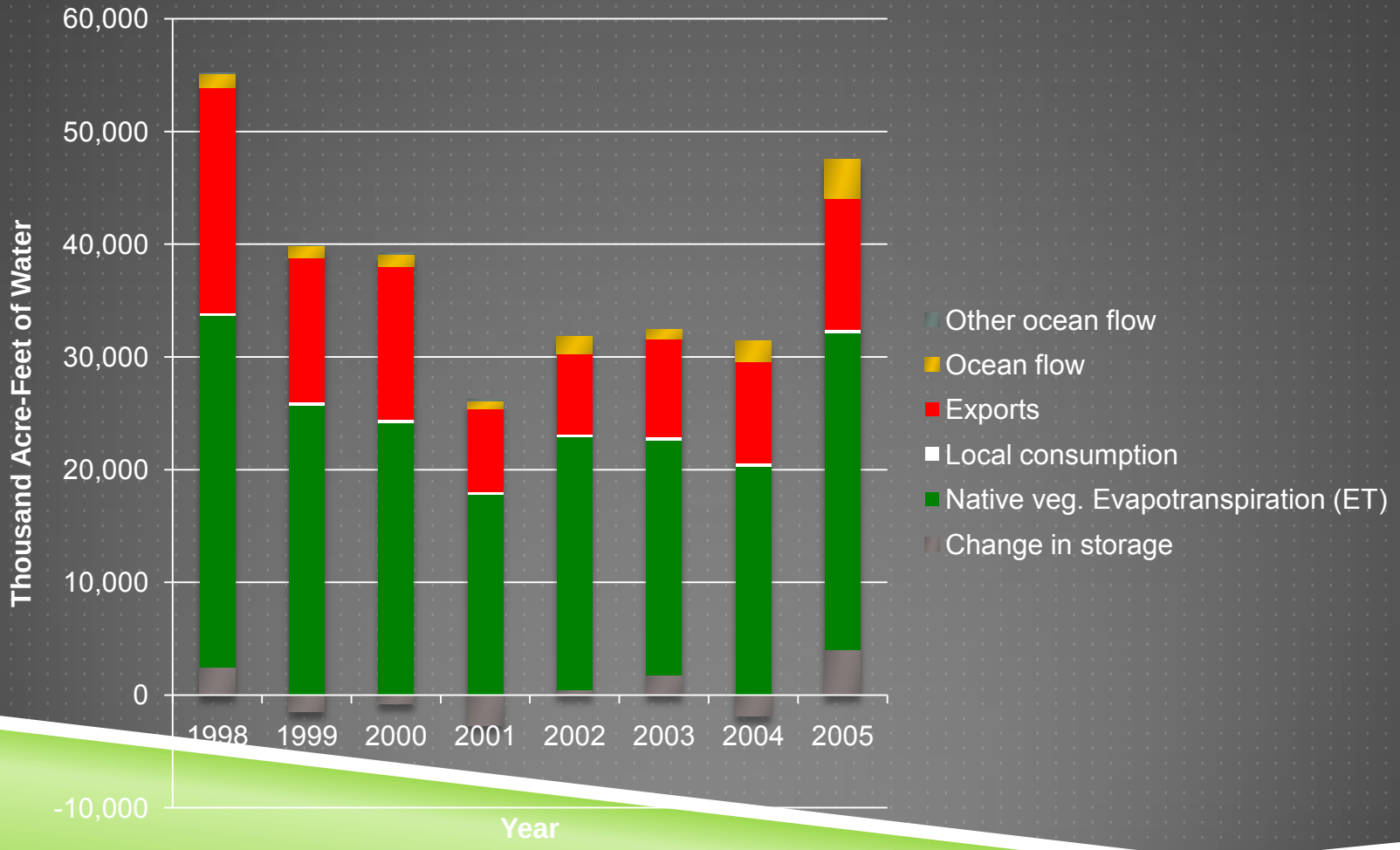
HOW WILL STREAMS CONTINUE TO RESPOND TO THE MOONLIGHT FIRE?

Water Balance for the Mountain Counties (Feather to the San Joaquin Rivers) 1998-2005 (DWR Water Plan Bull. 160)



Source: DWR Bulletin 160 (2009)

THE BAY DELTA PLAN PROJECTS DECLINING INFLOWS AND MORE DEMAND

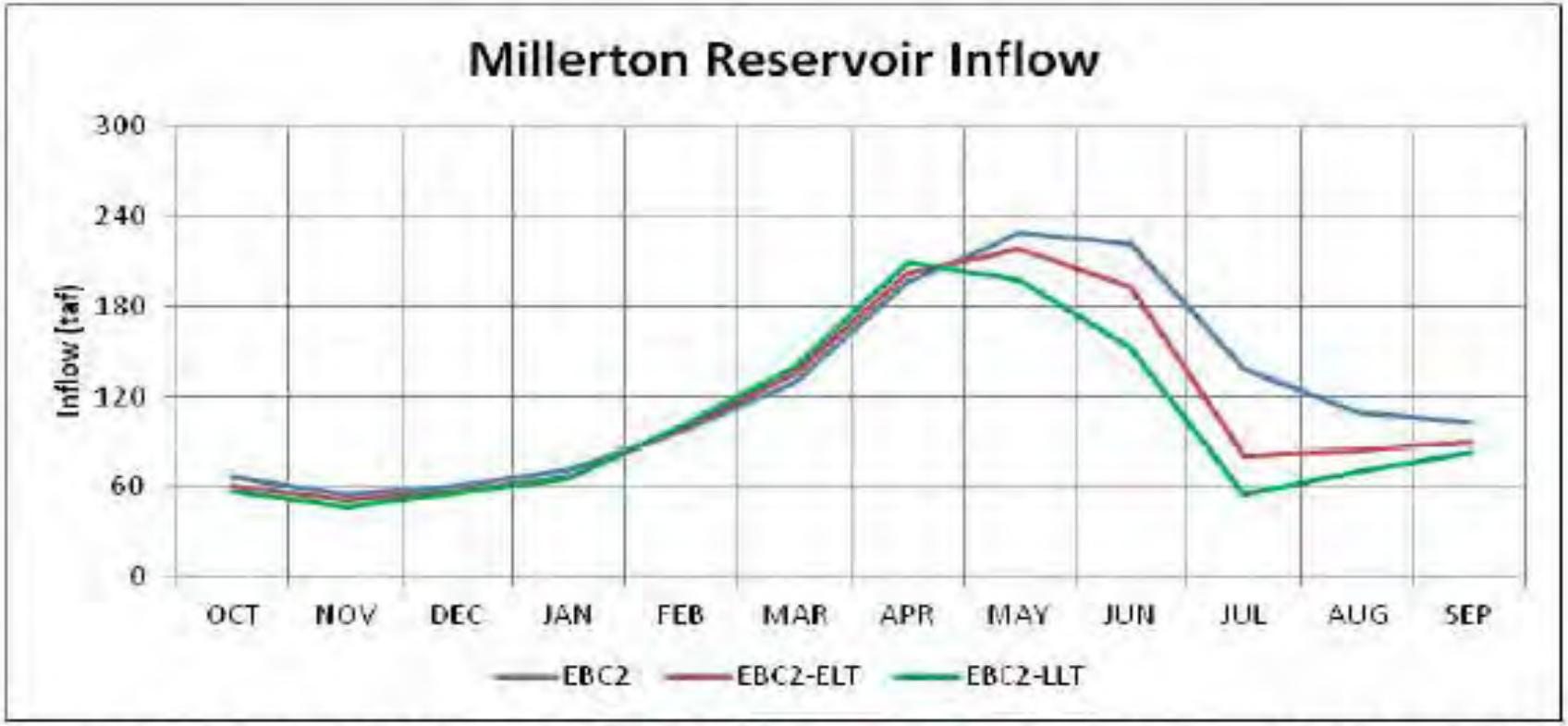
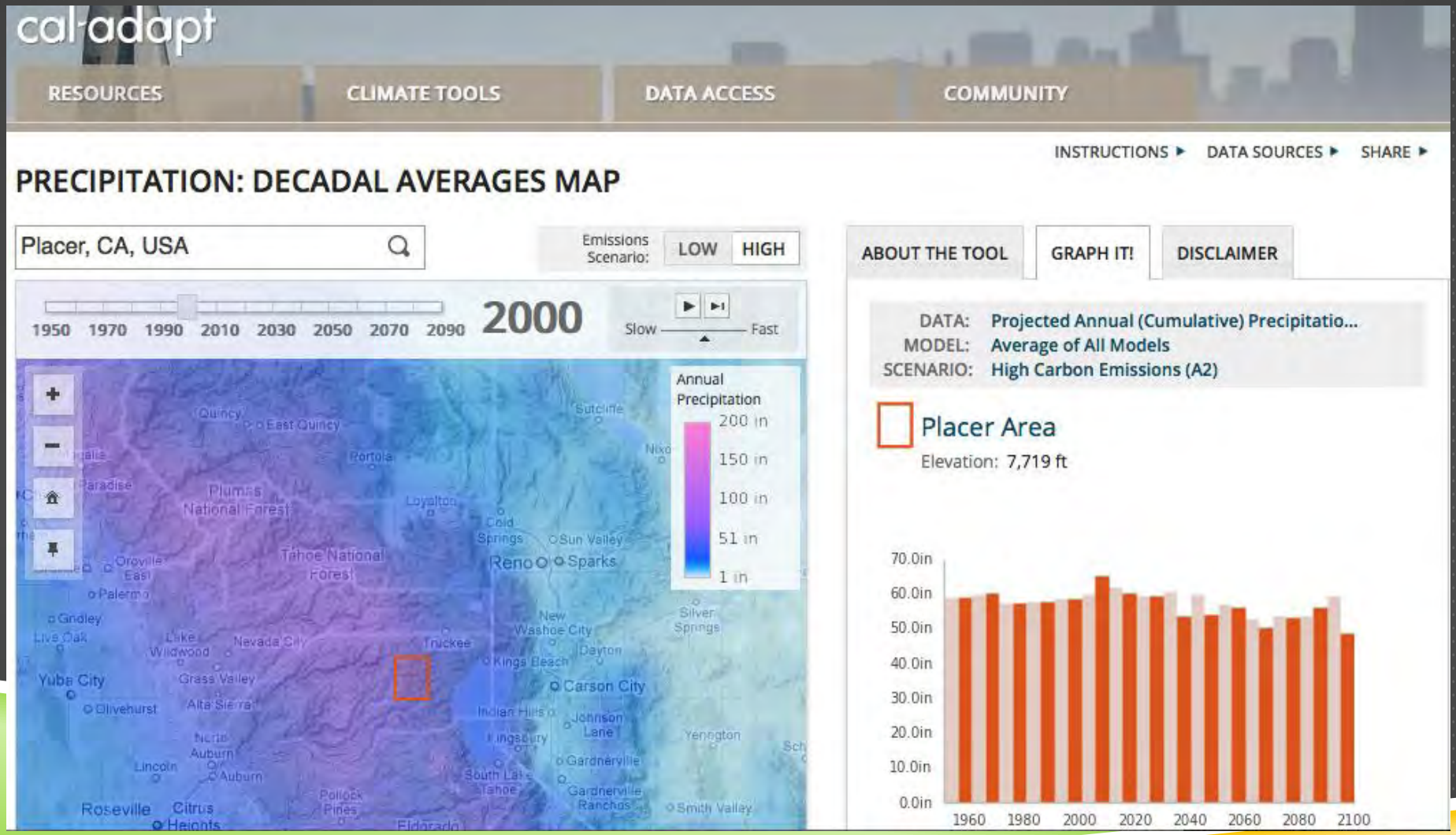


Figure 5A.2.4-8. Projected Shifts in the Monthly Median Millerton Reservoir Runoff (TAF) from Existing Conditions to Early Long-Term (2025) to Late Long-Term (2060)

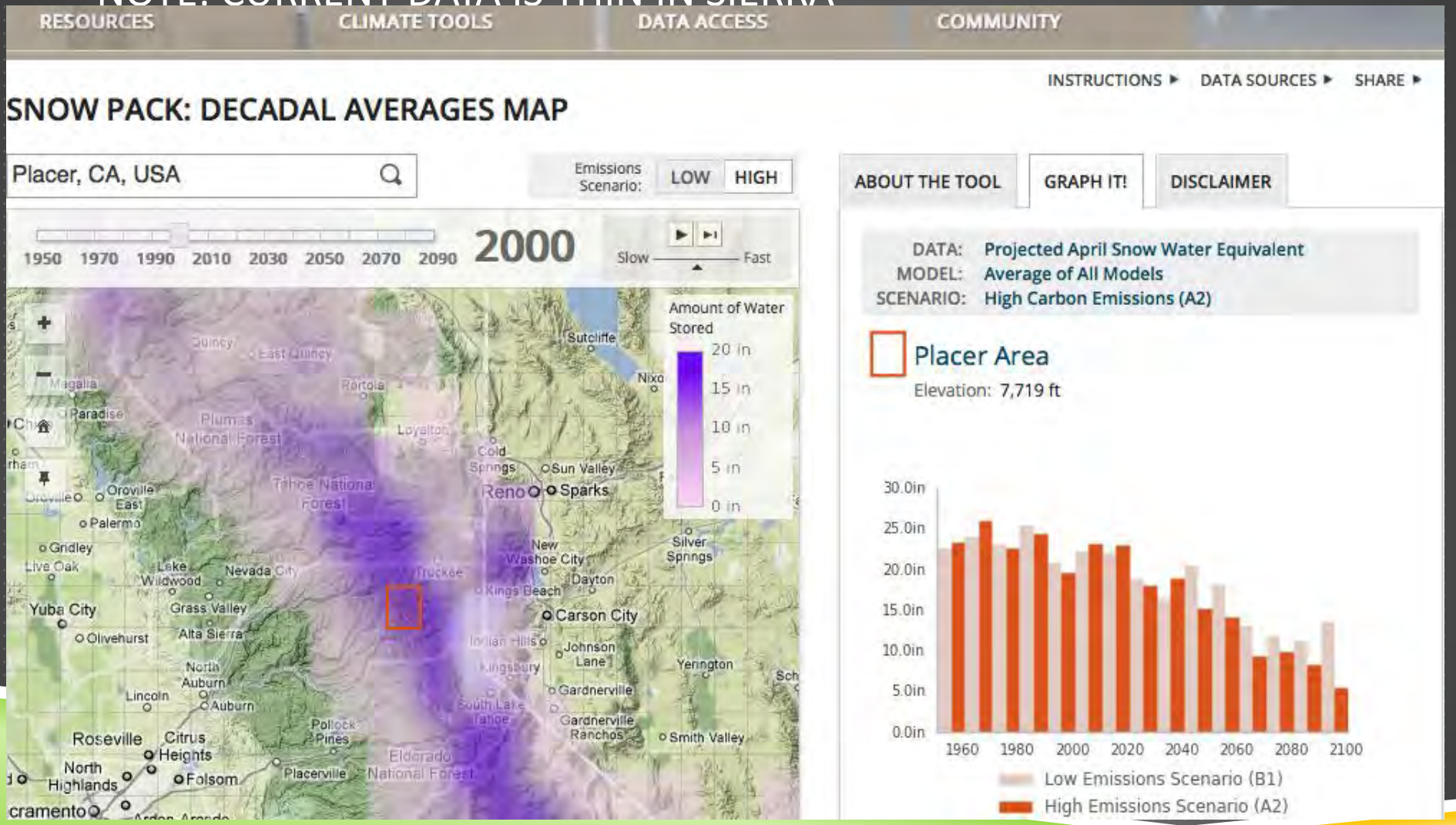
CAL-ADAPT.ORG – STEADY PRECIPITATION

NOTE: CURRENT DATA IS THIN IN SIERRA



CAL-ADAPT.ORG – DECLINING SNOW PACK

NOTE: CURRENT DATA IS THIN IN SIERRA



> 2/3 OF PRECIPITATION FALLING ON DENSE FORESTS NEVER GETS INTO THE STREAMS

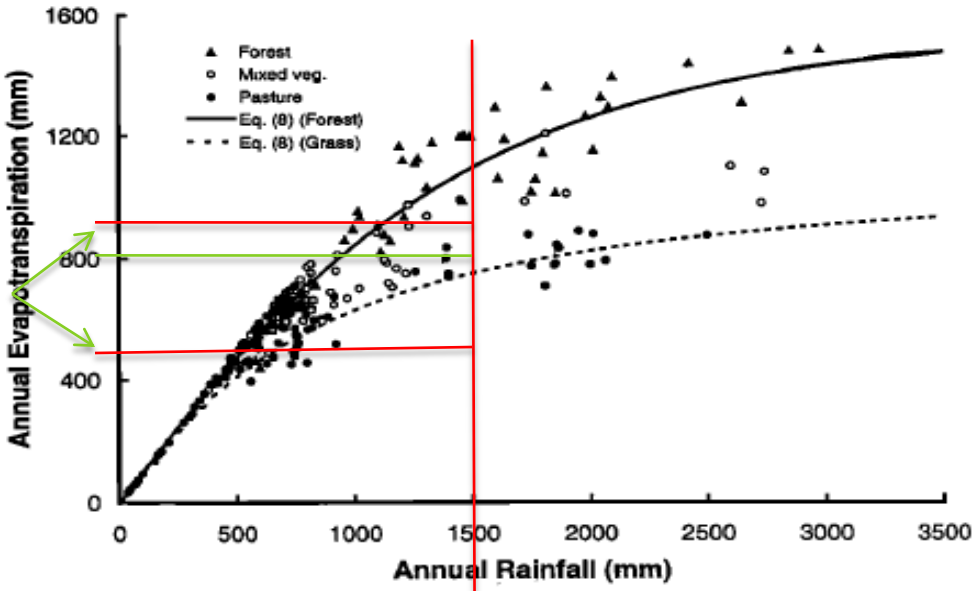


Figure 9. Relationship between annual evapotranspiration and rainfall for different vegetation types.

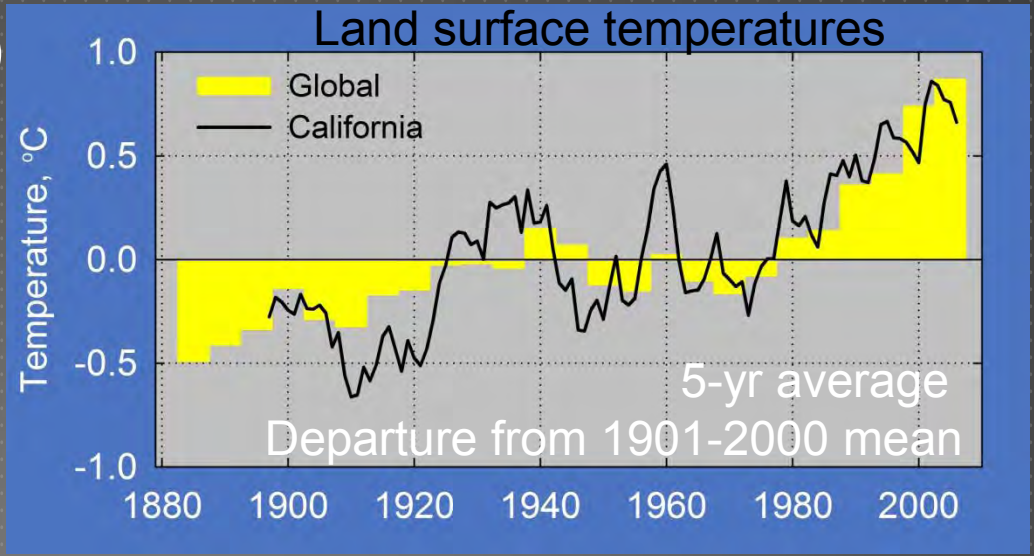
Every acre foot of water that runs through the full set of PCWA turbines generates about 2.8 MWh which is worth ~$130 (5 yr avg price)

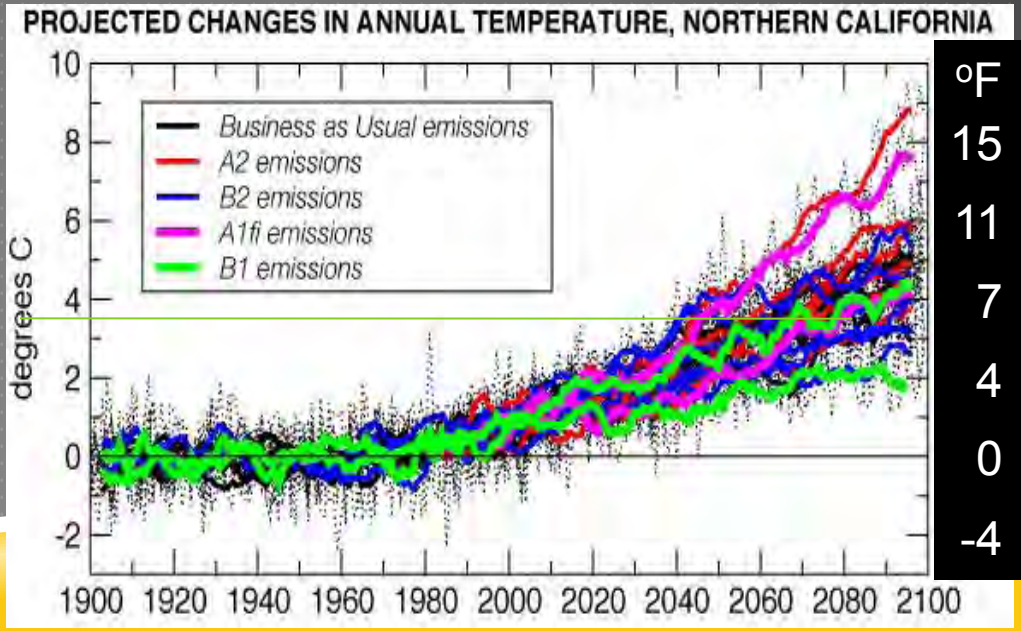
Change is coming – but what are we doing?

Warming by 2–6°C (4–11°F) drives significant changes:

- rain-vs-snow storms *
- snowpack amounts *
- snowmelt timing *
- flood risk
- streamflow timing *
- low baseflows
- growing seasons *
- recharge?
- drier soil in summer

Precipitation changes uncertain

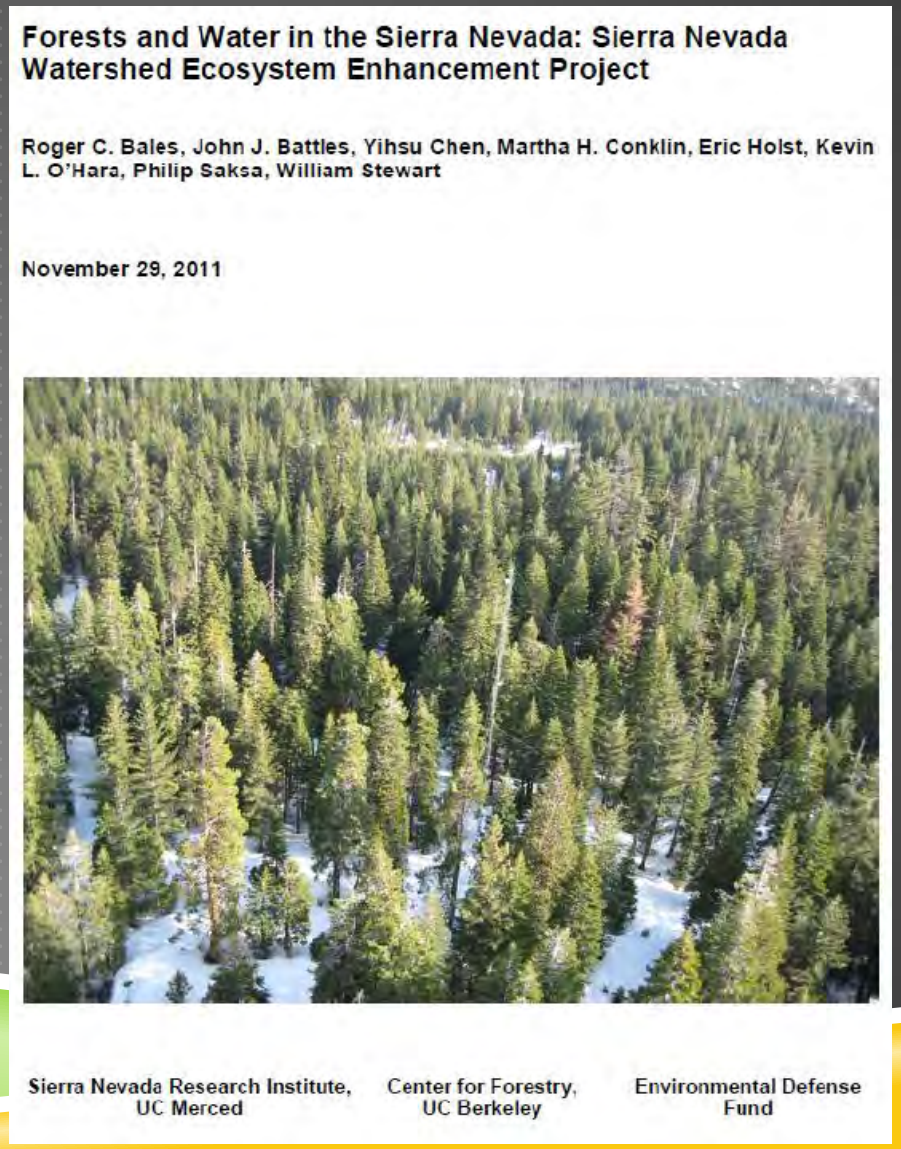




Already observed (*)

SIERRA WATERSHED ECOSYSTEM ENHANCEMENT PROJECT (SWEEP)

- **SWEEP Vision** - to quantify the effect of forest management on water yields and other ecosystem services in Sierra Nevada forests
- 1st phase in SWEEP report http://ucanr.edu/sweep/
- Goal – provide proof of concept that upstream management of Sierra Nevada forests can increase key forest ecosystem values – big trees, fire resilient forests, and water in creeks and rivers




Burn It


Thin It

Goal: Maximize total social value of precipitation

- 60-80% of precipitation is used by trees in a maximum canopy forest (often hi fire risk)
- Value of liter of water used by a tree depends on
  - Wood creation/tree respiration ratio
  - What society „pays' for different trees – sustainable harvest/regrow systems, habitat, total carbon sequestration value, on-site only C value, how future trees are „appraised'
  - Minus the regulatory costs
- Value of a liter of water not used by vegetation
  - Fishing & stream biodiversity „rentals' (Scotland, private ecological reserves, FWS Delta wetlands)
  - Hydroelectric power generation
  - Urban and agricultural water sales
  - Delta, wetlands and ocean outflow commitments (sales)
  - Minus the regulatory costs

High, medium, and low values to runoff depends on down stream diversions in the Sierra Nevada (SNEP 1996)

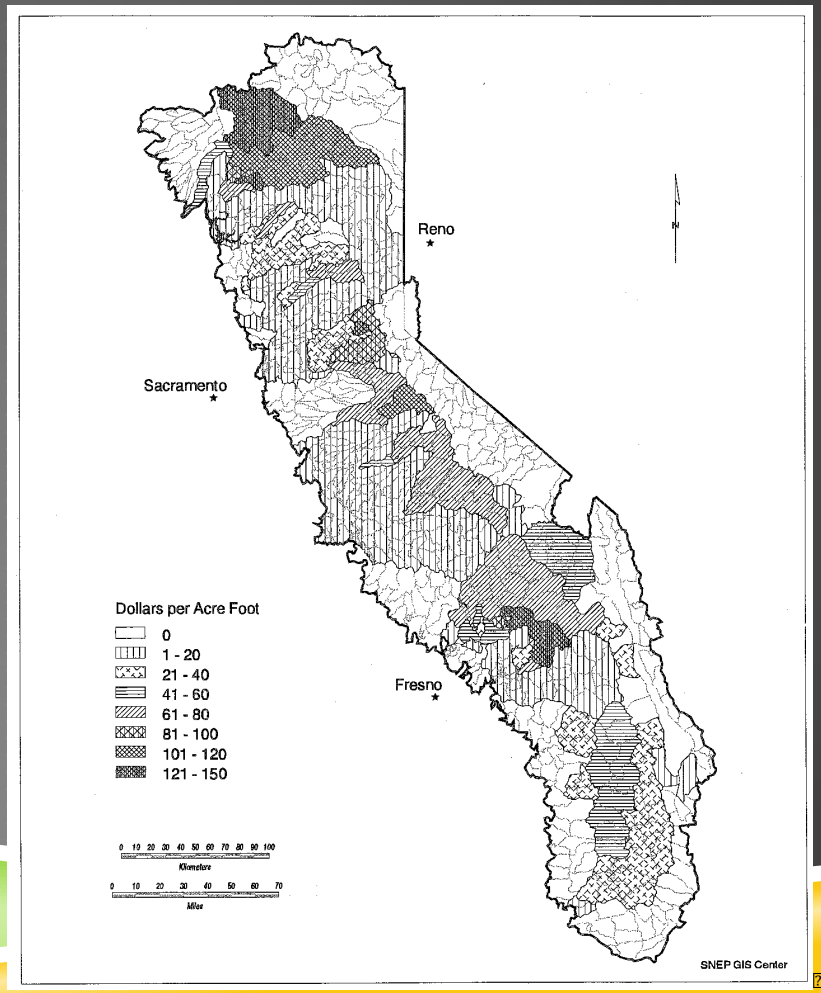
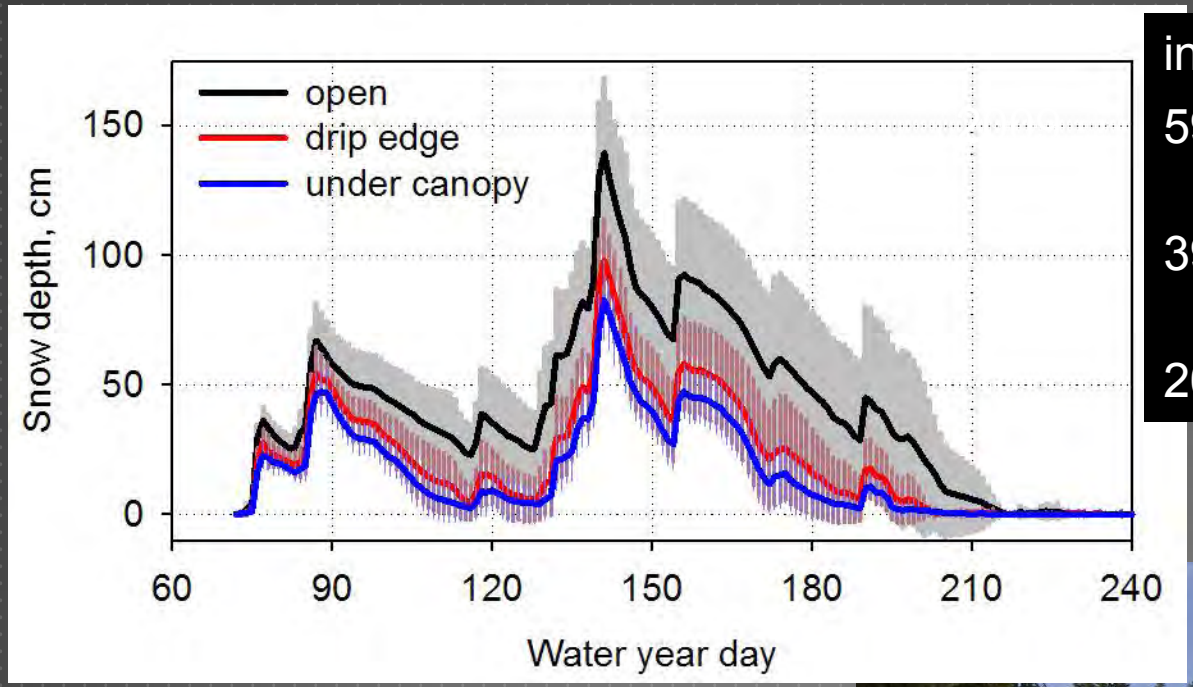


Figure 3.8 [illegible] 1014

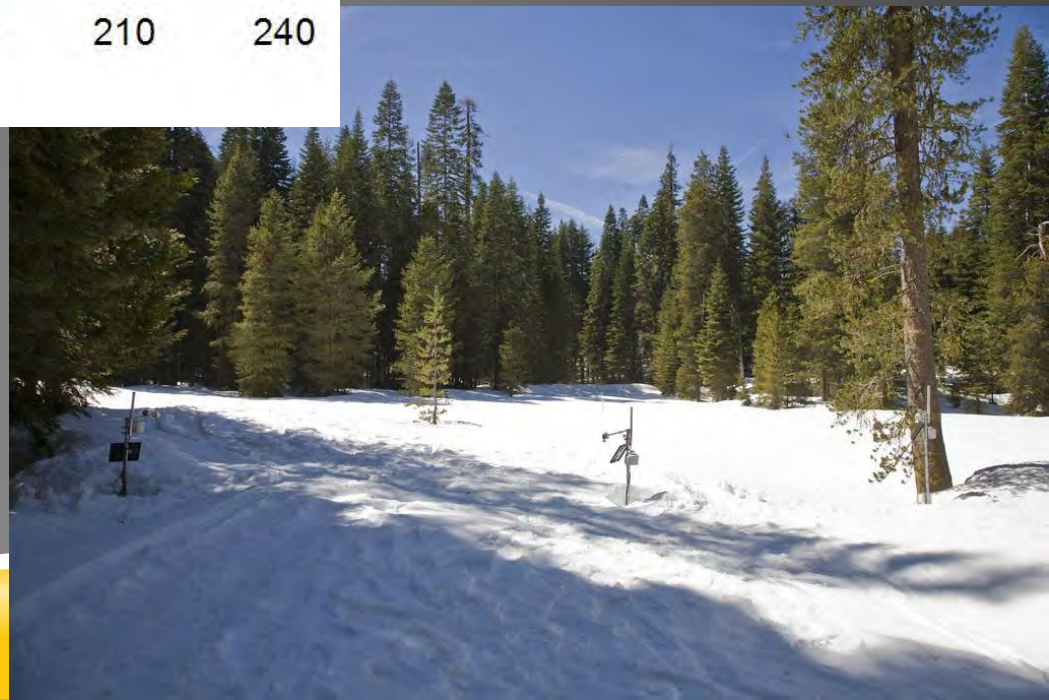
Snow depths in mixed-conifer forest

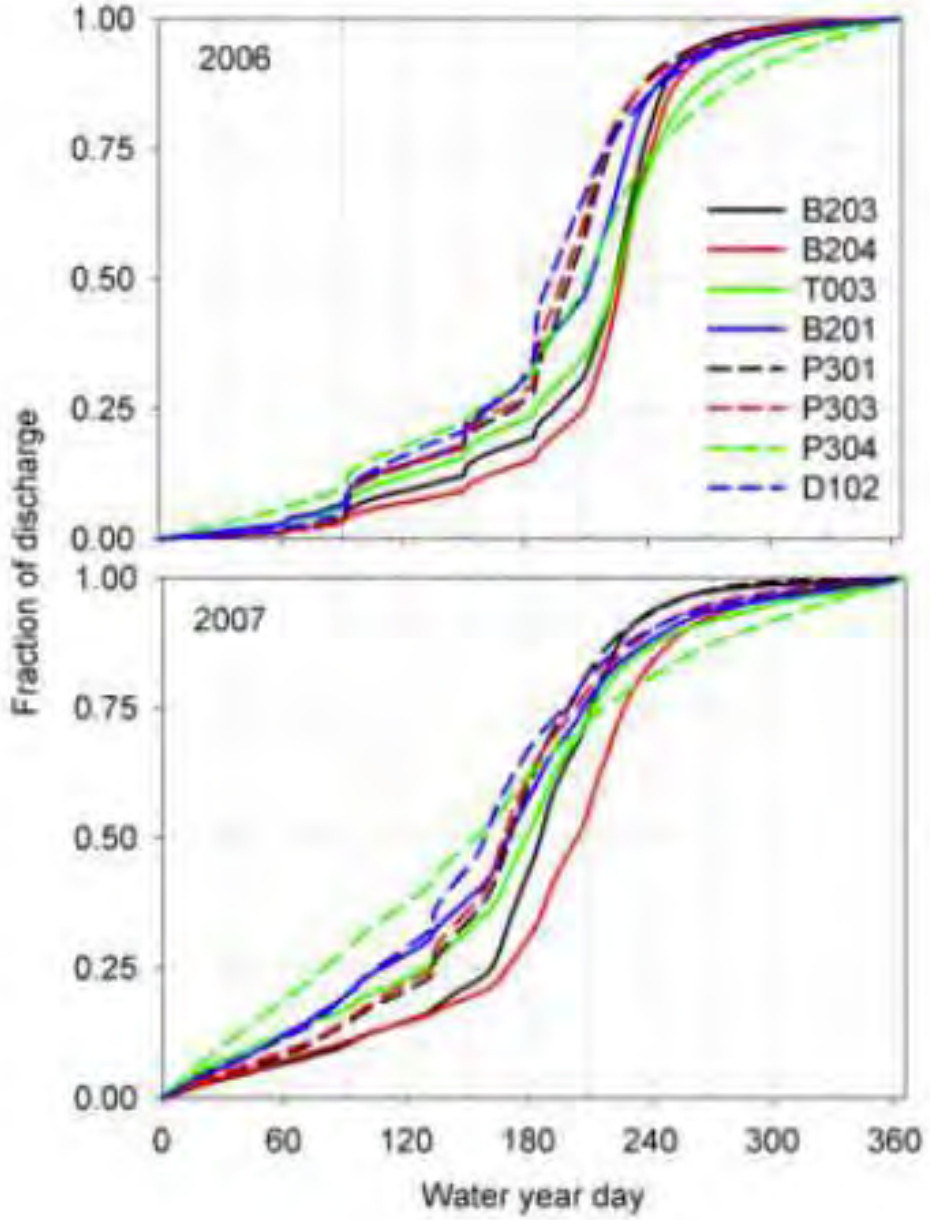


in
59
39
20

- Snow depth under canopy only about half to two thirds of that in the open
- Differences of about 40 cm (16 in)

Mean & standard deviation of snow depth over 6-mo period, Southern Sierra Critical Zone Observatory



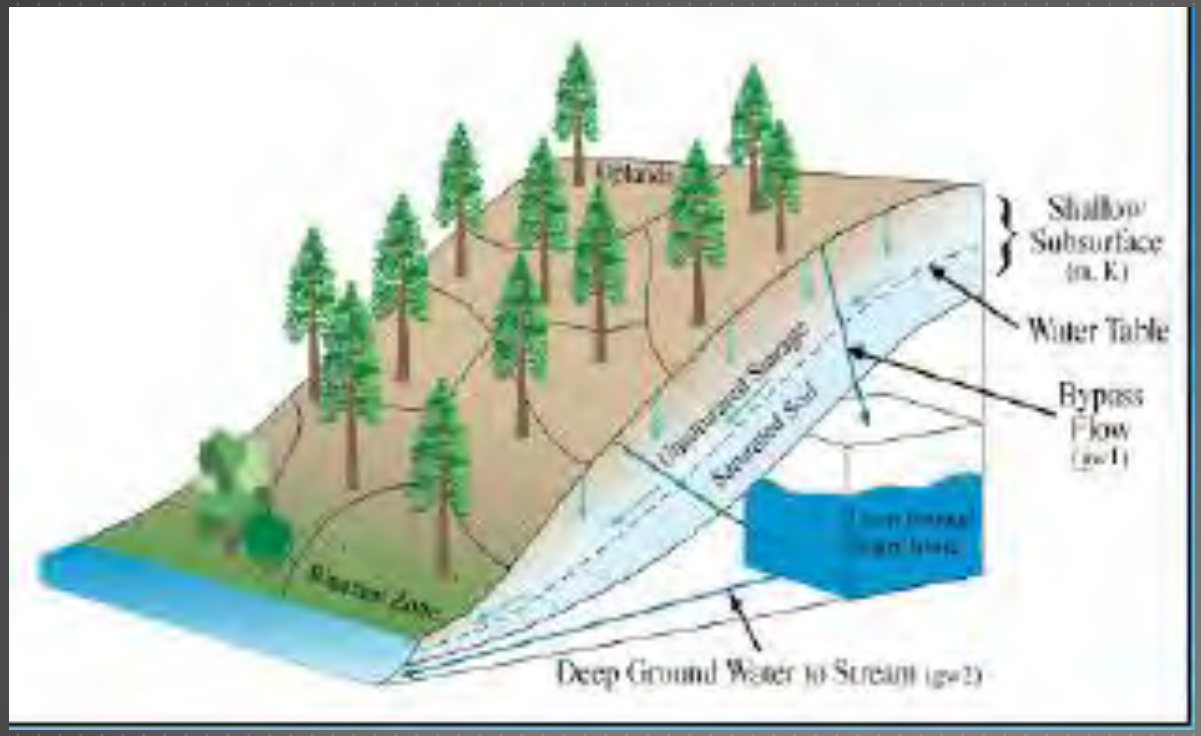


Wet (2006) and Dry (2007) runoffs vary differently in different watersheds

What happens in one watershed does not necessarily tell us what will happen in another watershed

There are no simple answers

This simply schematic from one of many amazingly complicated vegetation*hydrology models is useful to show the two main hypothetical areas of social gain.



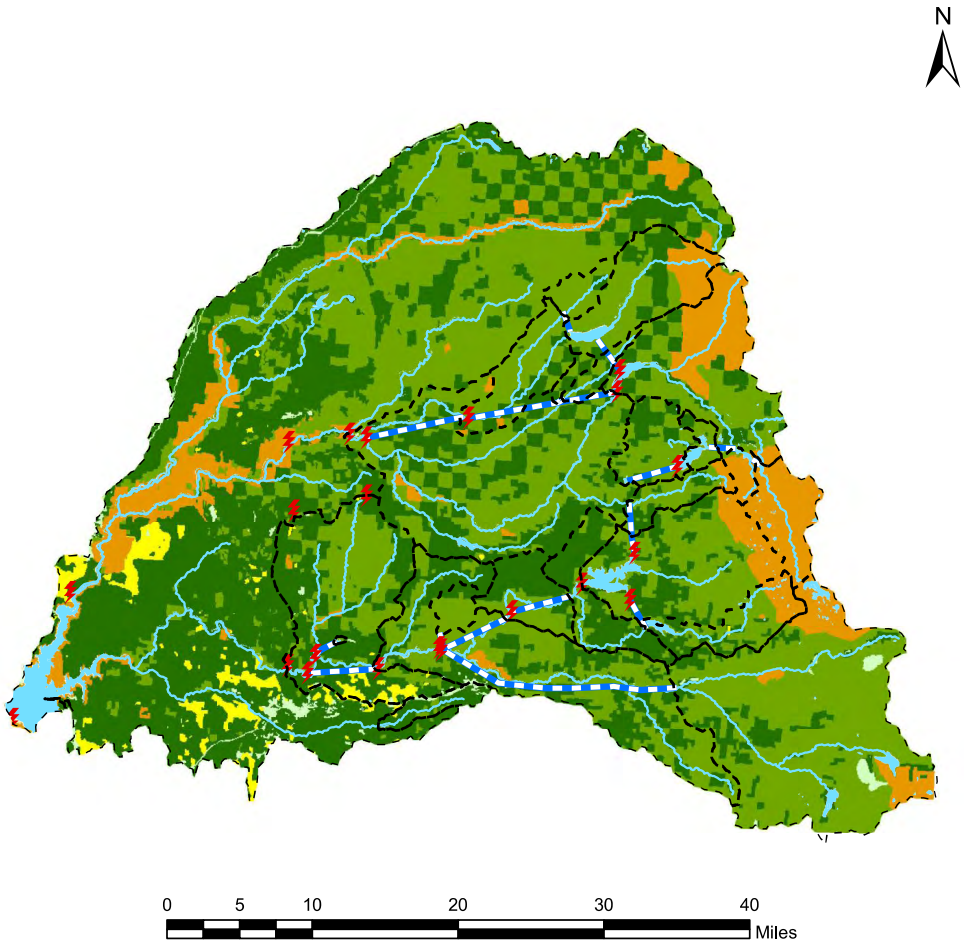
Goal 1: Reduce ET and fire risk with reduced canopy cover
Goal 2: Shaded snow as a cheap reservoir addition
Minimize watts/m^2 on snow

*Migrating strip cuts
*Perfectly uniform trees
*Random trees @ 60, 120, 180 TPA
*Clumps (gaps & groves)

Delaying runoff can allow use of reservoir space twice per season.
So what?
Was it spilling before?

How much more is late season water worth?
Are their contracts in place to sell more water?

Powerhouses and Watersheds in American River System



Legend

- Watershed Boundary
- Hydro Power Plant
- Stream, river, creek
- Aquaduct, tunnel
- Lake, pond, bay

Land Management Status	Area in different watershed areas (acres)		
	Upper	Middle	Lower
Agriculture	2,580	1,147	672
Urban Areas	82	178	3,190
Reserve	68,828	4,297	630
Private	50,433	120,755	34,756
Public	174,838	160,535	27,449

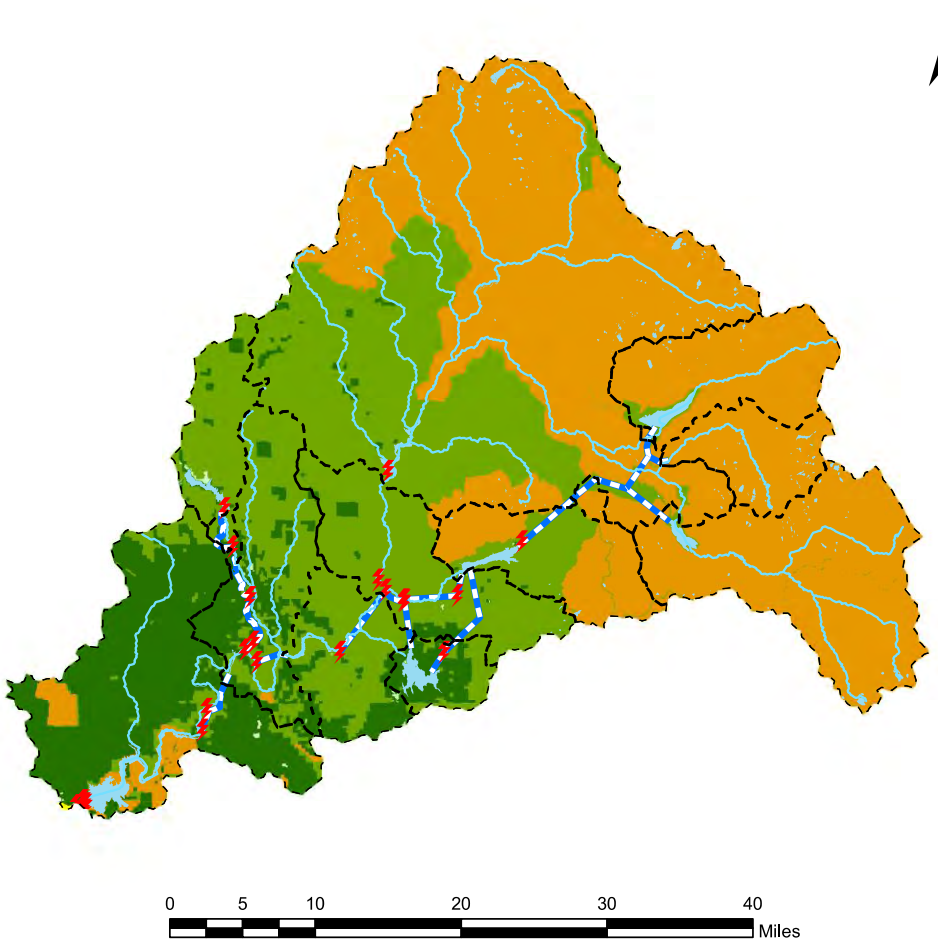
Data Source: Various; Credits: Various; Date: 04/01/2013

HOW FORESTS,STREAM,FIRE INTERACT
ORANGE – USFS RESERVED
LIGHT GREEN – USFS SNCF
DARK GREEN – PRIVATE

PUBLIC ENTITIES MANAGE THE RESERVOIR RELEASES, GENERATE HYDROELECTRIC POWER, SELL WATER, AND MEET FERC REQUIREMENTS

WHERE DO YOU THINK NEW MANAGEMENT COMBINATIONS WOULD HAVE THE HIGHEST CHANCE OF GENERATING MORE PUBLIC AND PRIVATE BENEFITS?

Powerhouses and Watersheds in San Joaquin River System



Legend

- Watershed Boundary
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- Lake, pond, bay

Land Management Status	Area in different watershed areas (acres)		
	Upper	Middle	Lower
Agriculture	-	529	31
Urban Areas	-	-	-
Reserve	472,746	30,968	398
Private	2,352	17,105	35,156
Public	159,168	123,728	77,689

Data Source: Various; Credits: Various; Date: 04/01/2013

A VERY DIFFERENT LAND MANAGEMENT PATTERN ABOVE A SIMILAR SYSTEM OF HIGH VALUE RESERVOIRS, TURBINES, AND CANALS

WHAT IS DIFFERENT?

Getting the best portfolio of forest/stream/fire mixes

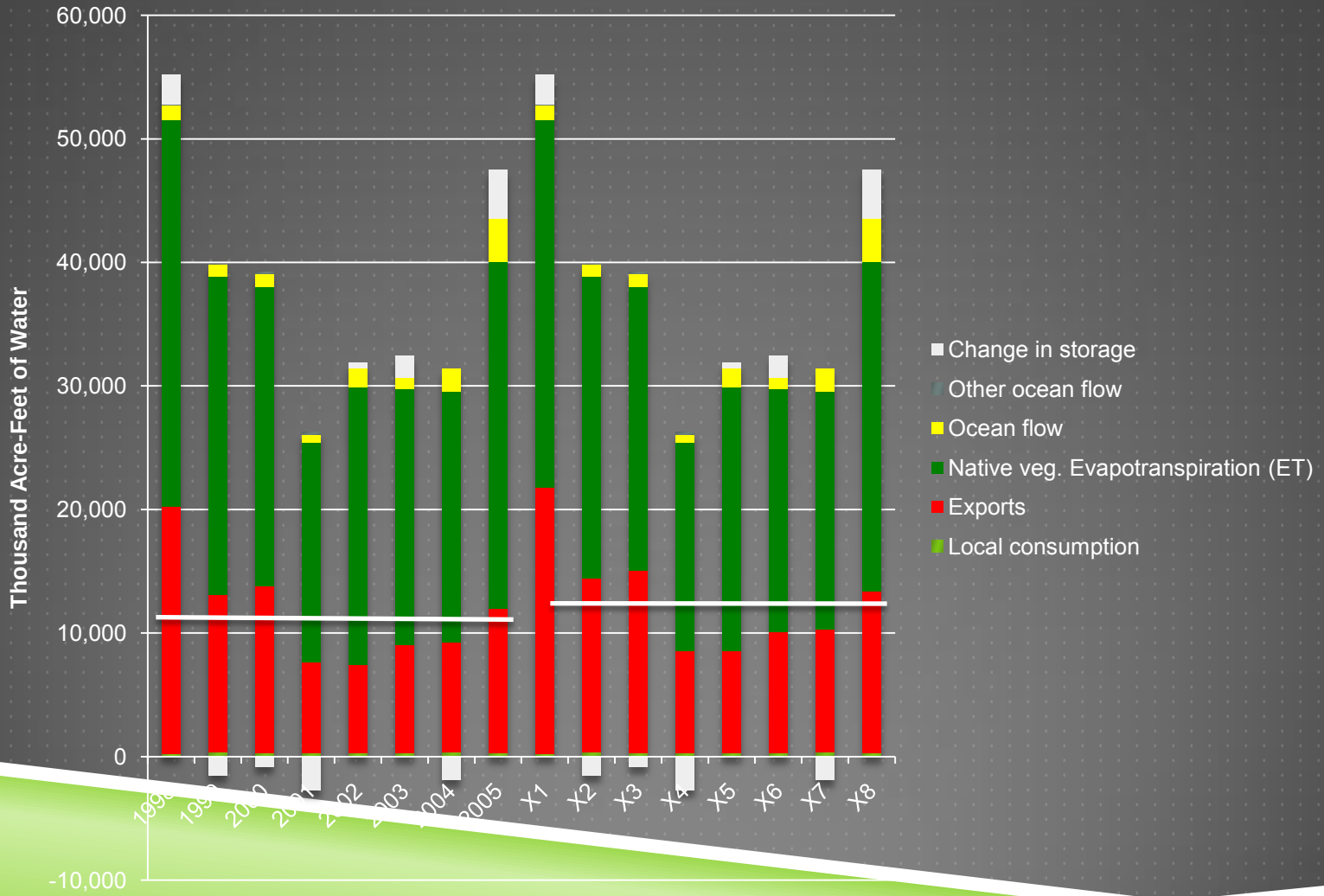
How do we address the costs of sub-optimal mixes?

- Import more timber from Canada
- Build more reservoirs, canals, and storage
- Spend unlimited money on fire suppression
- Spend on experimental watershed treatments

Figuring out how to pay for any additional costs

- Ask Southern California to pay for new systems (see Bay Delta 2013)
- Ask Southern California to pay for status quo
- Use revenue bonds
- Use General Obligation bonds
- Ask Wall Street for some “help”

SELLING A 5% SHIFT TO EXPORTS FROM ET REQUIRES ADDRESSING HIGH YEAR TO YEAR VARIABILITY



CHALLENGES TO MEASURING, TRADING, AND SELLING INCREASES IN TOTAL FOREST GOODS AND SERVICES

- The private sector and efficient government contracting requires clear rules for sharing costs, benefits, and risks
- We accurately measure sawlogs but not inventories
- We measure some streams but not groundwater
- There are an increasing number of state mandated 'programs' that seek to claim various 'social benefits' of forest management
- Addressing non-standard management requires more time and $$
- When complex forest management cases go to regulators or the court, assessing your innovative approach against the status quo defenders is not easy.

WHAT IS PROBABLY NEEDED ARE MULTIPLE FUNDING AVENUES, CONTRACTS, AND PARTNERSHIPS

- Private forest owners get the best revenue/public benefit ratio from sawlog harvests
- Downstream water users are interested in long term supplies and seem willing to invest in systems with high variability if they have access to government grant or long term bond funding
- California law sometimes considers hydroelectric „greeen and good', but sometimes not
- Wildfire suppression costs are going up and often squeeze out funds for experimenting on new approaches

CONTRACTUAL COMPLEXITY

Forest Land Managers

Downstream Water Managers

	One	Some	Many
One	USFS – Onion Creek Exp. Forest	Placer County Water Agency (Frenchmans Meadow)	PG&E Reservoirs
Some	SCE – Shaver Lake SCE – East Side	PG&E – NF Feather SCE – Big Creek PG&E, NID – Yuba Bear FERC #2310, #2266 S. Fork American R. Battle Creek	Individual Sierra Nevada River Basins
Many	Some USFS or NPS watersheds	Checkerboard ownerships across California	Sierra Nevada Western US

HOW TO CHOOSE A GOOD PROSPECT

- Signal > Noise
  - Worth investing in mutually beneficial contracts
- Signal < Noise
  - CEQA and political morass. Political push on regulators to ‘tax’ contracts, protect well connected status quo, etc. . Judges assess complex technical investments with uncertain outcomes
- Signal << Noise
  - If too many issues get involved, it won’t be worth it

Identify control and treatment small watersheds that meet water, tree & $$ criteria (above Frenchmans Meadow Reservoir on Middle Fork American R.)

UCCE OUTREACH FOR CURRENT RESEARCH

- Technical Advisory Committee (TAC) to 'value' ecosystem services related to SWEEP hypotheses.
  - Water agencies, other agencies, environmental consultants, hydro-electric generators, forest residents, forest managers, downstream water users
- 2 project meetings a year as well as collaboration in committees. Tasks:
  - Study plan phase - review the valuation study plan and add critical variables
  - Research phase - supply needed data for case study and vet findings.
  - End of study - assist in dissemination of results and advise on policy changes to develop ecosystem service markets based on project results.

THE PUBLIC WANTS TO BE INVOLVED BECAUSE THEY KNOW A HIGH RISK/ HIGH REWARD SCHEME WHEN THEY HEAR ONE

We are looking for involvement by agencies, landowners and other stakeholders.

- identify appropriate research sites,
- implement forest thinning treatments,
- collaborate on the economic valuation of ecosystem services provided by the forest both before and after thinning.

- Outreach Methods
  - Presentations, Website – http://ucanr.edu/sweep/ , Newsletter , Email list, Annual meeting, Valuation TAC

- Forester's roles: Measure how trees live and die but unfortunately not how to make money on selling a difficult to measure 'ecosystem service'