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CLIMATE CHANGE & THE SAN FRANCISCO BAY WATERSHED

WATERSHED IMPACTS PROJECTED FOR THE COMING CENTURY

Edited/Condensed from: James E. Cloern, US Geological Survey, et alia (see below)

Editors' Introduction: The article that follows has been abridged and reformatted from a Public Library of Science (PloS) online publication released in November. The original article is much more comprehensive and includes a much more extensive discussion of the methodology and data used for the reported-upon research and numerous links to additional information.

See www.plosone.org/article/info:doi/10.1371/journal.pone.0024465

PloS citation: Cloern JE, Knowles N, Brown LR, Cayan D, Dettinger MD, et al. (2011) Projected Evolution of California's San Francisco Bay-Delta-River System in a Century of Climate Change. PLoS ONE 6(9): e24465. doi:10.1371/journal.pone.0024465

Editors' Notes:

The article uses a superscripted minus one ($^{-1}$) to denote "per the preceding"
Example: L^{-1} $decade^{-1}$ = per liter per decade

In the article's context, "forcing" refers to externally imposed perturbation in the radiative energy budget of Earth's climate system.

The article's authors' noted:

> To our knowledge, (this Study) is the first attempt at an integrated quantitative assessment of how global signals of climate change would cascade to modify runoff, river discharge, water temperature, sea level, salinity intrusion and suspended sediments in a large watershed-river-estuary-ocean system.

INTRODUCTION

Planet Earth is warming at an accelerating rate. The latest assessments show the 2000s to be the third consecutive decade of record high global-average surface temperature (Hansen, et al. (2010)), and 2010 tied with 2005 as the warmest year since records began in 1880 (www.ncdc.noaa.gov/sotc/global/2010/13). This warming is attributed with high probability to increasing human emissions of greenhouse gases (IPCC (2007)). Global warming has altered water supplies through: changes in precipitation; evapotranspiration; runoff; and river discharge (Milly, et al. (2008)). Risks to coastal communities and infrastructure are growing as the rate of sea level rise accelerates (Rahmstorf S (2010)) and as the intensity of tropical storms is projected to increase (Knutson, et al. (2010)). Surface temperatures of inland water bodies (Schneider, Hook (2010)), rivers (Kaushal, et al. (2010)) and oceans (IPCC (2007)) have all increased significantly. Warming of streams and rivers contributes to local species extinctions and facilitates colonization by introduced species (Kaushal, et al. (2010)). Spring warming of temperate lakes disrupts the synchrony between zooplankton and their phytoplankton food supply (Winder, Schindler (2004)). Warming of the world oceans strengthens thermal stratification and has contributed to a 1% per year loss of oceanic primary production (phytoplankton decline) over the past century (Boyce, et al. (2010)). Therefore, evidence is accumulating on a global scale of strong links between climate warming and changes in availability of fresh water, risks to humans from coastal flooding and storms, and altered biological diversity and productivity of aquatic ecosystems.

Climate Projections

Local Scales

Study Area Significance

Snowmelt & Reservoirs

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Simulations with **g**lobal **c**limate **m**odels (GCMs) under a plausible range of greenhouse gas emissions scenarios all project substantial warming through the 21st century. Continued warming will have important consequences for social and natural systems, but these consequences will not be felt uniformly across the planet. Therefore, strategies for adaptation to climate change require quantitative projections of how altered global patterns of temperature, precipitation, and sea level will play out at regional and local scales. The Study illustrates one approach for developing quantitative projections by linking models of processes computed at sequentially smaller scales — i.e., from global to regional to local.

The Study focused on California's San Francisco Estuary-Watershed (SFEW), which includes San Francisco Bay, the Sacramento-San Joaquin Delta (Delta) and the Sacramento and San Joaquin river drainages (Fig. 1). The SFEW has social and economic significance as the source of runoff that provides drinking water to 25 million people and irrigation water to a million hectares of farmland producing crops valued at $36 billion per year (USDA website). It also has large ecological significance because the river system is habitat for native fishes including Pacific salmon and steelhead trout. San Francisco Bay is the largest estuary on the US west coast, providing habitat for endemic species (e.g. delta smelt, salt marsh harvest mouse) and marine species supporting fisheries (e.g. English sole, Dungeness crab). Fourteen species of migratory or Delta-resident fishes are imperiled, and their population declines motivate ambitious and costly programs of environmental conservation (Bay Delta Conservation Plan website) and habitat rehabilitation (Moyle et al. (2010)). On the shores of this estuary, 270,000 people and $62 billion of development are at risk of flooding as sea level continues to rise (San Francisco Bay Conservation and Development Commission website). Regional planning and conflicts of resource allocation in the SFEW are already great challenges. These challenges are likely to grow as the regional effects of global climate change and other changes accumulate through this century. The Study developed integrated scenarios of the future SFEW by projecting a suite of environmental responses to climate change and assessing their implications for sustainability of native biota, water supplies, and risks of coastal flooding.

REGIONAL SETTING

The San Francisco Estuary-Watershed is composed of an interconnected airshed, watershed, river network, estuary and coastal ocean. The 163,000 square kilometer (km^2) watershed is bounded by the Sierra Nevada and Cascade mountains. Regional climate is characterized by a winter wet season and summer-autumn dry season. An average of forty percent of annual runoff to the river network is produced from snowmelt (Knowles (2000)). Reservoirs are managed to capture this late-season runoff as a resource, while water reaching the reservoirs during the earlier rainy season is managed as a hazard and allowed to pass through the reservoirs to maintain flood control space. Runoff and reservoir outflows collect in the Sacramento and San Joaquin rivers, which converge in the Delta. Tides propagate through the Golden Gate to the Delta, and the extent of salinity intrusion into northern San Francisco Bay is determined primarily by sea level height and river inflow. California's hydrology has followed the climate-driven patterns of change observed across the western United States and been attributed to human-induced warming (Barnett, et al. (2008)). These patterns include trends of increasing winter and spring air temperatures and lengthened growing seasons (Cayan, et al. (2001)), decreasing contributions of snow to annual precipitation (Knowles, et al (2006)), and advancement of spring snowmelt by 5 to 30 days (Stewart, et al. (2005)). Mean sea level at the entrance to San Francisco Bay has increased about 2.2 **c**enti**m**eters per decade (2.2 cm $decade^{-1}$) since the 1930s and the frequency of extreme tides has increased 20-fold since 1915 (Cayan, et al. (2008)).

Future climates have been evaluated for the California region, where air temperatures are projected to increase 1.5 to 4.5°C this century in a range of scenarios (Cayan, et al. (2008)).

Projected outcomes of warming in California include:

- Further declines of snow accumulation
- Decreasing hydropower generation
- Reduced viability of many species of fruit trees
- High susceptibility of alpine and subalpine forests to warming
- Increasing fire frequency

(Cayan, et al. (2008))

Global sea level rise, expected to be a close index for that in California (Cayan, et al. (2008)), is projected to be 70–185 cm above the present-day level (Vermeer, Rahmstorf (2009)). Climate-driven changes in the California region are therefore expected to increase risks to the sustainability of native plant and animal communities and to human health, infrastructure, water supply and food production (Hayhoe, et al. (2004)). The Study builds from these past regional assessments to investigate how the combined effects of rising sea level and hydroclimatic changes could transform California's large watershed-river-estuary-

Climate Projections

Adaptations

ocean system through the 21st century. The Study's projections suggest that climate-driven changes to the SFEW could require adaptations to an interconnected suite of responses.

Effective adaptations to climate-driven changes will need to consider:

- Diminishing water supply
- Continued shifts toward wetter winters and drier summers
- Sea level rising to higher levels than were projected only a few years ago
- Salt water intrusion
- Reduced habitat quality for native aquatic species
- Environmental variability beyond the range of historical observations

Adaptations to these responses would require integrated and flexible planning to cope with growing risks to humans and the increasingly difficult challenge of meeting demands for fresh water and sustaining native biota and their supporting ecosystem functions.

Scenarios Evaluated

STUDY METHODS

The Study evaluates two very different scenarios selected from the GCM projections used in the IPCC Fourth Assessment Report. The "B1" emissions scenario (representing a future where GHG emissions are curtailed by mid-century) uses a model with relatively low sensitivity to GHG emissions (Washington, et al. (2000)). The second "A2" climate scenario corresponds to a future of continually increasing atmospheric greenhouse gases as modeled by a medium-sensitivity NOAA Geophysical Fluid Dynamics Laboratory model (Delworth, et al. (2006)). These model-emissions scenario combinations were chosen to span a wide range of possible futures with regard to amount of warming and precipitation change. In combination, they provide a comparison between a projection of a warmer future with little change in precipitation (B1) and that of a much warmer and drier future (A2).

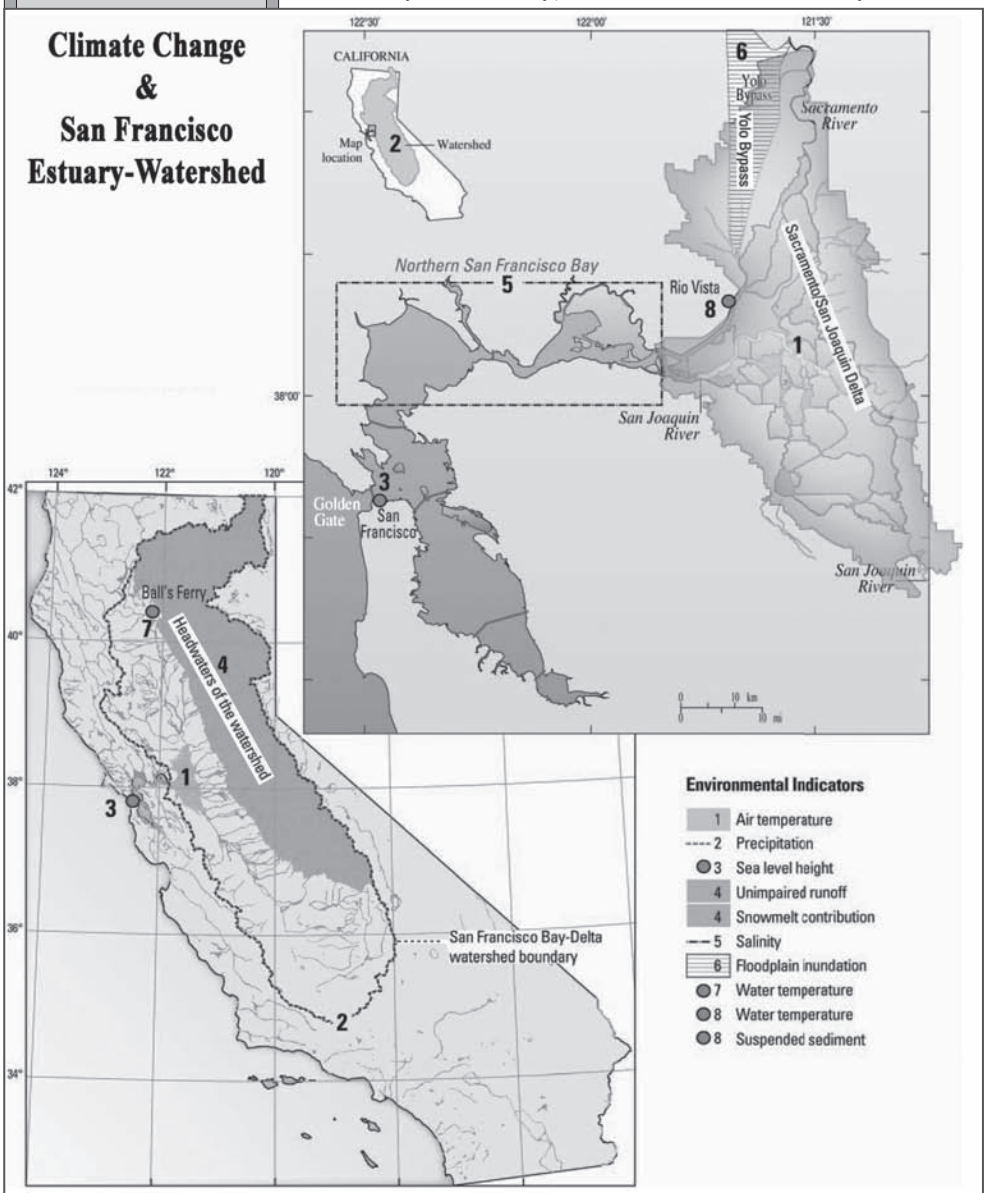


Figure 1. Spatial Domains of Environmental Indicators: Shaded, hatched and boundaried areas representing the areal averages or pertaining to a broad area. Dots represent locations of indicators corresponding to specific sites. Compare to Figures 2 & 3 and Table 1.
Adapted from color graphic available online at: www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pon.0024465

Our approach was to use linked models, each representing a different component of the system, to propagate the effects of the climate scenarios described above through the watershed-river-estuary system. The Study portrays these effects with a series of environmental indicators representing multiple components. These indicators were developed for the current century (2010–2099) and for a baseline period, defined as 1970–1999.

The indicators measure changes in regional climate, hydrology, and habitat quality in the San Francisco Estuary-Watershed system. The "historical" data represent simulated realizations of possible climates constrained only by historical "GHG forcing" (i.e., externally imposed perturbation in the radiative energy budget of Earth's climate system, which may lead to climate changes), and thus are not expected to track observed historical variability on a year-to-year basis.

Climate Projections

Indicators

RESULTS

Projected Responses to Climate Change in the 21st Century

The Study's objective was to develop quantitative visions of the SFEW system in two contrasting future climates and to communicate those visions in a way that makes them useful for planning adaptation strategies. The Study uses nine model outputs to use as indicators of changing climate, hydrology and habitat quality.

The climate indicators are:

1) Air temperature over the Delta
2) Precipitation over the Sacramento-San Joaquin River basin
3) Water elevation at the entrance to San Francisco Bay

The hydrologic indicators, modeled using the climate projections as inputs, are:

4) Unimpaired runoff from the headwater basins of the Sierra Nevada and Cascade ranges
5) Snowmelt contribution to runoff

The habitat indicators, modeled using the climate and hydrologic projections as inputs, are:

6) Water temperature in the upper Sacramento River
7) Water temperature in the Delta
8) Salinity (**p**ractical **s**alinity **u**nits (psu)) in northern San Francisco Bay
9) **S**uspended **s**ediment **c**oncentration (SSC) in the Delta

The Study shows future visions of the SFEW as yearly mean values of each environmental indicator for the period 2010–2099 and compared to the 1970–1999 baseline period.

Air temperature increases steadily in both scenarios (Fig. 2), but the rate of change is faster in the A2 scenario (maximum annual temperature reaches 21°C) than in the B1 scenario (maximum annual temperature of 18.6°C). Annual precipitation declines steadily in A2 and is persistently below the modeled 1970–99 baseline by the latter part of the century. There is no apparent secular trend of precipitation change in B2, but this projection has large interannual variability that includes years of extremely high precipitation and a simulated multi-year drought in the 2070 decade (Fig. 2). These two future climates span much of the range of temperature and precipitation projections made within a larger ensemble of climate models and GHG emissions (Cayan, et al. (2008)). Projections of sea level rise are within the range of global sea level rise developed in recent studies (Rahmstorf (2010)) and reach 125 cm (A2) and 96 cm (B1) above the observed and modeled baselines by the end of this century (Fig. 2).

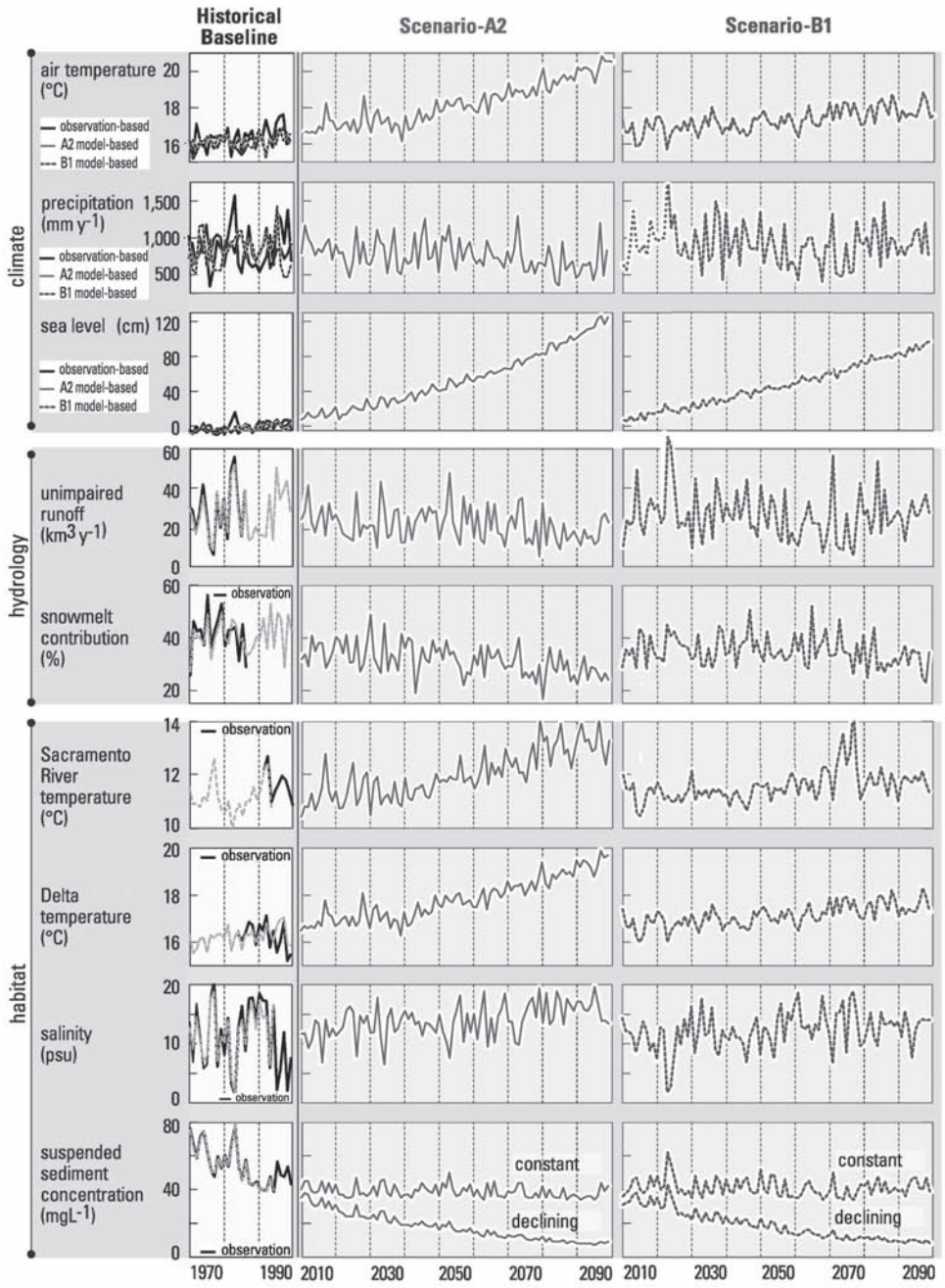


Figure 2. Projected 2010-2099 changes in annual mean values of nine environmental indicators for the A2 and B1 scenarios compared to modeled and observed values during the 1970-1999 baseline period (left panels). The model-based data in the left "historical" panels represent simulated realizations constrained only by historical GHG forcing, and thus are not expected to track historic variability on a year-to-year basis.

Adapted from color graphic available online at: www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pon.0024465

Climate Projections

Indicators' Parameters

Analyzed Indicators, Exceedences, & Spatial Domains

Table 1. Environmental indicators analyzed directly (top 10; see Figs. 2–3) or exceedences of thresholds (bottom 4; see Fig. 4), with corresponding spatial domains (see Fig. 1), units of measurement, and social/ecological significance.

Indicator	Spatial Domain	Metric	Significance
Air temperature	Sacramento-San Joaquin Delta	°C (annual mean)	Water supply; water & habitat quality; human health
Precipitation	Sacramento-San Joaquin watershed	mm yr^{-1}	Water supply; water & habitat quality
Sea level height	San Francisco Bay entrance	cm	Flood risk; water & habitat quality
Unimpaired runoff	Sacramento-San Joaquin headwaters	km^3 yr^{-1}	Water supply; flood protection; reservoir operations; water & habitat quality
Snowmelt contribution	Sacramento-San Joaquin headwaters	percent (of annual runoff)	Seasonal hydrology; flood protection; water & habitat quality
Salinity	Northern San Francisco Bay	psu (April–June mean)	Estuarine habitat quality; drinking-water quality
Water temperature	Upper Sacramento River	°C (annual mean)	Habitat quality
Water temperature	Sacramento-San Joaquin Delta	°C (annual mean)	Habitat quality
Suspended sediment - constant supply	Delta, Lower Sacramento River	mg L^{-1} (annual mean)	Habitat & water quality; estuary geomorphology; wetland sustainability
Suspended sediment - decreasing supply	Delta, Lower Sacramento River	mg L^{-1} (annual mean)	Habitat & water quality; estuary geomorphology; wetland sustainability
Extreme water level	San Francisco Bay entrance	h yr^{-1} >99.99th percentile	Flood risk
Lethal water temperature	Upper Sacramento River	months yr^{-1} >16°C	Sustainability of winter-run Chinook salmon
Lethal water temperature	Sacramento-San Joaquin Delta	days yr^{-1} >25°C	Sustainability of delta smelt
Floodplain inundation	Yolo Bypass	flow>113 m^3 s^{-1}, duration>29 d	Ecosystem restoration (floodplain habitat management)

Adapted from graphic available online at: www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pon.0024465

Hydrologic Indicators

The hydrologic indicators reflect combined effects of changing air temperature and precipitation. Projections of unimpaired runoff largely reflect changes in precipitation. Runoff in the A2 scenario is 11–12% below the baseline during the first two–thirds of the century. Then, coincident with the simulated end-of-century drought, runoff drops another 16% and persists at this low level for nearly 15 years. Runoff in the B1 scenario exhibits the same large interannual variability of precipitation, including an extremely wet year in 2023 and two very wet years and large droughts between 2065 and 2085. The snowmelt contribution to annual runoff declines steadily in the A2 scenario, but it shows no obvious trend in the B1 scenario until the last two decades when runoff is consistently below the historical mean (Fig. 2). These changes imply continuing shifts toward earlier runoff as a declining fraction of annual runoff occurs during the snowmelt season.

Earlier Snowmelt

Habitat Quality Alterations

The Study used these climate and hydrologic projections to develop the first quantitative assessments of how habitat quality in the SFEW will be altered by climate change. As a response to both sea level rise and reduced runoff, salinity in northern San Francisco Bay was computed as increasing above the 1979–1999 baseline by 4.5 psu in the A2 scenario and 2.2 psu in the B1 scenario during the last third of the century. Mean annual water temperature in the upper Sacramento River approaches or exceeds 14°C regularly toward the end of the A2 scenario, and also during the projected 2070s drought in the B1 scenario. Delta water temperatures also increase steadily in both future climates, most rapidly in the A2 scenario. Suspended sediment concentrations in the Delta were calculated as a function of river inflow, assuming that either: (a) the supply of erodible sediments in the river system remains constant; or (b) supply decreases as the declining trend of recent decades (Schoellhamer (2011)) continues. Sediment concentrations decline slightly under assumption (a), but rapidly under assumption (b) in both climate scenarios (Fig. 2).

Plausible Responses

We emphasize that such model-based projections are not predictions but instead are plausible depictions of how this complex landscape might respond to prescribed model- and emissions-specific future climates. Importantly, we have not considered potentially confounding effects of changing water resource management objectives, rules, or infrastructure. We also have not considered changes in land use or infrastructure that might occur through planned actions or catastrophic events such as major levee breaks. However, even considering these constraints and caveats, our projections from two different climate scenarios include years with mean air and water temperature, sea level height and estuarine salinity well above observed and modeled values in the 1970–99 baseline period (Fig. 2). They also include years with annual precipitation, snowmelt contribution to runoff and suspended sediment concentrations well below modeled and observed historical values.

Climate Projections

Rates of Change

Projected Trends

Water Temperatures

Trends of the Environmental Indicators

Indicators of climate-driven environmental change will be most useful to policy makers and resource managers if they measure rates of change and indicator sensitivity to different climate scenarios. We extracted this information from the time series of each indicator shown in Fig. 2 by calculating an overall trend for the period 2010–2099 and measuring its statistical significance. The trends represent median rates of change over the 90-year series, and are expressed as rates of change per decade. Results in Fig. 3 present an integrated view of how the SFEW system will respond to global climate change as realized in two future scenarios.

Among the climate indicators, air temperature and sea level increase significantly in both scenarios. Air temperature increases 0.42°C decade^{-1} in the A2 scenario, but only 0.14°C decade^{-1} in the B1 scenario (Fig. 3). Sea level increases 12.3 and 9.9 cm decade^{-1} in the A2 and B1 scenarios, respectively. Precipitation declines significantly (-28 mm decade^{-1}) in the A2 scenario, but does not have a significant trend in the B1 scenario. The hydrologic indicators respond to these changes in precipitation and air temperature. Unimpaired runoff, like precipitation, has a significant negative trend in the A2 scenario (-0.80 km3 decade^{-1}) but not in the B1 scenario (Fig. 3). However, the snowmelt contribution to runoff declines significantly in both scenarios, at -1.1% decade^{-1} (A2 scenario) and -0.4% decade^{-1} (B1 scenario).

Water temperatures in the Sacramento River respond to two factors, both of which trend significantly: 1) increasing air temperature, and 2) decreasing snowmelt runoff reducing the amount of cold water in the upstream reservoirs available to manage downstream temperatures. Water temperatures in the Delta, well removed from the effects of the major reservoirs, respond primarily to increasing air temperature. Sacramento and Delta water temperatures increase significantly, and at roughly the same rate, in both scenarios (Fig. 3). Salinity in northern San Francisco Bay (Fig. 3) also increases significantly in both scenarios (+0.46 psu decade^{-1} for A2, +0.33 psu decade^{-1} for B1), due to sea level rise in both scenarios and the added effect of declining runoff in A2. Suspended sediment concentrations in the Delta change only slightly if sediment supply in the river system remains constant, but they fall rapidly (-2.7 and -2.9 mg L^{-1} decade^{-1}) in both climates if sediment supply continues to decline. Therefore, projections of suspended sediment concentrations in the Delta, and consequently sediment transport to San Francisco Bay, are driven more by prescribed changes in sediment supply than by climate-driven changes in river discharge (Fig. 3).

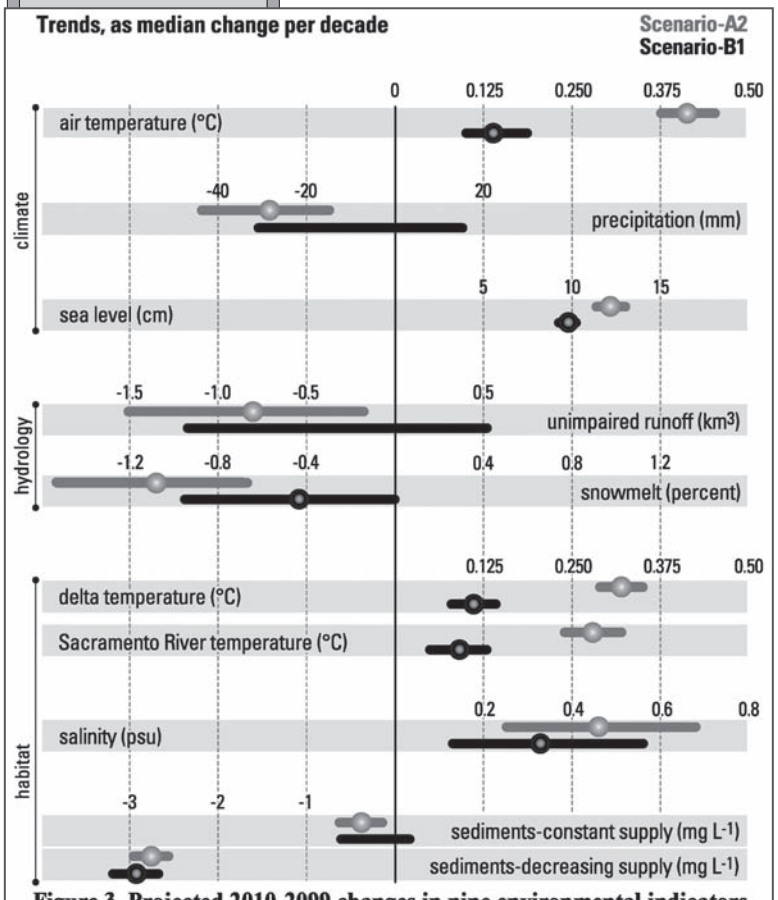


Figure 3. Projected 2010-2099 changes in nine environmental indicators, expressed as a median trend per decade, for the A2 and B1 scenarios. Statistically significant trends ($p<0.05$) are indicated with circles; horizontal lines show 95% confidence limits of the trend estimates.
Adapted from color graphic available online at: www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pon.0024465

Increasing Frequency of Extreme Events & Biological Indicators

Some important ramifications of climate change are not captured in annual mean indices because these don't depict changes in the frequency of extreme events. We computed four environmental indicators as exceedence frequencies of threshold values chosen to measure risks to humans or native biota. Projected water levels at the Golden Gate were compared to the historical 99.99th percentile of water elevation (141 cm, relative to the recent historical mean sea level). Both climate scenarios project marked increases in the frequency of extreme water heights over the historical rate of approximately 8 hours decade^{-1}, amounting to increases to 2,000 (A2) and 1,200 (B1) hours decade^{-1} by mid century, and 30,000 (A2) and 15,000 (B1) hours decade^{-1} by the end of the century (Fig. 4).

The indicators count projected exceedences each decade of threshold values based on historical extreme water elevation or having significance for sustainability of native species of fish (lethal water temperatures) or habitat restoration through management of floodplain habitats.

Delta smelt are endemic to the San Francisco Estuary (Bennett (2005), Moyle (2002)). They are listed as endangered by California, and a change in status from threatened to endangered has been deemed warranted under the federal Endangered Species Act. Thus, maintaining delta smelt population has become a key goal in managing the estuary (Sommer, et al. (2007)). To assess the effects of

Climate Projections

Endangered Fish

Temperature & Mortality

Flooding & Spawning

climate change on delta smelt, the frequency of mean daily water temperatures above 25°C was determined from modeled water temperatures at Rio Vista, a location within one tidal excursion of a large portion of delta smelt habitat in the Sacramento River. Multiple studies indicate that mean daily temperature of 25°C is a threshold for high delta smelt mortality (Bennett (2005), Swanson, et al. (2000), Nobriga, et al. (2008)).

Winter-run Chinook salmon are endemic to the Sacramento River system of California and are listed as endangered under both state and federal endangered species legislation (Moyle (2002)). Most of the population is subject to water temperature regulation by Shasta Reservoir. Winter-run Chinook salmon begin spawning in the spring. Developing embryos and pre-emergent fry are expected to be in the gravel from May through October. The effects of climate change on winter-run Chinook salmon were assessed by comparing projected mean monthly water temperatures for the period May–October against a threshold of 16°C, which would result in high mortality of eggs and pre-emergent fry. This is likely a conservative comparison since in a month with a mean of 16°C, approximately half the days would have higher temperatures. Comparisons were made for the Sacramento River at Balls Ferry (Fig. 1), which is at the lower end of the spawning reach. Historical temperature data were obtained for 1991–1999 from the California Data Exchange Center (CDEC, cdec.water.ca.gov) and were used to produce the corresponding observation-based historical indicator. Stream temperature data from the historical run of the stream temperature model (1970–1994) were used to produce the model-based historical indicator.

Sacramento splittail (Pogonichthys macrolepidotus) is a large cyprinid, endemic to the San Francisco estuary and watershed (Moyle (2002), Moyle, et al. (2004)). Splittail are true floodplain spawners and production of strong year-classes is associated with flooding of Sutter and Yolo bypasses, floodways designed to protect urban areas from flooding. Yolo Bypass (Fig. 1) provides benefits to native fishes, including Chinook salmon and splittail (Sommer, et al. (2001)). Floodplains must remain continuously flooded for a minimum of about 30 days (Sommer, et al. (1997)) for splittail to successfully spawn, and longer inundation periods result in greater production of young splittail (Moyle, et al. (2004)). Yolo Bypass provides appropriate spawning conditions at flows above about 113 $m^3 s^{-1}$. Therefore, for each scenario we counted the number of floods each year in which flows continuously exceeded 113 $m^3 s^{-1}$ for at least 30 days.

As an indicator of habitat quality for delta smelt, we calculated number of days each decade when projected water temperature in the Delta exceeds 25°C. The frequency of occurrence of temperatures greater than 25°C increases gradually in the B1 scenario but rapidly in the A2 scenario (Fig. 4). The frequency of occurrence of lethal temperatures for Chinook salmon (>16°C) grows modestly in the B1 scenario, except during the simulated drought of the 2070-decade when this threshold is exceeded in 17 months (Fig. 4). River temperatures above 16°C become common (>20 months $decade^{-1}$) after 2080 in the A2 scenario. The final habitat indicator is number of years each decade in which spring floods are large enough to inundate the Yolo Bypass (Fig. 1) for at least 30 consecutive days, a minimum threshold for successful spawning of Sacramento splittail. Spring flooding continues through the 21st century in the B1 scenario. But the warmer and drier climate in the A2 scenario reduces the frequency of spring floods having duration long enough for successful spawning and rearing of this species (Fig. 4).

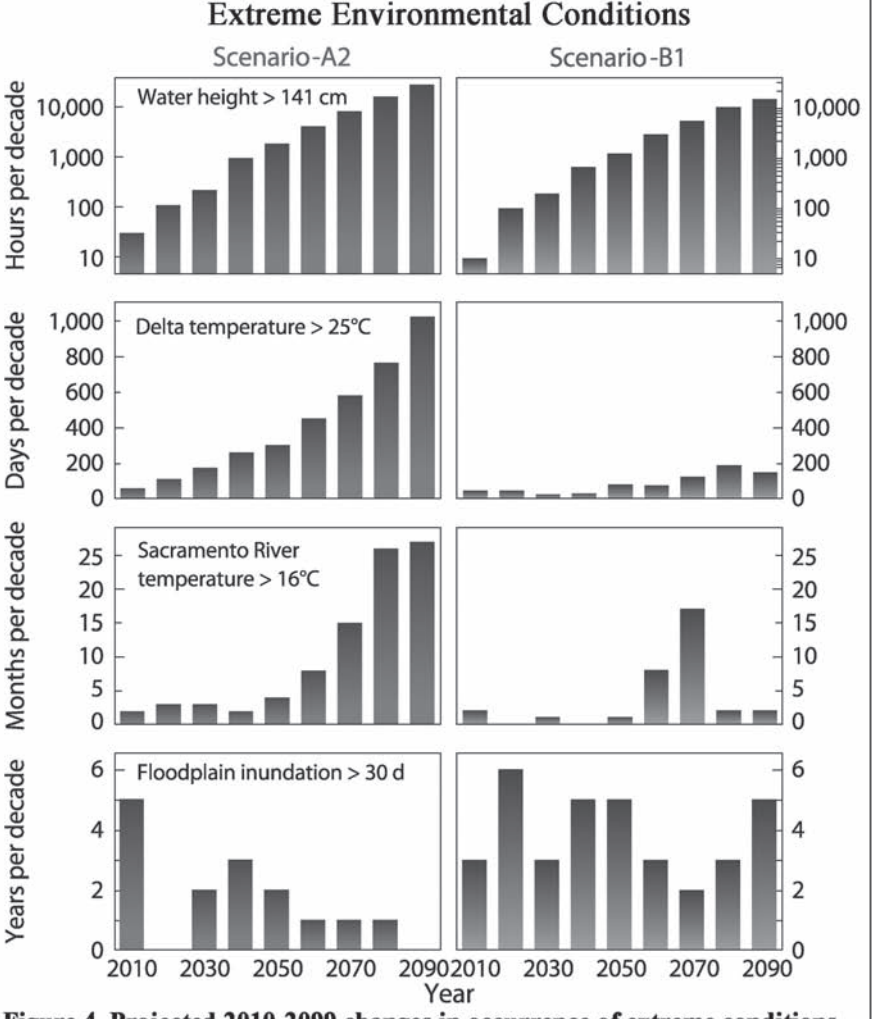


Figure 4. Projected 2010-2099 changes in occurrence of extreme conditions in the San Francisco Estuary-Watershed system for the A2 and B1 scenarios. Indicators count projected exceedences each decade of threshold values based on historical extreme water elevation or having significance for sustainability of native species of fish (letal water temperatures) or habitat restoration through management of floodplain habitats.

Adapted from color graphic available online at: www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pon.0024465

Climate Projections

Conflicting Objectives

Precipitation & Runoff

Projection Sensitivities

RESOURCE MANAGEMENT RAMIFICATIONS

California's San Francisco Estuary-Watershed system is the focus of continuing policy debates centered around the challenge of meeting multiple and sometimes conflicting objectives of resource management (CALFED Science Program website). The Study's projections show how those conflicts and the challenge of resource management could intensify as the water supply, sea level, and habitats are transformed by global climate change.

The Study highlights five conclusions that emerge from our analysis, and ends with general lessons to guide strategies of climate-change adaptation in this and other coastal landscapes.

Uncertainty about how SFEW will evolve in the future

The two scenarios used in the Study were chosen to explore possible futures and, at the same time, illustrate uncertainty. Different projected futures arise from differences among GCMs in their sensitivity to greenhouse gas emissions and from a range of possible GHG emissions trajectories. Propagation of this uncertainty into the physical and biological systems in SFEW varies among environmental indicators that fall into two classes. First are those with non-significant trends in the B1 scenario, but with large and significant trends in the A2 scenario: precipitation and unimpaired runoff (Fig. 3). Future changes of these indicators will depend on how much climate change is realized and thus on how sensitive the climate system proves to be to greenhouse gases and how future emissions evolve — neither of which can be predicted yet. If realized, the significant trends toward reduced precipitation and runoff in the A2 scenario would have important implications for California's future water supply. The second class of indicators includes those with significant trends in both scenarios, indicating that these represent likely regional responses to global warming. Within this class are two subclasses having different sensitivities to the uncertainty of climate projections. The projected trends of salinity increase, snowmelt decline, and SSC with decreasing supply have comparable magnitudes (overlapping confidence intervals) in the A2 and B1 scenarios (Fig. 3). Therefore, changes in these indicators are relatively insensitive to the uncertainty arising from differences among GCMs and emissions trajectories. The other subclass includes trends of air and water temperature and sea level, which have non-overlapping confidence intervals in the two scenarios. Therefore, changes in these indicators are likely, but the rates of change are strongly tied to projected rates of global warming, so these indicators are particularly sensitive to model- and emissions-specific scenarios.

Climate Change Handbook for Regional Water Planning

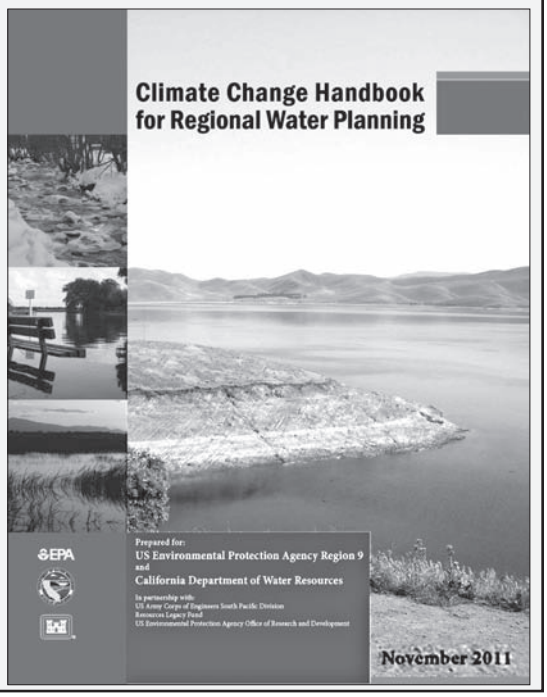
EPA, CDWR, Army Corps Release Water Planning Publication

Released on December 1, 2001, and developed cooperatively by the California Department of Water Resources (CDWR), The US Environmental Protection Agency, Resources Legacy Fund, and The US Army Corps of Engineers, the *Climate Change Handbook for Regional Water Planning* provides a framework for considering climate change in water management planning. Key decision considerations, resources, tools, and decision options are presented that will guide resource managers and planners as they develop means of adapting their programs to a changing climate.

The handbook uses California's Integrated Regional Water Management (IRWM) planning framework as a model into which analysis of climate change impacts and planning for adaptation and mitigation can be integrated. IRWM is a collaborative effort to manage all aspects of water resources in a region. IRWM attempts to address the issues and perspectives of all the entities involved through mutually beneficial solutions.

The handbook includes:

- Advice on how water resource managers can take climate change into consideration
- Tools for evaluating greenhouse gas emissions for a project
- Tools for measuring regional climate change impacts
- The science of climate change and information links
- Evaluating the energy-water connection and greenhouse gas emissions
- Assessing regional vulnerability to climate change
- Measuring regional impacts
- Evaluating projects, resource management strategies, and IRWM Plans with respect to climate change
- Implementing and quantifying uncertainty
- Case studies illustrating a range of climate change adaptation and mitigation issues within and outside of California



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Climate Projections

Effective Strategies

This classification of projected responses to climate change suggests that regional planners and resource managers should consider: (a) strategies for adaptation to progressively increasing air and water temperature, sea level and salinity intrusion in the SFEW, and further shifts toward more runoff in winter and less in spring-summer; but (b) planning for a broad range of future water supply because GCMs differ widely in their projections of precipitation trends. Effective strategies will be flexible and responsive to new data and assessments of climate change as they emerge (Dettinger, Culberson (2008)). For example, projections of global sea level rise are evolving rapidly (Rahmstorf (2010); Vermeer, Rahmstorf (2009)) and are likely to undergo further revisions in the future. Therefore, our projections of environmental change are best viewed as a starting place; each will be modified as new information and tools emerge for assessing regional responses to global change.

Increasing Extremes

Today's extremes could become tomorrow's norms

These projections highlight an important manifestation of climate change: changes in mean values of hydroclimatic variables can induce relatively large changes in the frequency of extreme events (Milly et al. (2008)). As examples, the Study shows projections of increasing frequency of exceptional sea level and water temperature in both scenarios, and of decreasing floodplain inundation in the A2 scenario (Fig. 4). These imply growing risks of coastal flooding, extinction of native fishes, and decreasing feasibility of some ecosystem restoration actions. Therefore, regional resource planning and risk assessments should anticipate shifts into regimes of environmental conditions unprecedented in the period of our social and economic development. This challenge is daunting because of large uncertainty reflected in the variability among indicators in their sensitivity to climate scenario (Fig. 4), and because changing frequency of extreme conditions implies that the indicators will fluctuate within new envelopes of variability over time — i.e., their underlying drivers become non-stationary. Today's resource-management tools are grounded in the assumption of stationary processes of natural variability. Climate change undermines that assumption (Milly et al. (2008)), so adaptation will require development of new probabilistic models to assess environmental changes and their uncertainty in a non-stationary world.

Management Uncertainties

It's not just climate change

The Study's projections illustrate how responses to climate change could transform the SFEW into a very different system by mid-century (Fig. 2). Transformative change is not new to this ecosystem, which has been altered over the past 150 years by massive landscape modifications, water development, pollutant inputs, and introductions of alien species (Nichols, et al. (1986)). We selected **s**uspended **s**ediment **c**oncentration (SSC) as one example of an environmental indicator that is more sensitive to landscape change than to climate change. Cessation of hydraulic mining, flood management, and damming the large rivers have decreased sediment delivery to the estuary by about half (Schoellhamer (2011)). Whether this decline continues or abates will have a much greater effect on the future trajectory of SSC than climate change (Fig. 2). This trajectory has important ecological implications because further reductions in sediment supply will increase vulnerability of tidal marshes and mudflats to sea level rise (Scavia, et al. (2002)), reduce habitat quality for some native fishes, and might promote blooms of toxic cyanobacteria (Lehman, et al. (2009)) that will be increasingly favored as nutrient-enriched Delta waters warm (Paerl, Huisman (2008)). Assessments of climate-change impacts must therefore be placed in the broad context of all the drivers that will continue to transform coastal ecosystems (Scavia, et al. (2002)), including: population growth and urbanization; nutrient enrichment; catastrophic levee failures from storms or earthquakes; modified reservoir operations and water conveyances; and implementation of ecosystem restoration plans. Planning will be most challenging with regard to environmental indicators, such as sediment supply, which contain uncertainties in their responses to both climate change and these other drivers of change.

Ecosystem Alterations

Sediment Supply

Other Drivers

Biological community changes are inevitable

Programs of biodiversity conservation will face an increasingly difficult challenge as environmental conditions in the SFEW diverge from those to which its native species are adapted (Moyle, et al. (2010)). Expected outcomes include increasing extinction risk of native species and continuing emergence of nonnative species as dominant components of biological communities. Fishes endemic to the Delta, such as delta smelt, are adapted to cool, turbid, low-salinity habitats (Feyrer, et al. (2010)). Sustaining populations of these species will become increasingly difficult as Delta waters warm, clear and become more saline (Fig. 2). Of the four runs of Chinook salmon that spawn in the Sacramento-San Joaquin drainage, the winter run is at exceptional risk because its spawning is timed such that eggs develop in summer, when projected river temperatures reach lethal levels (Fig. 4). Communities of fish and their zooplankton prey in the Delta have become increasingly dominated by nonnative species whose successful invasions have been facilitated by synergistic effects of climate anomalies (extended drought) and flow management (Winder, et al. (2011)). Our projections include significant departures from the contemporary climate and flow regimes in the future, so environmental conditions might continue to move toward those that select for nonnative biota.

Native v. Invasive Species

Climate Projections

Ecosystem Regime Shifts

We have learned from other studies that small perturbations can trigger ecosystem regime shifts. A recent example occurred in Denmark's Ringkøbing Fjord, where mean salinity increased 1.6 psu after actions were taken to enhance water exchange with the North Sea. This small salinity change was followed by sudden and unanticipated reorganization of biological communities at all trophic levels, from phytoplankton to macrobenthos and waterbirds (Petersen, et al. (2008)). We project larger salinity increases in San Francisco Bay by the end of the 21st century (Fig. 2). Therefore, conservation plans should expect surprises and include monitoring to detect and contingencies for adapting to unexpected shifts in habitats and their biological communities. In addition, they should be designed to accommodate a range of future climates. Feasibility and outcomes of proposed habitat restoration actions, such as creation of seasonal floodplain habitat (Fig. 4), low-salinity aquatic habitats and thermal refugia for native species (Moyle, et al. (2010)), will be very different as seasonal hydrology and water temperature change.

Water Demands

The challenge of meeting California's water demands will intensify

California's water supply (annual unimpaired runoff) is projected to decline or remain steady (Fig. 3), and demands are likely to increase as populations and temperatures rise. Deficits of surface runoff are now met with groundwater pumping. However, pumping between 1998 and 2010 depleted 48.5 km^3 of water from the Central Valley groundwater system, and continued groundwater depletion at this rate is unsustainable (Famiglietti, et al. (2011)). Future strategies of water management will require adaptations such as aggressively increasing water-use efficiency, reducing surface water deliveries, capturing more runoff in surface storage or groundwater recharge, and implementing programs of integrated regional water management (California Department of Water Resources website). Model results suggest that the inherent large annual variability of precipitation will persist (Fig. 2), even as longer-term trends of warming and possibly drying take hold. Therefore, water-resource planning should also include contingencies for longer dry seasons, extended droughts, and extreme floods due to shifts from snow to rain. Diminishing snow packs result in earlier reservoir inflow, so reservoir operations must adapt to a shift toward more water being managed as a hazard (flood control) and less as a resource (reservoir storage). Additional freshwater releases to mitigate increased salinity intrusion into the estuary will be required to maintain quality of drinking water to communities that use the Delta as their municipal water supply. These adaptations to maintain water supply for human consumptive uses will potentially constrain availability of water to meet objectives of habitat conservation plans, such as restoring natural flow and salinity variability to promote recovery of native biota in the Delta (Moyle, et al. (2010)).

Management Adaptations

Human Consumption v. Habitat

CLIMATE CHANGE IMPACTS

Climate change is expected to significantly affect the United States. By the end of this century, global sea level is expected to rise by more than 2 feet in a low emissions scenario or nearly 3.5 feet in a higher emissions scenario. Higher sea levels, especially in combination with storm surge, will increasingly inundate US coastal communities and threaten coastal ecosystems and infrastructure, such as military installations. Heat waves are expected to become more frequent and intense, posing a threat to human health and agriculture. For rivers fed by snowpack, runoff will continue to occur earlier, with reduced flows late in the summer, and the potential for water shortages that can affect the supply of water for drinking, agriculture, electricity production, and ecosystems. Economic, social, and natural systems are also inter-connected on a global scale, meaning that climate impacts in other regions of the world can pose serious economic and security risks to the United States.

Extreme Weather

Increases in extreme weather and climate events will contribute to food and water scarcity, which can intensify existing tensions over access to life-sustaining resources.

Extreme weather and greater climate variability is expected to become more common in the future. While it is not possible to attribute any individual extreme event to climate change, these events do provide valuable insight into the climate-related vulnerabilities and challenges faced by the United States. In April 2011, the United States experienced record-breaking floods, tornadoes, drought, and wildfires all within a single month. As of September 2011, NOAA's National Climatic Data Center had already reported ten weather events from 2011 for which damages and/or costs reached or exceeded $1 billion each, exceeding the previous annual record of nine events recorded over the entire year in 2008. NOAA estimates the total damage of property and economic impacts for all weather-related disasters during the spring and summer of 2011 at more than $45 billion. The severe and costly losses suffered during recent extreme weather events demonstrate the importance of increasing the resilience of the United States to climate variability and change in order to reduce economic damages and prevent loss of life.

Managing Water Resources in a Changing Climate

Climate impacts pose significant challenges for water resource managers. These challenges include ensuring adequate groundwater and surface water supply for human consumption, ecological integrity, agriculture, industry, and energy as hydrologic conditions shift and drought becomes more prevalent. New problems may also arise for water managers working to protect human health and property, such as increased water- and vector-borne disease, increased difficulty in treating drinking water, and disruptions of power, water, sewer, and emergency services as a result of more extreme rainfall events. Changing water resource conditions will also create challenges for protecting the availability and quality of freshwater resources, habitat, and aquatic life.

Excerpts from:

"*Federal Actions for a Climate Resilient Nation*"
Progress Report of the Interagency Climate Change Adaptation Task Force, October 28, 2011
www.whitehouse.gov/sites/default/files/microsites/ceq/2011_adaptation_progress_report.pdf

Climate Projections

Adaptation Strategies

Broader Context

Anticipating Change

Allocation Conflicts

Contrasting Futures

CONCLUSIONS

GENERAL LESSONS TO GUIDE CLIMATE-CHANGE ADAPTATION PLANNING

Although our projections of climate-driven change are specific to SFEW, lessons from this place-based study can be used as a starting place to guide adaptation strategies elsewhere.

The study indicates:

- Outputs from complex models can be explored by simplifying into a small set of environmental indicators chosen to develop an integrated view of how climate change will be manifested across landscapes.
- Climatic, hydrologic and habitat indicators vary in their sensitivity to uncertainty about the future; measures of that sensitivity provide important information for assigning priorities and including contingencies in adaptation planning.
- Results from climate simulations and resulting assessments of climate-change impacts will continue to evolve as the underlying science improves, so adaptation planning must be responsive to the continuing emergence of new models, analyses and insights.
- Assessments of climate-change impacts are best placed in the broader context of all the drivers of change because some environmental indicators are more sensitive to other drivers such as landscape transformations, species introductions, pollution and water development.
- Biological community changes are inevitable, and programs of ecosystem rehabilitation and biodiversity conservation will be most likely to meet their objectives if they are designed from projections of the future climate rather than today's climate.
- Environmental planning should anticipate and adapt to ecosystem regime shifts; monitoring is essential for detecting and responding to regime shifts.
- Warming in regions such as the western United States implies that sustainability of reliable water supplies will require changes in water management. These adaptations will potentially exacerbate conflicts of water allocation to meet human demands and goals of biological conservation plans.

Finally, our results are consistent with other model-based projections that California's climate will continue to warm through the 21st century. There is uncertainty about how much global temperature will rise in response to increases in greenhouse gases, but it is clear that the rate of warming will increase with higher greenhouse gas emissions (Cayan, et al. (2008); Hayhoe, et al. (2004)). Environmental indicators considered here respond more rapidly and more strongly to the A2 scenario than to the B1 scenario (Figs. 2, 3). Collectively, these indicators depict climate-driven changes in the reliability of California's water supply, in risks to humans and ecosystems due to coastal flooding, and in likely outcomes of ecosystem restoration programs. Contrasting futures in the A2 and B1 scenarios show that mitigation steps that slow greenhouse gas emissions in the first half of the 21st century would reduce the requirements for adaption to climate-change impacts through the end of the century. However, regardless of the greenhouse gas emissions trajectory, substantial global and regional warming is likely, so successful climate-change adaptation will require other near-term mitigation actions aimed at buffering some of the long-term climate-change effects depicted by our indicators.

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Climate Projections

CLIMATE CHANGE & THE SAN FRANCISCO BAY WATERSHED

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Projected Evolution of California's San Francisco Bay-Delta-River System in a Century of Climate Change

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Pesticides Permit

PESTICIDE USE & NPDES PERMITTING

PESTICIDE APPLICATIONS NEAR US WATERS BROUGHT WITHIN NPDES PERMITTING PROGRAM

by Meline MacCurdy, Marten Law, (Seattle, WA)

INTRODUCTION

EPA General Permit

NPDES Expansion

After years of debate stemming from a 2009 court order, the US Environmental Protection Agency (EPA) has released a final general permit governing the use of pesticides in and near lakes, rivers, and other navigable waters. As of October 31, 2011, at least 365,000 pesticide applicators, including farmers, forestland owners, and public land managers, must now seek permit coverage under the federal Clean Water Act (CWA). Approximately 10% of these entities can seek coverage under EPA's permit — EPA's general permit is applicable in areas where it is the permitting authority, such as tribal lands, some federal facilities, territories, New Hampshire, Massachusetts, New Mexico, Oklahoma, Alaska, and Idaho. The remaining applicators will be reliant on general or individual permits developed and implemented by EPA-authorized state water quality programs, for which EPA's permit provides a stringency baseline. Altogether, EPA estimates that the new permit requirements will more than double the total number of permittees under the CWA's National Pollutant Discharge Elimination System (NPDES) program.

Stakeholders have called the new permitting requirement impracticable, unnecessary, and prohibitively expensive, and have lobbied Congress to take action. To date, Congress has not done so.

BACKGROUND

CWA "Pollutant"

The CWA prohibits the discharge of a "pollutant" into waters of the United States from a "point source" without an NPDES permit. *See* 33 U.S.C. §§ 1311(a), 1342. The CWA defines a "discharge of a pollutant" to mean the "addition of any pollutant to navigable waters from any point source." *Id.* § 1362(12). The CWA defines a "pollutant" as including "chemical wastes" and "biological materials" (*Id.* § 1362(6)) — but does not define either of those terms. Under the CWA a "point source" is "any discernible, confined and discrete conveyance." *Id.* § 1362(14). Historically, applications of pesticides to waters of the United States have been considered as outside the NPDES program, so long as the applications complied with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA — 7 U.S.C. § 136 et seq.). However, a series of federal court decisions over the last ten years injected significant uncertainty regarding the need to obtain NPDES permits for these activities.

Talent "Pollutant" Decision

In a 2001 decision, *Headwaters, Inc. v. Talent Irrigation District* (243 F.3d 526 (9th Cir. 2001)), the Ninth Circuit held that aquatic herbicide residue left in water from pesticide applications was a "chemical waste" and thus a "pollutant" requiring a permit under the CWA. The Ninth Circuit declined, in *Talent*, to decide whether a pesticide that leaves no chemical residue in the water falls within the definition of a pollutant.

Forsgren "Point Source" Decision

The following year, in *League of Wilderness Defenders v. Forsgren* (309 F.3d 1181 (9th Cir. 2002)), the Ninth Circuit addressed whether an NPDES permit is required for the aerial application of insecticides to control pests, where some insecticide is inevitably discharged into waters. The court held that the application of insecticides over National Forest land constituted a "point source" discharge requiring an NPDES permit. The *Forsgren* court assumed that such insecticides were "pollutants," because the parties did not dispute this issue.

Fairhurst "Chemical Wastes"

In 2005, in *Fairhurst v. Hagener* (422 F.3d 1146 (9th Cir. 2005)), the Ninth Circuit tackled the question remaining after *Talent* – namely, whether pesticides that are directly and intentionally applied to water bodies, in accordance with the requirements of FIFRA, are "chemical wastes" — and thus CWA "pollutants" that require an NPDES permit. The *Fairhurst* court held that such pesticides that are intentionally applied to the nation's waters, in compliance with FIFRA, and that produce no residue or unintended effects, are not "pollutants" requiring a CWA NPDES permit. The Court distinguished its previous finding in *Talent* on the grounds that, in *Talent*, the pesticide remained in the water after it performed its intended beneficial function.

Pesticides Permit

EPA's 2006 Rule

Aquatic Pesticides

Petitioners' Issues

6th Circuit Decision

"Excess Portions"

THE AQUATIC PESTICIDE RULE

A year after *Fairhurst* was decided, in an effort to clarify the uncertainty stemming from these decisions, EPA issued a final rule on November 27, 2006, that exempted the application of aquatic pesticides in compliance with FIFRA from the CWA. 71 Fed. Reg. 68,483 (Nov. 27, 2006).

Specifically, EPA wrote that an NPDES permit was *NOT* required for:

1) The application of pesticides directly to water in order to control pests, such as applications to control mosquito larvae, aquatic weeds, or other aquatic pests; or
2) The application of pesticides to control pests present over or near water (such as via aerial application) where a portion of the pesticides would unavoidably be deposited into waters. EPA intended this second circumstance, among other things, to cover pesticide spraying to control non-native plants growing at the water's edge because some pesticide would unavoidably enter the water as a result of herbicide application.

EPA made clear that its rule was based on its longstanding policy that pesticides applied according to its federal label are not CWA "pollutants" and, thus, do not require NPDES permits. EPA explained that aquatic pesticides that are sprayed or otherwise applied consistent with FIFRA are not "chemical wastes" because "they are products that EPA has evaluated and registered for the purpose of controlling target organisms, and are designed, purchased, and applied to perform that purpose." *Id.* at 68,486. Further, EPA stated that aquatic pesticides are not "biological materials" because, to find otherwise, "would mean that biological pesticides are pollutants, which chemical pesticides applied in the same circumstances are not." *Id.* Finally, EPA wrote that while residual material remaining following pesticide application may be considered "pollutants," the pesticide itself is not a pollutant at the time of discharge. Accordingly, EPA encouraged treating the residual as a nonpoint source pollutant for which no NPDES permit would be required. *Id.* at 68,487.

NATIONAL COTTON COUNCIL V. EPA

Environmental and industry groups subsequently challenged EPA's final rule in eleven circuit courts throughout the United States. The petitions for review were consolidated in the Sixth Circuit by an order of the Judicial Panel on Multidistrict Litigation. *National Cotton Council v. EPA*, 553 F.3d 927 (6th Cir. 2009). A number of industry groups also intervened in support of the final rule.

The Environmental Petitioners were: Baykeeper; Californians for Alternatives to Toxics; Californian Sportsfishing Protection Alliance; National Center for Conservation Science and Policy; Oregon Wild; Saint John's Organic Farm; Waterkeeper Alliance, Inc; Peconic Baykeeper, Inc; Soundkeeper, Inc; Environmental Maine; and Toxics Action Center.

Environmental petitioners argued that:

- EPA exceeded its authority under the CWA by excluding pesticides from the definition of a CWA "pollutant";
- EPA exceeded its authority under the CWA by determining that, while pesticides are discharged from a point source, the residue of such pesticides is a "nonpoint source pollutant"; and
- EPA may not exempt FIFRA compliant pesticide applications from the reach of the CWA.

The Industry Petitioners were: Agribusiness Association of Iowa; BASF Corporation; Bayer CropScience, LP; CropLife America; Delta Council; Eldon C. Stutsman, Inc.; FMC Corporation, Illinois Fertilizer & Chemical Association; The National Cotton Council of America; Responsible Industry for a Sound Environment; Southern Crop Production Association; and Syngenta Crop Protection, Inc., LP.

Industry petitioners argued that:

- EPA's final rule was arbitrary and capricious because, under that rule, pesticides applied in violation of FIFRA are "pollutants" while the same pesticides applied in compliance with FIFRA are not.

The Court examined whether the CWA unambiguously includes pesticides within its definition of "pollutant" and concluded that it does. The CWA defines a "pollutant" to include "chemical wastes" and "biological materials." 33 U.S.C. § 1362(6). After analyzing the plain meaning of the word "waste," the court found that the CWA definition of "chemical waste" includes "discarded chemicals, superfluous chemicals, or refuse or excess chemicals." *National Cotton*, 553 F.3d at 936 (internal quotations omitted).

Like the ninth circuit in *Fairhurst*, the sixth circuit therefore found:

> "so long as the chemical pesticide is intentionally applied to the water [to perform a particular useful purpose] and leaves no excess portions after performing its intended purpose it is not a 'chemical waste'…and does not require an NPDES permit." *Id.* (internal quotations and citations omitted).

Pesticides Permit

"Chemical Waste" Defined

"Biological Materials"

Temporal Requirement Rejected

New General Permit

Stalled Proposals

However, the Court decided that excess chemical pesticide and pesticide residue may be "pollutants." *Id.* The Court observed that there are at least two situations in which excess pesticide or pesticide residue would meet the CWA definition of "chemical wastes."

According to the court, the CWA's definition of "chemical wastes" is met:

1) where chemical pesticides are applied to land or air, and excess pesticides or pesticide residue is subsequently deposited into jurisdictional waters; and
2) where residual pesticide remains following the direct application of chemical pesticides to jurisdictional waters. *Id*. at 936-37.

Next, the Court examined the plain meaning of the term "biological materials" and decided that that term unambiguously includes biological pesticides and their residues that are discharged into water. The Court therefore concluded that the application of biological pesticides should not be exempted from NPDES permitting requirements. *Id.* at 937-38.

Finally, the Court rejected EPA's argument that excess and residual pesticides should be exempt from NPDES permitting requirements because they do not qualify as pollutants at the time of discharge.

The court held:

> "[t]here is no requirement that the discharged chemical, or other substance, immediately cause harm to be considered as coming from a 'point source.' Rather, the requirement is that the discharge come from a 'discernable, confined, and discrete conveyance,' 33 U.S.C. § 1362(14), which is the case for pesticide applications." *Id.* at 939.

Thus, the Court held that EPA's attempt to inject a temporal requirement for the discharge of pollutants into water was unsupported by the CWA.

In light of the statutory language, the Court held that EPA's final rule was not a reasonable interpretation of the CWA since the plain language of the terms "chemical waste" and "biological materials" unambiguously include aquatic pesticides. Accordingly, the Court vacated EPA's final rule. The Court did not analyze arguments addressing the relationship between the CWA and FIFRA.

In June 2009, shortly after issuing the *National Cotton* decision, the Sixth Circuit granted EPA's request to stay the decision vacating the EPA rule until April 9, 2011. By issuing the stay, the Sixth Circuit allowed EPA and the states time to develop and issue appropriate general permits to authorize certain pesticide discharges to jurisdictional waters in accordance with CWA requirements. In March of this year, in response to a petition from EPA, the Sixth Circuit granted an additional extension on the deadline for compliance with the ruling to October 31, 2011.

In compliance with the *National Cotton* decision, EPA released a draft general permit in June 2010, which covered dischargers of biological pesticides and chemical pesticides that leave a residue in four categories of pesticide uses. See *Draft National Pollutant Discharge Elimination System (NPDES) Pesticide General Permit for Point Source Discharges From the Application of Pesticides*, 75 Fed. Reg. 31,775 (June 4, 2010). In April 2011, EPA released a pre-publication draft of the final general permit to allow states and the regulated community to familiarize themselves with the forthcoming requirements.

CONGRESSIONAL ACTION

Members of industry and other interested parties, including state water, agriculture, and other officials, have lobbied for a Congressional reversal of the Sixth Circuit's decision, following unsuccessful petitions for rehearing en banc in August 2009 and certiorari to the Supreme Court in February 2010. Stakeholders have cited the need to avoid having pesticide discharge permits duplicative of protections under other authorities.

The House of Representatives passed the Reducing Regulatory Burdens Act of 2011 (H.R. 872) by a 292 to 130 vote in March 2011. The bill, sponsored by Representative Gibbs (R-OH), would amend FIFRA and the CWA by exempting point source discharges of pesticides — or residue of pesticides resulting from the application — authorized for sale, distribution, or use under FIFRA, so long as the discharge does not result from a FIFRA violation. H.R. 872 § 2-3.

On June 21, 2011, the Senate Committee on Agriculture, Nutrition, and Forestry passed H.R. 872, but the bill has been in stasis in the Senate since that time. In light of the impending deadline, members of the Senate Committee on Agriculture this summer and fall repeatedly urged a vote on H.R. 872 on the Senate floor and made efforts to file amendments on other bills to move the legislation forward.

Pesticides Permit

As recently as the last week of October, Senators Boxer (D-CA) and Cardin (D-MD), who had put a hold on the bill, were working with the bill's proponents — ranking member of the Senate Committee on Agriculture, Nutrition, and Forestry Senator Roberts (R-KS) and Senate Agriculture Chairwoman Stabenow (D-MI) — to reach a compromise, but those efforts were unsuccessful. The nearly brokered deal would have placed a two-year moratorium on the requirement to obtain a permit, during which time a national survey of pesticide impacts in US waters would be conducted. Senator Roberts issued a statement regarding the failed compromise, explaining that "[a]ttempts to use a moratorium to leverage a controversial and overly broad study that threatens agriculture production will only increase confusion facing our farmers, ranchers and state and local health agencies," and that the compromise would "simply kick the can down the road."

EPA'S FINAL PERMIT FOR PESTICIDE APPLICATIONS

General Permit Requirements

In the absence of Congressional action, EPA released its final pesticide general permit on October 31, 2011. The permit generally tracks the draft permit issued in 2010, with some exceptions, covering discharges of pesticides (biological pesticides and chemical pesticides that leave a residue) to U.S. waters in four categories of use patterns (see below). Although the *National Cotton* decision held that NPDES permits are not required for chemical pesticide applications that leave no residue, EPA's permit presumes that chemical pesticides leave a residue, unless the applicant can show otherwise. In its fact sheet accompanying the permit, EPA provides guidance on the use patterns of chemical pesticides that are covered by the permit.

"Operators" Defined

The permit refines the definition of "operators" beyond that included in the draft permit in a manner that EPA believes will capture the unique circumstances of pesticide applications where, for example, an owner will hire a contractor to apply pesticides on the owner's property.

To address unique pesticide application circumstances, "operators" are defined as:

1) "applicators" who perform the application of pesticides or has day-to-day control over the pesticide applications that result in discharges to US waters; and
2) "decision-makers" who have actual control over the decision to apply pesticides that result in discharges to US waters.

The permit includes both of these classes of parties as "operators" that are required to obtain permit coverage and comply with the permit requirements, but attempts to assign particular roles for these parties under the permit conditions.

Use Categories

The four use categories that the permit applies to are:

1) control of mosquitoes and other flying insect pests that are present in or above standing or flowing water
2) aquatic weed and algae control in water and at water's edge, including ditches and/or canals
3) control of aquatic nuisance animals, such as fish, lampreys, insects, pathogens, and mollusks
4) applications to forest canopies where a portion of the pesticide is unavoidably applied over and deposited to water, including, unlike the draft permit, some application activities performed from the ground

Eligibility Provisions

An explanation of the types of parties that are likely to fall into these use categories is available in EPA's Federal Register notice of the final permit (www.epa.gov/npdes/pubs/pgp_final_registernotice.pdf) and in EPA's fact sheet accompanying the permit (www.epa.gov/npdes/pubs/pgp_final_factsheet.pdf).

In a change from the draft permit, the final permit expands eligibility provisions to provide coverage for certain discharges of pesticides or their degradates to waters that are already impaired by the pesticides or degradates, or to outstanding national resource waters (so-called "Tier 3 waters"), if particular circumstances are met. The covered categories are generally consistent with those addressed in the *National Cotton* decision, and do not represent every pesticide application activity that will require NPDES permit coverage.

Effluent Limitations

The permit also imposes technology-based effluent limitations, requiring permittees to minimize the amount of pesticide used and to perform regular maintenance to control unintended discharges, with specific tasks for the "applicators" and the "decision-makers" to perform. The permit also includes: monitoring requirements; corrective action procedures; the development and upkeep of planning documents; recordkeeping requirements; and annual reports (some of these obligations are focused on larger dischargers or dischargers in specific designated circumstances).

Pesticides Permit

ESA Limits to Coverage

Additionally, as a result of consultations under the federal Endangered Species Act (ESA) between EPA and the National Marine Fisheries Service (NMFS) that took place after release of the draft permit, coverage under the permit is generally only available for discharges and discharge-related activities that are not likely to adversely affect ESA-listed species or critical habitat. The permit contains specific provisions tailored to this purpose, including eligibility criteria and permit conditions to ensure that potential adverse effects have been properly considered and addressed, and extended waiting periods between when a discharger seeks coverage under the permit and receives authorization to discharge.

Scaled Approach

The permit includes a scaled approach for both obtaining coverage under the permit and for compliance. Generally, entities that seek coverage under EPA's general permit must submit a **n**otice **o**f **i**ntent (NOI) to EPA that includes information regarding the proposed discharge. *See* 40 CFR 122.28(b)(2). However, to streamline and focus the permitting process on larger dischargers, EPA is only requiring dischargers to submit an NOI (including a description of the target area and pesticide use patterns) when: they exceed an annual treatment area threshold for their use category; or when they have land resource stewardship responsibilities that involve the routine control of pests, are discharging to Tier 3 waters, or are discharging to waters containing NMFS-listed Resources of Concern (as defined in Appendix A of the permit). Any discharger that is below the annual treatment area threshold for their use category and does not fall within the other listed exceptions is automatically covered by the permit and exempt from some permitting requirements.

Effective Date

Additionally, for those parties that must submit an NOI to obtain coverage, EPA is delaying the date on which parties must do so. To allow time for covered parties to comprehend the permit requirements and comply with recordkeeping and reporting requirements, eligible discharges are automatically covered under the permit from October 31, 2011 until January 12, 2012. However, covered parties must immediately begin implementing technology-based effluent limitations consistent with the permit. To continue coverage under the permit for discharges after January 12, 2012, covered entities will need to submit NOIs at least ten days (or thirty days for discharges to NMSF-listed Resources of Concern) before January 12, 2012. EPA has stated on its website that, for the first 120 days that the permit is in effect, EPA "will focus on providing compliance assistance and education of the permit requirements, rather than on enforcement actions." (*see* http://cfpub.epa.gov/npdes/home.cfm?program_id=410).

CONCLUSION

Scope & Stringency

As noted, EPA's general permit will only directly apply to pesticide activities where EPA is the permitting authority, i.e., six states, tribal territories, most US territories and some federal facilities. However, EPA collaborates with states that have authority to implement the NPDES program. Under CWA implementation authorization, the pesticide general permits that those states develop, although tailored to state needs, cannot be less stringent than core aspects of EPA's general permit.

EPA has so far not objected to any of the permits that state permitting authorities have developed in response to *National Cotton*, and several states implemented general permits for pesticide applications long before the *National Cotton* decision. For example, in response to the *Forsgren* and *Talent* decisions, Washington, Oregon, California and Nevada implemented permits for the application of certain types of pesticides, such as products to control aquatic weeds and algae and products to control mosquito larvae.

Individual Permits

All pesticide applicators that were impacted by the 2009 *National Cotton* decision will be required to obtain coverage under a permit. In circumstances where no general permit applies to the pesticide activities, those entities will be required to go through the arduous and time-consuming process of obtaining individual permits.

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Eco-Markets

ENVIRONMENTAL MARKETS

USING ENVIRONMENTAL MARKETS TO EXPAND THE PACE AND SCALE OF RESTORATION

by Alan Horton and Marley Gaddis, The Freshwater Trust (Portland, OR)

INTRODUCTION

What do you think of when you hear "environmental markets?" Open-air bazaars filled with vegetables in straw baskets and bearded men talking about the benefits of cage-free eggs? Or maybe an expo hall filled with vendors hawking solar water heaters and bamboo sheets? Or perhaps it reminds you of the carbon market, and you wonder, "What ever happened with all that?"

Cumulative Effects

New Tools Needed

No matter how familiar you are with the concept now, it is almost certain that you will be hearing more about environmental markets in years to come. Why? Because our growing understanding of the cumulative negative effect of human impacts on ecosystems — from agriculture to urban development to industrial production — requires new methods and tools to address those impacts. Because critical environmental challenges far outpace traditional conservation funding models, which are dependent on the shrinking largess of publicly-funded government agencies, private foundations and environmental philanthropists. Finally, because economic and political forces increasingly encourage conservation models that make sense financially and environmentally, based on cooperation between regulatory agencies, conservation groups, landowners and regulated entities. Whatever the political stripe, most agree that increasingly acrimonious environmental politics hinder efficient and effective effort. Solutions that bridge the (often exaggerated) political, social, and economic chasms are needed to meet the very real challenges ahead.

So think again about the open-air bazaar and the conservation expo. Imagine a local farmer hawking not just the fact that all those tomatoes are organically produced, but that they were produced on land certified as environmentally restorative ("beyond sustainable"). Or the expo vendor that not only pitches the benefits of solar panels, but that those panels were manufactured in a facility that guarantees to offset its environmental impacts two-to-one.

ENVIRONMENTAL MARKETS IN BRIEF

Tradable Eco-Units

In simplest terms, "market" means trading. By environmental markets, advocates mean the trading of negative environmental impacts for positive environmental benefits. Put a different way, market proponents are translating the natural functions of our ecosystem into units that can be compared with and traded for impacts from wastewater treatment, road construction, development, even industrial production — and doing it all in a standardized and organized way.

Wetlands Precedent

Environmental markets are not new. In one form or another they have existed for decades. The carbon market spawned by the Clean Air Act worked very well to address acid rain in the 1970s and 1980s. Similarly, the Clean Water Act requirement of "no net loss" to wetlands created wetlands banking — a mitigation market whereby acres of wetlands drained for development are traded for restoration of wetland acres elsewhere. In fact, before the economic downturn slowed the pace of new construction, Ecosystem Marketplace reported that the wetlands market generated more than $1 billion annually.

Market Potential

Environmental markets are set to evolve, however, into forms that are brand new. Markets may, in fact, revolutionize natural resource conservation entirely, with extraordinary implications for understanding, measuring and fixing ecosystems.

Environmental Markets: Key Terms

Ecosystem Services: The natural functions provided by ecosystems, such as carbon sequestration, streamside shade, dissipation of flood energy, reduction of runoff from sediments, and, of course, habitat for species.

Credit: In the parlance of environmental markets, "credit" is a term to indicate some unit of benefit. For water temperature markets, the tradable "credit" is kilocalories per day. For nutrient markets, the credit may be pounds of nitrogen or phosphorous. For habitat markets, it may be acres of restored habitat or linear feet of restored streams.

Point-source Pollution: Pollutants discharged from any identifiable point, including pipes, ditches, channels, sewers, tunnels, and containers of various types (e.g. discharge from a wastewater treatment facility or industrial plant).

Non-point-source Pollution: As officially defined by EPA, pollution that occurs when rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants and deposits them into rivers, lakes, and coastal waters or introduces them into ground water. Increased temperature on waterways is also considered non-point source pollution. Generally, non-point source pollution cannot be corrected through treatment or engineered solutions, but through changes in land management and practice.

Total Maximum Daily Load (TMDL): EPA, under the Clean Water Act, is required to set limits on water quality impacts from regulated entities for all watersheds in the country. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. The regulated entities in most instances are NPDES permit holders.

National Pollutant Discharge Elimination System (NPDES): As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the US.

Eco-Markets

TMDL Compliance

Temperature & Nutrients

Ecosystem Benefits

Ecosystem Valuation

DEFINING IMPACTS AND BENEFITS

THE "COMMODITIZATION" OF NATURE

Before delving too deeply into market mechanics, let's first define what exactly is meant by environmental impacts and benefits, and describe how they are currently managed with regard to water. Under the federal Clean Water Act, the US Environmental Protection Agency (EPA) and its state government counterparts are empowered to regulate "point source" entities that discharge into waterways from a pipe — industrial factories, power plants, wastewater treatment facilities. To determine regulatory compliance, EPA evaluates each waterway in the US and sets a numeric limit on the maximum load of negative inputs that a waterway can sustain and still meet water health standards. Termed a "Total Maximum Daily Load" (TMDL), these limits must not be exceeded and place responsibilities for compliance on entities contributing to the impacts.

For most of the past four decades, regulators have focused their attention on the most visible and urgent impacts — using TMDLs to require point source entities to limit the discharge of toxins, poisons, heavy metals, etc. In aggregate, these entities annually spend billions of dollars to reduce these impacts, such as the City of Portland's recent $1.6 billion "big pipe" project to limit sewage overflow into the Willamette River. Historically, this money has been spent on expensive technological solutions that address specific water quality parameters, such as improved filtration to remove mercury or copper from a plant discharge. Cumulatively, these efforts to manage more direct water quality impacts have proven very effective, so now regulators are turning their attention to bigger, more broadly distributed problems — namely, water temperature and nutrient overload.

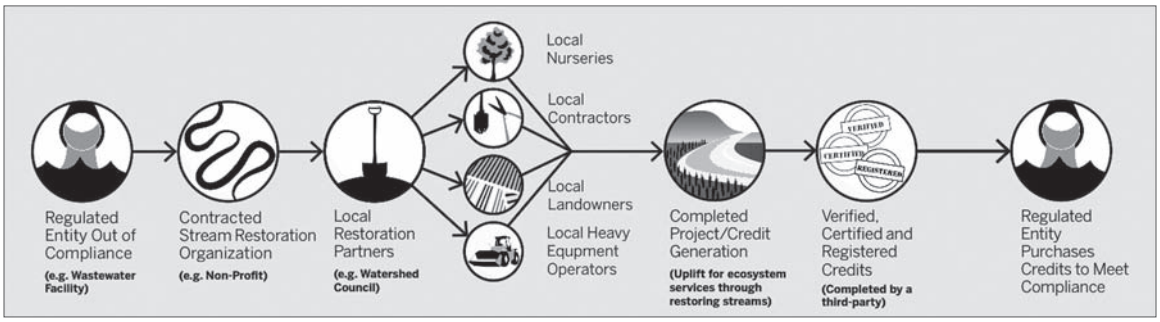
Why do these broad impacts matter? Water temperatures in many streams in the Pacific Northwest are too warm for fish. As a result, agencies that regulate water quality are now requiring facilities to minimize the effect of clean but warm discharge (effluent) entering rivers and streams. In addition, nutrient levels, such as nitrogen and phosphorous, increasingly exceed "drinkable, fishable, swimmable" standards for water quality across the nation, impairing aquatic habitat and contributing to dead zones near estuaries such as in the Gulf of Mexico, Puget Sound, and California's Bay Delta. Regulators are actively setting new limits on these nutrients as well.

On the benefits side of the equation are the multitude of natural "services" that healthy, functioning ecosystems provide to flora, fauna and humans. Now, you may have read that last sentence and the image of a vast tropical rainforest popped into your head. Massive deforestation has raised awareness of trees' ability to sequester carbon and release oxygen into the environment. Considering that virtually nothing survives without a steady stream of breathable air, this service our ecosystem provides is certainly very much appreciated by every creature on the planet.

Next on the list of "must haves" is water, and trees play a hugely important role in helping to keep freshwater sources cool and clean. Healthy streamside trees provide a multitude of "ecosystem services": overhanging branches shade the water, root systems filter nutrients from agricultural and urban runoff and stabilize banks, living trees help dissipate flood waters and provide habitat to terrestrial animals, and fallen trees create habitat for aquatic species.

That's a lot of benefit from a single resource, and we tend to take all of it for granted. What if trees were considered a product? We certainly don't take other multi-function products for granted. Think of a smartphone. It's a phone, it's a computer, it's a GPS unit, it's a life organizer. Most smartphone users are hooked and cannot imagine life before that tool provided so many essential services — a device many gladly pay hundreds of dollars to acquire and many more hundreds of dollars to use annually. What if ecosystems could be valued in the same way? What if people that need the services ecosystems provide, such as clean, cool water or runoff control, had some way to pay for those services and would gladly do so?

After more than a decade of work determining how to measure, quantify and ultimately monetize ecosystem services, market advocates argue that this new world of valuing environmental benefits has arrived.



Eco-Markets

Common Denominator

Temperature Benefits

"Bullet-Proof" Quantification

Measurement Protocols

Agencies' Agreements

Protocol Testing

UNDERLYING SCIENCE OF ENVIRONMENTAL MARKETS

The concepts of environmental impacts and benefits may appear somewhat abstract. How is it that these very different and complex "things" can be accurately measured as individual services? While regulatory effort has driven the mathematics behind measuring environmental impacts (as evidenced by the use of caps on regulated point source entities), until recently there has been little widespread agreement on calculations for quantifying environmental benefits. Without a common denominator that enables comparison of the impacts and benefits, there is little basis for a functioning market.

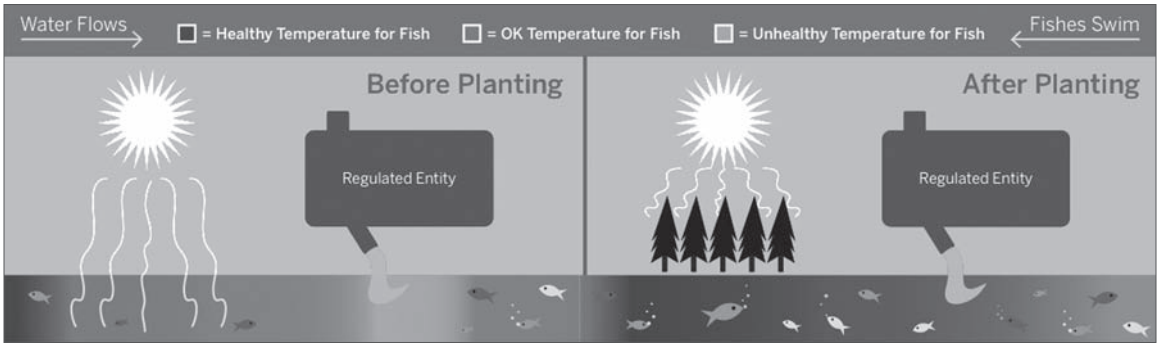
Let's say you have an antique desk gathering dust in the basement. You post an ad on Craigslist and note that trades are welcome. In order for a fair trade to occur, it is necessary for each party to present items with underlying values that can be agreed upon and compared "apples to apples" — as the saying goes. If someone comes to you with a modern entertainment center, you can roughly compare the value of these items in monetary terms. Of course, you may add subjective value based on your personal preferences, but your initial valuation will likely be based on "dollars to dollars." If another person offers you a property right to a parcel of lunar real estate, a direct comparison is far more difficult. Sure, you can consider the price the person paid for the deed to the land, but until the property value of an acre of crater in the Sea of Tranquility is defined and agreed upon, it's probably best to just take the entertainment center.

Now consider a key ecosystem service: water temperature. Conservationists have long known that streamside trees provide shade that reduces the temperature of the water by keeping the sun off of it. However, until recently, no science existed that enumerated the temperature benefits of planting a tree next to a stream — a critical piece of data, if one wants to, for example, trade the temperature impacts of a sewage treatment plant for the temperature benefits of replanting streamside vegetation.

In 2004, a small Oregon non-profit, Willamette Partnership, began working on how to measure environmental functions, addressing the key missing data needed for environmental markets to address water quality. "We knew we wanted to change how we spend money on watershed restoration. Water quality trading was a way to move investment from concrete to trees, a solution fish, ratepayers, and Mother Nature could all be happy about," says Bobby Cochran, Willamette Partnership's executive director. "We needed a radical new approach, something really outside the mainstream. But first, we had to have a bullet-proof way to quantify ecosystem services."

Willamette Partnership pulled together a task force to establish protocols for measuring these services. For example, the temperature benefits of an acre of streamside trees could be translated into a specific "kilocalories per day" reduction. With that science in hand, the benefit of replanting a denuded acre could be calculated. The difference between the current condition of that acre and the condition of a fully restored acre could be translated into a quantified ecological good. Every acre planted reduces adjoining water temperature by some quantifiable amount. Because temperature limits placed by regulators on point source facilities are also expressed in kilocalories per day, this development allowed the comparison and trade of a facility's kilocalorie debits for kilocalorie credits from planting projects, which could establish an environmental market for temperature. Beyond developing these calculations, the Willamette Partnership also secured agreement from nearly every federal and state natural resource agency in Oregon on a set of protocols and standards for quantifying benefits of freshwater restoration for application in environmental markets — the first agreements of their kind in the country.(*See* http://willamettepartnership.org/).

Of course, the services provided by watersheds, forests and other ecosystems are many, from carbon storage to species habitat to controlling runoff. The vision of Willamette Partnership and other market proponents is for a multi-service, self-sustaining and replicable marketplace that offers scientifically valid restoration compliance solutions, or offsets, to regulated environmental impacts — solutions that are ecologically and economically superior to technological, "built" solutions. To that end, Willamette Partnership also developed protocols for other ecosystem services that are still in the testing phase, such as nutrients, upland prairie restoration, and salmon habitat.



Eco-Markets

Discharge Temperature

Restoration Option

Implementation

Economic Benefits

Local Spending

MARKET MODEL APPLICATION: REAL-WORLD EXAMPLES

One of the original eight rivers of the Wild and Scenic Rivers Act of 1968, the Rogue River remains one of the most beautiful watersheds in Oregon. The Rogue offers world class salmon and steelhead fishing, whitewater rafting, and outdoor recreation of all kinds. But like virtually every other river in America, this river has issues — the Rogue is too warm.

In 2008, the Oregon Department of Environmental Quality (ODEQ) set a TMDL for the Rogue River, which included temperature limits on discharge from the City of Medford's wastewater treatment facility on the Rogue and the City of Ashland's facility on Ashland Creek, which feeds Bear Creek, a major Rogue tributary.

In 2009, both Medford and Ashland engaged separate consulting engineers to evaluate their compliance alternatives. Options included a cooling tower or refrigeration system to cool clean, but overly warm effluent as it discharges from the wastewater treatment facilities. While that legally addresses the water temperature load, it impacts other environmental factors through significant power consumption. Another option was a large lagoon to store effluent during the time of year the facility is out of compliance, which could then be pumped into the river at a different time. While legal, the lagoon is an imperfect solution with no real ecological benefit. And both chillers and lagoons are very expensive to build. These cities needed a different answer — one that would address the TMDL while providing real, measurable, and significant ecological benefit.

Walt Meyer of West-Yost Associates, Medford's consulting engineer, first heard about a new model for market-based restoration solutions early in 2010, from colleagues familiar with Willamette Partnership's work. "We were immediately very intrigued," recalls Meyer. "We were keenly interested in an approach that provided a cost effective approach with greater environmental benefits." Meyer also appreciated that the temperature trading protocols developed by Willamette Partnership were approved and promoted by ODEQ, the regulator that must sign off on any compliance plan.

In July 2010, Meyer presented his analysis of compliance alternatives to the City of Medford, including a restoration alternative side by side with a chiller and lagoon storage option. The restoration alternative model as presented was completely new in conservation and functioned as follows: a regulated entity would contract with a single organization to provide temperature reduction credits (translated as "kilocalories per day" from tree planting) to meet its regulatory temperature requirement. Project implementation, credit calculation and landowner relations would all be managed by the contracted organization. Once projects were complete and credits calculated, a neutral third party would certify the results and the city would be invoiced for the credits. The credit transaction itself would include two parts: a cash payment for the cost of credit generation (the project costs) and payment for the ongoing costs of monitoring and maintaining the sites for 20 years or more — including incentive payments to landowners for acreage converted to conservation use.

This model makes the restoration alternative easy for the city to understand and adopt; it was, in fact, just as turn-key as the construction of a chiller or lagoon. The restoration alternative was also significantly cheaper than the engineered solutions — roughly half — even with a robust planting regimen and landowner incentives. Further, costs were spread out over time, making it easier to fund than the large, one-time capital expense of a chiller or lagoon.

A MATTER OF PACE AND SCALE

Perhaps most importantly, this model demonstrates the revolutionary impact that market-based restoration solutions could have on the pace and scale of restoration. The existing systems for restoration in the US rely heavily on grant funding from public and private sources. Though there are billions of dollars up for grabs, that is only a small fraction of what is needed to advance a nation's worth of environmental improvements.

Now consider that, in the Medford example alone, one municipality will inject millions of dollars in restoration funding into a single watershed within a five-year period. The majority of the restoration investment will remain in the community, flowing to local restoration coordinators who will hire contractors to implement the work and purchase nursery stock, supplies, and materials locally. Local landowners who allow trees to be planted on their property will benefit from annual payments for use of their land, though they are not required to plant, water, or maintain the trees. This can catalyze action on the part of landowners who generally do not have the financial resources or willingness to forego agricultural revenue to undertake restoration projects on their land.

Though water quality trades have already occurred in isolated pockets across the country using a variety of approaches, for market advocates, the scenario playing out in Oregon may prove the replicable

Eco-Markets

Broad Scale Application

Another Tool

Market Sustainability

Real Progress

Concerns & Benefits

model needed for markets to work at scale. In addition to the Rogue basin, other municipalities in the state have either committed to or are considering adopting this restoration model to offset their temperature impacts. What this means is that for the first time, a state-approved system for calculating temperature credits is being broadly applied in multiple watersheds. Having a model that works at scale is the key to launching market efforts nationwide. Much like the car, it took an assembly line to park one in every driveway.

REALIZING ECO-MARKETS POTENTIAL

ECO-MARKETS PLACE IN THE CONSERVATION TOOLBOX

"Environmental markets have huge potential to meet regulatory and conservation goals at lower cost to society while providing additional revenues to farmers and forest landowners. But they are not a panacea," notes Mark Nechodom, Senior Advisor for Environmental Markets for the US Department of Agriculture. "They are part of the solution, an important new tool, but they must work in concert with other conservation strategies."

Market realists like Nechodom, are quick to remind market advocates that the tried and true conservation tactics — preservation, adjusting consumer behavior, point source impact reduction, and enforcement — remain key conservation tools. Markets will not and should not replace those efforts.

Some critics are also concerned that market development remains heavily grant-dependent and research-intensive. "We must be careful to design environmental markets that are self-sustaining over the long run," says Nechodom. "Many early market solutions underway around the country are precariously dependent on public and private grant funding — that won't work in the long term."

Nechodom goes on to note the importance of real-world application. "Critics often say environmental markets are a grand vision on paper, but deliver very little in terms of real-world benefit. If market-based conservation practices are to be more than just aspirations, we will need a lot more evidence of effectiveness and success than we have seen so far. From what I have observed in Oregon with temperature reduction credits, we're starting to see real progress. But it must get to scale with wide adoption."

CONCLUSION

Environmental markets hold out the promise of expanding restoration to a pace and scale commensurate with what is needed to attain true sustainability. There is, however, a risk of reducing the whole, connected dynamism of natural spaces into a series of individual, "commoditized" functions, of promoting ecosystems as factories for carbon storage, natural resources and animals — much like medicine tends to reduce the human body into a series of systems, organs, and seemingly discrete functions. That being said, it is important to note that medicine's ability to isolate and diagnose disease is extremely useful in treatment to the benefit of the whole body.

Environmental markets, entailing the scientific study and quantification of ecosystem services, can provide pragmatic diagnostic tools and effective treatments for natural spaces — and help maximize the beneficial impact of society's investment in conservation and restoration. Markets can help assure that what we invest in the environment occurs at a pace and scale equal to the ecological challenges we face. That alone would make this work a truly transformative innovation. With pressures on ecosystems continuing to mount, there remains little time for prolonging insufficient efforts.

For Additional Information:
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Alan Horton is the Managing Director of The Freshwater Trust with more than 18 years of senior-level not-for-profit experience. At The Freshwater Trust, he oversees operations, development, communications and The Freshwater Trust's StreamBank initiative. Prior to The Freshwater Trust, Mr. Horton served as Executive Director of Sedona Cultural Park in Arizona, where he managed the conversion of a 50-acre landfill into a nature preserve, park, performance facility, and small college branch campus. Earlier, Mr. Horton worked as Director of Finance and Operations for ArtsFund in Seattle where he oversaw over $5 million in annual grant-making efforts and helped facilitate numerous public-private development partnerships, including the $150 million campaign for the Seattle Symphony's new concert hall.
Marley Gaddis is the Grants Director for The Freshwater Trust in Portland, Oregon.

Speculative Use

Speculation & Demand

Application Approved

At Stake

Oregon Precedent

Regional Water Provider

Demand Evaluation

Agency Assessment

SPECULATIVE USE OR REGIONAL PROVIDER?

COMPANY APPLIES FOR MASSIVE WATER RIGHT IN OREGON

by David Moon, Editor

Due to increasing demand for water combined with water availability concerns, States throughout the western US are beginning to grapple once again with the concept of speculation and how that principle of water law limits proposed new water rights. Colorado, for example, has had a number of cases come before its Supreme Court that have addressed the issue of speculation in water law. *See TWR,* Water Briefs #88, #87, #83, #69; Zellmer, *TWR* #50; Hobbs, *TWR* #36.

How Oregon water law views the issue of "speculation" in water rights — and the showing of demand that is necessary to obtain a new water right — is part of a contested case currently before an Administrative Law Judge (ALJ) for the State of Oregon, on appeal from an agency decision.

The pending contested case, *In the Matter of Water Right Application S-87330 in the name of Willamette Water Company*, OAH Ref. No.: WR-10-003, stems from the Oregon Water Resource Department's (OWRD's) approval of an application for 34 **c**ubic **f**eet per **s**econd (cfs) for "quasi-municipal" purposes year-round from the McKenzie River. The McKenzie River is world-renowned for its fishing and rafting and is one of the few exceptions in Oregon where water is available for appropriation year-round. As part of its approval, OWRD attached a condition preventing diversions of the proposed water right when the flow of the McKenzie River drops below 2,000 cfs, based on recommendations submitted by the Oregon Department of Fish & Wildlife. The ALJ concluded a three-day hearing on the contested case in mid-November.

Willamette Water Company (WWC) is a small, private company that currently owns a four cfs water right and serves approximately 100 residential customers and another 60 or so businesses in Goshen, Oregon with part of that right. WWC is hoping that it can obtain water rights to an additional 34 cfs — conceivably worth millions of dollars — to enable it to become a regional water supplier in the southern Willamette Valley. WaterWatch of Oregon (WaterWatch), a well-known environmental group and rivers advocate, has objected to the application and is fighting what it considers a "speculative and extremely exaggerated…claimed water demand," according to WaterWatch's Trial Memorandum (p. 10).

For a water right application to be approved, it must be for beneficial use without waste. The "beneficial use" requirement has been interpreted over the years as preventing the approval of water rights for speculative purposes. An old water law case provides the Oregon Supreme Court's view of speculation at *Cookenham v. Lewis*, 58 Or. 584, 491, 114 P. 88, 115 P. 342 (1911). From *Survey of Oregon's Water Law*, Chapin D. Clark, Water Resources Research Institute (1983):

> "The right to the beneficial use of water to be acquired under the permit applied for under the Water Code is not an opportunity to acquire a monopoly of the water of a stream for promiscuous sale, but must contemplate a use upon specific lands…."

WWC, the applicant, has proposed a place of use or "proposed service area" of approximately 75 square miles, which includes the cities of Creswell and Cottage Grove as well as a significant area of rural land surrounding those cities. WWC maintains that there is sufficient demand in the area, especially considering potential problems with groundwater quality and the future needs of the cities of Creswell and Cottage Grove. WWC also is arguing that due to the economies of scale and costs needed to build a pipeline to transport the water and develop a community water system, it makes sense that WWC — which has the financial means to develop the water (as opposed to the small cities) — should be granted a permit and allowed to then act as the regional water provider.

WaterWatch, the Objector in the case, has raised several issues to try to convince the ALJ to reverse OWRD and reject the application. "WaterWatch's claims focus on: a) OWRD's failure to adequately evaluate the requested amount of 34 cfs, and; b) the fact that 34 cfs is an unlawful amount because it is an unreasonable and unnecessarily high amount when compared to water demand for WWC's Proposed Service Area." WatchWatch's Trial Memo, p. 1. WaterWatch pointed out in the hearing that there are no existing service agreements or contracts between WWC and the two cities to purchase water or otherwise use water from WWC. General letters of support from the two cities were submitted by WWC that basically state that if they need water in the future they would consider WWC in their planning. At the hearing, it was brought up that in assessing the application OWRD did not contact either city to see if they were actually interested in or planning to purchase water from WWC.

WaterWatch is also opposing OWRD's Proposed Final Order (PFO) based on the assertion that the "assessment of water necessary for the proposed use" is deficient because OWRD "failed to 'cite any

Speculative Use

Demand Forecast

Basis of Projections

findings of fact' which demonstrated a valid 'assessment of water availability and the amount of water necessary for the proposed use' as required by ORS 537.153(3)(c)." *Id.* at 3. Cited as a Key Fact in WaterWatch's Trial Memo was that "the only OWRD assessment of the amount of water necessary for the proposed use that was in the record at the time the PFO was issued was Mr. Fujii's email of December 17, 2008…That email never discusses any demand forecast for the water, never discusses any particular amount of water, never concludes that the amount is reasonable or needed, and instead raises a number of critical questions about the application which remain unresolved. The email does not provide substantial evidence in support of issuance of the permit in the amount of 34 cfs." *Id.* at 6. Mr. Fujii, an OWRD employee, testified at the hearing that he assessed whether 34 cfs was a reasonable amount of water based on a bigger service area than the area proposed.

The water demand projection for the proposed application is obviously a major factual issue in the case. WaterWatch disputes the WWC projection based on the fact that WWC's expert projects water demand for the rural industrial and commercial lands in the "proposed service area" based on per acre water use at the Port of Morrow as a comparison. WaterWatch maintains that the Port is not comparable because of its infrastructure (being a major shipping Port on the Columbia River with rail access, etc.) and its zoning. Another argument is that Port of Morrow's per acre water use is much higher than the per acre water use on lands zoned commercial or industrial within WWC's existing service area around Goshen, which WWC has been serving for over 50 years.

Naturally, the specific facts of this detailed case will determine whether or not WWC has a beneficial use for the water and has provided evidence of sufficient demand or whether the ALJ will rule that their proposal is simply speculation. The Water Report plans to follow this case and provide a more detailed article as the case progresses.

For Additional Information: Reed Marbut, Attorney for WWC, 503/ 363-2121; Lisa Brown, WaterWatch, 503/ 295-4039 x4

WATER BRIEFS

FRACKING WATER DISCLOSURES CO

COMMISSION PROPOSES REGULATION

The Colorado Oil and Gas Conservation Commission has proposed regulations that would require public disclosure of the composition of hydraulic fracturing water.

The proposed regulations would require operators of each oil or gas well that is fractured in Colorado to disclose to the public:

- the operator's name
- the date the well was fractured
- the location of the well, including the county in which it was drilled and also the latitude and longitude of the wellhead
- the well's name and registration number
- the true vertical depth of the well
- the total volume of water or other base fluid used as the fracturing fluid (and, if the base fluid is not water, the identity of the base fluid)
- the trade name of each fracturing water additive, as well as the supplier and the intended function of the additive (e.g., biocide, corrosion inhibitor, friction reducer, etc.)
- the Chemical Abstracts Service (CAS) number for each additive (CAS numbers are unique identifiers that scientists use to identify and distinguish each known chemical compound)
- the maximum concentration of each additive

Operators would have to disclose the information by posting it to FracFocus, a website operated by the Ground Water Protection Council and the Interstate Oil & Gas Compact Commission that has become a central location for the posting on information regarding the hydraulic fracturing of wells in several states (http://fracfocus.org). Visitors to the website can search for wells by county, longitude and latitude, or the name of the operator, as well as by other criteria.

If a particular additive in the fracturing fluid is a trade secret, the operator would not have to identify it to FracFocus, but the operator would have to identify the chemical family of the additive. In addition, the operator would be required: 1) to identify the additive to a health professional who needs the information for purposes of treating or diagnosing a person who has been exposed to the fracturing fluid; and 2) to identify the additive to the Oil & Gas Conservation Commission if it needs the information for purposes of responding to a spill or release.

The proposed regulations, if approved, could go into effect as early as February 1, 2012.

If Colorado adopts mandatory disclosure rules, it will join several states, including Wyoming, Arkansas, Montana, Louisiana, and West Virginia that have already enacted similar regulations. In addition, Texas is in the process of enacting such regulations, and New York is considering the idea.

For info: Colorado Oil and Gas Conservation Commission website: http://cogcc.state.co.us/

WATER BRIEFS

EXTREME WEATHER WORLD

EXTREME WEATHER & CLIMATE CHANGE NEW IPCC REPORT

The Intergovernmental Panel on Climate Change (IPCC) report "*Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*" addresses how integrating expertise in climate science, disaster risk management, and adaptation can inform discussions on how to reduce and manage the risks of extreme events and disasters in a changing climate. The Report evaluates the role of climate change in altering characteristics of extreme events. It assesses experience with a wide range of options used by institutions, organizations, and communities to reduce exposure and vulnerability, and improve resilience, to climate extremes. Among these are early-warning systems, innovations in insurance coverage, improvements in infrastructure, and the expansion of social safety nets. There is some discussion of sea level rise, water levels in coastal areas, floods and floodplain measures and other climate change adaptation issues relevant to wetlands and water resource management.

For info:
Fact sheet: www.ipcc.ch/news_and_events/docs/srex/SREX_fact_sheet.pdf
Full report: www.ipcc.ch/

NOAA ENFORCEMENT US

DRAFT PRIORITIES RELEASED
PUBLIC COMMENT THROUGH JANUARY 9

On November 8, the National Oceanic and Atmospheric Administration (NOAA, which includes the National Marine Fisheries Service (NMFS) released a draft of its enforcement priorities and invited the public to submit comments through January 9.

NOAA's jurisdiction spans more than 300,000 square miles of open ocean and 85,000 miles of US coastline. The agency is charged with enforcing laws and regulations found predominately in the Magnuson-Stevens Fishery Conservation and Management Act, the Endangered Species Act, the Marine Mammal Protection Act, the National Marine Sanctuaries Act, and the Lacey Act. To help accomplish its mission, NOAA's Office of Law Enforcement operates joint enforcement agreements with 27 coastal states and territories, and partners with the US Coast Guard.

The draft priorities were created collaboratively with the fishery management councils, interstate fishery commissions and interested stakeholders, including fishermen, representing public, private and nongovernmental organizations.

Draft priorities focus on:

- Helping the fishing industry understand and follow regulations that support sustainable fish stocks and a sustainable fishing industry
- Compliance and enforcement plans for catch share management
- Monitoring fish product imports for compliance with domestic and international laws and regulations
- Protecting marine resources in National Marine Sanctuaries
- Protecting marine mammal and endangered species by enforcing bycatch reduction, gear, and closed area regulations
- Supporting observer programs, which collect critical scientific data about fish stock status, bycatch, and fishery interactions with protected species

The draft priorities are available online: www.nmfs.noaa.gov/ole/ and www.gc.noaa.gov/enforce-office.html

For info: Lesli Bales-Sherrod, NOAA, 301/ 427-2300 x103
NOAA's Office of Law Enforcement: www.nmfs.noaa.gov/ole/
NOAA enforcement reforms: www.noaa.gov/lawenforcementupdates/

IRRIGATION TO INSTREAM WY

CHANGE TO STATE-OWNED SETS PRECEDENT

In a ruling in early November, the Wyoming State Board of Control, allowed the change of water right from irrigation to instream flow, setting a precedent for exactly how such a change can take place, should other Wyoming water rights holders decide to turn over a water right to the State to become protected instream flow.

Wyoming water law was changed 25 years ago to allow water left flowing in a stream to support fish to be protected with a water right. Instream flow rights have since been created in many locations, mostly on high Wyoming mountain streams. See Yates, *TWR* #86

Until now, however, no one has done what the 1986 law also allowed — i.e. taking an old private irrigation water right among settled ranch and farm lands and allowing it to change into a State-owned instream flow right to keep that water in a stream for fish.

Wyoming's first conversion of a private irrigation water right to a State-owned instream water right could keep more water flowing through a section of Pine Creek through Pinedale.

Paul Hagenstein, a life-long irrigator on Pine Creek who initially opposed proposals to create protected instream flows in Pine Creek, has now given to the State one of his water rights so that the water can stay in the creek, legally protected from diversion. The amount of water now protected to stay in the creek would be enough to irrigate about 45 acres.

Because of a water rights swap which gave him more senior, valuable water rights, Hagenstein now can't use the water right in question, and his neighbors don't have an on-ground use for it either. Turning this irrigation diversion right into an instream flow right will keep that water in the community, according to Hagenstein. "Though it's a 1949 right, it's good… Unless there's a complete drought, it always has been filled."

Turning an irrigation right into an instream flow right means other water users can't take it out of the stream in a defined, protected stretch and the State of Wyoming could, if necessary, restrict some others' uses to keep that water in the stream.

Wyoming's instream water rights law includes elaborate restrictions to ensure that the keeping of water instream — now recognized officially as a "beneficial use" of Wyoming water — would be to protect only the minimum amount of water that fish required. In addition, the water would be provided only from reservoirs whenever feasible and would not increase the amounts of water flowing to downstream states. Public hearings are also required to vet proposals for instream flow rights.

After a public hearing in the City of Pinedale, the Board of Control ruled that the right to protect Pine Creek's instream flow is limited to the irrigation season in Pinedale — i.e., during that time of year when the water was once diverted. The process gone through by the Board of Control laid down the process for any future changes of irrigation rights to instream flow rights.

The board decided that all the water that had been diverted for irrigation could be converted to instream flow, without a deduction for water that probably returned to the stream after a crop consumed only part of the water.

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Irrigation rights converted to other on-land uses (for industry or municipalities, for instance) typically are subject to such a deduction to make up for the fact that the new use may consume much more of the water diverted. In a conversion to instream flows, however, that is not necessary since the new use consumes none of the water, the Board decided. The right to protect the water instream is limited to the irrigation season in Pinedale, when the water was once diverted, the board ruled. It can only be used to support — not add to — the total water amount the Department of Game and Fish has shown is needed for minimal support for the fish, the board also ruled.
Source: WyoFile online news service, for complete article:
http://wyofile.com/2011/11/

TRIBAL WATER SUPPLY AZ

WATER RIGHTS SETTLEMENT

$11.8 million has been awarded to the White Mountain Apache Tribal Government as part of a self-determination construction cooperative agreement to greatly expand the current water delivery system to meet the critical water needs of the reservation. The agreement, between the Department of the Interior, the Bureau of Reclamation and the Tribe, will fund planning and design activities for the Miner Flat Project on the tribe's reservation in Arizona.

Bureau of Reclamation Commissioner Michael Connor stated, "This agreement will not only help provide a permanent water supply and economic security for the tribe, but it will also provide certainty to water users throughout the Colorado River Basin."

The agreement covers a three-year period for the initial planning, environmental compliance, feasibility engineering and design of the Miner Flat Project on the reservation. The completed project will include construction of a concrete dam, pumping plants, a water treatment plant and water distribution pipelines on the White River in southeast Navajo County, Arizona. The project is estimated to create over 120 direct and indirect jobs.

Under the terms of the agreement, the Tribe will contract for preparation of design specifications, cost estimates and environmental documents. Reclamation will perform technical oversight of the agreement, ensure adherence to all federal requirements including labor, safety and environmental regulations and provide other technical assistance as requested by the Tribe.

The Tribe was authorized to contract for the work under the White Mountain Apache Tribe Rural Water System Loan Authorization Act as amended by the Claims Resolution Act of 2010 which contained four Indian water rights agreements, totaling more than $1 billion, that will deliver clean drinking water for the Taos Pueblo and Aamodt case pueblos in New Mexico; as well as the Crow Tribe of Montana and the White Mountain Apache Tribe in Arizona. The agreements will build and improve reservation water systems, rehabilitate irrigation projects, construct a regional multi-pueblo water system, and codify water-sharing arrangements between Indian and neighboring communities.
For info: Adam Fetcher, Interior, 202/ 208-6416; Patricia Cox, Reclamation, 623/ 773-6214
White Mountain Apache website: www.wmat.nsn.us/

WATER SUPPLY TX

DROUGHT RESPONSE INITIATIVES

Amidst record drought conditions, the Texas Secretary of State recently announced that Texas voters passed two important initiatives supported by The Nature Conservancy to protect the water supply during the November 8, 2011 statewide constitutional amendment election.

Proposition 2, a statewide initiative, will help local communities grow and maintain their water supplies by allowing the state to create a revolving $6 billion bond package to finance water conservation, water supply, sewage, and flood control projects.

In addition, voters in Travis County passed their own Proposition 2, which sets aside $83 million to preserve Travis County's fragile water supplies and ensure water quality. It also funds countywide land conservation efforts and park improvements, all of which will benefit Travis County residents for generations to come.

Unfortunately, Proposition 8, which would have would have had a significant impact on Texas water conservation efforts by creating tax incentives for landowners who take measures to conserve water and preserve water quality did not pass at the hands of voters. The revenue neutral proposition was supported by farmers, ranchers, landowners, taxpayers' organizations, and conservation groups. Backed by both Republicans and Democrats, it was passed unanimously by the Texas Legislature in May 2011.

"The Nature Conservancy is pleased that two of the three important initiatives supporting water protection passed at the hands of voters last night," said Laura Huffman, executive director of The Nature Conservancy in Texas. "The Conservancy and our supporters will continue to work with legislators to pursue additional tools to ensure future generations have the clean, reliable water supply they will need."
For Info: Vanessa Martin, Nature Conservancy, 916/ 233-6722 or vmartin@tnc.org

TOXICS REDUCTION WA

PUGET SOUND POLLUTION
NEW REPORT RELEASED

The Washington Department of Ecology (Ecology) and the Puget Sound Partnership (Partnership) have released the latest look at what's known about toxic chemical pollution in the Puget Sound region.

The report, titled "*Assessment of Selected Toxic Chemicals in the Puget Sound Basin*" provides information to aid the effort to restore and protect the Sound.

The new toxic chemical assessment is the final component of a multi-year, multi-agency effort that started in 2006 to understand where toxic chemicals come from, how they get to Puget Sound, and the potential harm to people, fish, and other creatures.

The overall effort was called for in the Partnership's Action Agenda — the single playbook for prioritizing and focusing recovery and protection efforts for government entities and scientists, environmental groups, and business and agricultural organizations across the 12-county region.

While there are many chemicals in use today, the Puget Sound Toxics Assessment focused on 17 chemicals or chemical groups because they are commonly detected in Puget Sound, harmful to fish and other life, and may represent how similar chemicals reach the Sound.

The report evaluated a variety of ways that toxic chemicals reach Puget Sound. These include surface water runoff (stormwater) as well as groundwater releases, air deposition and

WATER BRIEFS

wastewater treatment plant discharges. Overall the study found that toxic chemical pollutants come from many scattered and hard-to-reach sources throughout the Sound.

Sources of toxic chemicals identified include:

- Copper, cadmium, zinc and phthalates from roofing materials. Phthalates are a group of chemicals commonly found in plastics.
- Copper from urban pesticide use, brake pads, and boat paint.
- Polycyclic aromatic hydrocarbons (PAHs) from creosote-treated wood, wood smoke, and vehicle exhaust. PAHs are known to harm fish.
- Petroleum-related compounds from motor oil drips and leaks from our cars and trucks, as well as routine fuel and oil spills on land and to the water.

The most common way toxic chemicals get into the environment is through polluted stormwater runoff that flows off of residential, commercial, and industrial areas. Toxic pollutants can threaten environmental and human health. Most don't break down easily, and they stay in the environment a long time. They can enter the Puget Sound food chain and wind up in the bodies of fish, seals, orca whales, and people.

Many chemicals in polluted runoff, such as copper, directly harm salmon and other fish. Copper interferes with salmon's ability to smell. They need their sense of smell to avoid being eaten by predators, navigate back to their natal streams to spawn, and to find mates.

"We've learned that adult Coho salmon are dying prematurely in large proportions when they return from the ocean to spawn in Puget Sound urban streams," said Jay Davis, an environmental toxicologist for the US Fish & Wildlife Service. "Although we don't know the precise cause of these die-offs, the most likely explanation is toxic chemicals in stormwater runoff."

The Partnership has applauded the Washington State Legislature for the important progress made to control many toxic chemicals in Washington. Measures include banning or reducing the allowable uses of certain pollutants.

Banned or Use-restricted pollutants include:

- Polybrominated diphenyl ethers (PBDEs) in flame retardants
- Copper in brake pads and boat paint
- Lead tire wheel weights
- PAHs in coal tar-based pavement sealants
- Phosphorus in lawn fertilizers
- Bisphenol A (BPA) in baby bottles

The Partnership will use Ecology's toxics assessment to help establish prevention and cleanup solutions in the Action Agenda, including preventing copper from getting into the Sound and expediting the removal of creosote-treated wood pilings.

For info: Michael Grayum, Partnership, 360/ 628-1907 or michael.grayum@psp.wa.gov)

Report website: www.ecy.wa.gov/biblio/1103055.html

STORMWATER REGS WA

NEW DRAFT GUIDANCE & PERMITS LID WHEREVER FEASIBLE

The Washington State Department of Ecology (Ecology) has developed improved guidance for reducing polluted runoff to Western Washington waterways.

The *Western Washington Stormwater Management Manual* (Guidance) — is a key resource used by local governments, industrial facilities, construction sites, and consultants for managing and controlling polluted stormwater runoff.

The manual provides guidance about how to prevent stormwater pollution and, where necessary, how to treat and cleanup stormwater to minimize pollution problems it can cause. Last updated in 2005, changes to the manual address **l**ow-**i**mpact **d**evelopment (LID) and best management practices.

LID refers to systems that strive to mimic the natural environment so water can be taken up by trees or vegetation, or soak into the ground. Best management practices are state-approved, on-the-ground actions that successfully manage runoff.

Changes to the Guidance reflect new knowledge about what works and what doesn't work in managing stormwater runoff, and are written using plain language. Ecology will accept comments on the draft manual until Feb. 3, 2012. Public workshops on the document are scheduled for January. See Ecology website (address below).

Feb. 3, 2012, is also the deadline for public comments on the proposed Phase I and Phase II Municipal Stormwater General permits, which include stipulations to use LID where feasible. See Ecology website (address below) for copies of the draft permits, fact sheets, and information about upcoming workshops.

Under the federal Clean Water Act, cities must update their permits every five years.

The new permits make the following changes:

- Local governments have the option to do their own monitoring, or join a regionalized stormwater monitoring program administered by Ecology;
- Cities are required to do new low-impact development, where feasible. Low-impact development mimics the natural environment so water can be taken up by trees or soak into the ground;
- Requires management of runoff at sites that are less than one acre;
- Cities and counties begin implementing LID site requirements by the end of 2015, and 2016 to update broader development codes;
- Additional communities may be subject to stormwater permits (Snoqualmie, Lynden, Clallam County, Port Angeles Urban Growth Area – UGA), Island County (Oak Harbor UGA), and Lewis County (Centralia UGA).

Ecology expects to issue final municipal stormwater permits in June 2012.

For info: Ecology websites

Guidance: www.ecy.wa.gov/programs/wq/stormwater/wwstormwatermanual/2012draft/2012draftSWMMWW.html

Permits: www.ecy.wa.gov/programs/wq/stormwater/municipal/2012draftMUNIcom.html

GREEN REMEDIATION OR

POLICY FOR CLEANUP SITES FINALIZED

The Oregon Department of Environmental Quality (ODEQ) has finalized a policy supporting more environmentally friendly methods to conduct investigation and cleanup of hazardous substance spills in Oregon. ODEQ will encourage responsible parties of contaminated sites and others to implement the greener technologies on a voluntary basis

ODEQ's green remediation policy applies to state actions, parties responsible for investigating or cleaning up contaminated sites, and those hired to conduct environmental cleanup investigations and cleanup work.

Green remediation takes into account the broader environmental impacts of cleanup actions such as energy use, greenhouse gas emissions

WATER BRIEFS

and waste production in order to lessen overall environmental impact at work done on cleanup sites. It can also cut costs in restoring a site contaminated by such hazardous substances as petroleum, PCBs, heavy metals, and pesticides.

In adopting this new policy, ODEQ is joining a number of states and the federal Environmental Protection Agency in trying to incorporate more environmentally sustainable practices into its cleanup program. This is also part of ODEQ's overall effort to conduct its business in a more sustainable way.

Green remediation practices include:

• Using alternative fuels such as biodiesel to operate heavy machinery.
• Using renewable energy sources such as solar power to run treatment systems.
• Using natural system technologies such as bioremediation (using microorganisms to remove or neutralize contamination) and phytoremediation (using plants to absorb, remove or break down contaminants).
• Employing on-site treatment of contamination instead of the more invasive excavation of contaminated material and off-site disposal.
• Reducing waste by reusing or recycling materials.

In August 2011 DEQ conducted a public comment period for a draft of the policy and received no comments.

For info: Tom Gainer, ODEQ Cleanup Program, 503/ 229-5326 or gainer.tom@deq.state.or.us
Website: www.deq.state.or.us/lq/cu/greenremediation.htm

WATER ASSESSMENT US

EPA BIOLOGICAL ASSESSMENT DOCUMENT WATER QUALITY MANAGEMENT

EPA has published *A Primer on Using Biological Assessment to Support Water Quality Management*. This technical document serves as a primer on the role of biological assessments in a variety of water quality management program applications including reporting on the condition of aquatic biota, developing biological criteria, and assessing environmental results of management actions. The primer provides information on new technical tools and approaches for developing strong biological assessment programs and examples of application of biological assessment information by states and tribes.

For info: http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/biocriteria/index.cfm

URBAN WATER QUALITY US

NEW EPA PLANNING PROCESS PRIORITZED APPROACH

EPA has announced a commitment to using an integrated planning process to help local governments dealing with difficult financial conditions identify opportunities to achieve clean water by controlling and managing releases of wastewater and stormwater runoff more efficiently and cost effectively. The integrated planning process, outlined in a guidance memo to EPA's regional offices from EPA's Office of Water and Office of Enforcement and Compliance, will help municipalities prioritize infrastructure investments to address the most serious water quality issues and provide flexibility to use innovative, cost-effective stormwater and wastewater management solutions.

EPA will work with local governments to review the Clean Water Act requirements that each municipality must comply with and look for opportunities to improve the efficiency and effectiveness of solutions developed to meet those obligations. This integrated approach will identify efficiencies where more than one water quality issue can be addressed by the same solution and where competing requirements may exist, including how to best make capital investments and meet operation and maintenance requirements.

Integrated planning approaches can also have other benefits, like leading to the identification of innovative, sustainable solutions that improve water quality and enhance community vitality. Green infrastructure, such as green roofs, rain gardens, planter boxes, and permeable pavement, is an example of an integrated solution that can reduce, capture, and treat stormwater runoff at its source before it can reach the sewer system. Green infrastructure provides a cost effective way to reduce overflows and add green space in communities.

For info:
EPA memorandum: http://cfpub.epa.gov/npdes/integratedplans.cfm
EPA green infrastructure website: http://cfpub.epa.gov/npdes/home.cfm?program_id=298

REGULATION & TAKINGS NE

SENIOR WATER RIGHTS UPHELD

The U.S. Court of Appeals for the Eighth Circuit ruled on November 7 in favor of the Nebraska Department of Natural Resources' actions regarding administration of surface water rights in the Niobrara River Basin. The case, *Keating v. Nebraska Public Power District*, No. 10-2441 (Nov. 7, 2011) began in 2007 when the Nebraska Department of Natural Resources (NDNR) issued closing and regulating notices to junior surface water users in the Niobrara River Basin so that a senior water right, held by Nebraska Public Power District, would receive the water it was entitled to.

Keating and other appropriators in the basin filed a lawsuit in the federal district court in May of 2007, claiming that the issuance of the closing notices was a deprivation of a property right and that they were entitled to the procedural due process protections of a "predeprivation hearing." The US District Court dismissed the proceeding in August 2007 holding that the claim was not ripe and that appellants had not exhausted the administrative remedies prior to filing the complaint. That decision was appealed to the U.S. Court of Appeals for the Eighth Circuit. The Court of Appeals reversed the district court's dismissal and remanded the case back to the District Court with specific instructions to the court to determine whether: (1) a deprivation of a property right had occurred; (2) if a deprivation had occurred, whether the deprivation was subject to an exception to the requirement that a predeprivation process be provided; and (3) if the deprivation was not subject to such an exception, whether NDNR's declaratory order procedures were constitutionally adequate predeprivation procedures.

Following remand, the US District Court found that there was no deprivation of a property right. The opinion found that "…a water permit entitling the holder to use surface water within the capacity limits of the Niobrara Watershed represents a property right under Nebraska law." The court found that the holder of a surface water permit acquires the rights granted by the permit and is subject to constraints articulated by the permit. The appellants' permits allow them to use specific amounts of surface water so long as there is sufficient capacity, subject to the rights of senior appropriators and subject to regulation by the State through NDNR. The court rejected Appellants argument that a hearing should be conducted prior to issuing notices on the basis that when NDNR determines that the watershed

WATER BRIEFS

no longer has the capacity to supply all permit holders, appellants no longer have a legitimate claim of entitlement to use the surface water and thus do not suffer a deprivation of a property right.

The States of Colorado, Montana, Nevada, New Mexico, North Dakota, Wyoming and South Dakota filed briefs in the Court of Appeals supporting Nebraska's position.

For info: Case available at: www.ca8.uscourts.gov/opndir/11/11/102441P.pdf

ESA UPHELD US

FEDERAL PROTECTIONS CONSTITUTIONAL

The US Supreme Court sided with conservation groups on October 31st by refusing to review a decision by the federal Ninth Circuit Court of Appeals that ruled federal protections for delta smelt are constitutional. *Stewart & Jasper Orchards v. Salazar*, No. 10-1551 (Oct. 31, 2011).

In March, the lower court ruled in a challenge to the listing of the delta smelt under the Endangered Species Act (ESA) brought by Pacific Legal Foundation (PLF). The group challenged the listing, claiming it violates the Commerce Clause of the constitution, which addresses interstate commerce. The challenge claimed the Commerce Clause doesn't apply since delta smelt have no commercial value and are only found in California.

The appeals court ruled in favor of the constitutionality of ESA intrastate species protection, citing previous cases that demonstrated a connection between ESA protections and interstate commerce, including the value of biodiversity as an underpinning of our economic enterprises.

For info: Trent Orr, Earthjustice, 510/ 550-6782 or http://earthjustice.org; Brief for Federal Respondents in Opposition: www.justice.gov/osg/briefs/2011/0responses/2010-1551.resp.pdf; US Supreme Court: www.supremecourt.gov/Search.aspx?FileName=/docketfiles/10-1551.htm

COLORADO BASIN WATER SW

DEMAND & SUPPLY ASSESSMENT PHASE 4 INITIATED

The Bureau of Reclamation has initiated Phase 4 of the Colorado River Basin Water Supply and Demand Study: Development and Evaluation of Opportunities for Balancing Water Supply and Demand. *See* Fulp, Adams, *TWR*#90. During this phase, the Basin Study team is seeking input on a broad range of options to help resolve future water supply and demand imbalances in the Colorado River. The team will explore the effectiveness of various options and groupings of options, referred to as strategies, for helping resolve projected future imbalances.

Additional information on the Study, including a report describing the preliminary assessment of potential future imbalances, the process for submitting options, and how options will be evaluated is available online: www.usbr.gov/lc/region/programs/crbstudy.html

For info: Pam Adams, Reclamation, 702/ 293-8500 or ColoradoRiverBasinStudy@usbr.gov Website: www.usbr.gov/lc/region/programs/crbstudy.html

TRIBAL WATER RIGHTS CA

SOBOBA SETTLEMENT FINALIZED

Secretary of the Interior Ken Salazar recently announced $21 million in federal funding under the Soboba of Luiseño Indians Settlement Act. This action marked the final step in an historic water rights settlement and fulfilling promises made to the Soboba Band and southern California communities when the Act was approved by Congress in 2008. Implementation of the settlement is expected to stabilize water supplies in the region and enhance economic development opportunities for the Band and its neighboring communities.

Disputes and litigation over the water resources date back to the late 1800's with multiple non-Indian water diversions from the San Jacinto River and the construction into the 1930's of the San Jacinto tunnel, a component of the Colorado River Aqueduct that transports water from the Colorado River to southern California. Years of growth in the region — which now serves over 18.5 million Californians — drastically affected groundwater supplies relied upon both by Band and the local communities of Hemet and San Jacinto.

The water rights settlement resolved longstanding disputes by providing the Soboba Band with quantified water rights and assurances of water supplies for its 6,000-acre reservation, as well as establishing a framework for regional water management that will help to restore groundwater levels and prevent ongoing overdrafts of this important basin.

The action also makes $10 million held in the San Jacinto Basin Restoration Fund available to two neighboring water districts — Lake Hemet Municipal Water District and Eastern Municipal Water District — for a groundwater restoration and recharge project. The Metropolitan Water District of Southern California, which is also a party to the settlement, will provide much of the water needed for the project, a total of 7,500 acre-feet of imported water each year until at least 2035. The provisions for recharge of the San Jacinto River Basin aquifer, which could not have been achieved through litigation, will also enable the development of thousands of acres of residential and commercial land.

In addition to the federal funding for the aquifer recharge project, Soboba's neighboring communities will receive up to 100 acres of Soboba reservation land for endangered species habitat and up to 4,900 acre-feet of Soboba water for 50 years for basin restoration.

For info: Adam Fetcher, Interior, 202/ 208-6416

AQUATIC BIOASSESSMENT US

USGS DATABASE

Access to aquatic bioassessment data (biological community and physical habitat data) collected by US Geological Survey (USGS) scientists from stream ecosystems across the nation is now available through the USGS BioData Retrieval system (BioData). Fish, aquatic macroinvertebrate, and algal community samples are collected and stream physical habitat surveys. Data from over 15,000 fish, aquatic macroinvertebrate, and algae community samples are available to the public, as are over 5,000 physical habitat data sets (samples) that were collected to support the community sample analyses. BioData is structured to support data collected by USGS scientists using protocols from both the National Water-Quality Assessment Program and EPA's National Rivers and Streams Assessment Program.

Scientists, resource managers, teachers, and the general public can retrieve data using an online query. Data can be downloaded in several formats.

For info: Pete Ruhl, USGS, 703/ 648-6841 or pmruhl@usgs.gov Website: http://aquatic.biodata.usgs.gov

CALENDAR

December 14-16 NV
Colorado River Water Users Association Annual Conference, Las Vegas. Caesar's Palace. For info: www.crwua.org/

December 14-Jan. 25 WEB
Sustainable Water Management & Landscape Design Course, Internet. Sponsored by UC Davis. For info: UC Davis Extension, 800/ 752-0881 or www.extension.ucdavis.edu/landuse

December 16 CA
GIS for Watershed Analysis: Intermediate Course, Davis. 1137 Plant & Enviro Sciences Bldg., UC Davis. For info: UC Davis Extension, 800/ 752-0881 or www.extension.ucdavis.edu/landuse

December 20 OR
Conservation Easements/Water Quality & Toxics Seminar, Klamath Falls. Sponsored by Water for Life & Schroeder Law Offices. For info: Helen Moore, WFL, 503/ 375-6003 or helen.moore@waterforlife.net

December 27 CO
AWRA Colorado Luncheon Presentation, Denver. Denver Water, 1600 W. 12th Avenue. For info: http://awracolorado.havoclite.com/events/luncheon-program/

January 9 OR
Source Control Workshop, Portland. For info: Holly Duncan, Environmental Law Education Center, 503/ 282-5220, hduncan@elecenter.com or www.elecenter.com

January 10-13 FL
Environmental Awareness Bootcamp, Orlando. Buena Vista Suites. For info: EPA Alliance Training Group, 713/ 703-7016 or www.epaalliance.com

January 11 HI
Hawaii Water Law Seminar, Honolulu. YWCA. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 12 HI
Financing Renewable Energy Seminar, Honolulu. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 13 WA
SEPA & NEPA Seminar, Seattle. Renaissance Hotel. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

January 17 OR
Conservation Easements/Water Quality & Toxics Seminar, Baker City. Sponsored by Water for Life & Schroeder Law Offices. For info: Helen Moore, WFL, 503/ 375-6003 or helen.moore@waterforlife.net

January 19 AK
6th Annual Permitting Strategies in Alaska, Anchorage. Anchorage Convention Ctr. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 23-24 AZ
Urbanization, Uncertainty & Water: Planning for Arizona's Second Hundred Years:WRRC 2012 Annual Conference, Tucson. Student Union Memorial Ctr. Pre-Conf. Workshop 1/23/11. For info: Jane Cripps, Water Resources Research Center, 520/ 621-2526, jcripps@cals.arizona.edu or cals.arizona.edu/AZWATER/programs/conf2012

January 24-25 NV
Indian Water Rights & Water Law Class, Las Vegas. For info: www.falmouthinstitute.com or 800/ 992-4489

January 26 OR
Impacts of FEMA Floodplain Mapping: Regulatory Changes & Implications for Local Jurisdictions & Property Owners Seminar, Portland. World Trade Center. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 26-27 WA
Endangered Species Act Seminar, Seattle. Grand Hyatt. Live Webcast. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 26-27 DC
Natural Resources Damages Seminar, Washington. Capitol Hilton Hotel. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

January 26-27 BC
Water Gathering: Collaborative Watershed Goverance in BC & Beyond - Solutions Forum, Vancouver. Sponsored by Pacific Business & Law Institute and The Summit Institute. For info: www.pbli.com/conferences/overview?itemid=40

January 27-29 CO
Downstream Neighbor Water Symposium: South Platte Watershed, Denver. Colorado Heights University. For info: www.downstreamneighbor.org

January 30 CO
Unheard Voices of the Colorado River Basin: Bringing Mexico & Native American Tribes to the Table (Speaker Series), Colorado Springs. Colorado College. Bidtah Becker & Osvel Hinojosa, Speakers. For info: www2.coloradocollege.edu/stateoftherockies/speakerseries.html

January 30-Feb. 2 FL
The Water & Wastewater Utility Management Conference 2012, Miami. Hyatt Regency. For info: Water Environment Federation, 800/ 666-0206 or WEFTEC website: www.weftec.org

January 30-Feb. 3 WA
11th Annual Stream Restoration Symposium, Skamania. Skamania Lodge. For info: River Restoration Northwest: www.rrnw.org

February 1 WA
Impacts of FEMA Floodplain Mapping Seminar, Seattle. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

February 2-3 AZ
Water Rights & Trading Regional Summit, Scottsdale. Montelucia Resort & Spa. Sponsored by WestWater Research & American Water Intelligence. For info: jmc@globalwaterintel.com

February 6 CO
Healthy Forests for the Colorado River Basin (Speaker Series), Colorado Springs. Colorado College. Harris D. Sherman, Speaker. For info: www2.coloradocollege.edu/stateoftherockies/speakerseries.html

February 7-10 TX
RCRA Compliance Workshop, San Antonio. Saint Anthony Wyndham. For info: EPA Alliance Training Group, 713/ 703-7016 or www.epaalliance.com

February 8-9 CO
Hydraulic Fracturing: Regulatory Perspectives & Achieving More ROI Conference, Denver. Sponsored by Electric Utility Consultants, Inc. For info: www.euci.com/events/register.php?ci=1523&t=R#7658s435582Kt0108

February 10 CA
GIS for Watershed Analysis: Advanced Course, Davis. 1137 Plant & Enviro Sciences Bldg., UC Davis. For info: UC Davis Extension, 800/ 752-0881 or www.extension.ucdavis.edu/landuse

February 10-11 OR
Pacific Northwest Ground Water Exposition, Portland. Red Lion on the River. For info: NGWA: www.ngwa.org/Events-Education/conferences/6031/Pages/6031feb12.aspx

February 15-16 FL
Sustainable Water Resources - Nutrient Dynamics, Policy & Management in Watershed: 3rd Water Institute Symposium, Gainesville. J. Wayne Reitz Union. Sponsored by University of Florida Water Institute. For info: http://waterinstitute.ufl.edu/symposium2012/index.asp

February 16 GA
Wetlands & Water Law Update Seminar, Atlanta. TENTATIVE. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

February 21-22 OR
Reservoir System Modeling Technologies Conference, Portland. DoubleTree by Hilton Hotel, 1000 NE Multhomah. Sponsored by Bonneville Power Administration. For info: BPA: www.bpa.gov/corporate/business/innovation/

February 21-23 OR
Northwest Hydroelectric Ass'n 2012 Annual Conference, Portland. Marriott Hotel Waterfront. For info: www.nwhydro.org/default.htm

February 22-24 CA
30th Annual ABA Water Law Conference, San Diego. Westin San Diego, 400 W. Broadway. Sponsored by American BAR Association. For info: www.americanbar.org/

February 22-24 NV
Family Farm Alliance Annual Meeting & Conference, Las Vegas. Monte Carlo Resort. For info: FFA: www.familyfarmallicance.org

February 24 OR
The Freshwater Trust's Annual Gala & Auction, Portland. For info: Sierra Smith, FWT, 503/ 22-9091 x14, sierra@thefreshwatertrust.org or www.thefreshwatertrust.org

The Water Report
Water Rights, Water Quality & Water Solutions in the West
260 N. Polk Street • Eugene, OR 97402

CALENDAR

(continued from previous page)

February 27-28 DC
NGWA's 15th Annual Groundwater Industry Legislative Conference, Washington. Holiday Inn Capitol. For info: NGWA: www.ngwa.org/flyin/Pages/default.aspx

February 27-28 TX
Emerging Issues in Groundwater Conference, San Antonio. For info: NGWA: www.ngwa.org/Events-Education/conferences/5013/Pages/5013feb12.aspx

February 27-29 ND
North Dakota Water Quality Monitoring Conference: State of Our Research, Information & Knowledge, Bismarck. For info: Mike Ell, mell@nd.gov, 701/ 328-5210, or www.ndwatermonit.org

February 28-March 1 DC
ACWA 2012 Washington, D.C. Conference, Washington. Washington Court Hotel. For info: Ass'n of California Water Agencies, www.acwa.com/content/event-registration

March 1 WA
Solar Power Seminar, Seattle. TENTATIVE. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

March 5-6 NV
2012 Lake Mead Symposium, Las Vegas. Tuscany Suites & Casino. In Conjunction w/Nevada Water Resources Ass'n Annual Conference. For info: Tina Triplett, NWRA, 775/ 473-5473 or www.nvwra.org

March 8 WA
Managing Stormwater in the Northwest Conference, Tacoma. Sponsored by Northwest Environmental Business Council. For info: Sue Moir, NEBC, 503/ 227-6361, sue@nebc.org or www.nebc.org

March 8 CA
Climate Change Adaptation Planning Course, Sacramento. Sutter Square Galleria, 2901 K Street. For info: UC Davis Extension, 800/ 752-0881 or www.extension.ucdavis.edu/landuse

March 9 WA
CERCLA & MTCA: Advanced Sediment Conference, Seattle. For info: Holly Duncan, Environmental Law Education Center, 503/ 282-5220, hduncan@elecenter.com or www.elecenter.com

March 14-16 DC
Western States Water Council Spring Water Policy Roundtable, Washington. L'Enfant Plaza Hotel. For info: WSWC, www.westgov.org/wswc/

March 15 OR
7th Annual Future of Oregon's Water Supply & Management Seminar, Portland. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

March 18-21 OR
2012 Sustainable Water Management Conference & Exposition, Portland. Marriott Waterfront Hotel. Sponsored by American Water Works Ass'n. For info: www.awwa.org/Conferences

March 20-23 LA
Environmental Awareness Bootcamp, New Orleans. Hilton Garden Inn French Qtr. For info: EPA Alliance Training Group, 713/ 703-7016 or www.epaalliance.com

March 22-24 UT
41st Annual Conference on Environmental Law, Salt Lake City. The Grand America. Sponsored by the American Bar Ass'n. For info: www.ambar.org/EnvironACEL

March 25-27 Quebec, Canada
3rd IWA-WEF Wastewater Treatment Modelling Seminar 2012, Mont-Sainte-Anne. Sponsored by International Water Ass'n & Water Environment Federation. For info: Bruce Johnson, bruce.johnson2@ch2m.com

March 25-27 CA
WateReuse California Annual Conference, Sacramento. Sheraton Grand. For info: WateReuse: www.watereuse.org/sections/california/conference