Sustainable Water Resources Roundtable

University of California, Davis Campus
Davis, CA

Proceedings

December 6 - 8, 2011

Theme: Sustainability Initiatives for Managing California's Natural Resources

The Sustainable Water Resources Roundtable (SWRR) normally alternates its meeting between the Washington DC area and elsewhere in the United States. The SWRR chairs and steering committee are grateful to Rich Juricich of the California Department of Water Resources for being the primary organizer of the meeting and to Fraser Shilling of the University of California, Davis for providing the venue and hosting the meeting. Individual presentations summarized in these proceedings are posted in their entirety at http://acwi.gov/swrr/p&p_library/dec6-2011_uc/index.html

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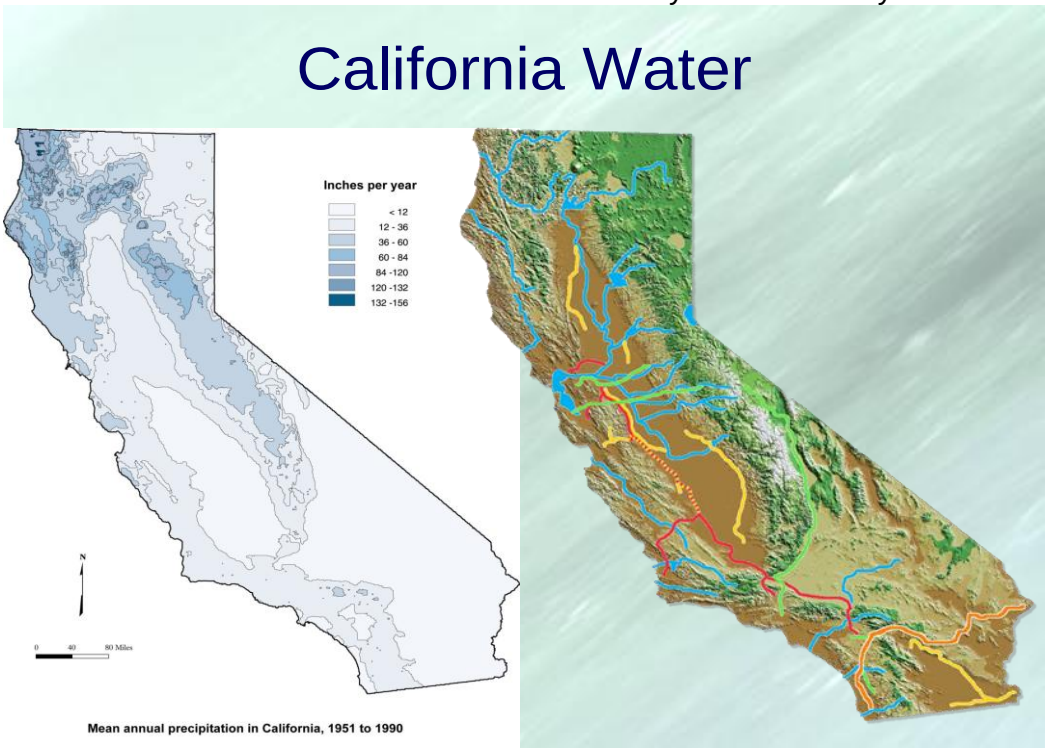
Welcome Remarks and Review of Goals for the Day:

Robert Wilkinson of the Bren School at UC Santa Barbara and David Berry the SWRR manager welcomed the participants to the SWRR meeting.

Welcome by the California Department of Water Resources

Kamyar Guivetchi extended greetings to the participants from Mark Cowin, The Director of the California Department of Water Resources. Kamyar then gave an interesting overview of water resources in California relative to the rest of the United States and a summary of sustainability Initiatives at CADWR.



Kamyar reminded participants that California is the most populous state in U.S. – representing about 12% of national population. The estimated 2010 population of California was about 38.6 million. California had been the top agricultural production state in the nation for more than 50 years with nearly 9 million acres of irrigated cropland. There are supply and demand issues of water distribution: about 2/3 of the State's surface water runoff occurs north of Sacramento, while about 2/3 of the State's water needs occur south of Sacramento.

Sustainability in an overarching theme and broad concept encompassing a wide array of critical issues such as: global warming and climate change, population growth, fresh water scarcity, fragmentation of ecosystems and species loss, and depletion of nonrenewable resources.

Kamyar said sustainability is ultimately the recognition that to maintain prosperous, thriving human communities requires adaptive social systems that understand various ecological and natural resources boundaries and know how to live within them. Sustainability can be achieved in many ways as it is a dynamic and iterative process without a particular end point.

At the California Department of Water Resources sustainability for a natural resources and public trust agency means recognizing the need for public agencies to implement sustainability in both their mission and their administrative practices and leading the way in implementing critical changes in the delivery of services and in agency business policies and procedures.

A Sustainability Directive issued September 20, 2010, declared it is the policy of the Department of Water Resources (DWR) to become a sustainability leader and ecosystem steward within State Government and the California water community. DWR will do so by promoting, and facilitating sustainability practices throughout its business operations and the State Water Project (SWP). And, in the context of technical feasibility and cost-effectiveness, will make sustainability a criterion in all decision-making processes.

The Department also issued the Environmental Stewardship Directive on September 21, 2010
The policy goals are to:

- Manage and protect natural resources and ecosystems in a sustainable manner
- Integrate into flood and water planning
- Include as criteria in project funding decisions
- Plan for conservation, restoration, and maintenance of biodiversity and natural processes
- Support projects that contribute to recovery of listed and at risk species

To support policy implementation, environmental stewardship principles have been placed into agency policy documents including:

- Engineering Bulletins.
- Grant guidelines
- Integrated Regional Water Management guidelines

A department wide implementation plan has been developed and a training class and case studies are being developed. Water resources sustainability involves developing and implementing integrated policies, plans, and activities that ensure safe, adequate, reliable and renewable water supplies and water infrastructure. It also includes developing new knowledge and solutions regarding the limits and boundaries of water use, strengthening information resources, monitoring, data integration and interpretation for informed decision-making.

Water Plan Update 2009

A key goal of the water plan is that California be prepared for climate uncertainty by developing adaptation strategies and investing in a diverse set of actions that reduce the risk and consequences posed by climate change, that make the system more resilient to change, and that increase the sustainability of water and flood management systems and the ecosystems they depend on. A guiding

principle is to determine values for economic, environmental, and social benefits, costs, and tradeoffs to base investment decisions on sustainability indicators.

The Water Plan update for 2013 includes the California Water Sustainability Indicators which are relevant to Integrated Regional Water Management Planning.

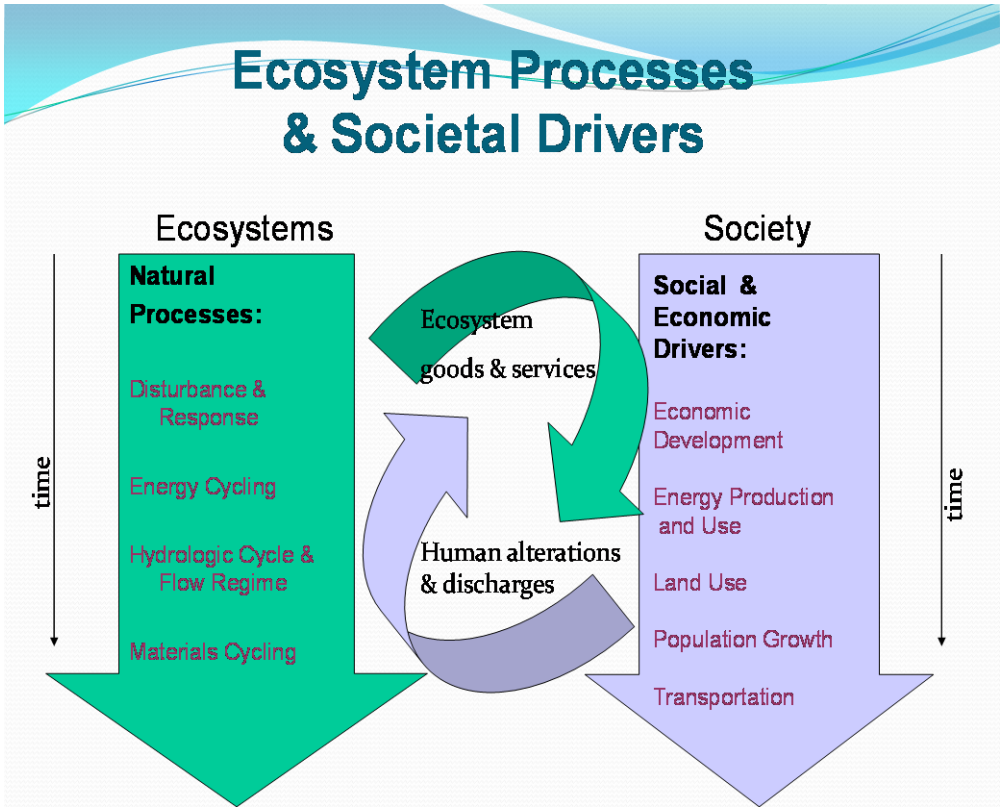
- Provides a toolbox for Integrated Water Resource Management (IWRM) regions to conduct water sustainability analysis at the local scale using local data, results from which may be rolled up to regional and state level.
- Agencies may improve their water sustainability through an evaluation of condition and trends of suitable indicators.
- The analysis may help identify issues and data gaps to inform future data monitoring needs.
- The analysis may highlight policy needs to ensure local and regional water resources sustainability.

Sustainable Water Resources Roundtable Background

Rich Juricich of the California Department of Water gave a summary of SWRR activities and history. He described the Sustainable Water Resources Roundtable as a national collaboration of federal, state, local, corporate, non-profit and academic interests that are organized as a subcommittee of the Federal Advisory Committee on Water Information which has its secretariat at the US Geological Survey.

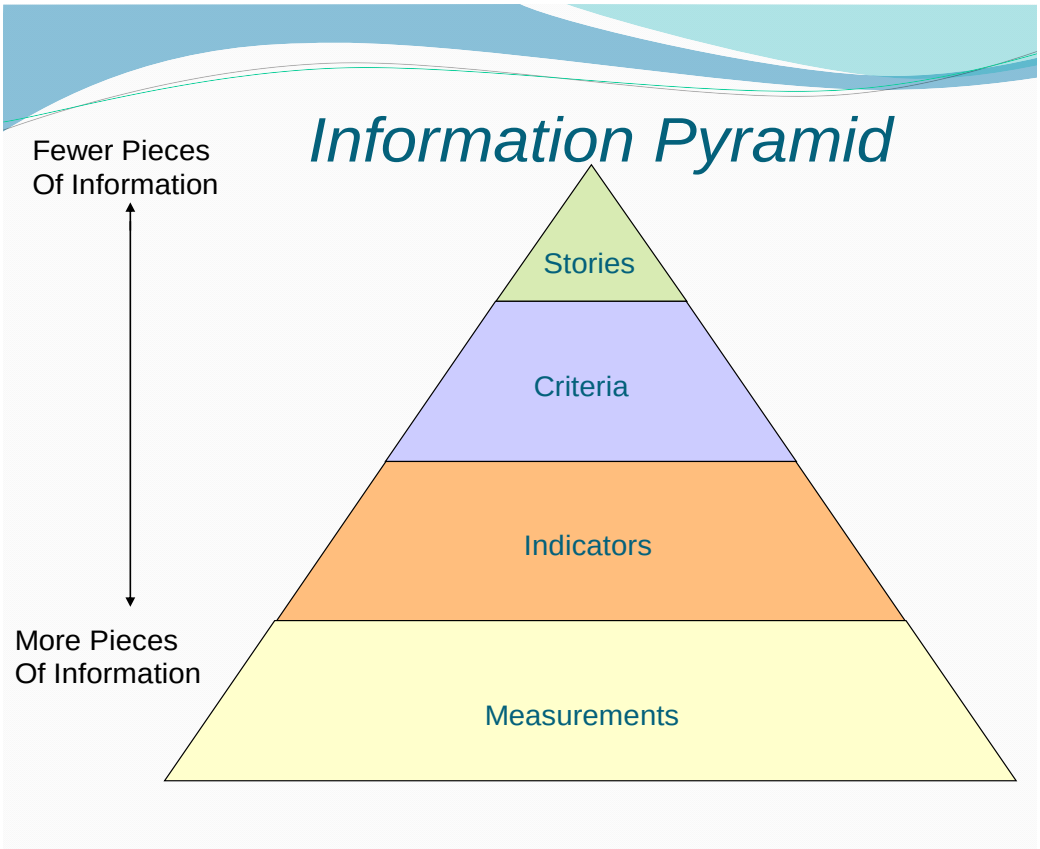
The SWRR Mission is to promote sustainability of the nation's resources through …

- Evaluation of information
- Development & use of indicators
- Targeting of research
- Engagement of people & partners



The SWRR Vision is of a future in which our nation's water resources support the integrity of economic, social and ecological systems and enhance the capacity of these systems to benefit people and nature. SWRR has more than 600 participants from federal, state and local governments; corporations; nonprofits and academia. Meetings have been held in California; Colorado; Maryland; Michigan; Minnesota; Virginia; and Washington, D.C.

Publications and conference presentations as well as the SWRR principles of water sustainability and the indicator framework for water resources can be at the SWRR web site: http://acwi.gov/swrr/



Rich pointed out that the ongoing work for the SWRR includes continuing roundtable outreach building regional connections and adding new private, nonprofit & public sector partners. We also hope to refine the roundtable's sample indicators addressing sustainability and scale and link to national and regional indicator sets as we collaborate with the National Water Census and other indicator initiatives across the nation. We also seek to assist agencies in describing the need for programs to collect indicator information.

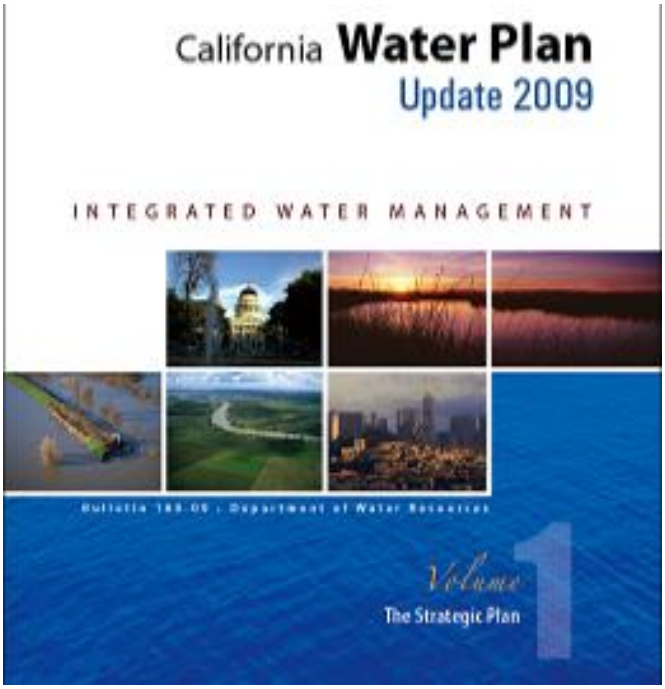
One minute round of BRIEF self-introductions

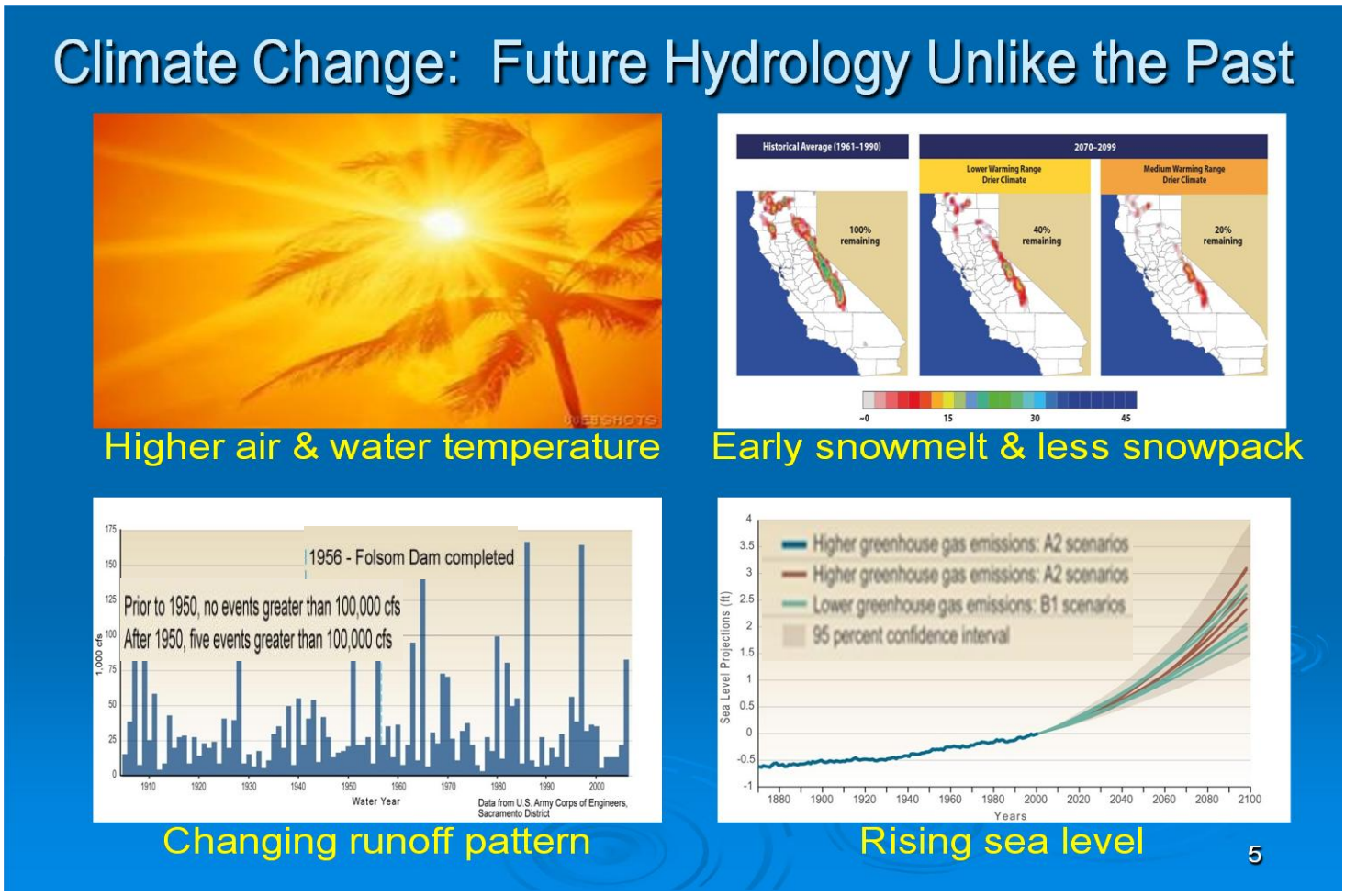
One of the most popular parts of a SWRR meeting is the one minute round of brief self introduction mentioning each participant's interest in sustainability and water resources. Since an important value of SWRR is the opportunities to make new contacts for collaboration to hear of the work and commitment of people in the room can be both interesting and inspiring.

California Water Plan, Integrated Water Management

Kamyar Guivetchi, Chief, Division of Statewide Integrated Water Management, California Department of Water Resources

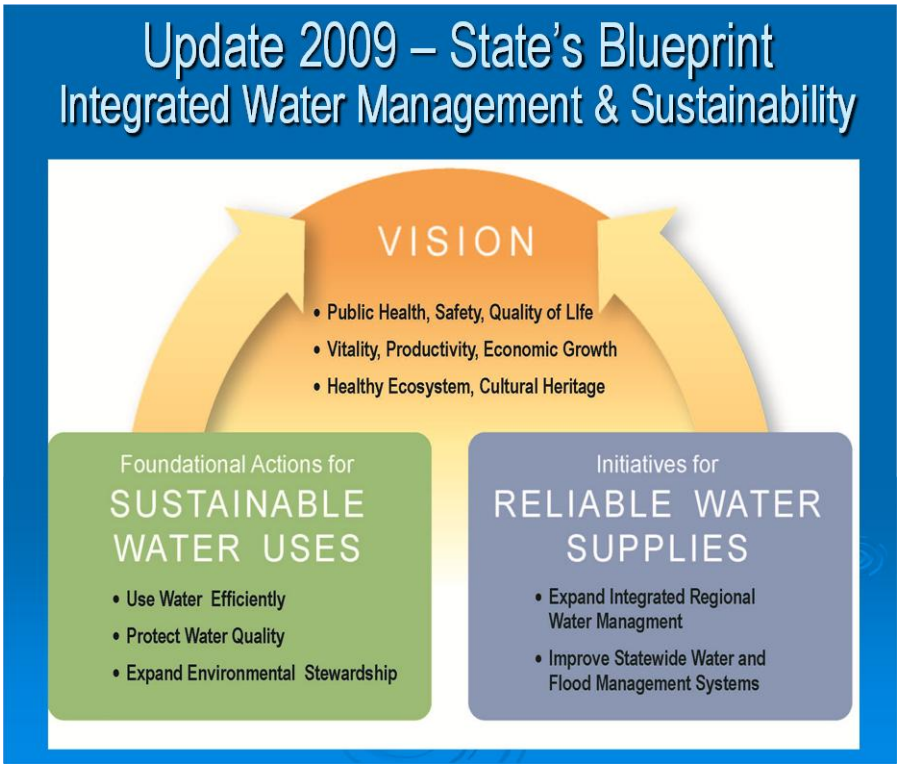
Kamyar began by discussing the imperative to act to keep pace with the changes faced in California and around the world. Population growth and migrations, a shift to permanent crops, increasing flood risk, declining Delta and watersheds, and impaired water bodies all pose challenges. In addition, climate change is profoundly impacting water systems. Other challenges include aging water infrastructure and flood systems. Fixes of these problems are limited by legal remedies and regulatory protections. All the while there are growing economic and societal consequences of declining water reliability and degraded quality of surface & groundwater supplies. The entire system – water and flood facilities, watersheds & ecosystems – has lost resilience and is changing in undesirable ways.





Kamyar said that with climate change the future hydrology of California will be unlike the past. The Department of Water Resources is creating alternate future scenarios to respond to key factors of uncertainty. They have a planning horizon out to 2050 looking at water projections with and without climate change assuming current trends, slower and strategic growth and expansive growth. The same assumptions and forecasts are done at the regional level throughout California.
The California Water Plan states its vision and mission and lays out seven goals, ten guiding principles, thirteen objectives and over one hundred and fifteen suggested actions. It concludes with nine recommendations. Kamyar said we need the "3 I's": to invest in innovation and infrastructure. The plan calls upon the California State Government in partnership with others to invest in water innovation and infrastructure to support integrated water management and sustainable outcomes

Water management is decentralized in California over 2,300 counties, cities, public agencies, and private water companies. They can use IRWM to coordinate land use planning with water supply, quality, flood management, and climate adaptation. To support integrated regional water management forty eight Regional Water Management Groups have been created to foster partnerships and promote regional solutions including diversification of water portfolios and integration of supplies. Working together in regions also allows water users to leverage economies of scale to reduce costs, integrate data, tools and resources, invest in multi-benefit projects with sustainable outcomes and increase regional self-sufficiency.



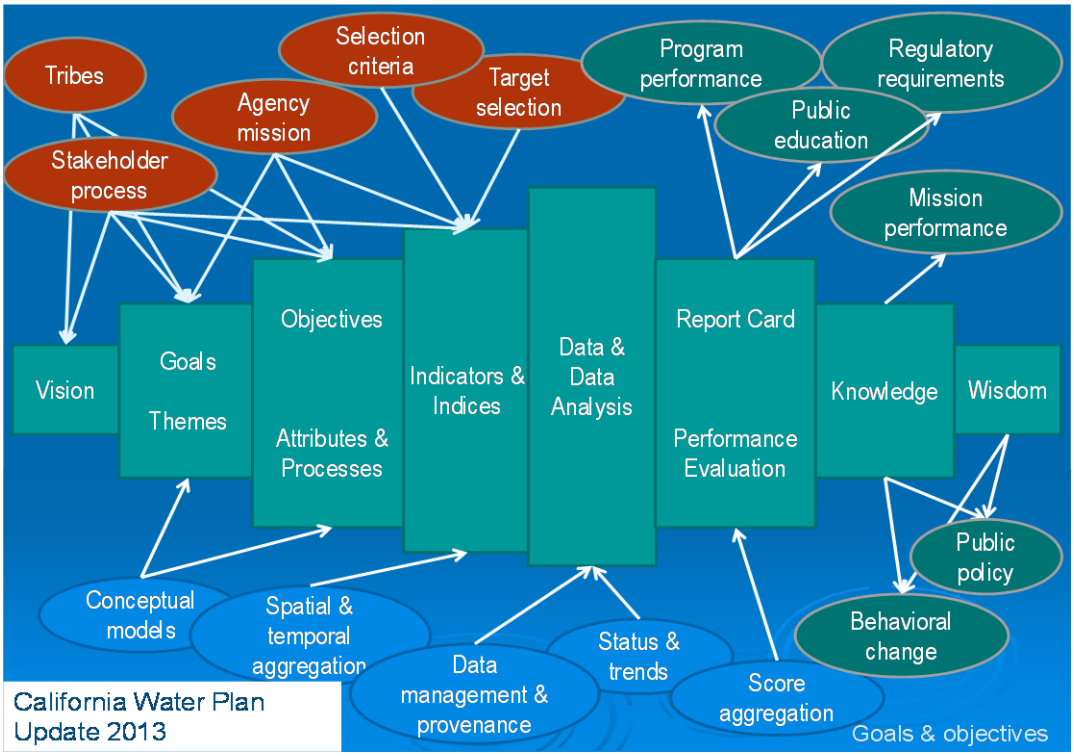
Kamyar invited participants to the ***Water Plan Web Portal*** at www.waterplan.water.ca.gov and to Subscribe to ***Water Plan eNews*** a weekly electronic newsletter at www.waterplan.water.ca.gov/enews

Questions from audience to Kamyar Guivetchi:

1) Is it possible to share the data about the case study mentioned on Yuba county restoring groundwater levels? Answer: Yes, and will provide contact information to put person in contact with DWR representatives following the presentation.
2) Is it true that when you overdraft a water table, you have subsidence and earth compaction such that the volume of the water table is diminished even though the water level may have reached some historical level? Yes
3) Are there any known cases of the worst possible scenario occurred where the aquifer was completely depleted? Not aware of any specific cases of that nature, but studies in certain regions have shown drastic reductions in water table levels and projections do show that unless withdraw rates are lessened, complete depletion will occur in the near future in some instances.
4) Is there any effort underway to involve insurance agencies and other businesses in sharing the information and projections from the Water Plan so that the main messages of water use and sustainability concepts can be translated in other terms such as risk and insurance premiums? Yes, a large part of the outreach effort with this Plan update will be to reach out to a broad array of stakeholders in conferences such as these and encourage sharing of information. Webinars will be a key part of sharing the Water Plan highlights.

California Water Sustainability Indicators System – Fraser Shilling, UC Davis

Fraser began by acknowledging the people who contributed to the extensive work on the Water Sustainability Indicator System including those at the Department of Water Resources, the CALFED Watershed Program, grad students and others at UC Davis, the Sacramento River Watershed Project, the North Bay Project in Napa County, and the Southern California Watersheds Project.



The assumption of the indicator project is that people, agencies and decision-makers want to know how environmental, community, and natural conditions are doing and changing. Indicators and report cards can be used to share with the public simplified interpretations of condition of a system and trends over time. Indicators represent the system(s) in question and can be analyzed over time as a way of measuring the pulse of the system(s).

After outlining the goals and objective of the Indicator System, Fraser reminded the participants that there are quantitative and qualitative Indicators. The selection criteria for indicators include the availability of high-quality data, data affordability, system representation, ability to detect change over time, independence of indicators from one another, that an indicator supports management decisions and actions and that it can be reported and understood in public arenas

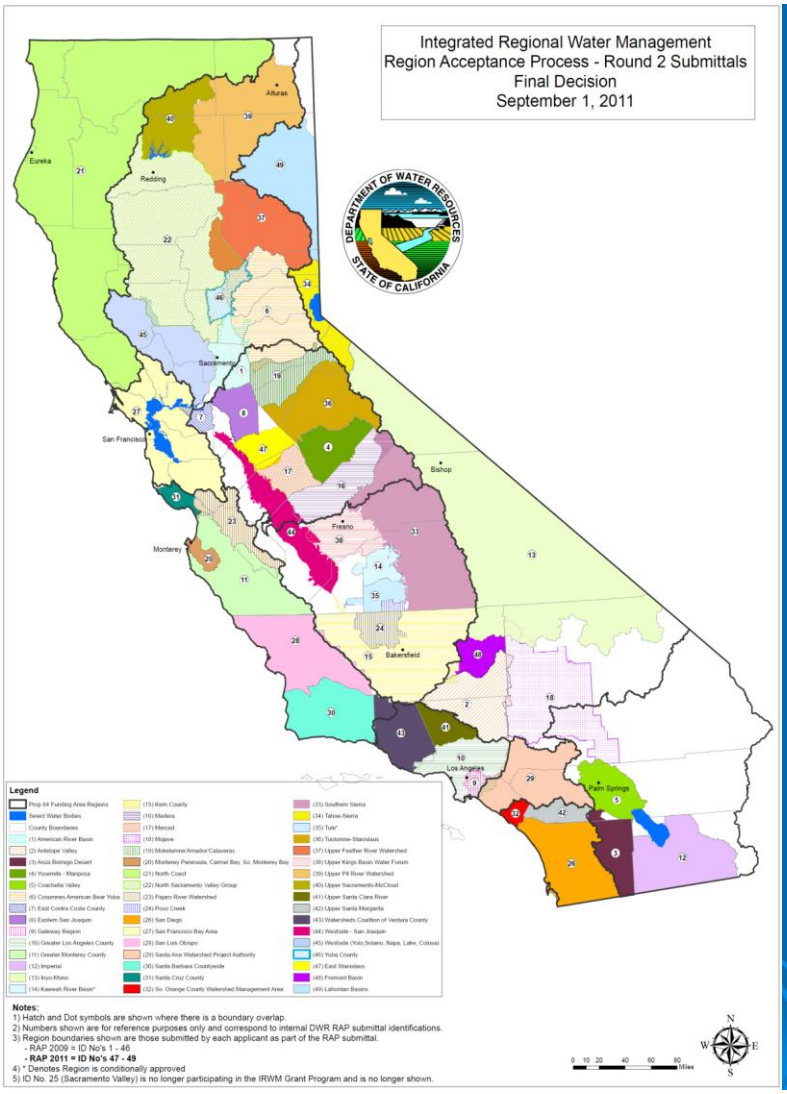
We should measure sustainability by choosing regionally-specific targets for social, economic, ecological, and management-system indicators. When measuring performance, we are almost always measuring condition against some standard. It is unlikely that report cards and indicators would be useful without this comparison. This approach is called normalization or re-scaling. The specific approach used is "distance to target", measuring distance to "poor" or "good" conditions. This grounds indicator evaluation and allows inter-indicator and inter-regional comparison.

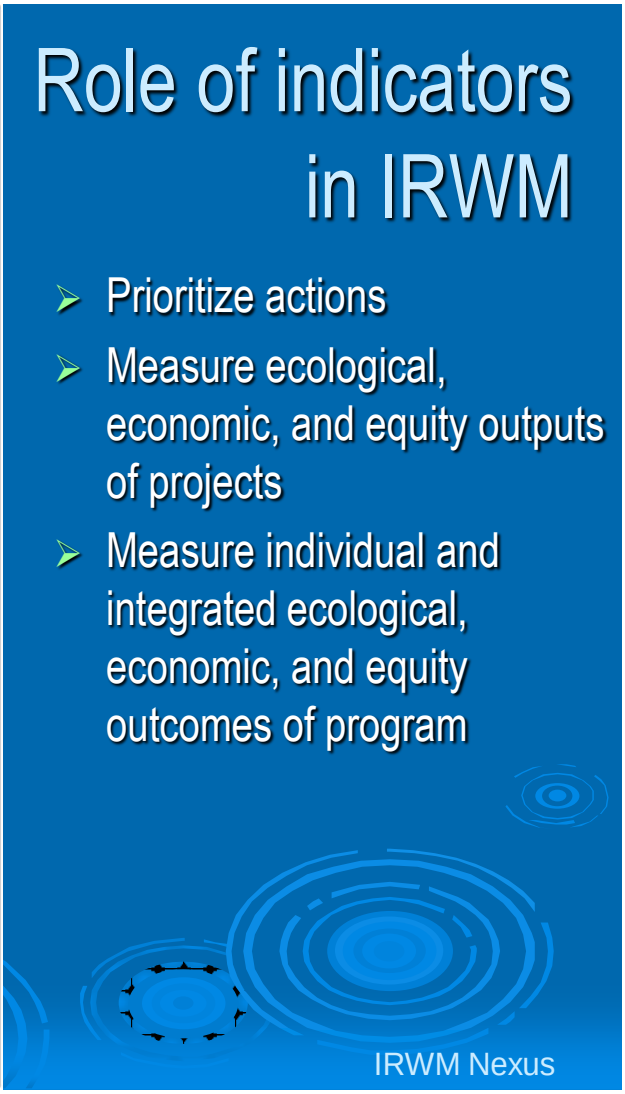
Fraser presented some of the statistical normalization and distance to target methods used. See at http://acwi.gov/swrr/p&p_library/dec6-2011_uc/Sustainability_indicators_shilling_1262011.pdf

Then Fraser asked "Who Should Measure Sustainability?" and listed the strengths of many stakeholders:

- Academia (Objective, trusted, place of learning and investigation)
- Public (Audience, ultimate decision-makers in democracy, actors)
- Agencies (Intermediaries, rule setters, policy implementers, regulators)
- Elected Officials (Respond to social priorities, set policy, direct agencies)
- Consultants (Technical, familiar)
- State (Summarizing regions, comparison among regions, priorities)
- Region (Largest participation extent, first aggregation of jurisdictional and natural boundaries)
- County (Unit of measure, unit of action)
- City (Unit of measure, unit of action)

The project envisions a report card containing many indicators. The indicators can be disaggregated to the regional level and have a role to support integrated regional water management as well as watershed management at the sub regional level.





More information can be found at www.waterplan.water.ca.gov

Questions for Fraser Shilling:

1) Is the information presented today available online or via a journal? Information is available via a Report, but not yet in a journal- Fraser offered to share via email.

2) Is there any effort underway to integrate the indicators in a way to tell a story (i.e., about social effects or specific impacts to ecosystems)? Yes, this is underway, but the effort is very preliminary at the moment and a primary challenge is that we have assembled thousands of indicators and it would be fairly daunting to attempt to aggregate the data to tell a certain story, but realize that these types of stories are important and useful to tell.

3) Are regions freewheeling? They are relatively, yes, decision-making is more autonomous – state controls regulations and funding to keep things moving in a common direction. IRWMs are consistent because we have a consistent vision, but how they do things may vary across them.

California Ocean Protection Council: Taking Action

Amber Mace PhD, Executive Director, California Ocean Protection Council

Amber listed the role of the California Ocean Protection Council on a PowerPoint slide that brought participants face to face with the resource and habitat we seek to protect.

The Members of the California Ocean Protection Council are:
• John Laird Secretary for Natural Resources, Council Chair
• Matt Rodriquez Secretary for Environmental Protection
• Gavin Newsom Lt. Governor & Chair, State Lands Commission
• Susan Golding Public Member
• Geraldine Knatz Public Member
• Fran Pavley State Senator
• Toni Atkins State Assembly member

State Coastal Conservancy's Executive Officer is the Council Secretary.
The California Ocean Science Trust's Executive Director is the Science Advisor.

Amber explained that the Ocean Protection Council is informed by a science advisory team that is coordinated by the California Ocean Science Trust, a non-profit that provides independent and credible science integration for the state. The Council has been working with our leading scientific minds and we will continue to do so to ensure we have the best science to help us understand where we are vulnerable and what we can do about it.

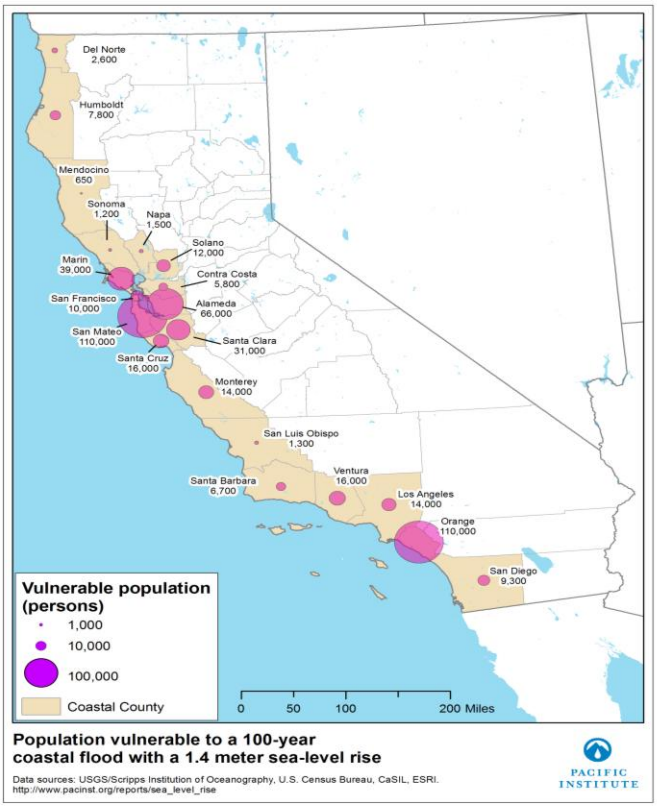
The four most serious threats to the Pacific Ocean are:

- Overfishing
- Pollution
- Climate Change
- Habitat Destruction

There are many challenges to addressing these threats:

- Troubled financial times
- Multiple agencies with overlapping authority
- Scientific uncertainty
- Information transfer to local and regional decision makers

The risks to California coast are serious as a slide made clear:



At Risk:

- 480,000 people
- $100 billion in property
- 8900m roads/highways
- 700m railways
- 28 wastewater treatment plants
- 30 coastal power plants
- 330 hazardous waste sites

Amber explained that there are.2800 km of coastline and 85% of the state population living in coastal counties. Thirty two 32 million people are expected to live along the coast by 2025 when the effects of climate change are becoming more severe.

The OPC Strategic Plan is focused on

- A. Science-based decision-making
- B. Climate change
- C. Sustainable fisheries and marine ecosystems
- D. Coastal and ocean impacts from land-based sources
- E. Existing and emerging ocean uses and cumulative impacts

Further information and publications are available at www.opc.ca.gov

Question from audience:

1) Does the OPC assess how climate change effect's oceanic biota and biology? Seems as though presentation discussed mainly anthropogenic impacts and was silent on effects to oceanic species. A: Yes, this presentation was focused on land use and related climate change scenarios but the Council is also assessing how climate change would impact oceanic species.
2) Has OPC engaged with business community? A: We worked with The San Francisco Bay Conservation and Development Commission (BCDC) to develop their sea level policy and engaged with industry during that process; so, yes; we haven't experienced as much resistance because we're non-regulatory; the problem seems to be when our recommendations are put into policies.

Discussion and report out - California Water Sustainability Indicators Framework

- Led by Fraser Shilling, UC Davis

After lunch the participants had the opportunity to discuss the Water Sustainability Indicator System and provide ideas and suggestions directly into the process. Since a majority of those present were representing organizations with a focus on California water resources, it was real and informed input to the indicator plan and not an academic exercise.

Fraser Shilling began the session with and overview and reminder of the goals and objectives and the other information he had presented in the morning and then set up a 15 minute discussion of each of two topic areas to be followed by reports back from the discussion groups at each table.

Proposed Sustainability Goals and Objectives

Goal 1: Manage and make decisions about water in a way that integrates water availability, environmental conditions, and community well-being for future generations.

Goal 2: Improve water supply reliability to meet human needs, reduce energy demand, and restore and maintain aquatic ecosystems and processes

Objectives: Improve water use efficiency; Increase water recycling; and Increase water conservation.

Goal 3: Contribute to social and ecological beneficial uses and reduce impacts associated with inter-basin water transfers and to the Delta.

Objectives: Improve regional water movement operations and efficiency; Investigate new water technologies.

Goal 4: Increase quantity, quality, and reliability of drinking water, irrigation water, and in-stream flows

Objectives: Increase conjunctive management of new and recycled water from multiple sources.

Goal 5: Safeguard human and environmental health and secure California water supplies

Objectives: Protect and restore surface water and groundwater quality; Protect the natural systems that maintain these services.

Goal 6: Protect and enhance environmental conditions by improving watershed, floodplain, and aquatic condition and processes

Objectives: Practice, promote, improve, and expand environmental stewardship.

Goal 7: Integrate flood risk management with other water and land management and restoration activities.

Goal 8: Support decision-making, especially in light of uncertainties, that support integrated regional water management and flood and water resources management systems.

Objectives: Improve and expand monitoring, data management, and analysis.

He then offered the following questions for the group”

A. What barriers do you think are likely to exist that inhibit rollout and adoption of the indicators system at local, regional, state, and national scales?

B. How can the state and federal governments collaboratively help people get on-board and using such a system?

C. What can the state do to help make the system operational at the local and regional scales (including the Water Plan 2013 sustainability indicators project)?

In addition he said the project team had developed several criteria to select a region:

a) The region represents a cross-section of the wide range of activities and natural conditions of California;

b) Working with the region will assist with regional management needs and meet state-level/Water Plan management needs;

c) High-quality data is available for a cross-section of indicators; and

d) The region has the capacity and desire to engage with the project team.

Fraser asked the participants to provide feedback on these criteria and to also provide feedback on the appropriate size (e.g., IRWM region) and type (e.g., county, river basin) of a region. Further, given that all regions can't implement this Framework immediately, is there value in using a set of screening indicators aggregated across regions to the state scale?

There were many animated discussions around the tables of the breakout groups. Fraser Shilling's team will process the input they received. Here is a summary of comments:

1. Framework Question A: What barriers do you think are likely to exist that inhibit rollout and adoption of the indicators system at local, regional, state, and national scales?
    - Data, cultural change – training, education, lack of understanding because it's a new concept, they need to have a good understanding of what it is – education/outreach through regional forums.
    - Local jurisdictional issues – personal ownership and attachment to "my land", decision capability, versus state control – need to roll it out as a local initiative as opposed to a state tool – fear, caution,
    - How to overcome this barrier – build trust, have solid scientific information.
    - More stakeholder involvement from the beginning. Education of the stakeholders. Existing best practices. Figuring out the specifics of compliance with the indicators. Standardizing indicators. What kind of available data.
    - Creating public awareness about compliance –showing this in the Website.
    - State agencies – initial training and ongoing mentoring – continuing. Incentives/rebates.
    - Interface with locals.
    - Entrenched economic interests, data availability,
    - Determine what stories indicators to tell for a region to have people on board.
    - Lack of understanding on sustainability – very clearly define sustainability – not end up in confusion
    - Whether doing all the work in 2013 – going too fast?
    - Staff time limitation.
    - Get key players – state agencies prior buy-in and get funding from those agencies
    - Demonstrate early tangible value for agencies and public
    - Templates/handbook – for easy replication
    - Use social media – silicon valley water

2. Framework Question B: How can the state and federal governments collaboratively help people to get on-board and using such a system?
    - Participation – draft proposal – matrix of indicators system
    - Education - data consistency
    - Enroll the private sector/insurance companies/large oil companies – pay back – how to do that?
    - Have a process to co-develop the product bring together local and regional agencies into the development process.
    - Put together a local/regional workgroup to build trust – when developing the hydrologic region analysis Pilot – get buy in of local stakeholder when doing the HR based indicators Pilot.
    - Identify stakeholders – they should be involved from the very beginning
    - Educate stakeholders so that they can give valuable input
    - Do not use a top down approach; rather use a bottom up approach.
    - Mandate activities and support with funding.

3. Framework Question C: What can the state do to help make the system operational at the local and regional scales, including the Water Plan 2013 sustainability indicators project?
    - Use technological marvel – the web – decision support tool.
    - Make this part of funding, technical assistance and local assistance funding.
    - Need to have meetings in the evening instead of day time.
    - Easy to use website – aimed at high school level. Bringing in sustainability indicators related information at the school as a science project.
    - Pay for the data.
    - Encompass all end uses and all hydrologic characteristics.
    - One region analysis will have bias – do a series of smaller pilot studies.
    - Present all data in standardized, organized way.

4. Pilot Question A: Please provide feedback on these (region selection) criteria (a. the region represents a cross-section of the wide range of activities and natural conditions of California; b. working with the region will assist with regional management needs and meet state-level/Water Plan management needs; c. high-quality data is available for a cross-section of indicators; and d. the region has the capacity and desire to engage with the project team).
    - Good starting point. Add visibility of the region. Do not make it too complex. Big basin will skew the result. Criteria should be viewed as neutral.
    - High quality data is not the norm – go where data is poor and see what improvisation you can make to get reasonable results.
    - Choose region with a diversity of activities.

- Represent multiple regions – coastal, inland, upland, water use.
- Ensure agreement on goals.
- Data issues – are data driving what the indicators should be? Choose indicators broadly applicable across regions. Indicators should drive data collection, not the other way round
- Statewide agreement about overall goals even if the objectives are different.
- Choose where data are available – forgot about high quality data.
- Do not make this too complicated.

5. Pilot Question B: Please also provide feedback on the appropriate size (e.g., IRWM region) and type (e.g., county, river basin) of region.
    - Watershed, river basin. Watershed – data, process happen at that scale.
    - IRWM region is political region – does not work for sustainability.
    - Consider headwaters to ocean. Do multiple pilots – upland, inland, and near coastal basins. Do Pilots on Lower Pajaro and Sacramento River.
    - Do Pilot on CVFPP Pilot region.
    - IRWM region is the right size.
    - Easier to work at the watershed or county scale
    - Come up with a small, powerful set of indicators.
    - Like to have cooperation – choose a Pilot in an area/agency where you have no cooperation.

6. Pilot Question C: Given that all regions can't implement this Framework immediately, is there value in using a set of screening indicators aggregated across regions to the state scale?
    - Yes, if you can make it work. Can you really come up with a set of indicators that really apply across the regions?
    - Need to look at system resilience.
    - Nice exercise if this can be done.

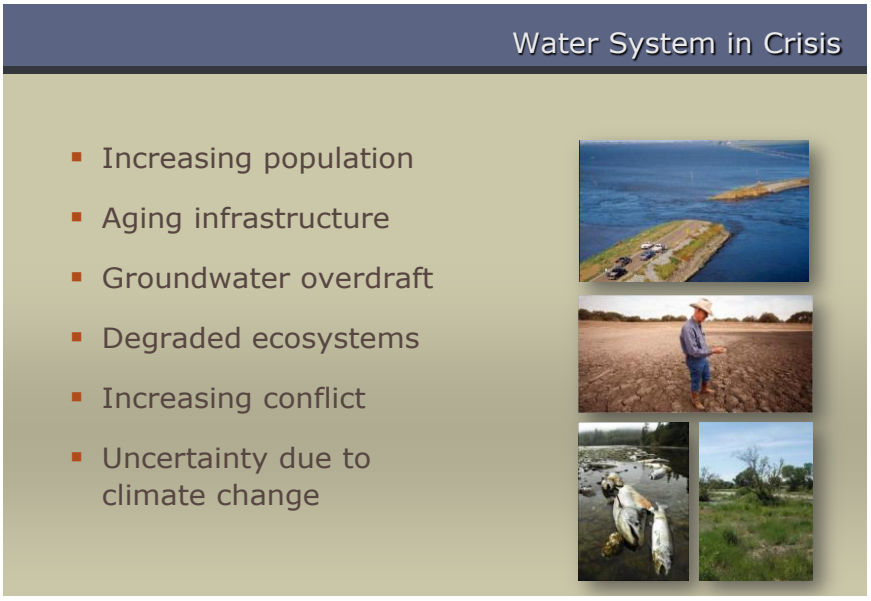
As the California Water Sustainability Indicators Framework is updated and further developed with this input and other stakeholder input, information will be posted at www.waterplan.water.ca.gov

California and Regional Sustainability Efforts

This session offered a roundup of regional sustainability efforts that have statewide significance in California. The presentations described important water sustainability actions that could be considered by the Water Plan in the framework described in the earlier session.

California Water Foundation, Draft Concept for Water Sustainability. Lester Snow, Resources Law Group

Lester Snow introduced the California Water Foundation as an initiative of the Resources Legacy Fund. California depends on water and the state's health and prosperity are fundamentally tied to water. There is variability in water supply and water use. Two thirds of precipitation in California occurs in the north and two thirds of the use occurs in the south.



Climate Change Impacts to California's Water Resources

- Diminishing snowpack (25-40% by 2050)
- More extreme weather patterns – droughts & floods
- Rising sea level
- Higher air/water temperatures
- Increased uncertainty

In discussing solutions to California's water crisis, Lester said that no single strategy can meet all the needs related to water. Integrated and diverse strategies can contribute to sustainable solutions and are needed because water management actions and issues are interconnected. We need to manage water as a natural resource.

The vision of the California Water Foundation is that California's 21st century economic and ecological water needs are sustainably met. Elements of implementing this vision include:

- EFFICIENCY: Make every drop of water count
- GROUNDWATER: Sustainably manage groundwater
- RIVERS: Protect and restore river systems
- MANAGEMENT: Create and sustain change

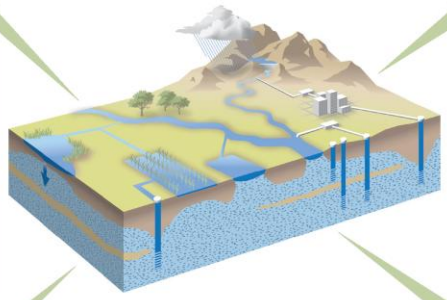
Potential approaches to applying the profile of sustainable water resources are quantitative metrics regularly reported to align community around common vision and identify focus areas for improvement;

common rubric applied to assess current state and help identify practices and tactics for improvement; the application of expert judgment (often using criteria or guiding principles) to inform discussion of current state and create pressure for change; and the expert opinion approach which allows qualitative assessment of product performance on a number of dimensions, scored on a set rubric and combined into an overall assessment. In the third approach all assessments are conducted by testing experts and informed by standards the individual expert thinks should apply. .

Integrated Resource Management

Increase Water Use Efficiency

- Exceed current urban conservation targets
- Increase agricultural water use efficiency
- Expand water recycling and stormwater capture opportunities
- Promote new regional water management strategies



Strengthen Management Structures

- Build broad-based coalitions with vibrant leadership
- Support changes to laws, management, funding mechanisms, and institutions needed to maximize success of statewide strategies

Improve Groundwater Management

- Reduce groundwater overdraft and increase recharge
- Increase data and monitoring of groundwater

Restore Central Valley River Systems

- Protect floodplains while improving flood protection and water supply
- Advance State policy of integrated flood management
- Integrate regional land use planning
- Reservoir re-operation

Framework and composition of the sustainability profile

- Expert interviews conducted
- Initial Framing for discussion

1. Supply Reliability a. Diversity & resilience of supply sources b. Risk of judicial and regulatory conflict c. Reserve sufficiency d. Emergency preparedness	**2. Demand Management** a. Conservation planning b. Supply and demand balance c. Land use planning integration d. Water use development standards
3. Ecosystem Stewardship a. Source watershed protection b. Habitat conservation *c. In-stream conditions* *d. Water quality*	**4. Adaptive Management** a. Integrated resource management b. Financial strategy *c. Climate adaptation planning*

More information is available at www.resourceslegacyfun.org/water.html

Question from participants:

1) Q: Water districts consistently report to the communities they serve that their water delivery system is resilient, safe, clean and effective, and yet this reporting tends to hide some of the underlying systemic problems of inefficient water withdrawal and system-wide issues with long-term reliability. Question is whether the presenter recognizes this and feels there is a need to shift the dialogue and interaction between water districts and customers, particularly since the public is not always being told the full scope of long-term water system resilience issues such that when they finally are told, they are likely to be skeptical since all of the dialogue and interaction historically has been positive? Answer: Recognize this as a central communication issue, see value in recognizing those water districts that are doing a superb job in managing water and use this as a point of interaction.
2) Q: As a commodity we can put a value on ecological resources – isn't this a way to manage for sustainability? A: Too many managers look for commodities ("I need more from my pipe") – if we had a model of natural resource economics it would be useful, but we don't yet.
3) Q: Some water managers shield users from any concept of unreliability - customers haven't known they're on the edge; should we have a cultural shift? Could conveying this make it easier to impose a water fee? How can we address this culture? A: No, this should be a tool for those who want to take the next step; don't think water districts are malicious, we'll be able to handle this without them conveying risk.
4) Q: For regional reports, if areas get lower scores are they contacting you to improve their scores? A: We consult with regions throughout their reports, so we heard from them. Some regions have paid more attention than others; No one likes to look bad – we try to explain any anomalies and data gaps.

The California Regional Progress Report, Trish Kelly, Principal, Applied Development Economics, consultant to the Strategic Growth Council

Trish Kelly said that to thrive into the future Californians must make good decisions about how and where we grow, how we plan for and invest in our future and how we become better stewards of our natural resources. Today's decisions will influence how well we prepare for and address our future…a framework to define and measure progress towards sustainability will help us get there…

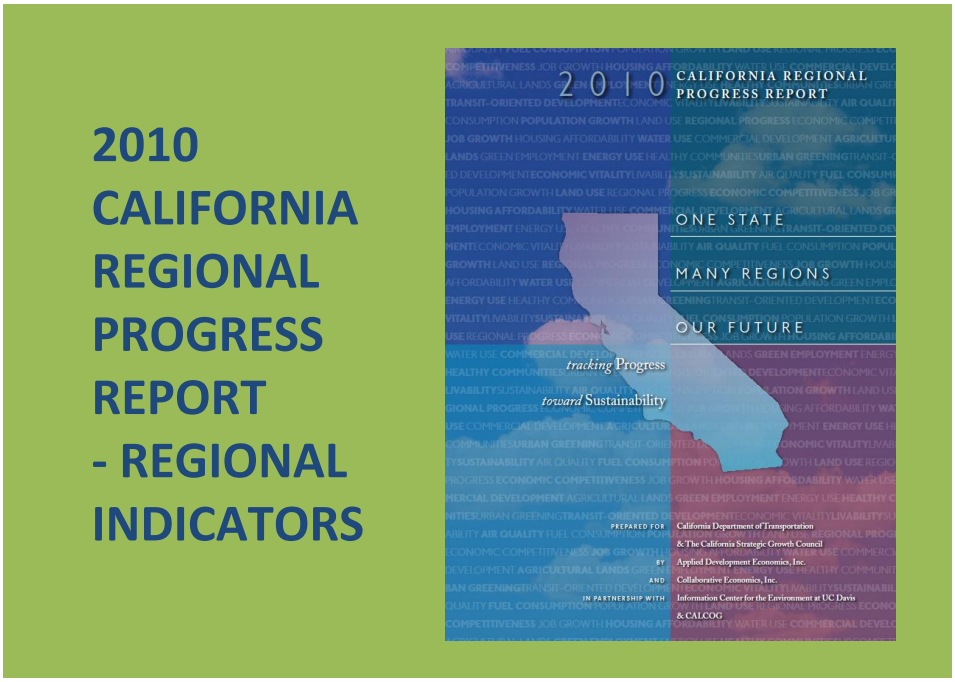
Caltrans and the Strategic Growth Council sponsored the 2010 CALIFORNIA REGIONAL PROGRESS REPORT. Partners in the project included the Information Center for the Environment (ICE) at UC Davis, CALCOG and members, Project Advisory Team (State agencies, regional planning agencies, and Blueprint stakeholders), California Forward, and the WELL Network. The focus if the report is State of the Regions.

Why Regions?

- The scale of natural systems – watersheds, air basins, geographical boundaries
- The scale of economic activities, labor markets and commute sheds
- The scale at which certain challenges are best addressed
- We compete with other regions in the global economy
- Federal and state partners emphasize regions

The 2010 report was an update of 2007 Report – the first statewide Regional Quality of Life Indicators Report, based on Regional Blueprint Goals. The purpose of the report is to assist the mission of the SGC to provide information resources for state, regional, and local policy makers, planners, and residents to inform planning and investment decisions critical for our economic prosperity and quality of life. The

report also measures regional and state progress toward sustainability through place-based, cross-cutting indicators and will help identify regional disparities, focus state resources, share successes and encourage action to address issues. “What gets measured gets done.”



Trish described how the indicators will support planning for a different future. Growth is a driving force, in California with population expected to rise from 37 million in 2010 to 47 million in 2030. There will be an aging population especially in rural areas and a growing diversity with increasingly racially mixed, young, mobile, with new life style preferences. These changes will lead to unmet and changing infrastructure needs and growing natural resource scarcities. Some key challenges include unemployment and poverty; housing and financial crises; state budget issues; pressure on agricultural lands, open space and ecosystems; water supply, quality and distribution; health of the Sacramento-San Joaquin Delta, Colorado River and other waterways, and coastal areas; air quality, and climate-related hazards such as drought, wildfires, flooding, and extreme heat.

California also has great opportunities:

- Global economic leadership
- Intellectual capital
- High share of national venture capital for clean tech and clean energy
- New technologies and innovations to address sustainability challenges
- New policy innovations (state and federal)
- New partnerships and planning resources

The regional sustainability framework provides a new baseline for transition to a more comprehensive, integrated sustainability framework. The indicators are directional (no targets yet) and there are twenty indicators in four interrelated groupings:

- Efficient Transportation and Land Use
- Economic Competitiveness and Opportunity
- Environmental Health
- Resource Efficiency and Conservation

SB 732: CALIFORNIA STRATEGIC GROWTH COUNCIL

THE Strategic Growth Council

- Members:
  - Business, Transportation and Housing Agency
  - CAL EPA
  - Health and Human Services
  - Governor's Office of Planning and Research
  - Natural Resources Agency
  - Public Member
- Mission:
  - Coordinate state agency activities to support local and regional sustainability activities
  - Provide grant programs to support planning and development of sustainable communities, including urban greening
  - Provide information

Key Findings – Resource Efficiency and Conservation:

- Negative trends in per capita residential energy use, mixed trends in natural gas use
- Mixed trends in non-residential electricity and natural gas use
- Positive trends in per capita water use, but better indicators needed

Some Data Gap Priorities:

- Baseline for Greenhouse Gas Emissions
- Refine Vehicle Miles Traveled
- Conservation Indicators
- Density, Access and Connected Land Use
- Housing and Transportation Affordability Index
- Energy Use – such as renewable energy generation and use
- Water Use – capacity, supply, sustainability

Current Work:

- Coordinating with state agencies and other partners on sustainability indicators and data
- California Water Indicators Sustainability Framework
- Healthy Communities Indicators looks at broad array of indicators for health status and outcomes re land use and access to housing, jobs, green space, clean air and water, etc.
- SGC supports the Sustainable Communities Learning Network with the Institute for Local Government and UCD
- Conducting scoping process for 2013 Progress Report to identify key emerging policy issues and priorities, such as climate change risk and adaptation
- Will coordinate with Governor's Office of Planning and Research on Environmental Goals and Policy Report (EGPR)

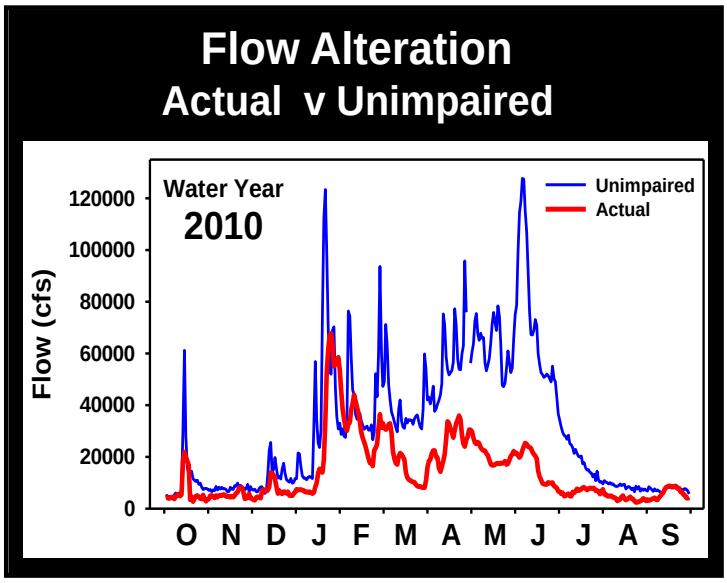
More information is available at http://www.sgc.ca.gov/ and http://www.dot.ca.gov/hq/tpp/offices/orip/Collaborative%20Planning/California_Regional_Progress_Report.html

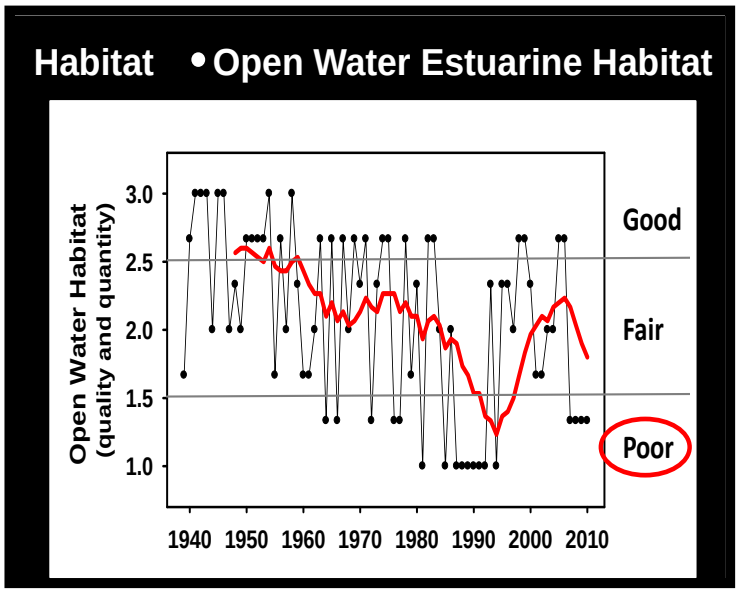
Ecologically Sustainable Water Management for the San Francisco Estuary

Christina Swanson, Natural Resources Defense Council

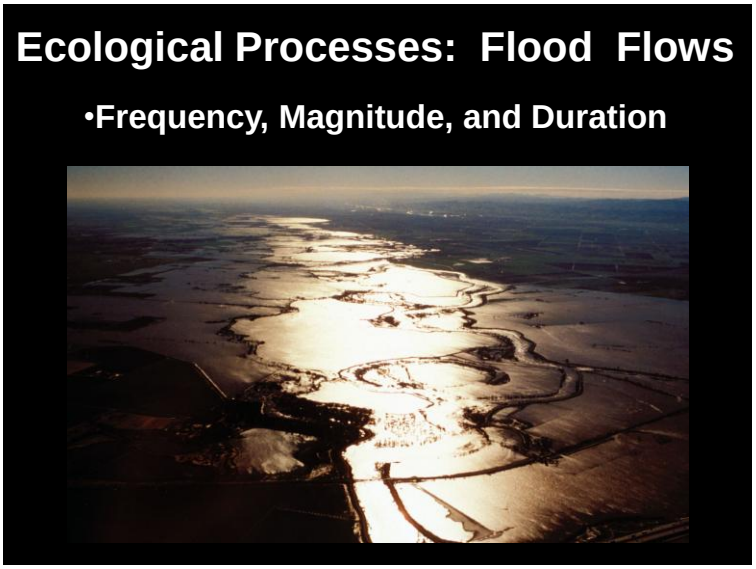
Christina gave an overview of California's water supply and then listed some important indicators for ecologically sustainable water management

- Flow Alteration
- Habitat Quality and Quantity
- Ecological Processes





Christina presented the data on flow alteration, habitat change and ecological processes. On the habitat chart all measurements are for the spring (Feb-June) period when quality and quantity of low-salinity, open water habitats are known to be important drivers for biota. The black line and symbols are annual measurement (average of score of 3 metrics), and the red line is a 10-year running average. The third area for which indicators have been developed is Ecological processes.

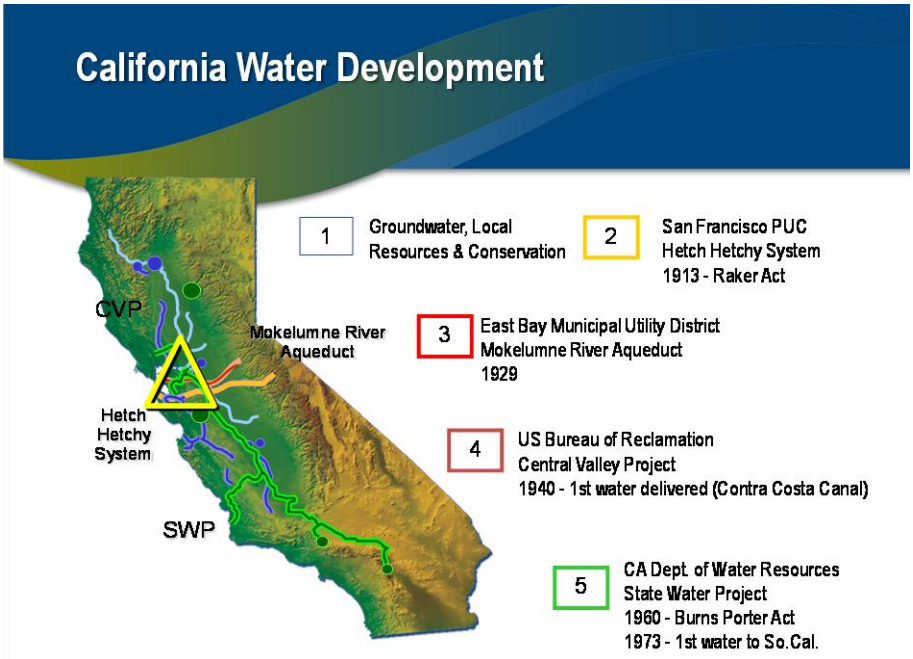


Christina reminded participants that the power of measurement is to provide understanding, evaluation, management and accountability. She went over the charts and indicators and the interesting details are available at http://www.sfestuary.org/StateofSFBay2011/

The Delta Plan, Keith Coolidge, Delta Stewardship Council

Keith outlined the importance of the Delta as California's "Water Hub" which transfers water from north to South and the Bay Area. Twenty seven million Californians depend on the Delta for part of their drinking water and over three million acres of agricultural land are irrigated by Delta water. It is the west coast's largest estuary and it is a unique place to live, work, and recreate.

But, Keith told the participants, the Delta is at a crossroads. Delta exports of water are unreliable, native fish populations are crashing, and there are systemic problems such as ecosystem degradation, flood risk, and water quality problems. The stakes are high and there is tremendous risk to California's economy, environment, agriculture industry and Delta residents. Decades of conflict have yielded little progress.



The 2009 Delta Reform Act is a legislative milestone. There was bipartisan support for a new Delta Council and the development of a legally-enforceable Delta Plan that can make landmark changes to California water management through the establishment of the coequal goals – putting the protection of the ecosystem on equal footing with water supplies. There is an acknowledged requirement for "reduced reliance on the Delta for future water supplies." A seven member independent council with

actual authority to achieve the coequal goals

There is a new legislative mandate for water management. The State policy for the Delta says:

> "*Coequal goals means the two goals of providing a more reliable water supply for California and protecting, restoring and enhancing the Delta ecosystem. The coequal goals must be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource and agricultural values of the Delta as an evolving place."* State Water Code §85054

The Delta Stewardship Council was created to:

- Develop a "legally enforceable plan", not a report
- Perform a synthesizing and coordinating role among
- various agencies – not a super-regulatory agency
- Ensure best available science informs all processes and projects
- Serve as an independent decision-making body to mediate the state's interests, not California's water wars

The Delta Plan is foundational. It lays the groundwork for near-term actions and focuses on the avoidance of further harm or increased risk to the Delta. It is also adaptable in that it builds on other plans and new information as it becomes available. Portions of the Plan that do not meet stated goals over time will be refined or revised.

The Delta Plan is also designed to be practical and build on years of planning and incorporate actions, recommendations, and strategies developed by others who have invested countless hours on Delta issues. It is enforceable and contains a set of integrated and legally enforceable regulatory policies that apply to certain proposed plans, projects, or programs that are known in the Plan as "covered actions".

Why this Approach for the Delta Plan?

When you are in a hole: STOP DIGGING! Multiple problems need multiple and simultaneous solutions: TRIAGE!

Limitations on funding and resources means: PRIORITIZE!

We don't have all the info we need but can't afford further delay: ACT & ADAPT!

Keith presented the top ten actions to make clear what the Delta Plan will do.

1. SET DEADLINES for completion of BDCP and for the State Board to update Delta flow objectives

2. PROTECT high priority restoration areas from development and PRIORITIZE top five habitat restoration areas

3. PRESERVE & PROTECT critical floodplains and encourages setback levees

4. REDUCE RISK by requiring new development to have adequate flood protection/levees

5. INCREASE WATER SUPPLY RELIABILITY by requiring users of Delta water to implement local plans to diversify supplies, increase reliability & reduce pressure on the Delta

6. IMPROVE TRANSPARENCY by requiring that transfers of Delta water and contracts for Delta water must be done openly and transparently

7. REDUCE STRESSORS with specific recommendations to address toxics, nutrients, invasives and PRIORITIZE State & Regional Water Board actions

8. Require ADAPTIVE MANAGEMENT for significant ecosystem and water management projects

9. ENSURE FAIRNESS by using the financing principles of beneficiary pays and stressors pay

10. RECOGNIZE that all actions must be done in a manner that protects and enhances the Delta as an evolving place

Keith told the SWRR participants that the Delta Plan is the product of thousands of public comments and the best available science and information. It sets a common-sense path forward and focuses on action rather than additional delay. It will NOT give any interest group everything they want, nor should it. It is foundational and adaptive, and will change over time

More information is available at www.deltacouncil.ca.gov

Question from a participant:

Q: Putting risk into the plan can be risky because it may not address the underlying sustainability issues.

A: We do want to set back levees (that's in the plan), but also have to have no net losses of farmland, which is a challenge.

The meeting adjourned to a reception generously provided by Fetzer and Bonterra Vineyards where discussions continued. Following that a significant number of participants shared dinner at a restaurant in downtown Davis.

Day 2: December 7th

Recap and Review of goals for the day

David Berry called on participants to call out what were the highlights of the previous day for the benefit of the several people that were just joining us and as a review of what we had discussed.

Highlights and Comments from Attendees from Day 1:

- Proof of Life – maybe a way to engage the public more in what we're doing.
- Water as a commodity vs. a natural resource, an ongoing debate.
- Yesterday demonstrated the impact that simple graphics can have.
- During roundtable discussions we had more obstacles than opportunities.
- It's hard to agree on what sustainability is, but people have less of a problem deciding what's not sustainable.
- "Go loud" – we need to find effective ways to communicate to different audiences with finesse. Think about ways to convince people and get them to change the way they do things.
- Indicators are like fruit salad – there are many different kinds, we need to connect, rank, and possibly combine them more.
- Lots of talent in the room – but we need to get more, key people in the room to listen and hear the message.

USEPA Indicator Efforts

The morning session described pilot studies being funded by the USEPA to develop different components of sustainability indicators. Individual studies are looking at water footprint, ecological foot print, and the use of satellite information to evaluate groundwater conditions and exploring interactions between crop patterns and plant growth.

Introduction: California Footprint – Sustainability Indicators

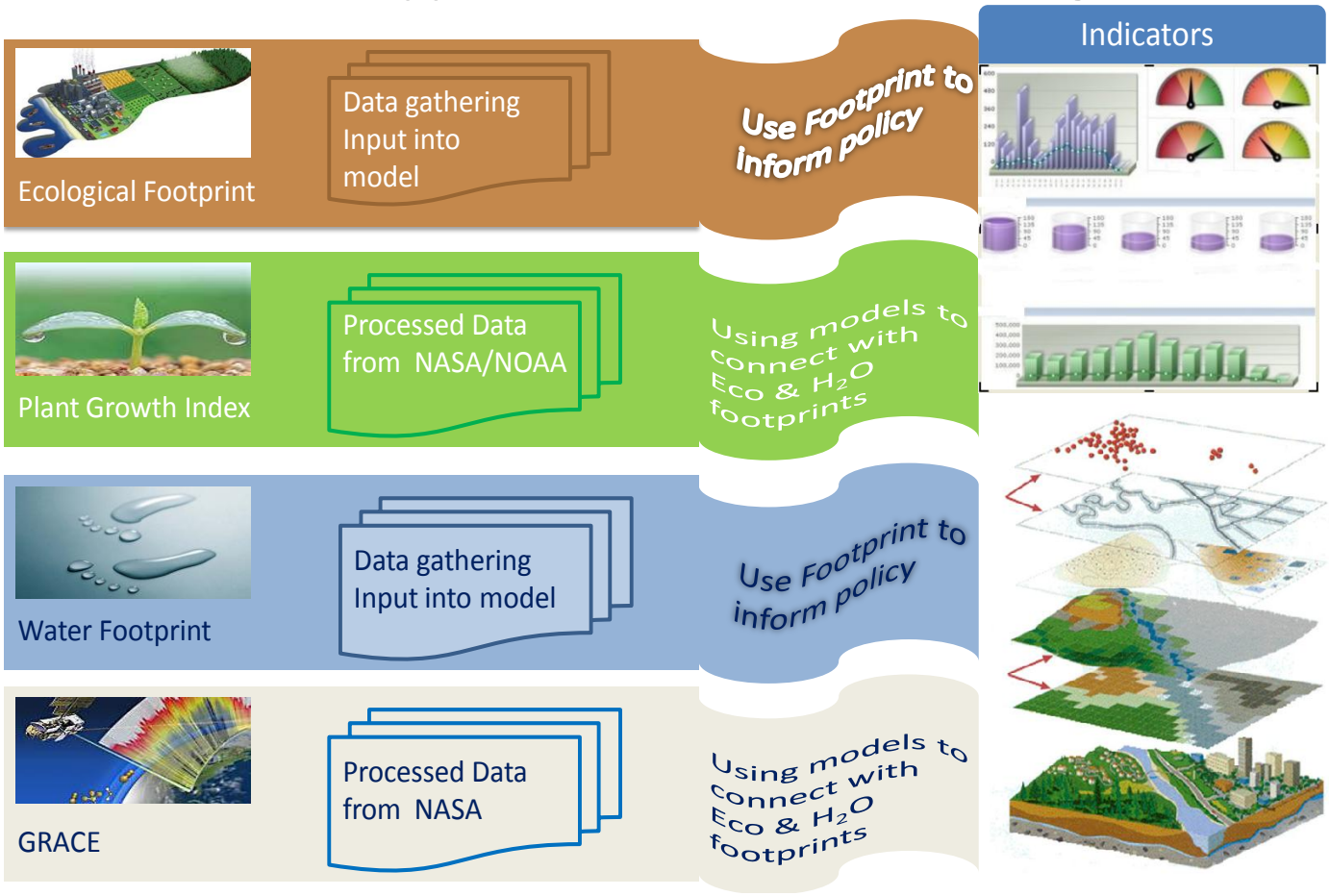
Vance Fong and Don Hodge USEPA, Region 9

Introduction:

- A funding priority is the decision support tool – we're going to have to start with something less comprehensive than we would like due to funding constraints.
- There are still more internal sales and marketing to do within EPA to really set this effort up.

There are several useful frameworks for presenting information on the status and trends of environmental and natural resource conditions. The Ecological Footprint compares the population's use of natural resources with the ecosystem's ability to provide those resources. The Water Footprint compares available sources with uses of freshwater. The Plant Growth Index (PGI), based on earth observation data, measures plant communities' response to stressors. Finally, the Gravity Recovery and Climate Experiment (GRACE) is an indicator of groundwater flux based on earth observation data.

California Footprints
Decision Support Tools for Resource Management



Why would federal agencies choose to work on indicators of California's sustainability?

- History of proactive response to global change
- State agency experience with indicators
- Availability of data
- Methodology pilot for potential projects on other states and the nation as a whole

Footprints provide a means to summarize and convey large body of information through an accessible metaphor. Using both the ecological footprint, which addresses terrestrial resources (and fisheries) in units of area, and the water footprint which addresses water resources in units of volume, provides a more comprehensive complementary summary of information and presentation. To add earth-observation indicators corroborates footprints' resource economic data and supports geo-spatial data presentation.

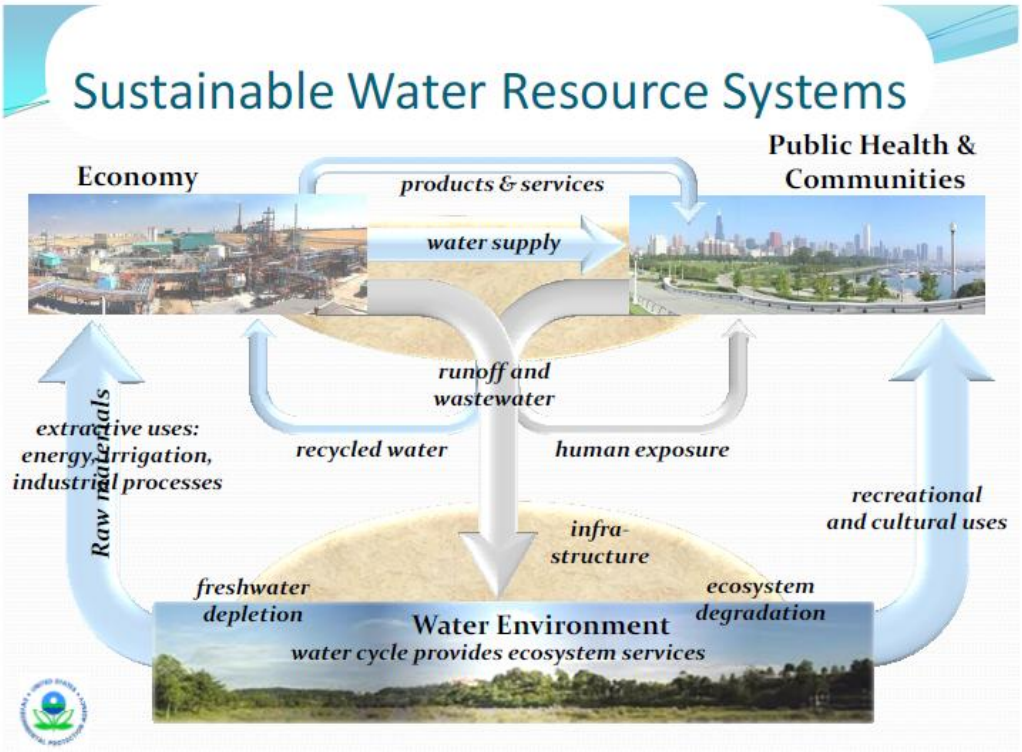
The potential and desired outcomes of this use of varied indicators are decision-maker support and increased public awareness.

Don and Vance then turned to a summary of USEPA's Safe and Sustainable Water Resource Research Program and its two themes:

Theme 1 -- Sustainable Water Resources: Ensure safe and sustainable water quality and availability to protect human and ecosystem health by integrating social, economic and environmental research for use in protecting and restoring water resources and their designated uses

Theme 2 -- Sustainable Water Infrastructure Systems: Ensure the sustainability of critical water resources using systems-integrated water resource management.

Conceptual Model: goal of sustainable water resource systems



Questions from participants:

1) Q: Can farmers take advantage of this information? A: yes, anyone with an internet connection and browser can use this; smart phones can be used too; technological capacity is there, but outreach and education will take more work

2) Q: how do you hone in on the useful data? How do you know what data is useful? A: This is the crux of data management; are we spending our time on the correct data and not wasting time solving problems no one cares about? The only way to do this is to ask the stakeholders what data they need. It's more of a consulting approach, rather than a technological approach.

Water Footprint as Part of a Sustainability Indicators Framework

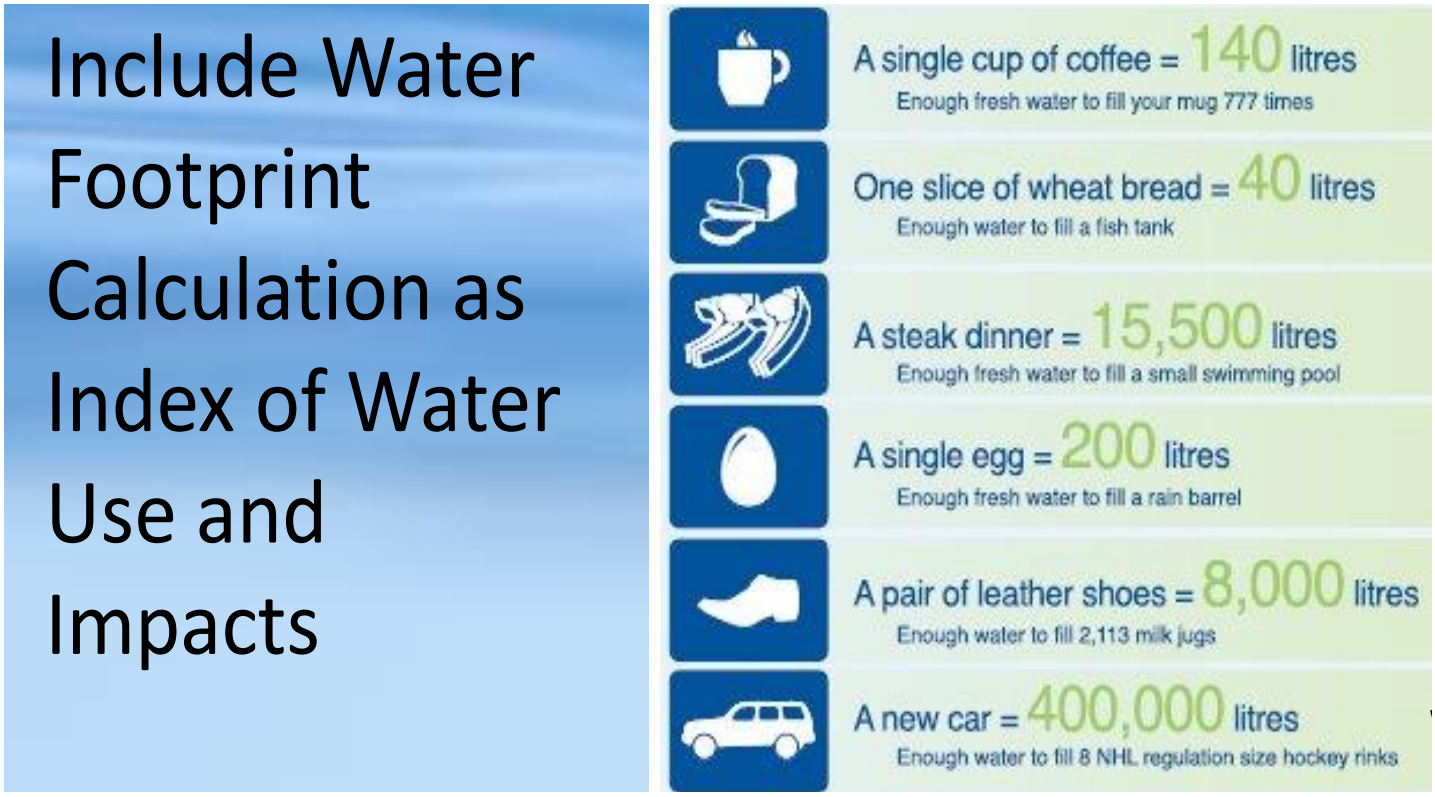
- Fraser Shilling, UC Davis

Fraser Shilling explained that products and activities have “virtual water content” – the volume of water used directly in operations or indirectly in the supply chain in the processes that result in the production of a product or activity. The term Water Footprint refers to the total volume of water used to produce goods and services used by and individual organization or jurisdiction (e.g., state, country). Virtual water trading is the process of trading water embedded in imported/exported goods. Water stressed countries can save water by importing goods with high water content, rather than producing them.

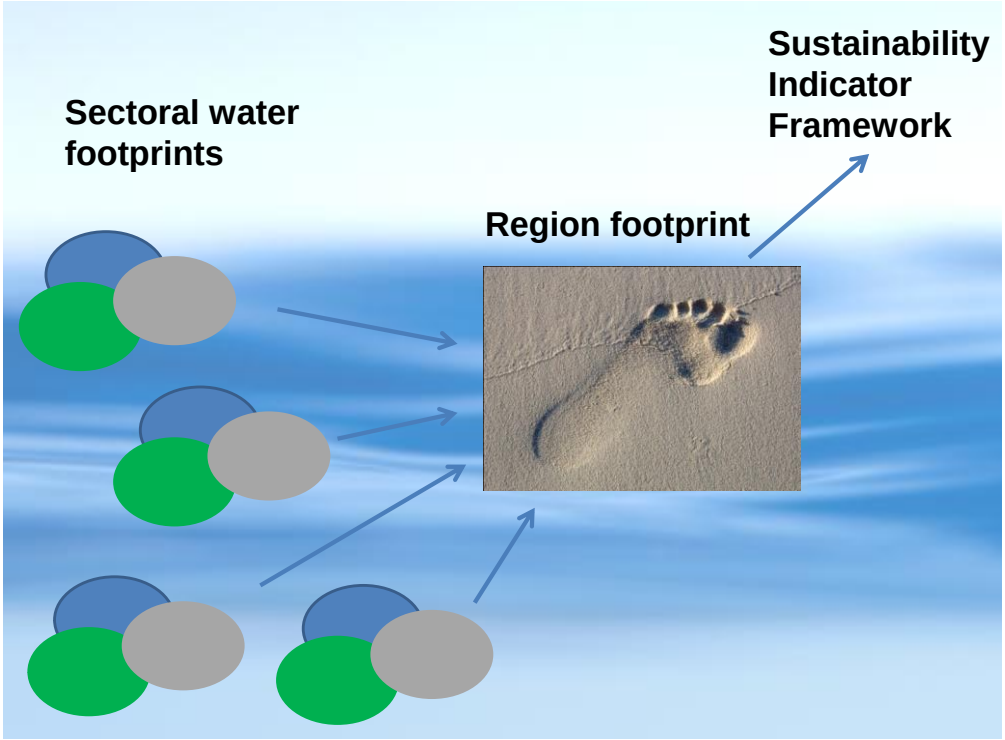
Jurisdictions seek to meet water demand through water supply whether from existing sources, new sources or water recycling. Fraser gave three definitions:

“Gray water” = amount of water needed to assimilate pollutants to meet water quality standards
“Blue water” = surface or ground water evaporated as a result of production
“Green water” = rainwater /soil moisture evaporated during production process

Economic benefits per unit water is way to measure economic efficiency of water use but virtual water volume per unit of product and water footprint measures the total impact, regardless of economic benefits. National water footprints have been estimated in Indonesia, Greece, China, Tunisia, UK, Cyprus, Germany, Canada, and Spain (which includes the water footprint in determining government policy).



There is a working assumption is that the water footprint is an important element of water sustainability. This relationship can be seen when comparing water footprints of water consuming and polluting activities and sectors with the water available in a given geography. Water footprints are also tied to responses – “right actions” as part of water demand management.

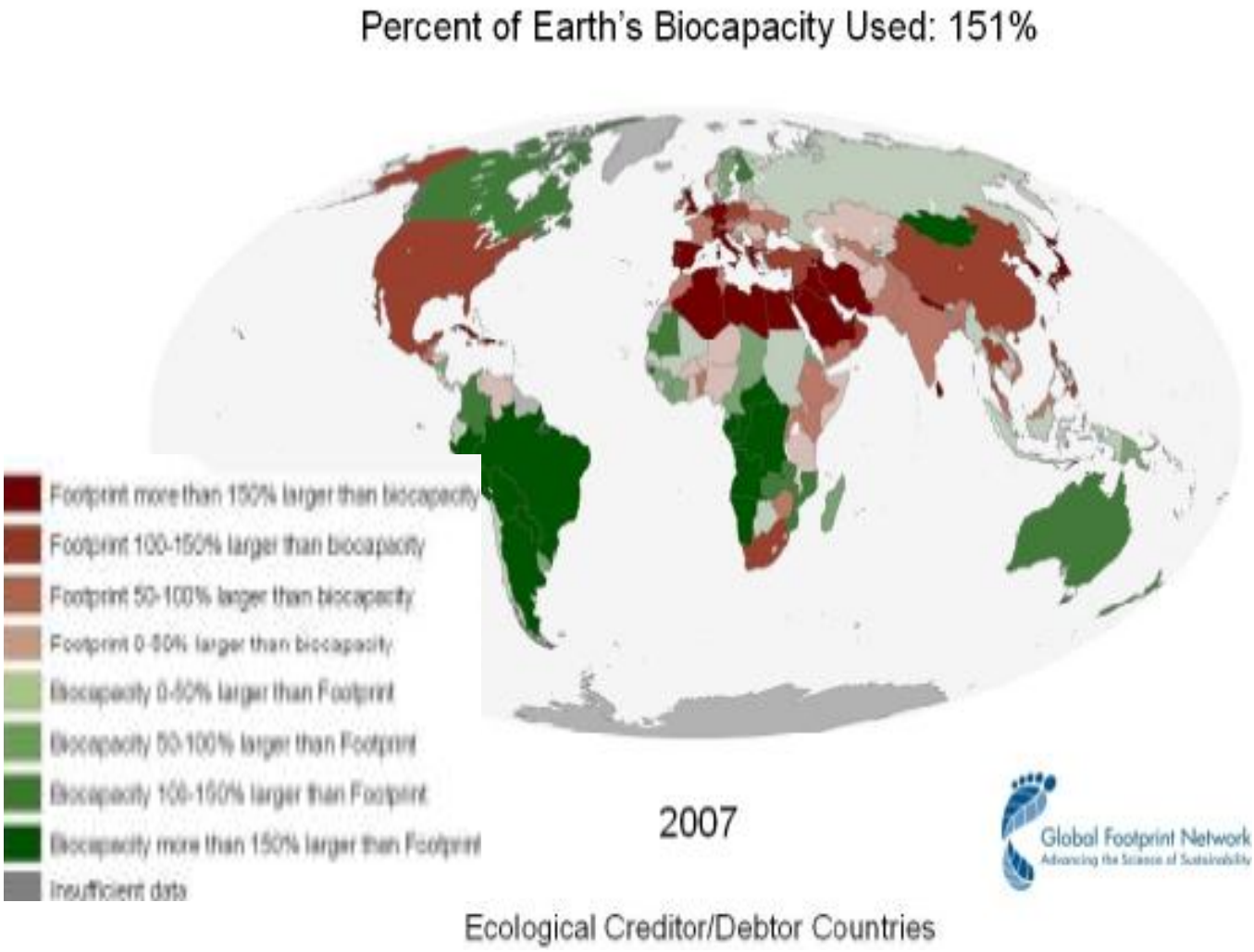


We can use the water footprint index (aggregation of indicators of consumptive-impact) as a complementary index to withdrawal, ecosystem needs, natural processes, equitable distribution of benefits, and other indices of water sustainability. In measuring sustainability we can compare the footprint to other measures in a region (e.g., economic productivity, or ecosystem needs) and to the water available as part of impact assessments, where available water equals runoff minus environmental flow requirements.

More information is available at the Water Footprint Network (www.waterfootprint.org)

Ecological Footprint of California – Joy Larsen, Global Footprint Network

Joy Larsen began by reviewing the idea that the Ecological Footprint is an accounting framework for biocapacity to answer the questions “How much bioproductive area is available to us? “and “How much bioproductive area do we demand?”



In the United States we can calculate the footprint from carbon emissions, cropland, grazing land, fishing ground, forest land and built-up land. In total, California was responsible for 7 percent of the total U.S. ecological footprint, while comprising 12 percent of the population. The California Ecological Footprint from consumption leading to carbon emissions is nearly 2 global hectares (gha) less (36 percent less) than the USA. This difference could be due to use of hydroelectric power to a greater degree in California.

In 2008, the estimated biocapacity of California was 362 million global hectares. This is 23% of the demanded California Ecological Footprint and 3% of the biocapacity available in the whole of the U.S. (1.2 billion global hectares). At 1.0 gha per person the biocapacity of California is much less than the national average of 3.9 gha per person. California is a net importer of crop, fish, and forest products. It’s Ecological Footprint by land use has the following components:

- Crop production accounts for 52% of consumption
- Fish production accounts for 27% of consumption
- Forest production accounts for 32% of consumption

California is a net exporter of grazing land products, producing more than it consumes. Although California has a large economy that benefits from increases in crop prices, it is still reliant on imports. This poses a potential risk as global resources prices increase. Potential next steps for deficit reduction include evaluation of the footprint of production compared to the GDP, an evaluation of the costs of inputs like water and fossil fuel and an evaluation of the extent to which California is losing the ecological capital needed to maintain high productivity – such as ground water, soils, and precipitation. More Information is available at www.footprintnetwork.org

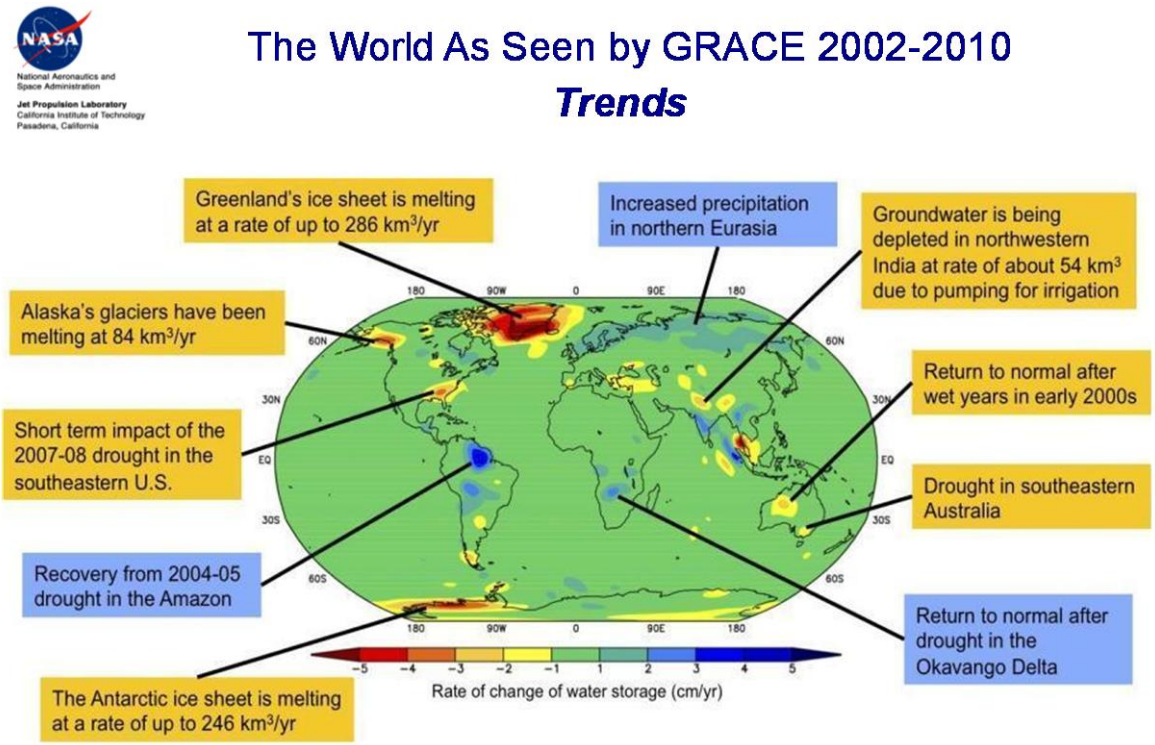
Groundwater Estimates from the Gravity Recovery and Climate Experiment (GRACE) – Applications to the State of California Footprints

Felix W. Landerer, Jet Propulsion Laboratory and California Institute of Technology with support from Vance Fong, Don Hodge (EPA-Region 9)

Felix Landerer captured the attention of the participants with an explanation of the method the GRACE System uses to detect changes in water resources including groundwater:

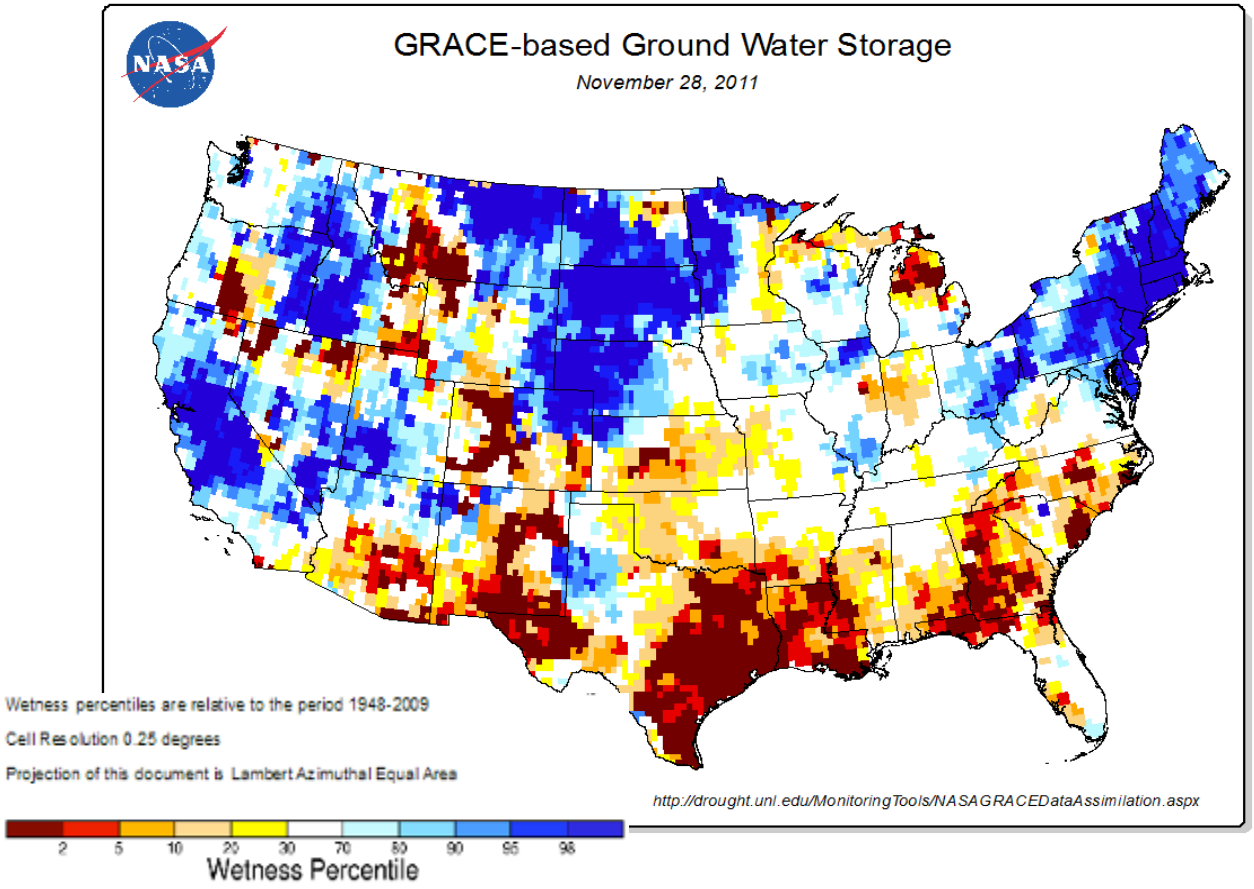
- Measurement: variation in distance between the two satellites moving in the same orbit
- Infers monthly gravity anomalies (GRACE, GPS)
- Corrects for tides, alias signals, atmospheric loading, (GIA)
- Over land: registers surface mass changes related to hydrology, ice sheets & glaciers, earthquakes
- Over oceans: registers ocean mass (bottom pressure)
- Typical unit: equivalent-water-height [cmH2O]

When the force of gravity beneath the two moving satellites increases due to increased mass due to the presence of groundwater for example, the first satellite slows down prior to the satellite following it. When the gravity declines the lead satellite speeds up first. This effect changes the distance between the satellites and gives a measure in the variation of the water below.



Using this technique, GRACE has been able to measure all components of terrestrial water storage including soil moisture, snow, reservoirs, and groundwater. The resolution can be quite localized. For example, GRACE is showing that in California's Central Valley even after record snow winters, the water table in early 2011 still below pre-drought levels.

Felix presented an image that showed the groundwater storage levels for the Lower 48 states.



Summary & Outlook

- GRACE can clearly observe water storage changes over CA's Central Valley
- Spatial resolution still challenging, but improvements have been made
- From 2006 to 2010, about 27 to 28 km3 of groundwater were depleted
- After 2010, total water storage increased again close to pre-drought levels, but groundwater (as of May-2011) appears to be still below 2006 levels

Felix said upcoming work includes the DEVELOP program in collaboration with NASA Ames & DWR; new snow-water estimates from JPL as an in-house product. What is needed is to compare GRACE-derived groundwater estimates with in-situ observations, downscaling (e.g., Drought Monitor), release-05 GRACE data and design the GRACE follow-on.

Additional information is available at http://grace.jpl.nasa.gov

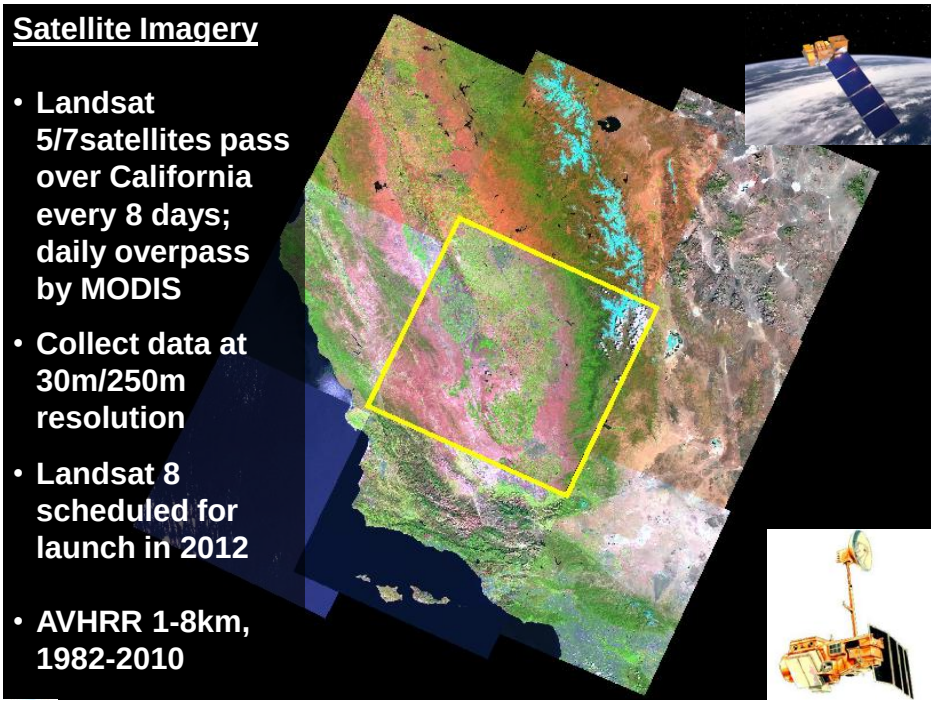
Satellite Indicators of Vegetation Condition, Crop Canopy Development, and Agricultural Water Use in California, Forrest Melton, NASA Ames and CSU Monterey Bay

Forrest Melton began by acknowledging the project team at the Ecological Forecasting Lab CSU Monterey Bay and NASA Ames Research Center at Moffett Field; collaborators from the California Department of Water Resources, USDA Agricultural Research Service, Western Growers, Del Monte Produce, Constellation Wines, CSU Fresno, Davids Engineering, NOAA NWS, and USGS, and support for the project provided by EPA and the NASA Applied Sciences Program.

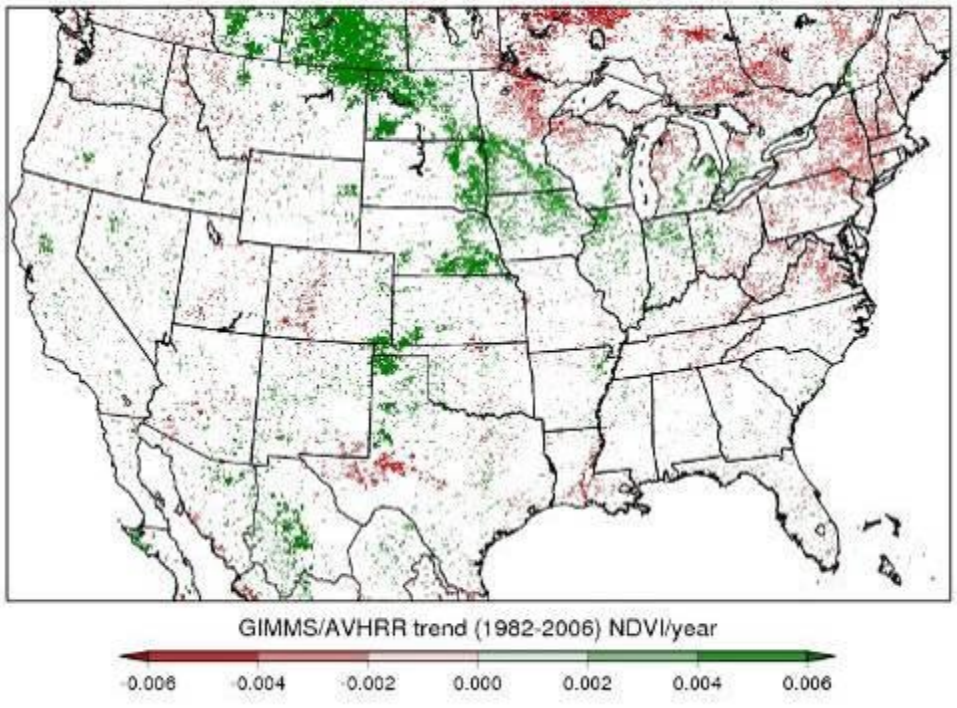
Satellite indicators are being used for sustainability monitoring and reporting including the plant growth index which identifies trends in vegetation condition. This is supported by long-term satellite data records and indicators of crop water use using applications of satellite data and the NASA Terrestrial Observation and Prediction System to map NDVI, fractional cover, crop coefficients, and basal crop evapotranspiration.

Forrest gave the participants some definitions:

- NDVI: normalized difference vegetation index
- Fc: fractional cover (% of ground area covered by vegetation)
- ETo: reference crop ET; grass, collected by CIMIS
- Kcb: crop coefficient; “fraction of reference ET”
- ETcb: basal ET, unstressed crop on dry soil surface



The Plant Growth Index which tracks trends in ecosystem conditions was included in the 2008 Heinz Center State of the Nation’s Ecosystems Report. It is based on NDVI. Changes in the amount of energy captured by plants over large areas, as reported in this indicator, may signal significant changes in ecosystem functioning. The indicator can provide information about influence of climate, nitrogen deposition, disturbance, etc.



Global Inventory Modeling and Mapping Studies/Advanced Very High Resolution Radiometer **(**AVHRR**)**

Forrest showed a map of the Lower 48 state that indicated significant trends in NDVI. Green values represent an increase in index values over the period for a particular 5-mile square pixel, and red values represent a relative decrease. White represents areas with no significant trend up or down.

California Agriculture:

- Leads the nation in cash farm receipts ($38B)
- Major domestic and international supplier of specialty crops
- Includes 9 of the top 10 national counties for agricultural production
- Half of US-grown fruits, nuts, vegetables
- More than 400 commodities produced

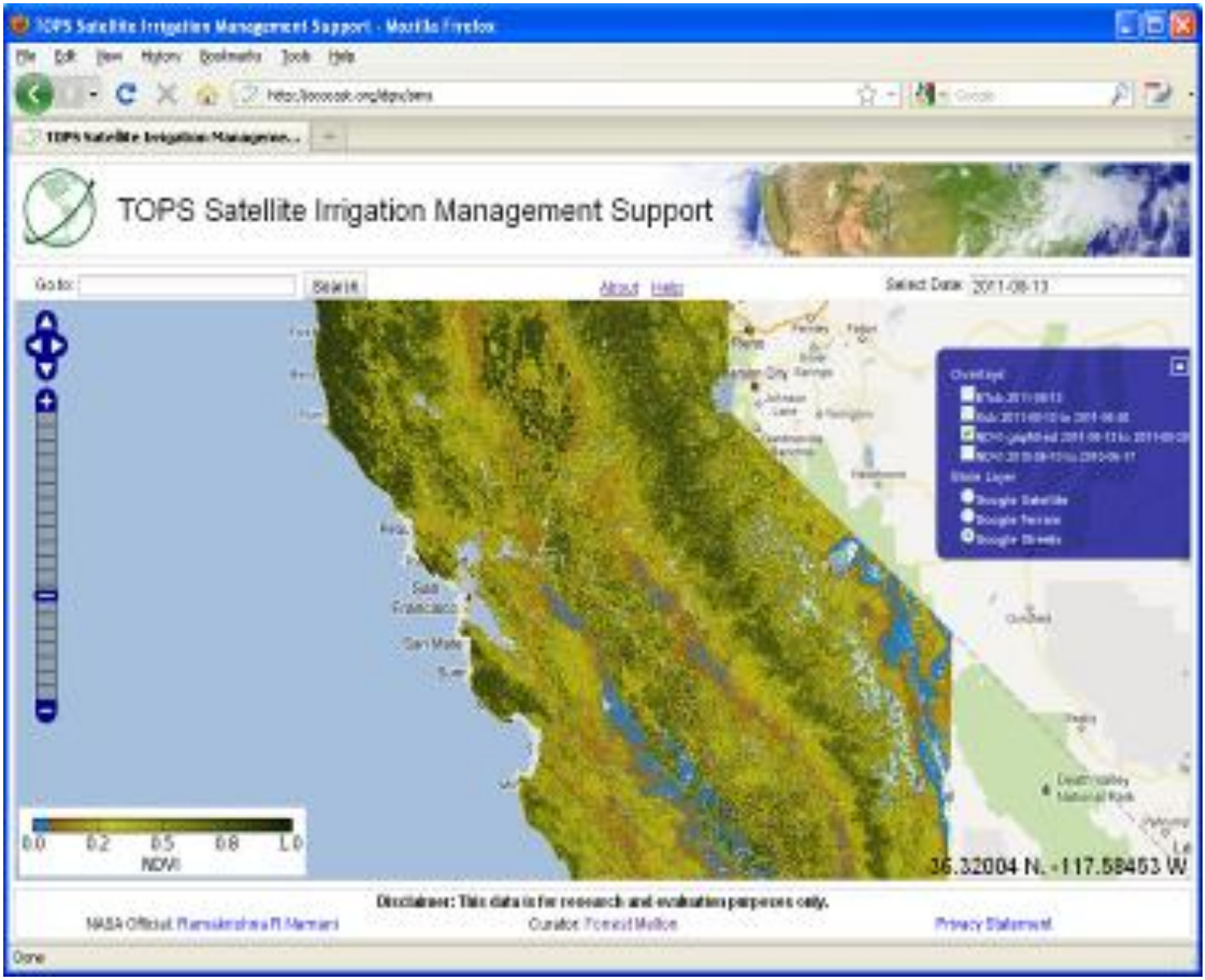
Forrest listed some of California's water resource management challenges:

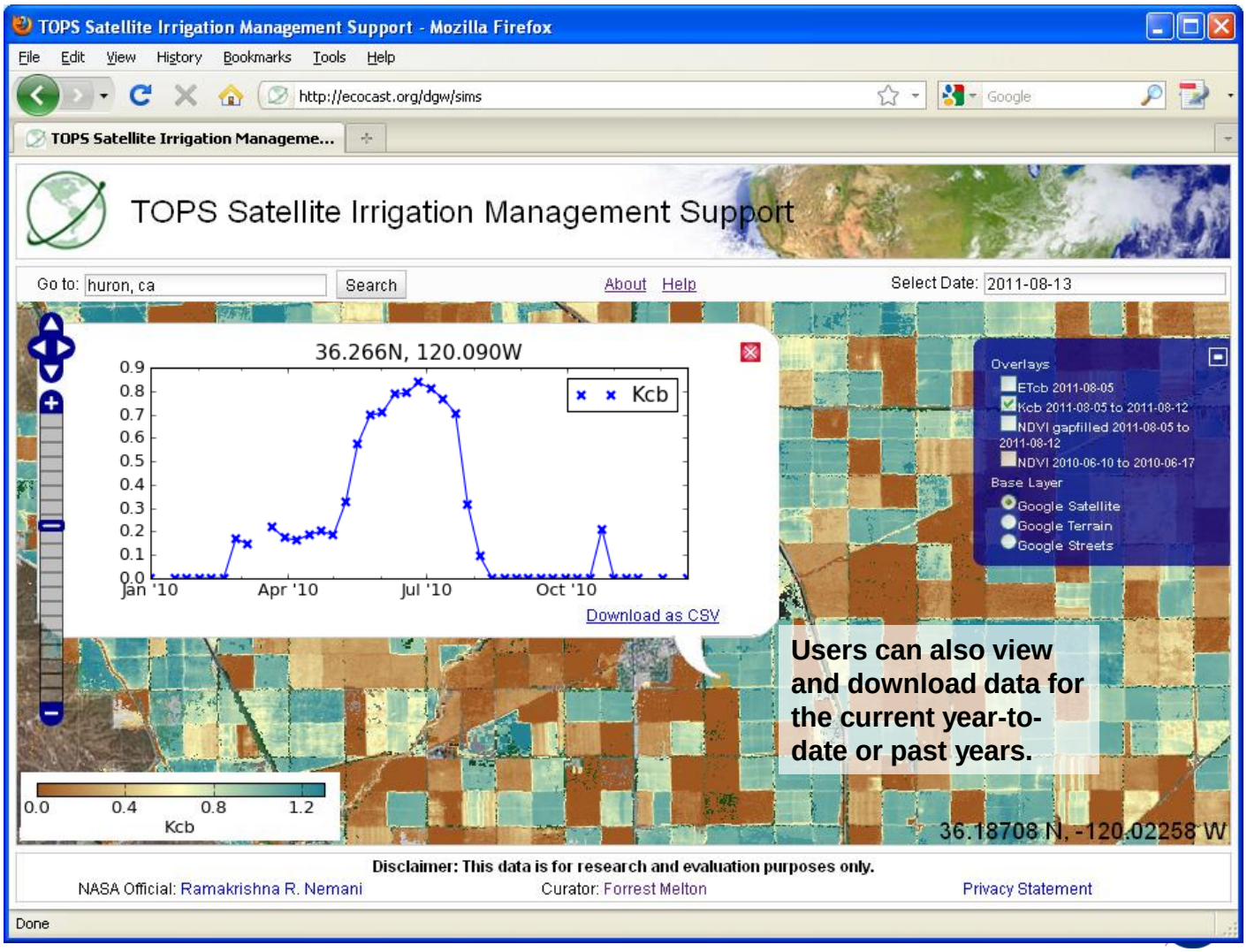
- Competing demands
- Drought impacts
- Ecosystem decline
- Impaired water bodies
- Aging water conveyance infrastructure
- Groundwater overdraft
- Climate change and population growth

He told the participants that a roadmap for next decade includes the need to use and re-use water more efficiently, to reduce water-related energy consumption, invest in new water technology and to improve data and analysis for decision-making. There have been some advances. The California Department of Water Resources and UC Berkeley surveyed growers in 1990s and found that those who utilized weather data reported an increase in yields of 8% and a decrease in applied irrigation of 13%. Even with cost saving results like this, use of ET data in irrigation scheduling is increasing but is still not widespread.

Combining satellite data with the California Irrigation Management Information System (CIMIS) which is a surface observation network gives a clearer picture on water resources.
Forrest described the TOPS Satellite Irrigation Management Support system. Its coverage includes about 15 million acres of farmland in the Central Valley and coastal agricultural valleys. Resolution is down to the field scale so the individual farmers can access information that will provide them with a reference for irrigation management support, optimization of irrigation – especially during fertilizer applications and calculation of seasonal ETcb for reporting of sustainability metrics for on-farm water use (applied irrigation as a % of ETcb make irrigation and crop decisions.)

Users can query maps for current values and can also view and download data for the current year-to-date or past years. Integration of data from CIMIS also allows automated calculation of ETcb on a daily basis and provides answers for questions such as “What was the potential crop transpiration for the San Joaquin Valley last week, month or year?” “How did crop water use for the Central Valley last year compare with the historical norm?” and “What is the anticipated irrigation demand for an irrigation district next week?”





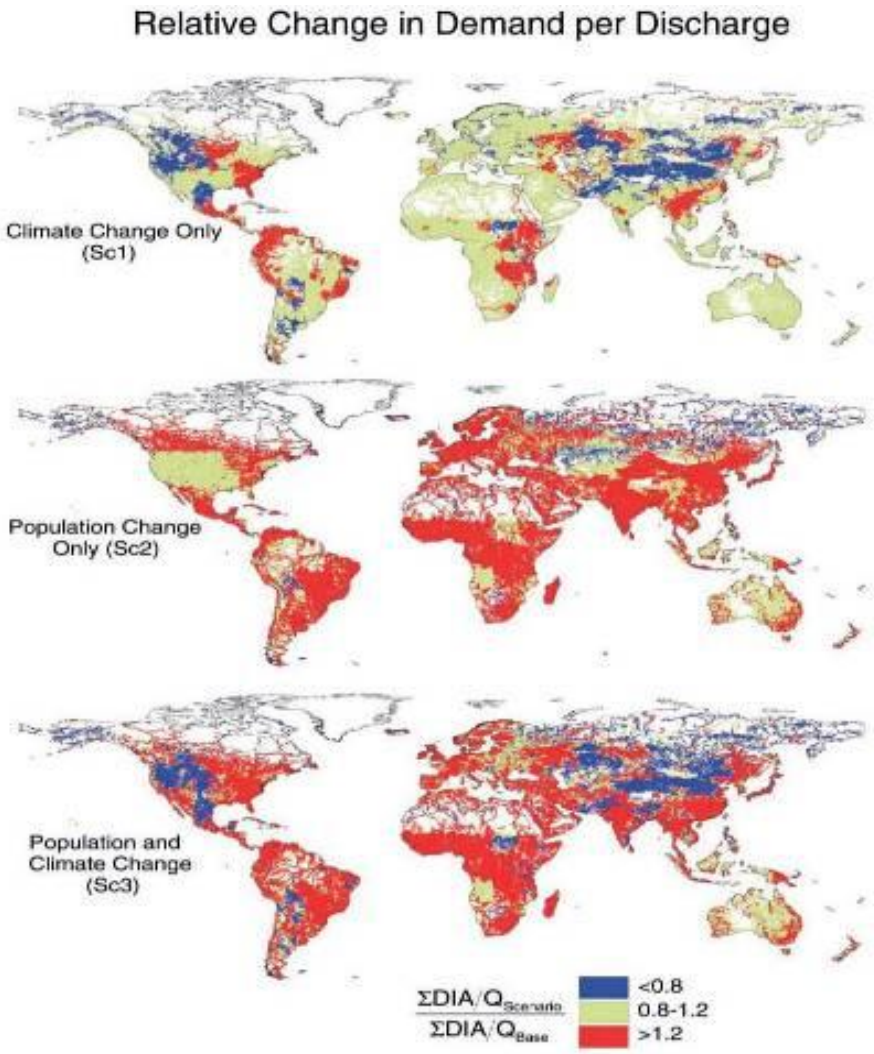
Summary

- Satellite observations offer promise for supporting development of sustainability indicators with spatially continuous, consistent observations
- There are applications for tracking indicators of ecosystem change and crop water use among many others
- Value of satellite data increased when integrated with observations from surface networks

Future Work includes integration of data from the International Space Station Agricultural Camera (ISSAC) as alternate to Landsat 5 for 2012 and outreach and education activities in partnership with Western Growers, UCCE, USDA, and local water districts. There is a proposal pending with NASA for continued work on TOPS-SIMS focused on transfer to CDWR as the long-term operational partner and another proposal with NASA for work on fallowed area mapping with USDA, USGS, and CDWR to provide early assessments for drought impact monitoring. California Department of Food and Agriculture funding has been received to conduct side-by-side irrigation trials to quantify benefits of use of Kcb / ETcb data in terms of reduced inputs (water, fertilizer, energy) and / or increased yield; integrate TOPS-SIMS with UCCE irrigation calculator. California State University Agricultural Research Institute funding has been received to continue work on integration of TOPS-SIMS and the CSU Fresno Wateright irrigation scheduling tool and continue weighing lysimeter experiments.

More information is available at www.ecocast.arc.nasa.gov/sims/

Using Climate and Hydrological Models to Assess Potential Future Conjunctive Use -- The Central Valley Example - Randall T. Hanson, U.S. Geological Survey



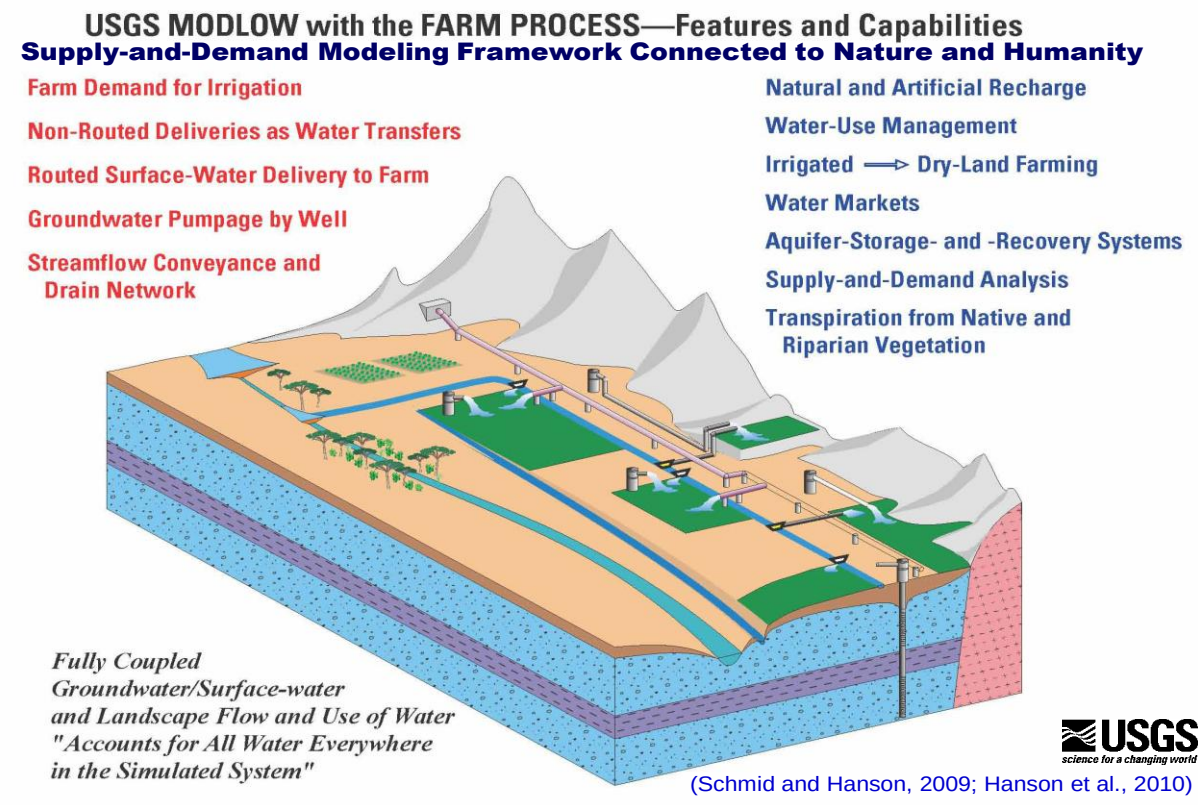
Randall Hanson began his presentation with a definition of water sustainability as *development and use of water in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences.* USGS defines conjunctive use *as joint use and management of surface-water and groundwater resources to maximize reliable supply and minimize damage to the quantity or quality of the resource.*

USGS has done global analysis of water stress from major surface-water drainages which show a large part of the world's population experiencing water stress. Rising water demands outweigh effects of greenhouse warming-climate change through 2025. Direct human impacts on global water supply may be poorly articulated but important to the larger global change questions of climate hazards and vulnerabilities, adaptive capacity and sustainability.

How can conjunctive use/sustainability analysis help stakeholders?

- Climate Vulnerabilities? Extreme events, sustained events, permanent changes to system, unsustainable adaptation. Primary effects include more dry springs and higher minimum temperatures,
- More cloudy/foggy days, more windy days, amount/timing of snowmelt runoff, frequency of wet years, frequency of storms, length of growing seasons, etc. Secondary effects: land subsidence, seawater intrusion, decreased streamflow gains/losses, and increased soil salinization, decreased soil moisture, land-use adaptation (esp. urbanization!)
- Variables/metrics used for vulnerabilities? Focus of current research and analysis of coupled models -- most "Indicators" only based on data. Need to make decisions on indicators from data and physically-based models.
- Ensemble Analysis Adequate? Maybe not. The traditional statistical and probabilistic approach to synthesis of results may not capture linkages or secondary-limiting factors of conjunctive use. Indicators from ensembles may not catch extremes or tipping points

- Current Observational Networks & Associated Data Adequate? Maintenance of Input Data Streams for regional hydrologic models one of biggest challenges and needs. Part of the Decision Support System should include integrated ground and remote-sensing networks in Mountains & Valleys. Support of SELF-UPDATING MODELS



(Schmid and Hanson, 2009; Hanson et al., 2010)

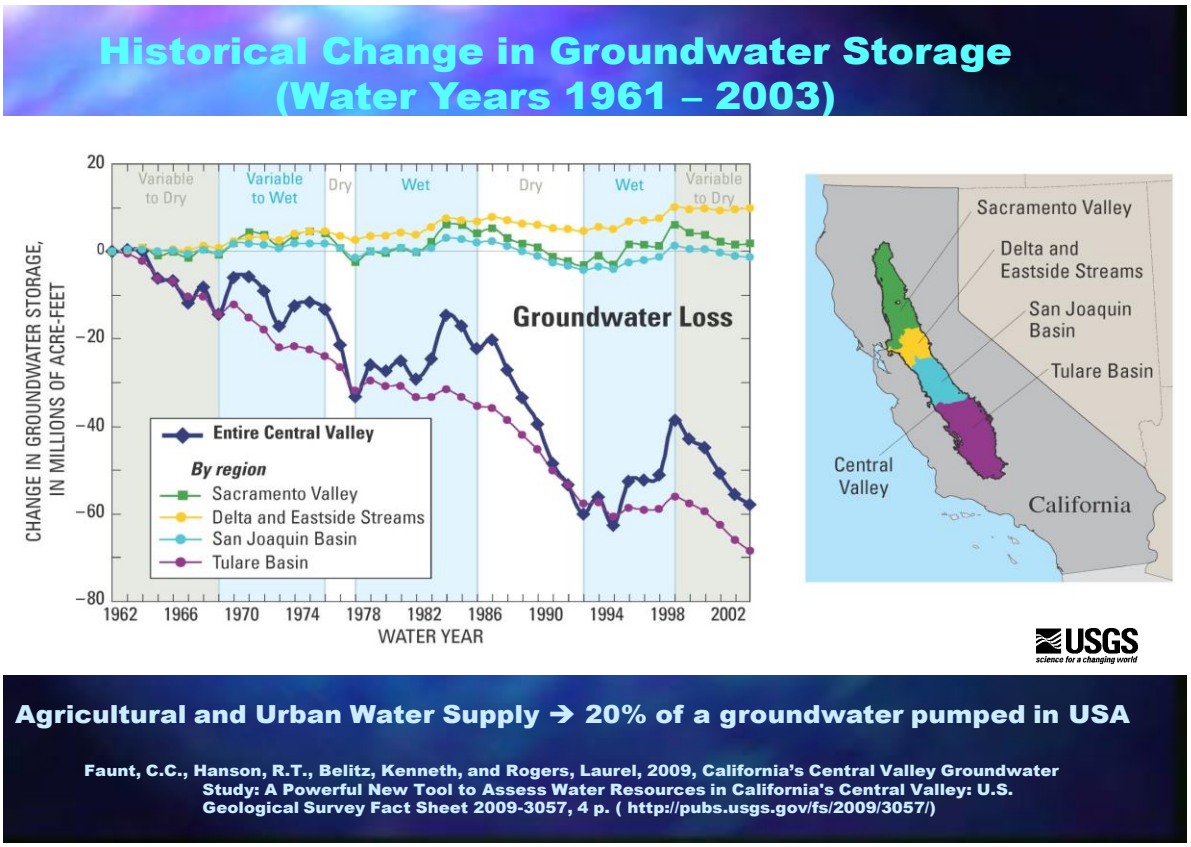
Randall outlined USGS missions related to sustainability and conjunctive use in the Central Valley:

- One Water: Single resource whether from precipitation, surface water or groundwater
- Competition for Water: Demand for water resources for people, agriculture and environment
- Sustainable development: Complex system requires integrated water-management approach
- Availability/Sustainability: Changes in streamflow, groundwater storage, regions suitable for agriculture, and dynamics between natural and societal water-supply demands
- Groundwater effects: Significant changes in Flows, Storage, & Secondary effects on multiple time scales (Flow-centric & Storage-centric Indicators)
- Climate variability/change Analysis.
- Climate change: Important influences on management strategies for conjunctive/sustainable use on periods of 100 years or more

Randall proceeded to give a summary of A2 Scenario Simulation of 21st Century for the Central Valley:

- Increased Groundwater Storage Depletion under A2 scenario for 21st Century in Central Valley
- Increased Land Subsidence throughout Central Valley and especially in the Tulare Basin and areas adjacent to Sierras (southern Central Valley)
- Increased streamflow infiltration and decreased groundwater outflow in the Sacramento Delta from 1-meter rise in sea level & 1.2% per year Urban Water Growth (model sensitive to even larger urban-demand growth rates!)
- Decreased Precipitation .Intermittent droughts in first half of century followed by sustained drought in 2nd-half of 21st Century
- Decreased Outflow at the Delta plus many rivers & diversions

- Water-Use Transition Surface-water dominated irrigation supplies to groundwater supplies with sustained drought.
- No Operational Drought Simulated capacity of sw/gw supply in system still greater than combined potential demand on conjunctive-use system
- Climate Change and Increased Urban water use .Both affect sustainability. land subsidence and reduced outflow at the Sacramento Delta
- GCM-MHWM-CVHM Linkage Coupled physically-based, supply-constrained, and demand driven models Basis for a Decision Support System Evaluate Outflow of streamflow at the Delta, Streamflow, Surface-water Diversions, Land Subsidence, & Drought Scenarios, Supply-&-Demand Components
- Hydrologic projections of a Century are more reliable in trends and changes than actual outcomes



Modeling current (1962-2003) data and future 20-year projections of total basin discharge for 4 basins in the study area, suggest streamflow reductions of ~30 – 40% from major rivers flowing from the Sierras to the Central Valley in later decades of 21st Century.

Randall closed by summarizing the take-home messages

- One Water – consider all sources to be interconnected
- Linked & Integrated Models and Observation networks needed for Physically-based Resource Analysis (Self- Updating Models. DSS & Indicators)
- Sustainability, Conjunctive Use, Adaptation Controlled by Secondary effects
- Management horizons may range from years-decades to more than a Century (2050 time frame may be inadequate)
- Multiple Stressors on Resource. Climate change, Urbanization, Agricultural, Environmental

For more information refer to USGS Office of Groundwater Software:
http://water.usgs.gov/nrp/gwsoftware/fmp/fmp.html/

Smart, Distributed Water Infrastructure and Technology

This session focused on the activities of industry to innovate around sustainable business practices.

Communicating and Implementing Indicators - Marianna Grossman, Executive Director, Sustainable Silicon Valley

Marianna Grossman began by sharing two quotes the show the challenge of communicating climate change:

"I'm a climate change skeptic and, perhaps a skeptic of most things trendy and alarmist."
– Head of money markets investment group for major European- owned bank in U.S.

"*There has always been climate change. I drive a hybrid but I don't believe that climate change is caused by human beings."*
– Head of a wastewater treatment utility in the SF Bay Area

Communicating with Indicators

- Who needs to understand story behind data?
- The public (ratepayers, voters, investors)
- Utility management (staff and elected officials)
- Agricultural, industrial, commercial water users
- Non-human water users (ecosystems, fish, etc)
- What is their responsibility?
- What information do they need to make good decisions in a meaningful timeframe?
- What are their constraints?

Marianna told the participants that to develop indicators to drive and evaluate action we need to know what indicators are enough to characterize the system, identify levers for change and track changes. We need to determine what policies and measures are needed to change system performance and consider pricing signals for appropriate investment and rules to govern use of common resources including the consequences for cheating. How is this information conveyed to result in meaningful action at scale of the challenge?

Marianna talked about regional resiliency being improved through local use of water, energy, and material resources and smart infrastructure for distributed water and energy. Regions can share information and culture locally and globally, and invest in education, training, & research. There is an opportunity to design land use and transportation to enhance interaction and relationships and support an augmented regional food system.

Marianna explained the resources available through the EcoCloud Innovation Platform. The EcoCloud supports collaborative innovation including optimization of resources, materials, energy, and water flow. collaborative sharing of project information and best practices, unique models enable systemic solutions for reducing energy usage, conserving resources, eliminating waste, and cutting costs to improve the bottom line. The EcoCloud supports sharing product information in a virtual marketplace and exchanging knowledge in a virtual webinar.

EcoCloud™ Innovation Platform

- http://ecocloud-sv.com
- Major Focus Areas

- Platform where companies, municipalities, thought leaders and academia can collaborate and innovate sustainable solutions.

With respect to water the EcoCloud covers recycled water, decentralized water, water conservation, the energy/water connection, policy and planning and metrics and reporting.

Marianna invited SWRR members to participate on EcoCloud in the blogs, forums, events, suggestions, videos, groups, technical assistance and free product marketing to qualifying businesses. Participants can contribute indicators, stories, case studies, policy guidelines, reports, or recommendations.

More information is available at http://ecocloud-sv.com

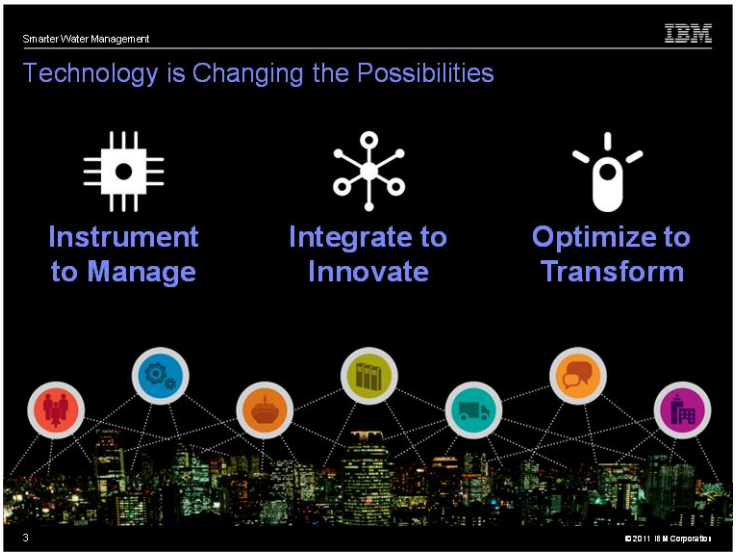
Questions from Participants:

1) Q: Are you also told to dumb down messages and not be alarmist so we don't scare people away (re: climate change)??

   A: There's a need to find the story in the indicators (based on science, but also able to communicate) Challenge to everyone to communicate – be scientifically rigorous but also communicate the truth.

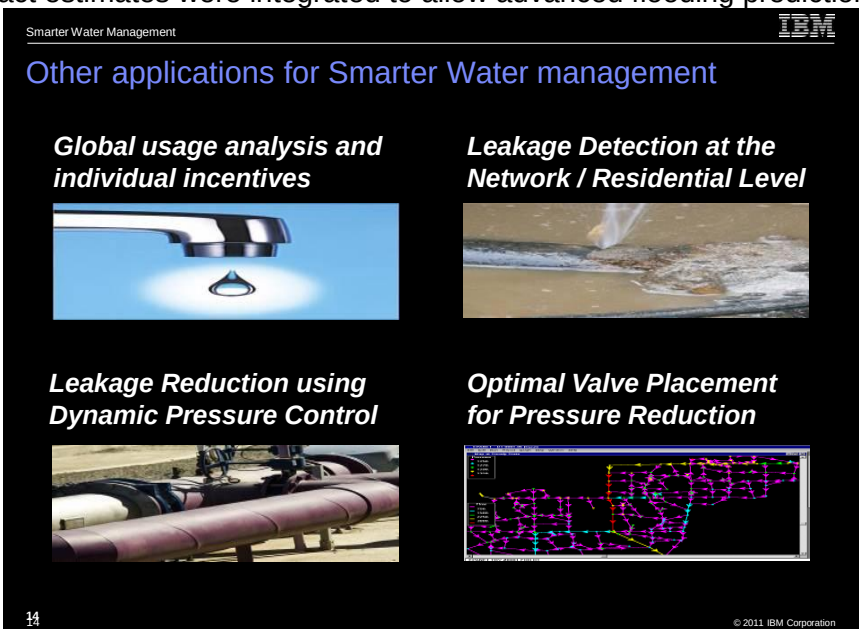
Building a Smarter Planet: Innovation in Smarter Water Management

- Andrew Clark, Director of Strategy, IBM



Andrew Clark told the group that water management is critical to building smarter cities. The Smart Water Network is a 21st century system that gathers data from usage, pressure, and contamination; analyzes for leak detection and valve placement; and optimizes for work scheduling and collaboration. This use of information improves the entire water ecosystem from availability (run off systems and climate models), delivery (leak detection and risk of levee failure) through to consumption (more precise irrigation and smart metering.

Drew shared case studies IBM has worked with in Sonoma County where a collaboration platform was designed, Dubuque Iowa where a project focuses on sustainable consumption and usage, Galway Bay where the application was natural water system management, Washington DC where the Water and Sewer Authority needed automated scheduling, and Rio de Janiero where analysis of precipitation, flood prediction and impact estimates were integrated to allow advanced flooding predictions.



More information on Smarter Water Management is available at http://www.ibm.com/smarterplanet/us/en/water_management/ideas/

Agricultural sustainability topics

This session highlighted examples of sustainable initiatives within the agriculture sector both at the on farm scale and larger initiatives

California Roundtable on Water and Food Supply,

- Katy Mamen, Program Director, Ag Innovations Network

Katy Mamen explained that Ag Innovations Network is a non-profit organization focused on convening and facilitating dialogues to build democratic food and agriculture systems. Its flagship projects are the Food System Alliances which are statewide.

The California Roundtable on Water and Food Supply (CRWFS) was launched in 2010 as a consensus-based process. The objectives are to build relationships between agriculture and other key stakeholders to generate common principles and recommendations for decision-makers and the public. The rationale of the roundtable is that stakeholders can help "unstick" thorny public issues by working together to surface and promote common interests. The roundtable concept is to create a process wherein creativity and wisdom can flourish and lead to new thinking and strong new paths forward for water management. The Roundtable is a space where a select group of thoughtful and committed leaders can engage in facilitated, off-the-record process, bringing individual perspective and deep experience to the membership. The members are 25 leaders from specialty crop agriculture, water supply management, state and federal government, fish and wildlife, natural resources, stewardship, environmental justice, rural economic development, and academia. There is a five member steering committee

The Agricultural Water Stewardship Framework:
•Agricultural water stewardship is the use of water in a manner that optimizes agricultural water use while addressing the co-benefits of water for food production, the environment, and human health.
•Effective water policy must be rooted in the local
•Embraces full spectrum of approaches, from high-tech to cultural and agro-ecological practices.
•Outcomes: Increased resilience of farm operations to irregularities in water supply; provision of ecosystem services; balanced trade-offs for society as a whole.

Current Roundtable Activities

- Dialogue: Water storage through an agricultural water stewardship lens
- CAWSI Agricultural Water Stewardship Resource Center www.agwaterstewards.org
- Communications efforts to raise awareness about approaches to agricultural water management that support the viability of agriculture, conserve water, and protect ecological integrity in California.
- Online clearinghouse
    - On-farm practices
    - Interactive case studies database
    - Resource Library

In the interactive database of case studies there are thirty-two case studies searchable by location, irrigation method, production type, water management practice, and other features. Additional case studies have been invited and these will be added over time. The cases cover many applied practices including benchmarking, management innovation, irrigation scheduling, groundwater recharge, water recycling, soil amendments, and nutrient management.

More information is available at www.aginnovations.org/Roundtables/CRWFS,
www.agwaterstewards.org,
www.twitter.com/agwaterstewards
www.facebook.com/agwaterstewards

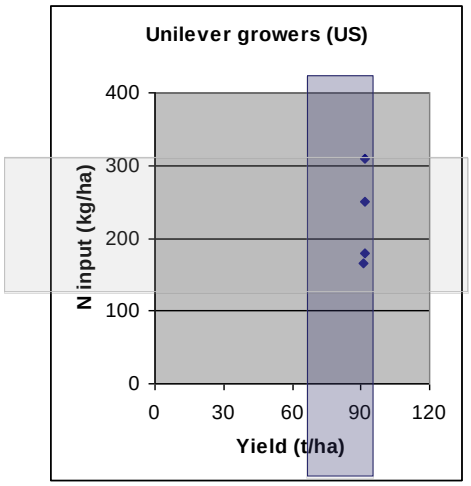
Stewardship Index for Specialty Crops, Presented by Katy Mamen on behalf of Jessica Siegal, Program Director, Stewardship Index

Katy Mamen gave an overview of the Stewardship Index. The purpose is to develop a metrics-based system for benchmarking, comparing and improving sustainable performance in the specialty crop supply chain. The scope is to provide measures of sustainability in the United States for "People, Planet, and Profit" on the farm, through distribution, processing, to use in retail of food service.

The Stewardship Index Coordinating Council is made up of
Growers:
Community Alliance with Family Farmers, Jacobs Farm / DelCabo, Farm Fresh Direct, Georgia Fruit and Vegetable Association, National Potato Council, Torrey Farms, United Fresh Produce Association, Washington Horticulture Association, and Western Growers
Buyers:
California League of Food Processors, California Sustainable Winegrowing Alliance, Compass Group, Del Monte, Food Marketing Institute, Heinz, Markon Cooperative, Produce Marketing Association, Sodexo, SYSCO, Unilever, Wal-Mart, Wegmans
NGOs & Experts:
American Farmland Trust, Defenders of Wildlife, Environmental Defense Fund, NRDC, The Organic Center, SureHarvest, Sustainable Food Lab, University of Arkansas, World Wildlife Fund.

Benchmarking

Borrowing a Unilever Idea



"We compared our key growers' nitrogen fertilization rates and found that application rates could differ by almost 200%."

Stewardship Index Coordinating Council Metric Calculator (Beta Version 1.0)

Water Use	Soil	Energy	Nutrients
•Acre inches applied / ton harvested •Acre inches applied / Crop ETc	Soil organic matter/ Soil organic matter potential	Total BtU/ ton harvested	Pounds of N and P / ton harvested

Katy gave examples of a metrics related to water:

Component 1: Water use efficiency = total amount of water used to produce the crop

- Acre-inches applied water / ton harvested or acre planted

Approved methods for measuring water:

- Irrigation District Reporting
- Closed Conduit Measuring Devices
- Standard Open Channel Measuring Devices
- Alternative to Direct Measurement: Power Records

Component 2: Simple irrigation efficiency

- Acre-inches applied water / Etc

Where:

- Applied water = irrigation water applied by grower
- ETc = crop water demand resulting from transpiration and evaporation

A spreadsheet-based calculator has been developed with team of experts that calculates Etc for the growing season using the method published in the FAO Irrigation and Drainage paper No. 56.

More information is available at www.stewardshipindex.org

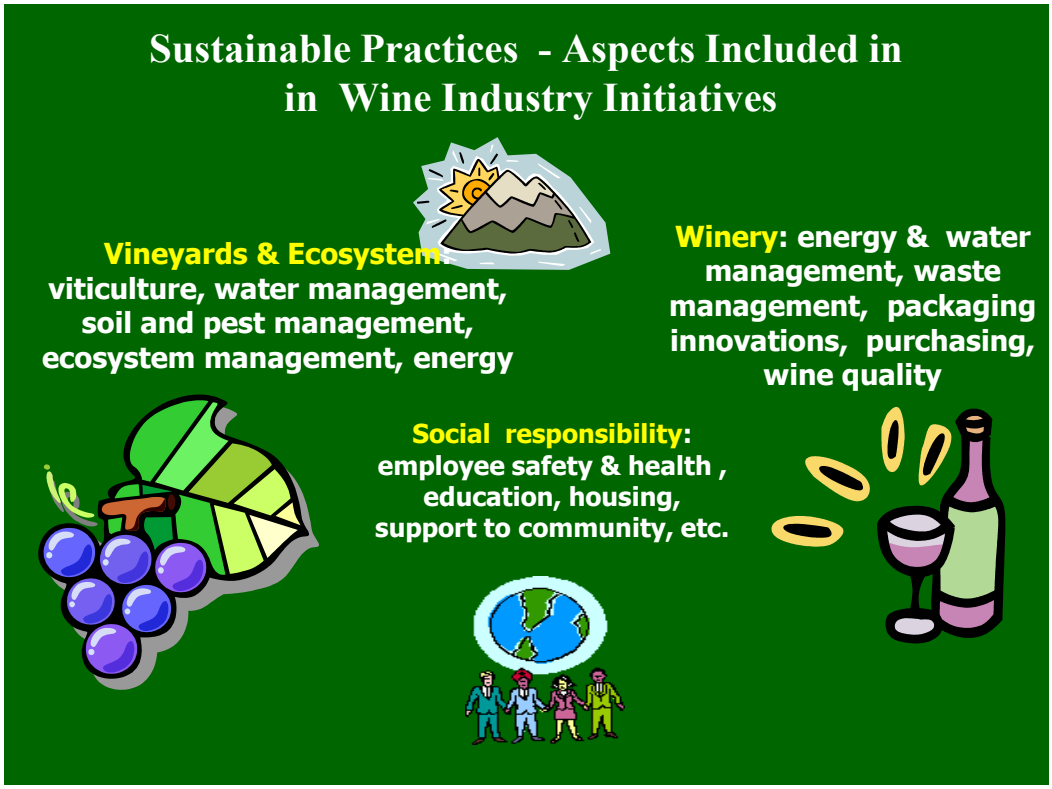
Wine Industry Stewardship Initiatives, Ann Thrupp, PhD, Manager of Sustainability & Organic Development Fetzer & Bonterra Vineyards & Consultant on Sustainable Agriculture

Ann Thrupp began by saying she would talk about sustainability and stewardship initiatives in the California wine industry including programs & trends, adoption of practices, drivers of change and water-related challenges and opportunities in the vineyards and beyond.

Sustainable Winegrowing Programs have offered "free" opportunities for learning, involving multi-stakeholder participation and supported by government grants since the early 1990s. Self-evaluation and education programs include:

- Organic Farming – preceded "sustainability" programs
- Lodi Sustainable Farming Program (since 1996)
- Central Coast Vineyard Team – Positive point system (since mid-90s)
- CA Sustainable Winegrowing Alliance - added winery aspects (since 2001)
- Collaborate with University scientists (eg, UCCE)

The current accepted general definition of sustainability in the California Wine Industry (for grape growing & winemaking) is that Sustainable Winegrowing means "Growing & winemaking practices that are sensitive to the Environment, responsive to the needs and interests of society-at-large (social Equity), and Economically feasible to implement and maintain." Also – there is concern about future generations.



A sustainable winegrowing workbook has been produced with 14 chapters and 227 criteria from "ground to glass." The workbook contains criteria for evaluation, not "prescriptions and covers the following areas:

- Viticulture
- Soil Management
- Vineyard Water Management
- Pest Management
- Wine Quality
- Ecosystem Management
- Energy Efficiency
- Winery Water Conservation & Quality
- Material Handling
- Solid Waste Reduction & Management
- Environmentally Preferred Purchasing
- Human Resources
- Neighbors & Communities
- Air Quality

There is a cycle of continuous improvement and increasing involvement in sustainable wine-growing programs. There are thousands of growers and winery participants in regional and statewide winegrowing sustainability programs for education and evaluation. For example the California Sustainable Winegrowing Program (statewide) has had 1,566 winery and vineyard representatives participate in CSWA self assessments, and report results. This represents more than 65% of land area and 60% of wine case volume in California. More than 7,000 people have attended educational events since 2002.

There is a high level participation in other educational programs on sustainable winegrowing and stewardship practices in many regions.

Emergence of Sustainability and Stewardship Certification programs for vineyards & wineries grew out of education and evaluation programs and stakeholder involvement to develop standards. It resulted from a desire for labeling and third Party verification, and enables communication to buyers and consumers. So far 46 vineyards totaling 20,000 acres have been certified.

Another program implemented by the California Land Stewardship Institute is Fish Friendly Farming. The FFF® program is an incentive-based method for creating and sustaining environmental quality and habitat on private land. The program consists of Best Management Practices that have been identified by environmental groups, government agencies and others. FFF operates in four counties: Mendocino, Sonoma, Napa and Solano. To date, over 100,000 acres have been enrolled in the program – approximately 110 growers.

Ann next reviewed University of California and its Cooperative Extension programs. For more than 15 years, UCCE has included water conservation and watershed management education, technical assistance, seminars, short-courses for wine grape growers.

What are impacts of these programs? What does this mean for implementation of practices?

- Increasing Adoption of sustainable farming practices & conservation methods, and other innovations (documented in surveys & reports)
- For example, in 2011, 78% of wine grape growers participating in the California Sustainable Winegrowing Alliance CSWA have adopted drip irrigation (CSWA)
- Wide use of “Regulated Deficit Irrigation” (minimal water use) for maximizing grape quality

Example: Additional Results of the Sustainable Winegrowing Program (SWP) Survey on Sustainable (Stewardship) Practices in Vineyard - adoption in 2009

1. Regular monitoring of pest insects and/or diseases (96%)
2. Reduced risk pesticides (95%)
3. Reduced tillage approaches (91%)
4. Conserving natural vegetation on their property (91%)
5. Leaf pulling (82%)
6. Cover crops (80%)
7. Bird boxes (75%)
8. Erosion control measure (72%)
9. Use Weather station (60%)
10. Monitor beneficials (59%)

Challenges and Effective Actions: Recent controversy & activities tied to water for frost protection – Mendocino and Sonoma

- Water use controversy – Russian River 2008 frost event – 10 fish stranded
- Extrapolation of data about impact on fish populations
- Great increase in regulatory concerns about pumping from Russian River for frost control
- Grower actions and Responses -- Increase Monitoring, installation of meters throughout watershed, strengthen Stewardship groups, proactive measures include building ponds for off-stream storage, and increase in education and adoption of water conservation measures

Ann gave many examples of actions being taken in the wine industry to conserve water and become more sustainable. These include long term off-stream water storage, cover crops, habitat corridors or hedgerows, creek restoration, plantings for creek bank stabilization, and other measures.

More information is available at www.sustainablewinegrowing.org

Day 3 December 8th Field Trip (8am-2pm)

A number of the SWRR participants got up and out early to visit Sierra Orchards and the Center for Land Based Learning founded by Mr. Craig McNamara.

The Center for Land-Based Learning is dedicated to creating the next generation of farmers and teaching California's youth about the importance of agriculture and watershed conservation. Combining innovative hands-on experience with classroom learning, participants in CLBL's many programs develop leadership skills, learn how sustainable agriculture practices contribute to a healthier ecosystem, and create connections to agricultural, environmental, and food system careers. We toured wildlife-friendly demonstration projects, tail water reuse facilities, educational gardens, teaching kitchens, and the farm incubator.

A highlight of the visit was an extensive tour of Craig McNamara's Sierra Orchards, a large farm that produces organic walnuts and olive oil. We walked among the walnut groves and learned about water management and organic growing techniques for walnuts and other crops. Since the walnut harvest was complete for the season the SWRR participants were able to engage in the age old process of gleaning and found the walnuts to be outstanding.

Mr. McNamara received the Leopold Conservation Award in 2008 and serves as Chair of the California State Board of Food and Agriculture.

More information is available at http://landbasedlearning.org