Sustainable Water Resources Roundtable

November 20, 2014

NASA Ames Research Center at Moffett Field

Proceedings

A State of Drought: California Surface & Groundwater Sustainability Assessments

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Opening Remarks

Bob Wilkinson SWRR Co chair, Steve Hipskind, Chief, Earth Science Division, NASA Ames Research Center, and Mariana Grossman, Executive Director, Sustainable Silicon Valley, welcomed the participants.

Bob Wilkinson greeted the participants and pointed out that the range and variety of organizations present was a good example of collaboration among federal agencies, national labs, states, and private organizations interested in sustainable water management.

Steve Hipskind thanked the participants for coming and said he appreciated the opportunity to host the meeting. NASA Ames was established in 1939 and this year is its 75th anniversary. They are committed to optimizing water use and last year they received the California Governor's Environmental and Economic Leadership Award for Sustainable Facilities.

Marianna Grossman described Sustainable Silicon Valley (SSV) as a consortium of companies, government entities, non-profits, and academic and research institutions working together to inspire collaboration, accelerate innovation, and encourage prosperity for a sustainable future. SSV collaborates with NASA Ames through a Space Act Agreement to engage academe and the private sector to identify and highlight sustainable approaches that could have regional, national and global impact. They are working on climate change through this agreement. Sustainable Silicon Valley has launched a new initiative called Net Positive Bay Area that aims to use the region's ingenuity to achieve these audacious goals by 2050: produce more renewable energy than we use, sequester more carbon than we emit and use only local water resources. More information is available on the website: http://www.sustainablesv.org/ecocloud/index.php/net-positive

Sustainable Water Resources Roundtable Activities and History, John Wells SWRR Co-chair

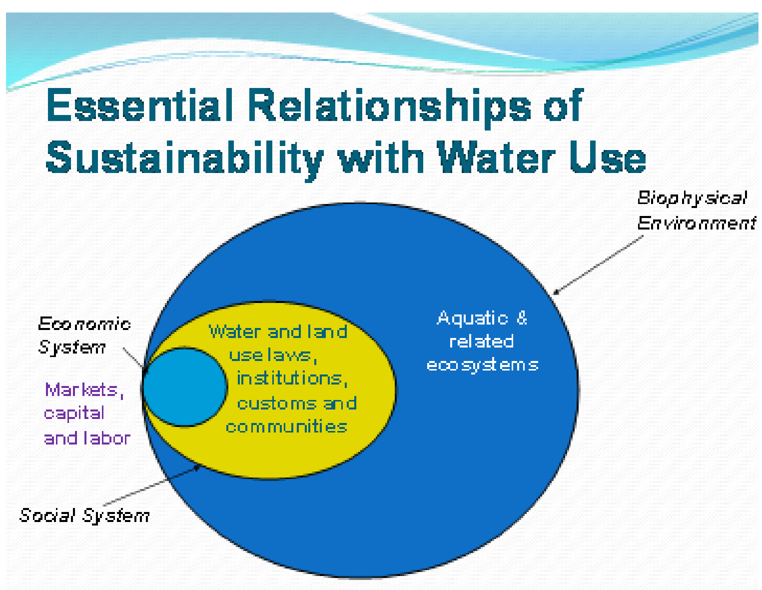
John Wells gave an opening presentation of the history of SWRR and the various activities and projects the Roundtable has engaged in over the years. He explained that by participating in a SWRR meeting the audience joined the more than 1,000 representatives from federal, state and local governments, corporations, nonprofits, and academia as SWRR members,

SWRR has held meetings in California, Colorado, Florida, Maryland, Michigan, Minnesota, New Hampshire, Virginia, and Washington, D.C.

John provided the following links for the SWRR web-site.: the home page: http://acwi.gov/swrr/index.html, the 2005 Preliminary SWRR Report: http://acwi.gov/swrr/Rpt_Pubs/prelim_rpt/index.html, and the 2010 SWRR Report: http://acwi.gov/swrr/Rpt_Pubs/SWRRReportMarch2010.pdf .

John summarized the relationships of sustainability with water use and then outlined the elements of the SWRR Indicator Framework:

- **Water availability**
- **Water quality**
- **Human uses and health**
- **Environmental health**
- **Infrastructure and institutions**



Example: Water Availability

- Renewable water: Upper limit of water availability
- Water in the environment: Water remaining after human uses
- Water use sustainability: Degree to which water use meets current needs while protecting ecosystems and the interests of future generations

John discussed observations made in the Minnesota water planning process of the differences between water availability and sustainability.

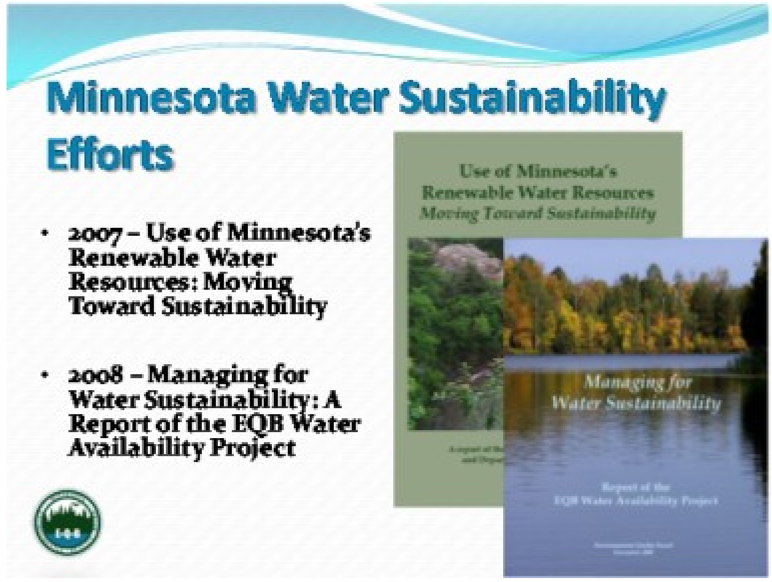
- Availability is short term; sustainability is long term
- Availability may not consider impacts on ecosystems or future generations
- Availability does not factor in long term consequences of depletion
- Rates available for use today may not be possible long term
- Sustainability implies long term availability over decades – not just this year – and with quality left unchanged
- Availability evaluates whether you can get the water out of the ground in useful quantities; sustainability evaluates whether you should

John presented some highlights of the California Water Plan, an effort in which several SWRR members were active. Each sustainability objective of the California Water Plan has associated indicators, and John discussed an example of the objective to improve water use efficiency, increase water recycling, and increase water conservation in order to improve water supply reliability, reduce energy demand, and restore and maintain aquatic ecosystems and processes.

California Water Plan Sustainability Objective	Related CWP Objective and RMS	Example Indicators	Relevance to Sustainability Objective
1. Improve water use efficiency, increase water recycling, and increase water conservation in order to improve water supply reliability, reduce energy demand, and restore and maintain aquatic ecosystems and processes.	CWP Objective 2, 9; RMS Reduce demand	Energy required per unit of clean drinking water	Reduce energy demand for providing water
		Average water use per household per capita, 20% reduction by 2020	Increase water conservation
		Sufficient flows and timing of flows for maintaining historically-present native aquatic fauna	Restore and maintain native ecosystems

He then gave examples of activities in other states to make clear that California is not the only state making advances on water sustainability:

- The Great Lakes Compact states have agreed to manage basin water use collectively for current and future generations with routine system-wide cumulative impact assessments designed to protect and restore the hydrologic and ecosystem integrity of the basin.
- Illinois State Water Survey has a plan for scientific assessment of water supplies, including ability to meet existing and projected demands.
- Florida is focused on the interplay between water quality, water use and land use, climate change, and sea level rise.
- Michigan's water withdrawal Impact Assessment Model links water use and water withdrawal to maintenance of the ecological integrity of streams.
- New Hampshire's Water Sustainability Commission goal is to ensure that quality and availability of water in 25 years will be as good as or better than today.



John concluded by saying that California's sustainability solutions require a systems thinking holistic approach with awareness of time horizons and scales. The elements of the system include:

- Managing Risk and Uncertainty
- New Tools
- Common Ground for Solutions
- Continuous Education

Round of Brief Self-Introductions

David Berry facilitated the participants in introducing themselves with a sentence on their interest in sustainability and water. It was a good way for everyone to identify sources of information and experience relevant to their own work as well as potential collaborators.

California Sustainability Assessment, Moderator Abdul Khan

Abdul Khan noted that the California water indicators would not have been possible without the work of SWRR.

An Update on US-EPA Sustainability Effort, Alan Hecht, Ph.D., Director for Sustainable Development in the Office of Research and Development (ORD), U.S. EPA

Alan Hecht greeted the participants and stressed EPA's recognition of the importance of sustainability of water resources. He said EPA is taking action toward a sustainable future through advancing:

- Integration across agency program nexus in air, water, and land
- More state, local, and international partnerships
- Advance systems thinking
- Opportunities to work with communities, stakeholders, and other partners
- Development of tools and approaches to impact decisions

California Sustainability Assessment Project, Vance Fong, P.E., Manager, Environmental Indicator Program, Exchange Network Coordinator, Field Operations Lead, U.S. EPA Region 9 (Fong.Vance@epamail.epa.gov) and Don Hodge, Safe Drinking Water Information system (SDWIS) Coordinator, Drinking Water Office, U.S. EPA Region 9 (hodge.don@epa.gov)

Vance Fong and Don Hodge told participants how U.S. EPA Region 9 conducted a project to develop a suite of four sustainability indicators for California. Simultaneously, California's Department of Water Resources (DWR) built a coalition to develop water sustainability indicators to inform the 2013 California Water Plan. Region 9 collaborated and supported DWR's process.

During project scoping, EPA Region 9 asked the following questions:

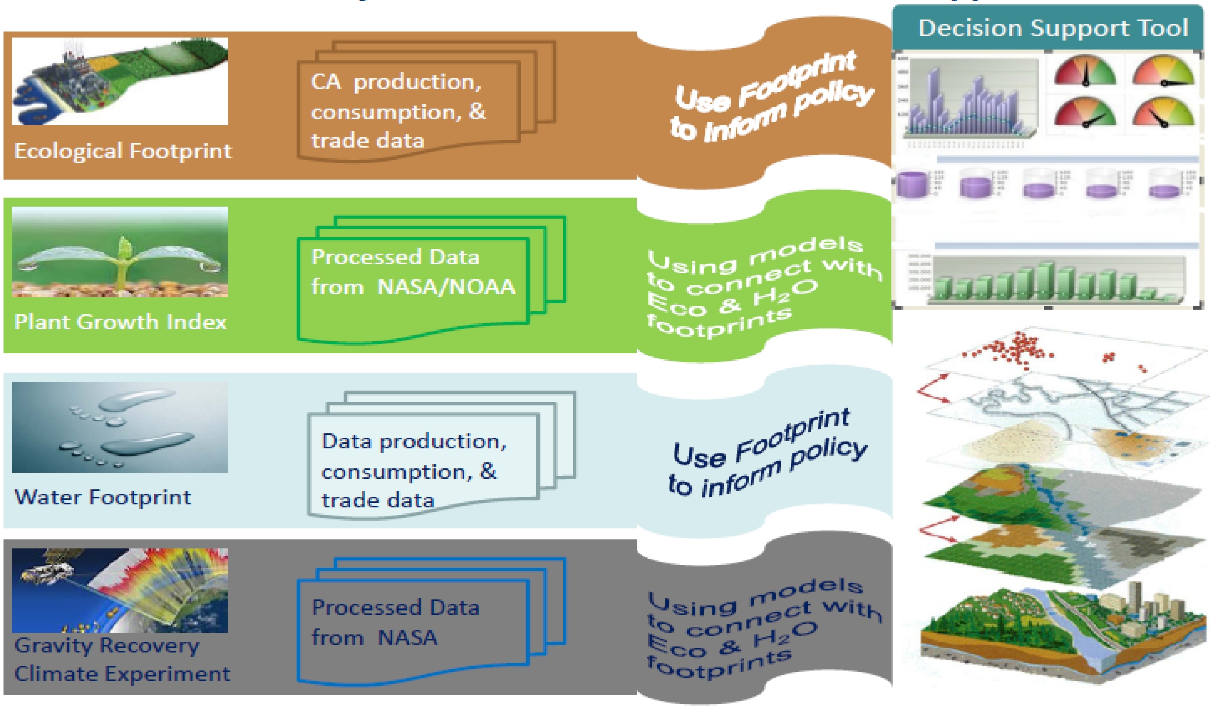
- What broad sustainability indicators would be helpful to California, serve as a model for other states, and be suitable for inclusion in the EPA's Report on the Environment?
- Is state-level data available to support such broad indicators?
- Will CA decision-makers and policy makers find the indicators informative?

As the result of asking these questions, the following indicator suites were selected for development:

- Ecological Footprint
- Water Footprint

California Ecological Footprint

A sustainability indicator within EPA's Decision Support Tool



EPA Region 9 also collaborated on the development of a web-based Decision-support tool to facilitate meaningful use of the indicators. Collaborators include California Department of Water Resources, UC Davis, Pacific Institute, NASA-JPL, California State University - Monterey Bay, and the Global Footprint Network.

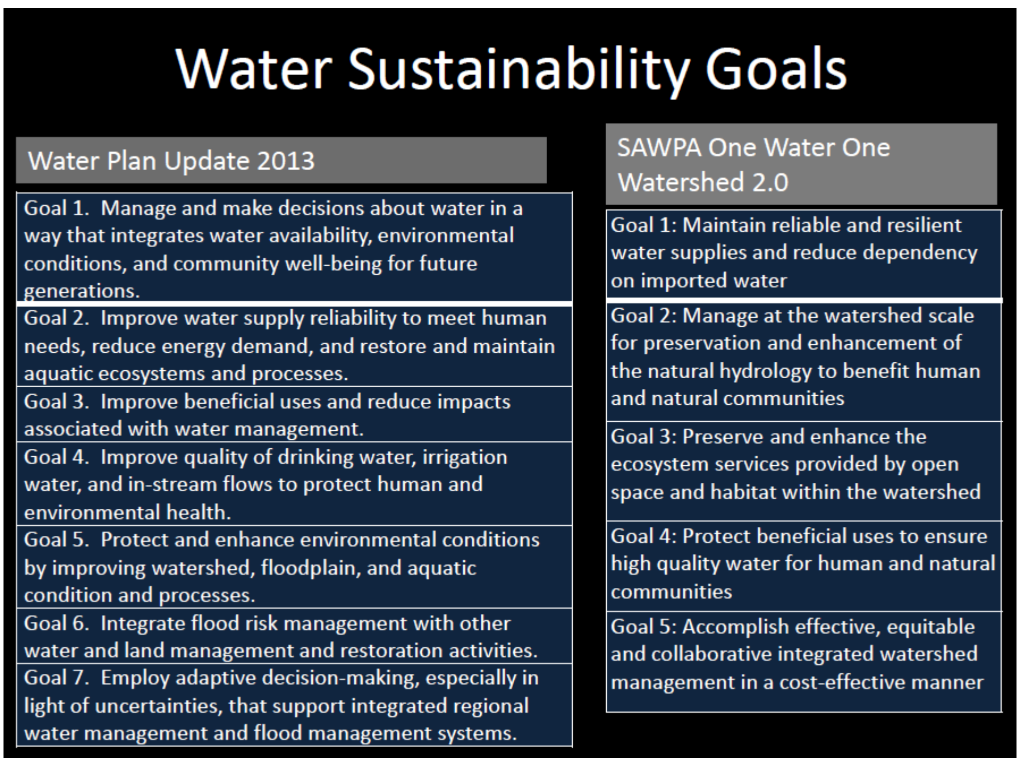
California Water Sustainability Indicators Framework, Statewide and Regional Assessments,
Fraser Shilling, Ph.D., Researcher, Department of Environmental Science and Policy, UC, Davis (fmshilling@ucdavis.edu)

Fraser Shilling began his presentation with a very useful set of definitions:

- Metrics– things we can measure "in the wild"
- Indicators – often composed of metrics, things we can evaluate around us that can tell us a story about components of a natural or human system
- Performance Measures – similar to indicators, except often confined to management actions and other intentional human actions
- Index – an aggregation of indicators that convey a more complete story about a system

Water sustainability is the dynamic state of water use and supply that meets today's needs without compromising the long-term capacity of the natural and human aspects of the water system to meet the needs of future generations. (California Water Plan, 2013)

Fraser pointed out several current major indicator programs around the world and the U.S., and then outlined the framework for the California Sustainability Indicators (above). He also gave examples of sustainability goals from the California Water Plan update of 2013 and the Santa Anna Watershed Project (below).



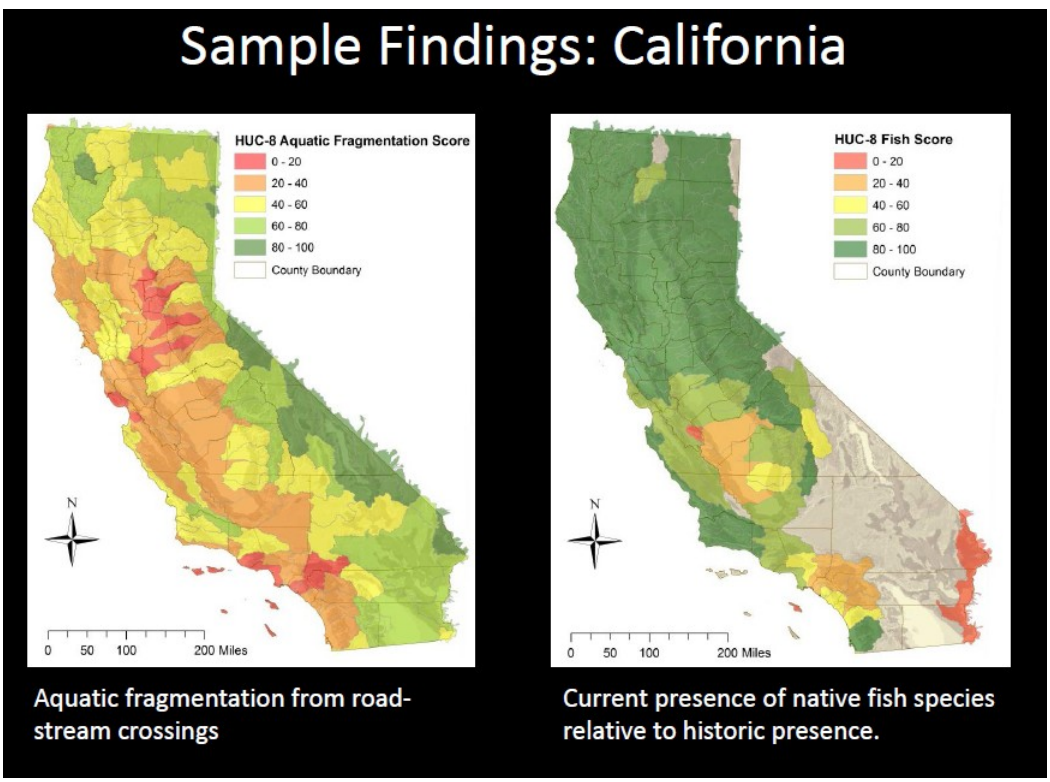
He then presented the sustainability indicators for California and pointed out which of them related to which sustainability goals.

Two important sample indicators were presented in graphic form – aquatic fragmentation from road stream crossings and current presence of native fish species relative to historic presence.

Sustainability Indicators: California

Indicator Name	Sustainability Goals
Aquatic Fragmentation	5
Baseline Water Stress	1,2
California Stream Condition Index	5
CalEnviroScreen-Groundwater Threats	4
Geomorphic Condition	5,6
Groundwater Quality-Nitrate	4
Groundwater Stress	2
Historical Drought Severity	2,5
Historical Flooding	6
Interannual variability	2,5,7
Native Fish Species	5
Public Perceptions of Water	7
Return Flows	2,3
Threats to Amphibians	5
Upstream Protected Lands	2,4
Upstream Storage	2,3
Water Footprint	1,2,7
Water Quality Index	4
Water Use and Availability	2

State pilot indicators and indices and corresponding Sustainability Goals. 19 of 120 indicators in the Water Plan Sustainability Indicators Framework

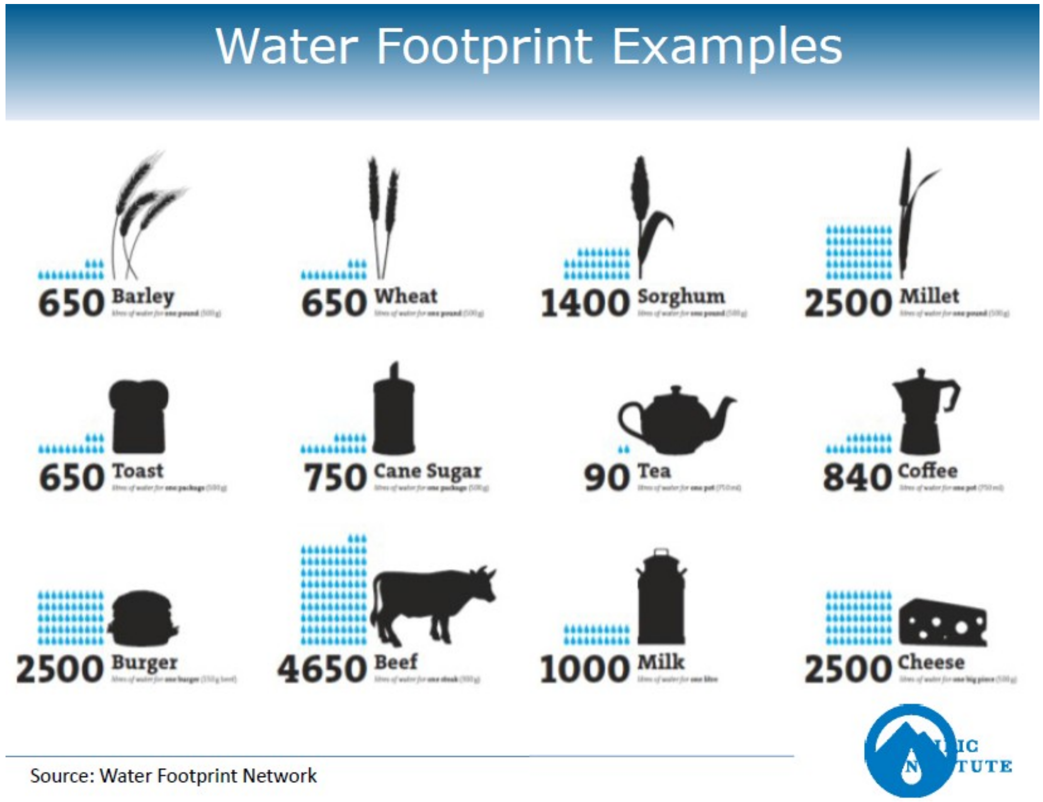


Aquatic fragmentation from road-stream crossings

Current presence of native fish species relative to historic presence.

He summarized by saying some interesting things about measuring performance. “We are almost always measuring condition against some standard. It is unlikely that indicators would be as useful without this comparison. What approach allows inter-indicator and inter-regional comparison?” He reminded participants that there are complications: some individual metrics or indicators may be more influential than others, or their influence varies in time or space. Temporal resolutions and steps may be inconsistent among indicators and spatial resolution and meaning varies among indicators. Indicators are usually imperfect reflections of process, patterns, and values.

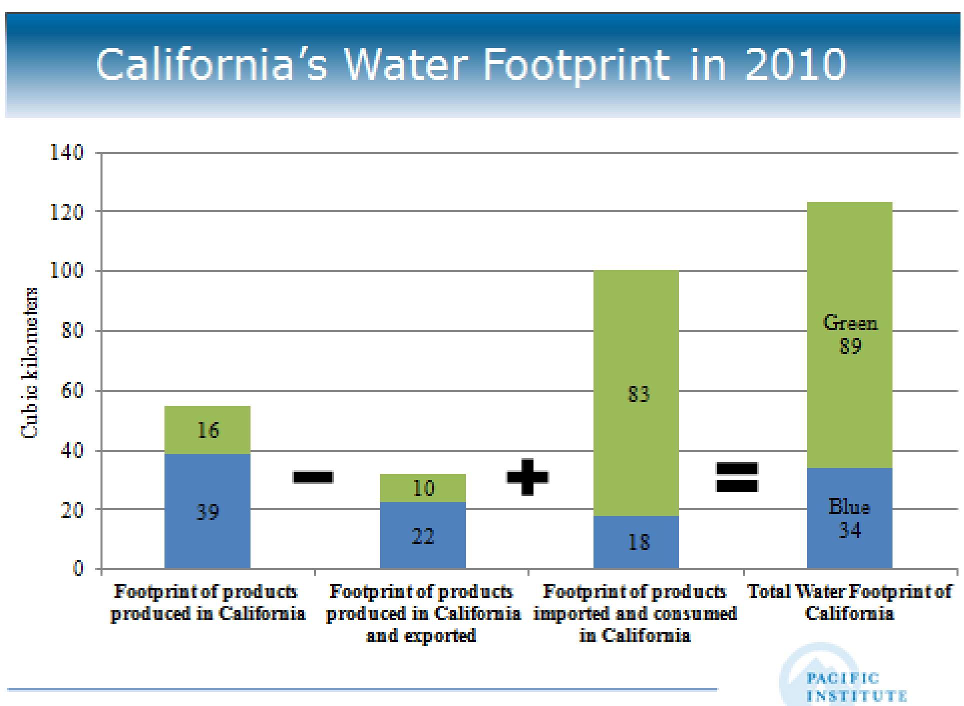
California's Water Footprint and Trends, Heather Cooley, Water Program Director, Pacific Institute, Oakland (hcooley@pacinst.org) and Julian Fulton, Energy and Resources Group, University of California, Berkeley (julianfulton@gmail.com)



Heather Cooley began the summary of the research by the Pacific Institute and UC Berkeley by showing the water used in production of various food products and then surprised participants by saying analysis showed that the footprint of products imported and consumed in California was greater than the footprint of products produced in California and exported.

She summarized the key findings of the research:

- California
  - is a net virtual water importer
  - exports half of the blue water that goes into production
  - depends on blue water more than the rest of the United States
- California's water footprint is growing faster than population and the water footprint of the state's energy use is growing and is almost entirely external

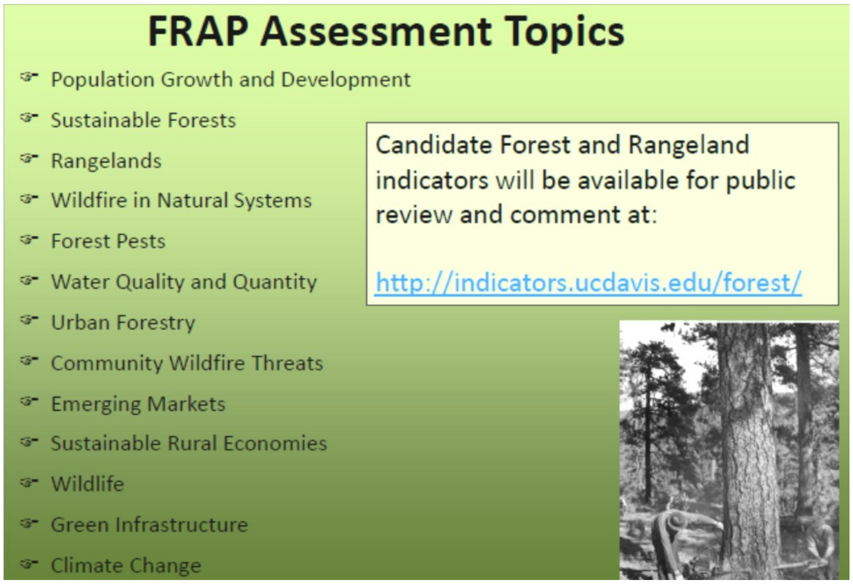


Heather said the next steps would be to update the time series through 2012 and examine how California's water footprint is expected to change over the next 30 years. They will also examine how climate change is likely to affect California's water footprint and link California's water footprint to water scarcity and other related risk factors. Another question to explore is how regional population and economic growth affect how water footprints are distributed.

California Biodiversity Council Collaborative Project on California Indicators and California Forest and Range Assessment, Chris Keithley, Ph.D., Fire and Resource Assessment Program, Department of Forestry and Fire Protection, Sacramento, California (Chris.Keithley@fire.ca.gov) (Project Team: Kelly Larvie (CAL FIRE), Mathew Bokach (USFS), Abdul Khan (DWR), Rich Juricich (DWR), Don Yasuda (USFS), Junko Hoshi (DFW), Armand Gonzalez (DFW), Russ Henly (Resources Agency)
http://indicators.ucdavis.edu/
https://d3.water.ca.gov/owncloud/public.php?service=files&t=5ea06c2973b9d31724c5f1419913fe5a

Chris Keithly told the participants that the California Biodiversity Council (CBC) was formed in 1991 to improve coordination and cooperation between the various resource management and environmental protection organizations at federal, state, and local levels. Strengthening ties between local communities and governments has been a focus of the Council by way of promoting strong local leadership and encouraging comprehensive solutions to regional issues.

The benefits of collaboration among the participating agencies have included increased acceptance of indicators as tools for use in creating valid description of sustainability, reducing in duplication of effort, and (most importantly) leveraging resources to facilitate adaptive management.



Panel 1 Discussion

Q: What are the pitfalls and roadblocks from analysis to action?

Shilling – The difficulty of getting political concern to match the data is considerable for sustainability.

Cooley – We see where we need to go but do not know how to get there so we do the same old things. For example, water utility agencies think like water suppliers not water service providers.

Fong – There is a realization that there should be more interagency joint writing of sustainability indicators.

Keithley – Lack of a common language is a constraint. Often there is only a vague understanding of other's projects. We need to develop common understanding and communications.

Q: What role can scientist play in changing policy?

Shilling – Scientists are generally responsive but some such as James Hanson are proactive. I do not see a problem with activism.

Cooley – We are seeing more engagement in policy and science.

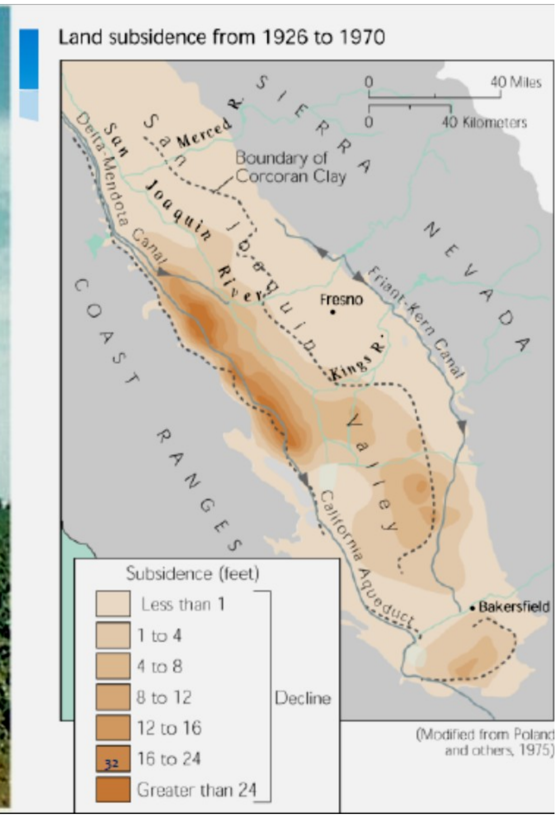
Keithley – We need to make progress on determining quantitative data and trends.

California forests are part of a fire prone landscape. A dilemma for water resources and climate change is trying to maximize how much carbon can be stored. In some areas, there is an overstock of small trees leading to fire. The Yosemite Rim fire slowed down because of park management practices. We need to encourage sectoral analysis of forest management but regional data is harder to find. We need to be creative. The wild land - urban interface is a major issue; how do we plan for communities in forested areas.

EPA is working with other agencies to develop sustainability tools. Sharing tools and matching tools with each individual situation is important.

The water footprint is a great tool and there are many opportunities to overlay risk factors in a variety of different situations.

Groundwater in California, Carl Hauge, DWR Chief Hydrogeologist, (retired)



The participants welcomed as lunch keynote speaker, Carl Hauge, former Chief Hydrogeologist of California DWR. He began by saying that 100 years after California regulated surface water but not groundwater the Sustainable Groundwater Management Act will go into effect on January 1, 2015. The existing local agencies must now develop Groundwater Sustainability Agencies to manage their groundwater as a sustainable resource. The Act includes some definitions:

Sustainable yield—The maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result. This is the same as 'safe yield' defined by David Todd in 1959.

In the new act, *de minimis* extractors, those who extract less than 2 acre-feet or less per year, are not required to report how much they extract—these are called exempt wells in other states. All other well owners must report to the Groundwater Sustainability Agency the amount of groundwater they extract

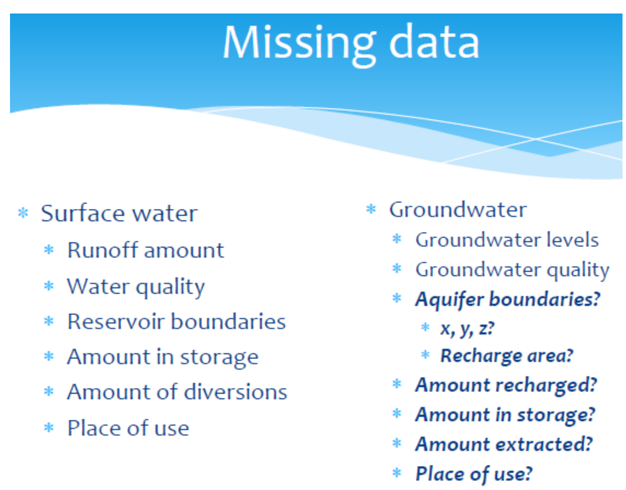
Carl reminded the audience that management of every basin for sustainable yield requires development of a water budget: Inflow – Outflow = Change in storage.

In addition to the amount of extraction, several other issues must be considered in groundwater management — recharge, subsidence, stream flow depletion, and the hyporheic zone. Recharge areas must be identified and protected from contamination and maintained so that recharge of surface water will replenish the aquifer.

Groundwater levels in confined aquifers must be maintained above the level that lowers pore pressure and leads to compaction of clays causing subsidence of the land surface.

The hyporheic zone, where surface water enters the stream bottom and groundwater enters the stream channel, is an important source of nutrients for fauna in the stream, including fish. Hauge said it is important to protect the hyporheic zone from stream-flow depletion

In areas with live streams, the amount of stream-flow depletion caused by groundwater pumping must be recognized and quantified. Carl presented a list of important factors for which data is not fully available:

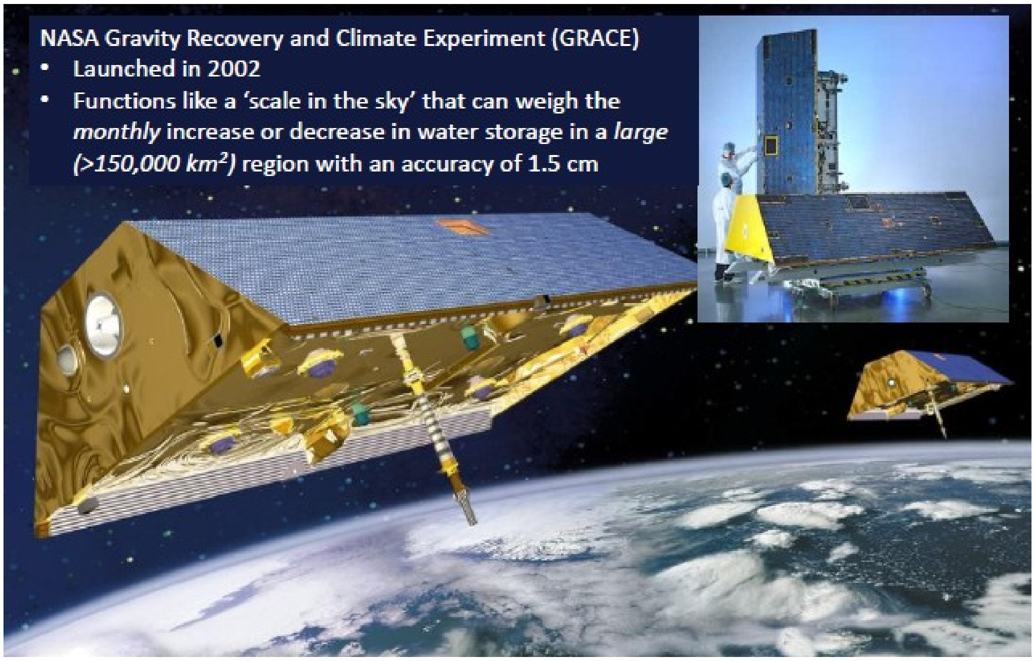


He concluded by asking the question: Are laws from the 1800s and early 1900s suitable for resource management with the population and resource issues of the 21st century?

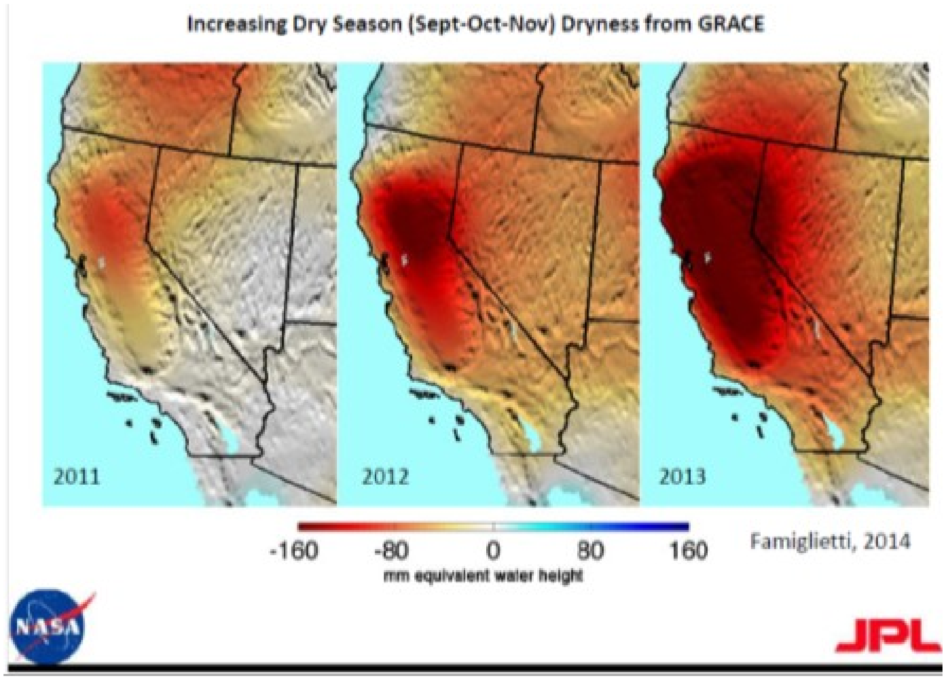
Groundwater Measurement and Management, Moderator Rhonda Kranz, Kranz Consulting

Rhonda Kranz introduced the session by noting the increasing spotlight on ground water use and management, especially in California. Groundwater use is complicated by its interlocking economic, political, social, and ecological impacts. We need more information and tools. In this session, we are given a glimpse of three very different ground water monitoring efforts taking place in California

Observing Groundwater from Space: GRACE, Jay Famiglietti, Jet Propulsion Laboratory, NASA, California Institute of Technology, and U.C. Irvine



Jay Famiglietti reminded the participants that groundwater depletion during drought threatens the water security of the Colorado River and other basins. He explained how the two orbiting satellites of the Gravity Recovery and Climate Experiment (GRACE) detect total water storage changes and anomalies because of slight variations in the Earth's gravitational field above locations with changes in levels of groundwater.



Jay pointed out the increasing drought in California and said that the NASA GRACE satellite mission has detected water storage declines in several of the world's major aquifers in Earth's arid and semi-arid mid-latitudes.

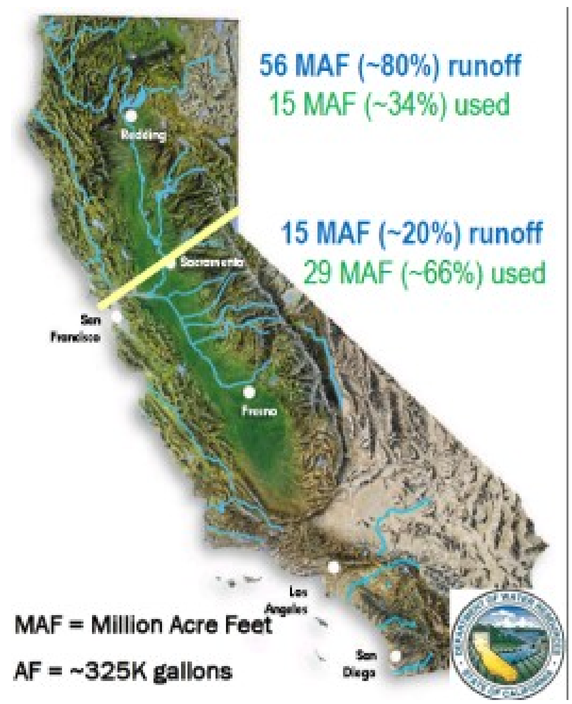
The potential contributions of NASA/JPL to SWRR and Western U.S. drought include:

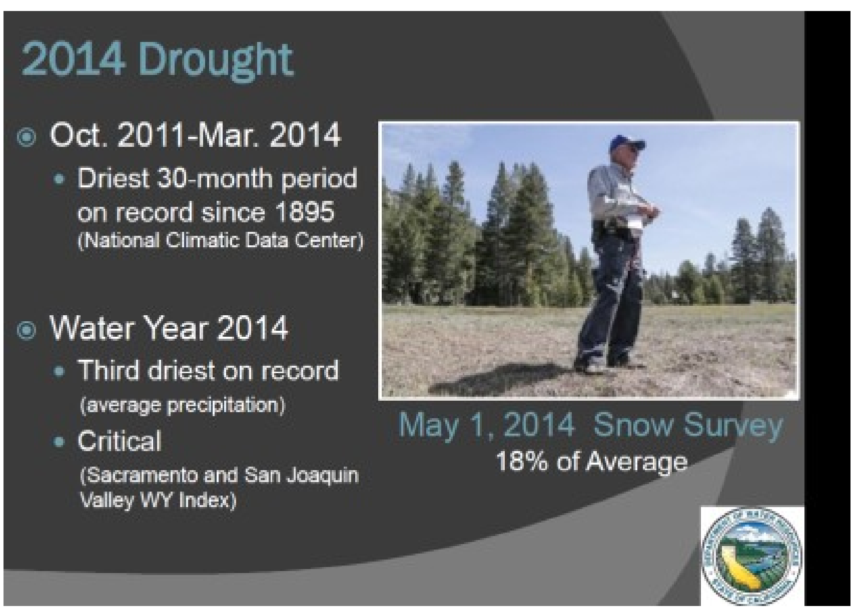
- Upcoming flagship missions are water focused: SMAP, GRACE-FO, SWOT, NISAR
- Radar observations of levee integrity and subsidence
- Smaller missions and aircraft observatories: ASO, ECOSTRESS remotely-sensed and aircraft data for forecasting surface
- An agriculture focused airborne observatory to measure soil moisture, evapotranspiration, vegetation stress

NASA and JPL want to be a go-to source for aircraft and satellite data, and to help California and other regions. They are in the planning stages of a Center for Snow and Water Availability and are inviting heavy stakeholder engagement

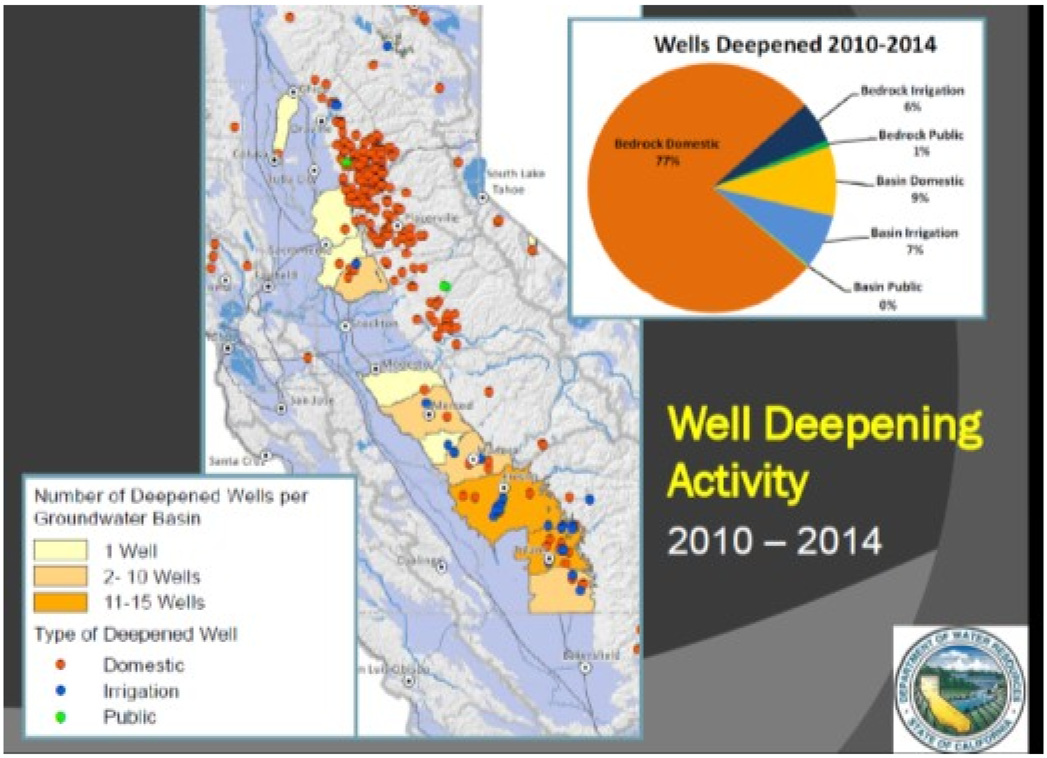
California's Groundwater and the Impact of Drought, Dane Mathis, Senior Engineering Geologist, Division of Integrated Regional Water Management, South Central Region Office, Department of Water Resources (Dane.Mathis@water.ca.gov)
http://www.waterplan.water.ca.gov/cwpu2013/prd/index.cfm http://www.water.ca.gov/groundwater/
http://www.water.ca.gov/waterconditions/docs/Drought_Response-Groundwater_Basins_April30_Final_BC.pdf

Dane Mathis began with a thorough and interesting background on the precipitation, surface water, and types of aquifers of California and the great differences in precipitation, runoff and use in southern California compared to northern California.





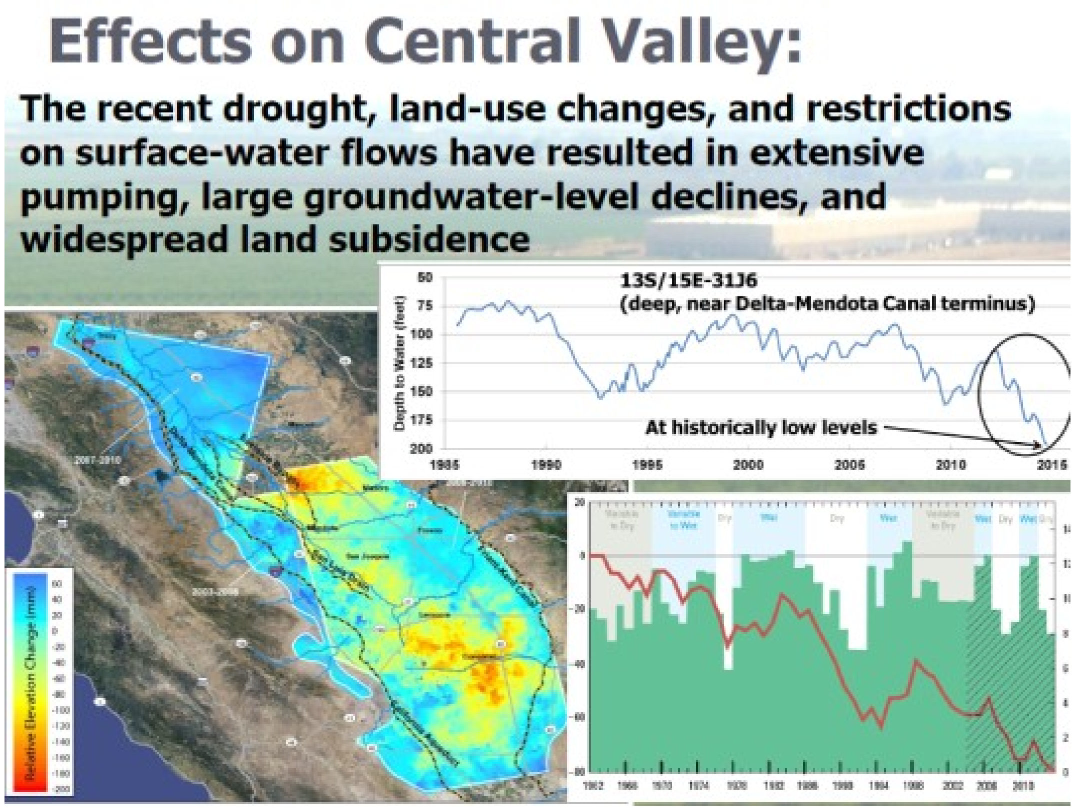
He then outlined the extent of the California drought and the impact it is has had on groundwater levels and use. There are 515 alluvial basins and sub-basins in California that account for 30 to 40 per-cent of the state's water supply. Water supply, basins, precipitation, population, and water demand are not evenly distributed in the state. As the drought has progressed, drought response has included well-deepening activity and increased groundwater reliance as surface water levels have dropped. Mathis reminded the group that there are gaps in groundwater monitoring and we often do not know how much groundwater there is. He said a study in 1980 showed 31 basins with evidence of overdraft and 11 basins subject to critical overdraft. Thirty years later, many of these basins show signs of continued overdraft and impacts have not yet been adequately addressed.



In January 2014, Governor Brown declared a State of Emergency, called for conservation statewide, and directed the state to manage water for drought. In April, he issued an Executive Order to redouble state drought actions. Later in the year, for the first time in California history, legislation was passed to phase in regulation of groundwater.

Assessment of Recent Land Subsidence in California, Claudia Faunt, Ph.D., P.E., Hydrologist, U.S. Geological Survey, California Water Science Center, San Diego Projects Office, CA (ccfaunt@usgs.gov)
http://ca.water.usgs.gov/pubs/2014/sir20145075.html http://ca.water.usgs.gov/mojave/sub2010.html
http://ca.water.usgs.gov/pubs/2013/sir20135142.html http://pubs.usgs.gov/fs/2009/3057/pdf/fs20093057.pdf
http://ca.water.usgs.gov/projects/central-valley/index.html http://pubs.usgs.gov/pp/1766/PP_1766.pdf
http://ca.water.usgs.gov/projects/central-valley/central-valley-hydrologic-model.html

To illustrate the issue of land subsidence in California, Claudia Faunt used Central Valley as an example. Central Valley is about 20,000 square miles and comprises about 1% of U.S. farmland. It produces more than 250 different crops and supplies 7% of the U.S. agricultural output (by value), one-fourth of the nation's food, including about half of the nation's fruits, nuts, and vegetables. Approximately 20% of the nation's groundwater is pumped from the Central Valley aquifer system.



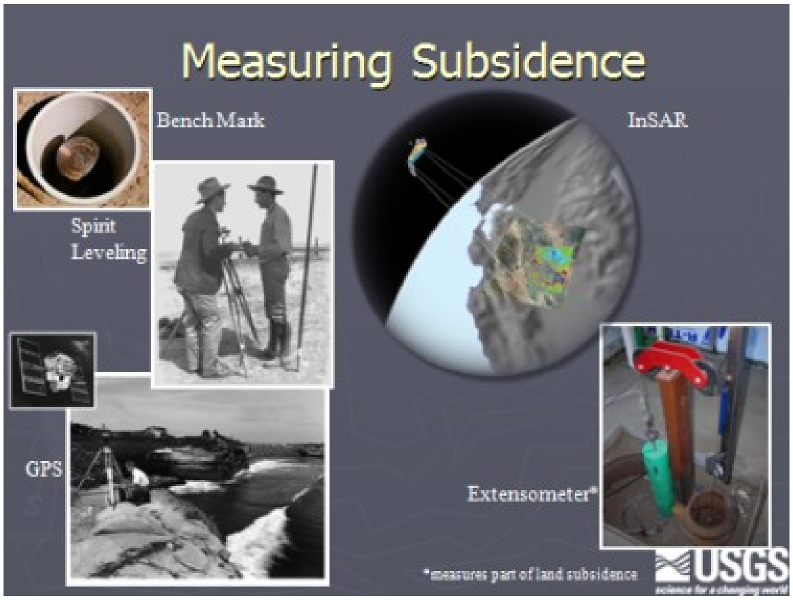
Subsidence damages natural resources in the following ways:

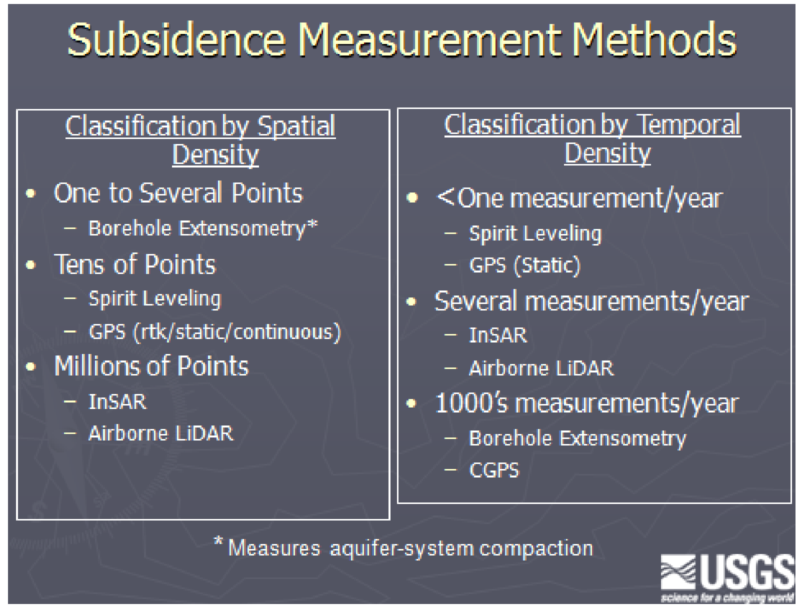
- Reduces aquifer system storage capacity
- Impacts wetland, riparian, and aquatic ecosystems
- Restricts land uses

Subsidence damages infrastructure. Risks are dependent on

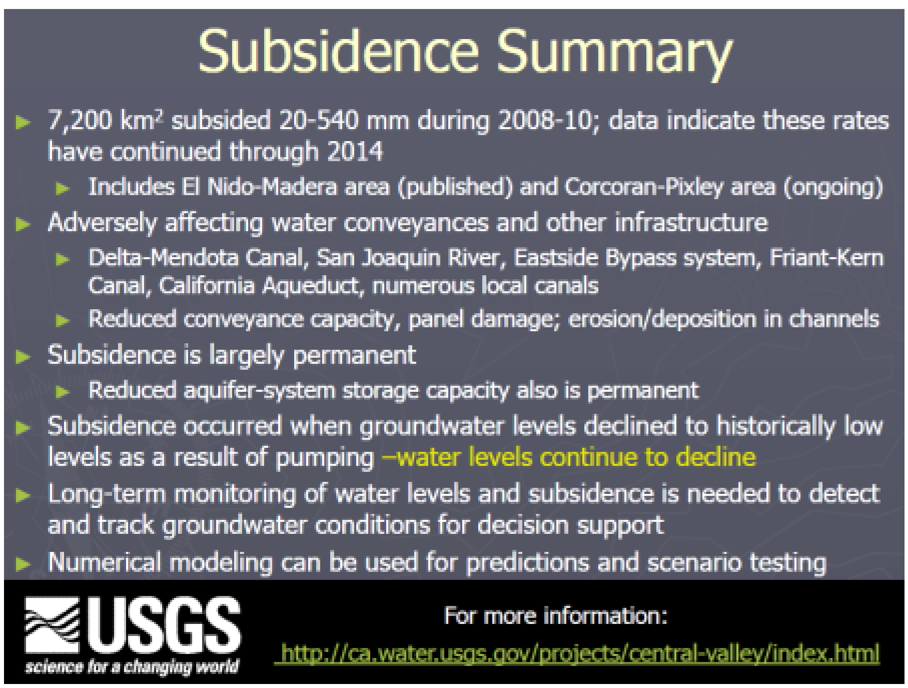
- type of infrastructure
- magnitude of subsidence
- subsidence gradients (differential subsidence)

Claudia said the highest risk is for infrastructure built at specific elevations such as water conveyances, and freeway overpasses, and pipelines. There is also high risk to infrastructure not dependent on specific elevations such as roads, railways, bridges, and wells.





Claudia told the Roundtable that the best results come from combining measurement methods. Satellites can guide terrestrial monitoring schemes and we can ground truth the InSAR data with spirit leveling or GPS. This can improve the spatial/temporal resolution of sparse data. She presented several startling examples of the degree of subsidence over both the past century and the past few years of drought.



Claudia concluded by asking, "What can we do about it?" She said models can be used to predict groundwater elevations and subsidence and to simulate scenarios including extended drought/climate change, reduced surface water deliveries, pumping (reclamation), and artificial recharge.

Long-term monitoring of water levels and subsidence is needed to track groundwater conditions in the context of historical levels.

Snow, Forests, and Drought: Three CA projects

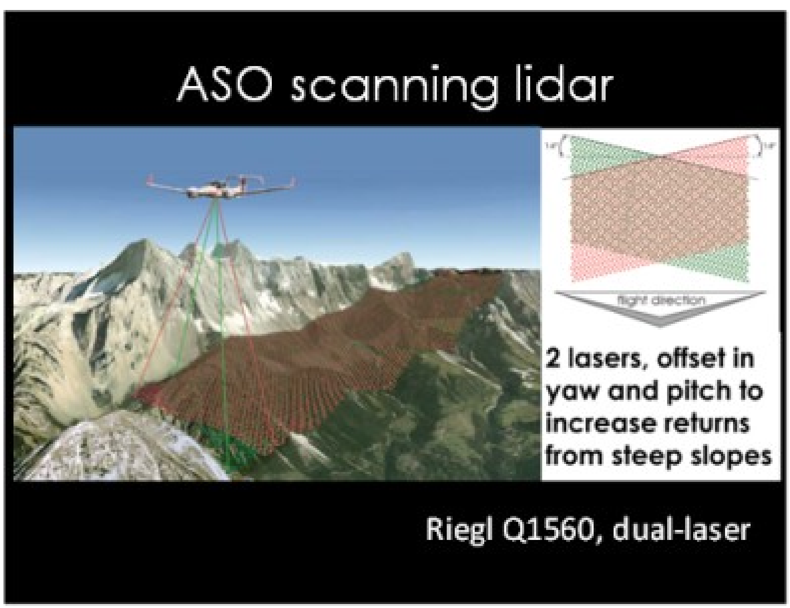
***Snowpack and Water Supplies for California*,** Thomas H. Painter, PhD, Jet Propulsion Laboratory, NASA, California Institute of Technology, and Frank Gehrke, Chief of Snow Surveys, DWR

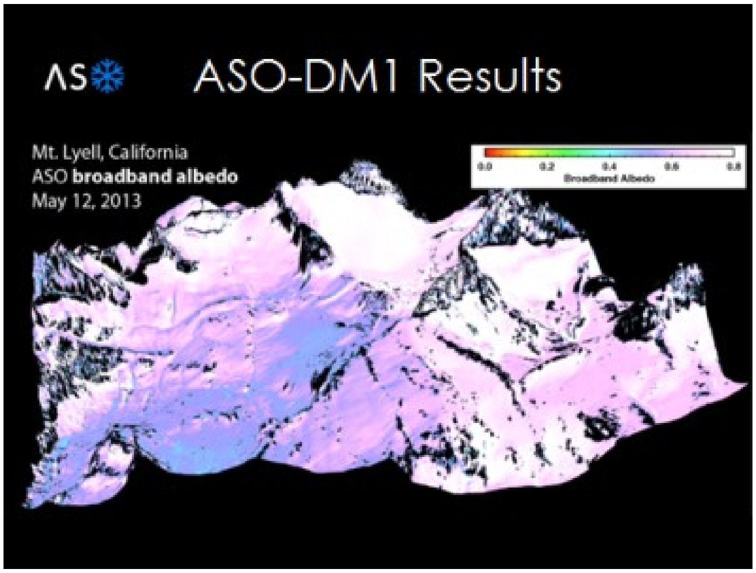
Thomas Painter presented the impact of a technology new to most of the participants — the Airborne Snow Observatory (ASO). In contrast to the longstanding methods of estimating the depth of mountain snowpack by sampling actual depths in a few places, the ASO uses airborne lasers to measure the winter topography of a snow-covered mountain range. A digital comparison is made of the topography snow-free and snow-on and the difference gives the snow depth to one-meter spatial resolution. This technique gives 39 million times more coverage than ground sampling alone.

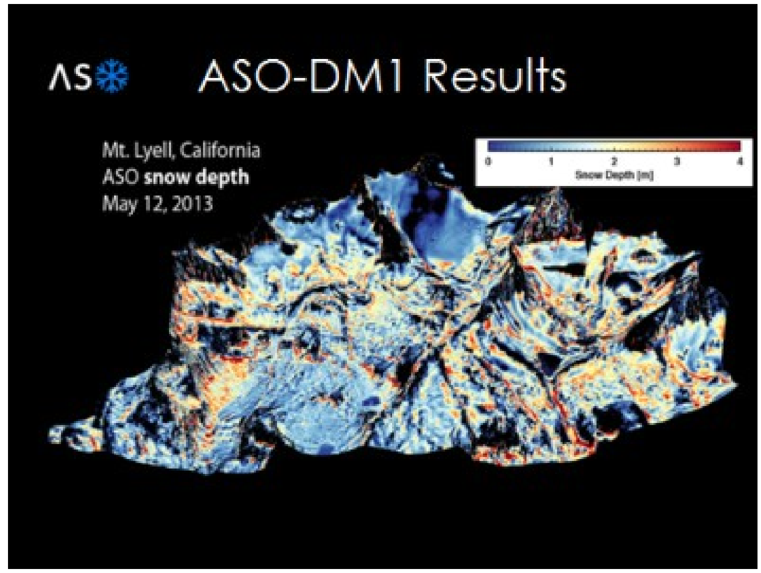
This technique supports knowing the magnitude and timing of snowmelt runoff. To calculate that requires knowing the snow water equivalent and the snow albedo or brightness. The more dust or dark particulate matter in the snow, the greater the absorption of the sun's radiation and the faster the melt rate.

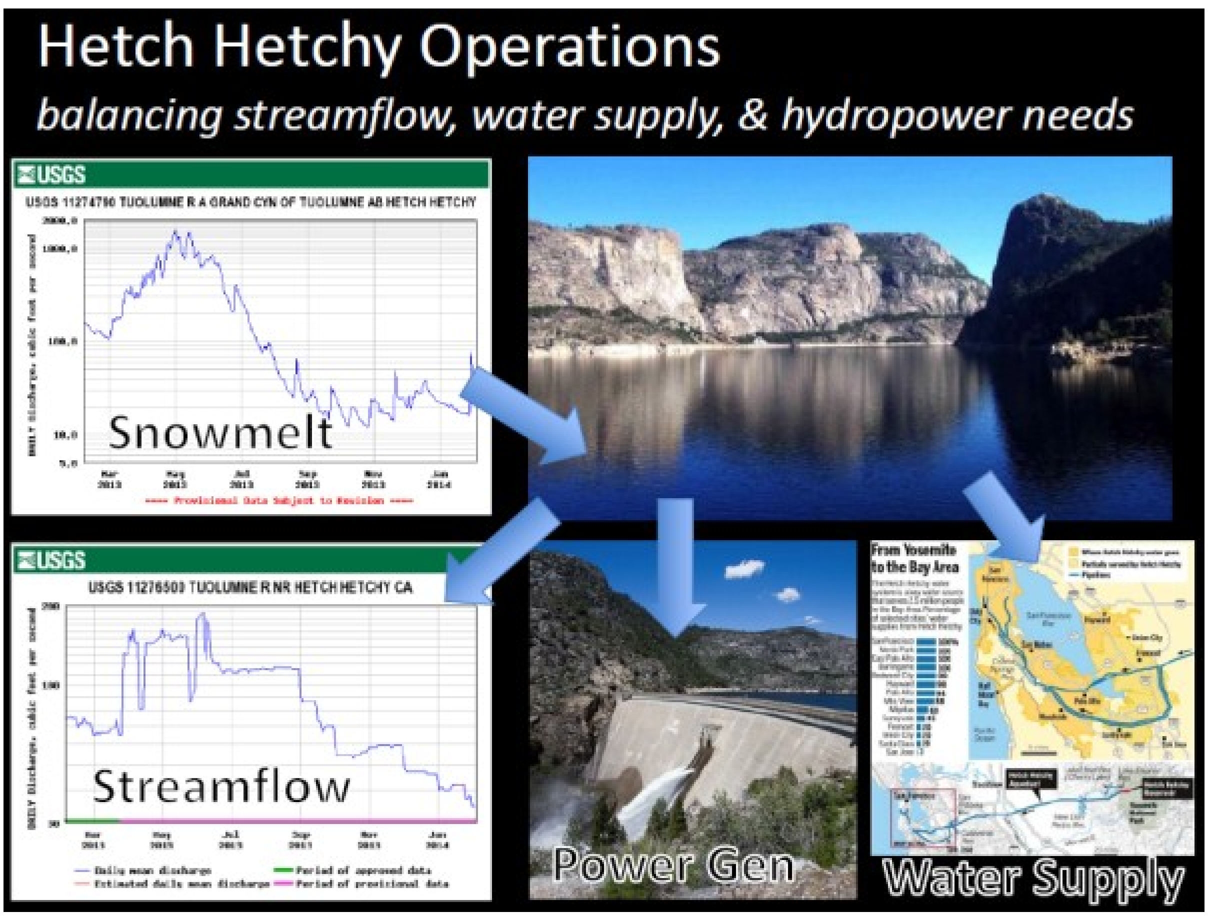
Data processing is now very fast. From flight landing, there is a less than 24 hr turnaround of snow water equivalent and albedo maps at 50 m resolution through a complex interwoven data chain between spectrometer and lidar to provide a model of hydrologic response units.

The applications for integrating ASO with water management include stream-flow, water supply, and hydropower needs.




ASO-DM1 Results
Mt. Lyell, California
ASO **broadband albedo**
May 12, 2013
Broadband Albedo


ASO-DM1 Results
Mt. Lyell, California
ASO **snow depth**
May 12, 2013
Snow Depth [m]


Hetch Hetchy Operations
balancing streamflow, water supply, & hydropower needs
USGS
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Snowmelt
USGS
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Streamflow
Power Gen
From Yosemite to the Bay Area
Water Supply

Mokelumne Watershed Avoided Costs Project, Kim Carr, Sierra Nevada Conservancy and Chris Nota, U.S. Forest Service. Project webpage: http://www.sierranevada.ca.gov/our-work/mokelumne-watershed-analysis

A hot topic in forest management today is linking costs for maintaining healthy forests to avoided costs of future fires and damage to water infrastructure.

Kim Carr spoke about the relationships among the forests or the watershed and fire. She presented the results of the Mokelumne Watershed Avoided Cost Analysis. The study set out to answer the question – Does it make economic sense to increase investment in fuel treatments to reduce the risk of large, damaging wildfires?

The planning team was comprised of the U.S. Forest Service Region 5, the Sierra Nevada Conservancy, The Nature Conservancy, and a large number of partner organizations.

Primary Goals of the Project:

- Calculate the avoided costs of implementing forest treatments to reduce fire risk compared to paying costs associated with wildfire
- Through collaboration, identify project treatments and locations that show multiple benefits
- Encourage new investment in forest treatment to increase pace and scale and reduce fire risk
- New investment/investors
- Education – link headwaters to water users/rate payers

Costs not included in the analysis included water yield and quality, air quality, pollination, habitat and biodiversity, aesthetic values, recreational values, and cultural resources.

Costs and Benefits of Modeled Fuel Treatments

Costs		
Fuel Treatment	$68,000,000	$68,000,000
Benefits	**Low**	**High**
Structures Saved	$32,000,000	$45,600,000
Avoided Fire Cleanup	$22,500,000	$22,500,000
Carbon Sequestered	$19,000,000	$71,000,000
Merchantable Timber from Treatment	$14,000,000	$27,000,000
Avoided Suppression	$12,500,000	$20,800,000
Biomass from Treatment	$12,000,000	$21,000,000
Avoided Road Repairs and Reconstruction	$10,630,000	$10,630,000
Transmission Lines Saved	$1,600,000	$1,600,000
Timber Saved	$1,200,000	$3,130,250
Avoided Sediment for Utilities (water supply)	$1,000,000	$1,000,000
Total Benefits	**$126,430,000**	**$224,260,250**

Figure ES-3. Total Costs and Benefits for Fuel-Treatments Scenario

www.SIERRANEVADA.ca.gov

Kim Carr concluded with a summary of the key findings of the analysis.

- Fuel treatments can significantly reduce the size and intensity of wildfires
- The economic benefits of fuel treatments can be three or more times the costs
- There are many beneficiaries from increased fuel treatments, especially taxpayers
- The estimated volume of sediment from post-fire is estimated to be large, however the avoided costs to downstream utilities were less than anticipated

Remote Sensing of California Agriculture for Drought Impact Assessment and Mitigation,
Forrest Melton, Senior Research Scientist NASA Ames Research Center - Cooperative for Research in Earth Science and Technology (ARC-CREST) and California State University, Monterey Bay

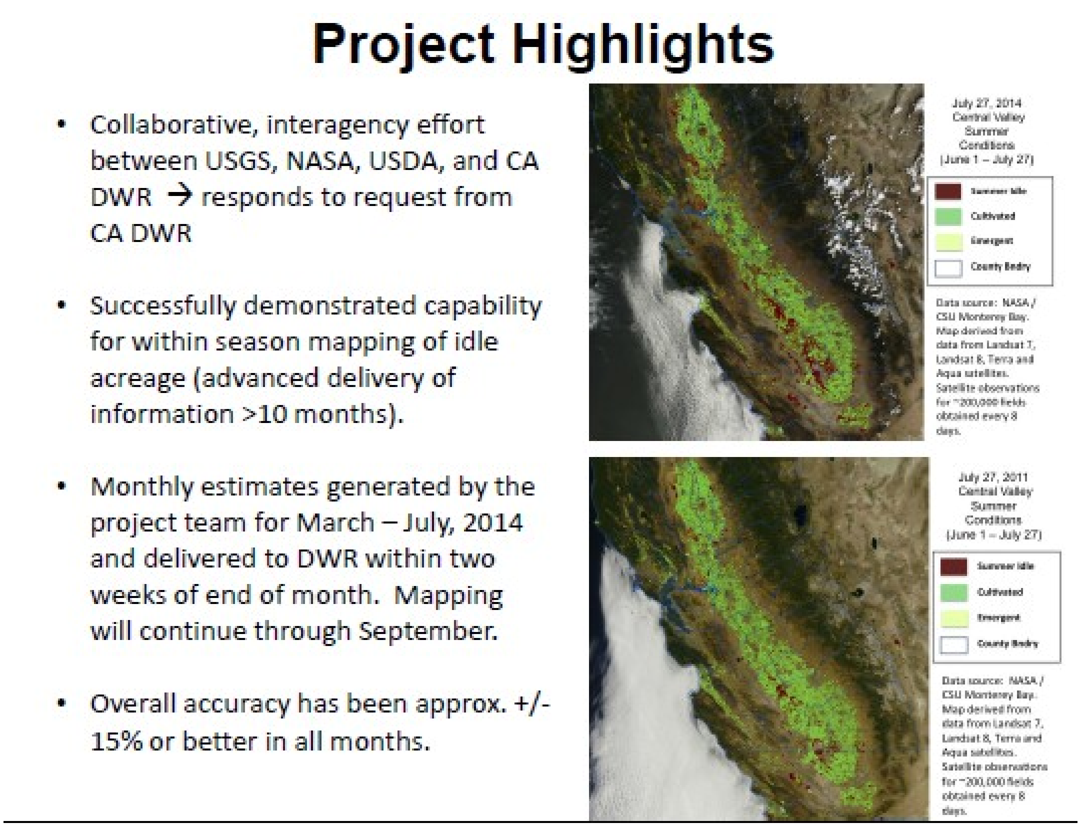
Forrest Melton acknowledged the team of people that had worked on the project. He then outlined the project on drought impacts on land fallowing:

- Background: Mapping of fallowed areas during drought identified as a research priority for NIDIS by CA Department of Water Resources (CDWR).
- Information needed: Product similar to "idle lands" class in NASS crop data layer for California, but on a monthly basis during growing season(s).
- Project objective: Apply satellite data to provide information that will allow CDWR and other stakeholders to identify extent of, or change from historical conditions in, fallowed acreage due to water shortage.

- **Decisions supported**:
    - State proclamations of emergency pursuant to the California Emergency Services Act and allocation of drought relief funding
    - State priorities for providing assistance with and processing of local water transfer requests

- **Limitations of previously available information:**
    - USDA NASS Cropland data layer (CDL) considered confidential and market sensitive during the growing season
    - Fallowed acreage reports from other sources do not follow standard definitions or data collection methods often generate conflicting estimates

In addition to applying satellite data to map crop cultivation and idle acreage to quantify drought impacts on agricultural production, the project partners are also working to integrate satellite observations of crop cover with surface measurements from the California Irrigation Management Information System to map crop water requirements.



Panel 3 Discussion

Snow observatory cannot keep up with requests. The new national water center is working on global snow packs.

Timber was a big conflict but we now have some partnerships. There is manages culling without taking out large trees.

Q. What do we do with brush?

We should thin and reduce fuels but a majority is piled and burned because there is no economic incentive or infrastructure to use the brush. Problems of overharvesting etc, lead to shut down of the work. We need to develop use of the brush not timber. Biofuels are one area. We need entrepreneurs to work on this.

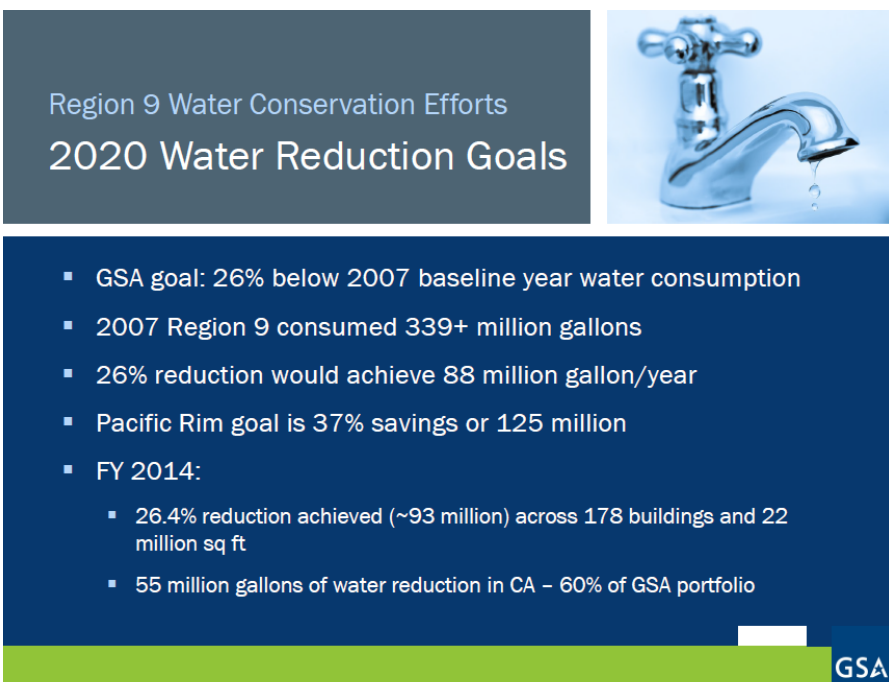
Q. What are your suggestion for young folks on where to focus efforts?

- They have an opportunity to make improvements. The technology is there but weneed to put it in place.
- Diverse experience is key. Acting at the municipal government level is an important way to build sustainable models.
- California is working in the carbon realm and is building an incredible model for solving problems. The state is taking in revenue and reinvesting it.

Keynote Talk: Green Proving Ground (GPG) Initiatives and Emerging Technologies, Ruth Cox, Pacific Rim Regional Administrator, GSA

Administrator Ruth Cox reported that the General Services Administration has an aggressive plan to reduce water consumption beyond the Presidential mandate of 26% by 2030 (which they have already achieved).

She began with examples of several energy-saving measures GSA has undertaken, reminding participants of the connections between energy production and use, and water consumption.



Administrator Cox then told participants that GSA has already implemented short-term measures that required little or no investment but did involve a lot of behavioral change. In addition, they have long-term measures that will significantly reduce water consumption, especially at Land Ports of Entry and other large water-consuming location, but they will require funding which they are now lining up.

She then turned her attention to the California drought and summarized the short-term and long-term drought response actions taken by GSA in the region.


don't be a drip
turn it off every time
Quick Fact
3,000 gallons
Amount of water wasted per year from a leaky faucet dripping at a rate of 1 drip per second. That's enough water for 180 showers.
Region 9 Water Conservation Efforts
Short Term Drought Response
Creation of Water Conservation Taskforce
Designated Water Efficiency Coordinator
Immediate actions:
Education and Outreach Programs
Tenant Engagement
Adapted Custodial Practices
Assessing Plumbing Fixtures, and HVAC Systems
Landscape and Irrigation
GSA


US Courthouse - Albuquerque, NM
Land Port of Entry – Mariposa, AZ
Living Roof GSA R9 HQ - San Francisco
Region 9 Water Conservation Efforts
Long Term Drought Response
Introduction of water efficient fixtures
Upgrading cooling towers, boiler and hot water systems
Use of water resistant plants and efficient irrigations systems
Gray water systems at Land Ports of Entry and other appropriate sites
Continue to pursue green & living roofs
GSA