

## Groundwater Dispute Resolution Workshop: Background Material

November 5 & 6, 2014  
Stanford University

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### Introduction

Making decisions about appropriate levels of groundwater pumping, and allocating available groundwater among competing users, is a central issue for California and other western states. This workshop brings experts from a variety of fields together to discuss potential tools and processes to support sustainable groundwater allocation decisions.

Groundwater plays a crucial role in California's freshwater supply system. It provides nearly 40 percent of California's freshwater supply in average climatic conditions, and more than 60 percent during periods of drought and lower surface water availability. Groundwater provides a portion of the drinking water supply to more than 75 percent of all Californians. Many communities throughout the state rely exclusively on groundwater for their municipal and agricultural water demands.

This heavy reliance on groundwater pumping has resulted in declining groundwater elevations throughout much of the state. However, the rate of decline has increased markedly in the past few years, with many areas of the San Joaquin Valley reporting groundwater levels more than 100 feet lower than previous historical lows (DWR, 2014). Chronic lowering of groundwater elevations, or groundwater overdraft<sup>1</sup>, can lead to a breadth of serious environmental, economic, social impacts and conflict.

Groundwater managers in California have historically had limited tools to control overdraft, particularly where it is necessary to calculate the amount of groundwater available on a sustainable basis and reduce the pumping of existing users to achieve that level of use. One of the most powerful tools for doing this has been filing an adjudication – a lawsuit asking the court to establish the safe yield<sup>2</sup> for a basin and allocate it among users and water rights holders. Adjudications have had a mixed history in the state. Some adjudications have produced negotiated resolutions resulting in innovative and effective management regimes; others have been legal quagmires, where disputation, litigation, and related expenses carry on for years or even decades. The state has just passed a new law mandating a framework for sustainable groundwater management. Many localities will face difficult allocation decisions under this law, as they will have to draft "groundwater sustainability plans," and implement those plans to achieve sustainable levels of groundwater use.

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<sup>1</sup> Groundwater overdraft: the condition that results when groundwater withdrawals in a basin exceed the amount of recharge over several years. This condition results in persistent declines in groundwater levels that do not fully recover, even during wet years.

<sup>2</sup> The California Department of Water Resources defines safe yield as the amount of groundwater that can be withdrawn from a groundwater basin without adverse effects.

Stanford University's Water in the West is embarking on a research project to develop tools for reaching successful, negotiated resolutions to groundwater allocation decisions and disputes. These tools could be used under the new groundwater statute, or to assist in resolving adjudications. Convened by Stanford's Water in the West program and Stanford Law School's Gould Center for Conflict Resolution, this 1.5-day workshop aims to integrate groundwater policy and technology research to achieve the following goals:

1. Identify the major barriers groundwater management agencies, water users, and others confront in making groundwater allocation decisions, with a particular focus on factors that contribute to disputes. These barriers may include data limitations; modeling uncertainty or other model limitations; policy barriers; legal rules regarding groundwater rights; or problems with existing processes.
2. Determine the consistency of these barriers across groups and regions.
3. Solicit suggestions for practical and meaningful next steps in streamlining groundwater management and allocation decisions, and facilitating sustainable and negotiated resolutions to groundwater allocation disputes. These next steps could include exploration of improved models, study of better negotiating processes or other dispute resolution tools, more robust data, or new laws and policies.
4. Examine the possibility that information technology can aid in resolving disputes and what such tools would look like.
5. Develop a research agenda for designing dispute resolution tools tailored to the unique circumstances surrounding groundwater allocation and management.

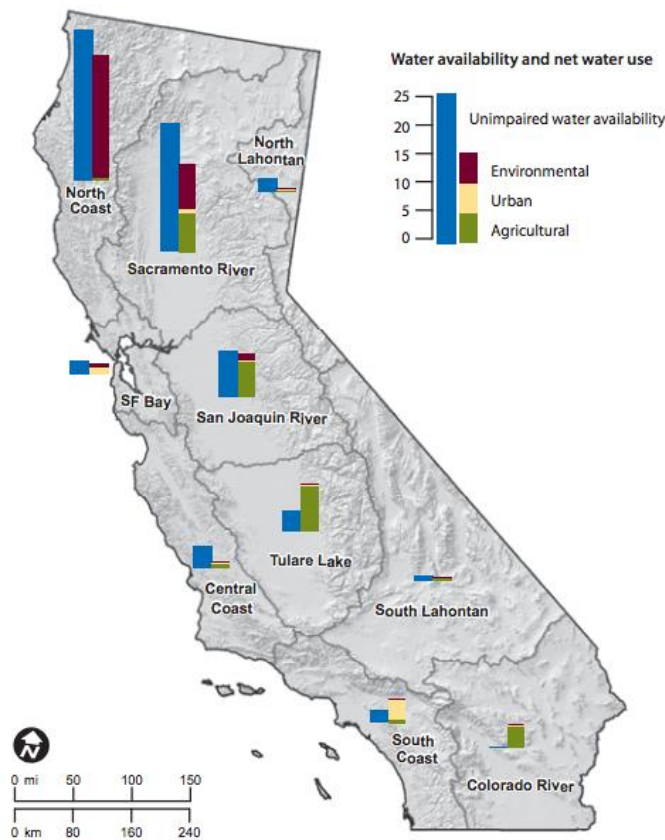
## Using this Background

This conference brings together individuals from a diversity of backgrounds to discuss current and anticipated barriers in groundwater allocation decisions under the new groundwater legislation and to develop an improved understanding of how conflict resolution tools and techniques can be used in successful groundwater negotiations and allocation decisions. Many conference participants are experts in groundwater management or conflict resolution, but not both. This background document provides an introduction to the major issues that will be covered during the workshop on November 5<sup>th</sup> and 6<sup>th</sup>, 2014. The document structure roughly follows the conference logic and flow. We have interspersed some of the questions that we seek to discuss during the workshop throughout this document. We hope you will consider these in advance of the workshop and bring specific examples of scenarios or situations that may help to answer some of these questions. This background provides an overview of the issues and some additional references to consult if you desire. We hope that it also provokes thinking and questions for you in advance of the conference. If you have suggestions, concerns, or thoughts you would like to share before the conference, please send them to Tara Moran (Program Lead, Sustainable Groundwater, Water in the West) at [tamoran@stanford.edu](mailto:tamorán@stanford.edu) or Amanda Cravens (Fellow, Gould Center for Conflict Resolution) at [acravens@stanford.edu](mailto:acravens@stanford.edu).

## Water in California: Facts and Figures

- California receives an average of 200 million acre-feet (maf) (an acre-foot water is enough to supply two to four families with enough water for a year) of precipitation each year (Water Plan, 2009).

- Just over 70 maf of the precipitation received flows to rivers and streams or infiltrates into groundwater aquifers where it can be used – the remainder is lost through evaporation and transpiration from plants.
- Water availability and use across the state varies immensely, both in the amount of water used and the sectors that use it. Net water use in Southern California far exceeds water availability (see Figure 1).
- Between 1920 and 1960, Southern California water districts focused on increasing imported water supply. However, as imported water sources became increasingly difficult to find and expensive to procure groundwater adjudications became more common.
- California’s first groundwater adjudication, the Raymond Basin Adjudication, was filed in 1937.



- Between 1998 and 2005 groundwater accounted for an average of 15 maf/year or approximately 25 percent of the state’s agricultural and urban water use. Owing to recent droughts, this number has increased in recent years to nearly 40 percent of the state’s total water supply.

- The California Department of Water Resources estimates that statewide overdraft of groundwater may be as high as 2 maf/year, with 1.4 maf/year of that occurring from agricultural use in the Tulare Basin.

- Agricultural use accounts for approximately 80% of all groundwater used in the state (Nelson, 2012).

**Figure 1.** Water availability and net water use by sector in California’s ten hydrologic regions. (Hanak et al., 2011).

## Groundwater Management and the Adjudication Process

Until recently, groundwater in California has been largely unregulated. This lack of regulation has resulted in groundwater overdraft in many groundwater basins throughout the state, and a host of direct and indirect impacts, including saltwater intrusion, land subsidence, the loss of wetlands and other groundwater-dependent ecosystems, reductions in surface water flows, and diminished groundwater quality. Oftentimes the impacts of groundwater overdraft can lead to conflicts between groundwater users seeking to protect their property rights. While the actual number of conflicts is difficult to determine due to the number and diversity of agencies involved in groundwater management, a study investigating groundwater - surface water conflicts found that they exist across the state in significant numbers (Nelson, 2104).

Legal rights to groundwater in California fall into three main categories. The first is overlying property rights. Landowners overlying a groundwater basin have “overlying” rights to pump the groundwater for reasonable use of the resource, as long as it does not harm other overlying property rights. These rights are often referred to as “correlative,” as all pumpers share the “safe yield” of the basin; they are roughly analogous to riparian rights in surface water law. The second category is appropriative groundwater rights. These rights are obtained when groundwater that is within the basin’s safe yield is used outside of the basin. Groundwater use by municipalities, even if they overlay the basin, are appropriative. Among appropriators, the rights are first in time, first in right. Finally, prescriptive rights can occur when users pump more than the safe yield of the basin for more than five consecutive years.

California does not have comprehensive regulation of groundwater pumping (although the recently passed law is intended to change that). Groundwater management has been done by a range of local governments and districts through a variety of means. Many groundwater basins have groundwater management plans (called AB 3030 plans), which are required for local government entities to obtain funding under certain state programs. However, the law behind these plans does not give groundwater management agencies the authority to monitor groundwater pumping, limit withdrawals through regulation, or levy fees to deter overpumping and pay for supplemental water. As a result, many basins with well-established groundwater management plans have continued to suffer the effects of groundwater overdraft. Some groundwater management agencies are specifically authorized to implement regulation, pumping fees, and other tools by state legislation specifically passed to create these agencies (these are often called “special acts districts”). Local groundwater management is a mixed patchwork that, overall, has not succeeded in stopping groundwater overdraft.

In many cases, adjudicating the water rights of all groundwater users in a basin through the courts has been the only effective means of stopping and/or reversing groundwater overdraft. Given the complexity of property rights, adjudication is often also the only way of clarifying users’ legal rights to groundwater. Twenty-nine of California’s 515 alluvial groundwater basins have been adjudicated or are currently in the adjudication process (SB 1168, 2014). Most adjudicated groundwater basins are in Southern California, with only two located north of Kern County: the Scott River Valley Basin and the Seaside Basin, in Siskiyou County and Monterey County, respectively. While some stakeholders appreciate the certainty and clear mandate adjudication can provide, the process itself can be time consuming, expensive, unpredictable, and largely driven by the narrow goal of attaining “safe yield” for a groundwater basin. Additionally, as pointed out by Enion (2013) many groundwater adjudications have not actually resulted in clear definitions of property rights and often favor the status quo, protecting the interests of large water users over smaller pumpers.

## Sustainable Groundwater Management Act

In September 2014, Governor Brown signed the Sustainable Groundwater Management Act (SB 1168, AB 1739, and SB 1319) into law. This legislation seeks to ensure that California’s groundwater is “managed sustainably for long-term reliability and multiple economic, social and environmental benefits for current and future beneficial uses.” In the law, sustainable groundwater management is defined as the management and use of groundwater that can be maintained over a 50-year time period without causing any “undesirable result,” a term which includes “significant and unreasonable” levels of aquifer overdraft, land subsidence, saltwater intrusion, and other negative consequences of overpumping.

The act provides clear deadlines for sustainable groundwater management objectives – groundwater

sustainability agencies<sup>3</sup> (GSAs) have 20 years from the time that their groundwater sustainability plan (GSP) is finalized to achieve their sustainability goal<sup>4</sup> – and authorizes several regulatory tools to help GSAs achieve these goals, including levying fees, regulating groundwater pumping, and metering wells. In essence, GSAs must balance the inputs and outputs of the basin through reductions in pumping, increased supply, or some combination of the two. While conjunctive use<sup>5</sup> will play an important role in meeting a groundwater basin’s sustainability goals, allocating available water among users and reducing groundwater extractions by existing pumpers is inevitable.

The statute requires agencies to consider the interests of, “all beneficial uses and users of groundwater...” in the development of GSPs. These interests include, but are not limited to: 1) overlying property owners, 2) municipal well owners (which do not have overlying property rights), 3) public water systems, 4) local land use agencies, 5) environmental users, 6) surface water users (if surface water and groundwater bodies are hydrologically connected), 7) the federal government, 8) California Native American tribes, 9) disadvantaged communities and 10) listed monitoring entities. We refer to these interests throughout this document (and at the workshop) collectively as stakeholders and interested parties.

The new statute does not change water or propriety rights, meaning that the murky system of correlative, appropriative, and prescriptive property rights amongst the stakeholders and interested parties could act as a constraint on the ability of GSAs to most effectively manage groundwater. Because the statute does not provide clear details on how to allocate groundwater based on property rights or the priority that these various rights should receive, GSPs remain vulnerable to adjudication if groundwater pumpers believe there has been a violation of their property right, or are unhappy with the terms of the GSP.

## Opportunities for Negotiated Resolutions

Given the burdens and costs of the adjudication process and the new mandate to allocate groundwater under the new statute, there is a major need for the development of policy recommendations and dispute resolution tools that can help to achieve groundwater allocation decisions that are negotiated, supported by the water users and other stakeholders, sustainable, and equitable for all parties involved. More work is also needed to determine the proper relationship between the new law and its framework and potential adjudications (currently adjudicated basins are largely exempt from the statute). Our hope is that this workshop will be a first step towards the project’s larger goals to develop processes and tools that can be used within the framework of the statute to create effective GSPs that avoid adjudication or other unnecessary conflict. We may also evaluate policy recommendations that facilitate these processes and better resolve the interaction between the adjudication process and the new law.

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<sup>3</sup> Groundwater sustainability agencies: one or more local agencies that implement provisions of the sustainable groundwater statute.

<sup>4</sup> Sustainability goal: the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield.

<sup>5</sup> Conjunctive use: the coordinated use and management of surface and groundwater supplies to increase yield and enhance water supply reliability.

Some of the questions that we seek to address are:

- What factors drive groundwater disputes?
- Are there patterns in adjudications that have been either extensively litigated or effectively resolved that we can learn from?
- What methods have been used in groundwater or other natural resource allocations to ensure a fair process for all stakeholders? Can we apply these proactively to the GSP development process?
- What role do data and data sharing play in the allocation and negotiation process?

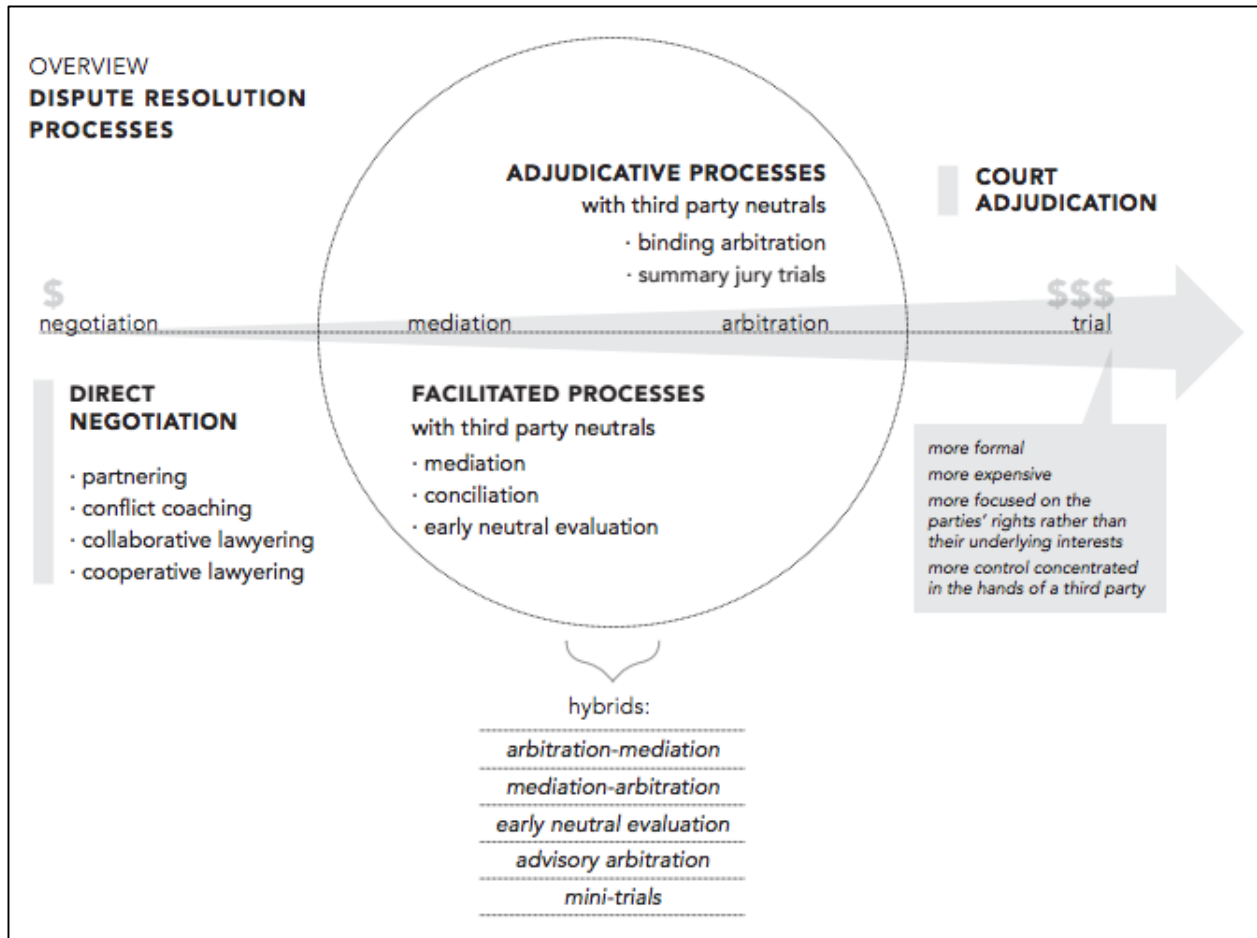
The complexity of groundwater allocation and adjudication decisions require that these issues be tackled using a variety of tools and incorporate a breadth of expertise. In addition to understanding groundwater from both the management and legal perspective, we are working with conflict resolution and collaborative technology experts to develop policies, processes, approaches and/or tools to foster sustainable groundwater allocation decisions.

## What is conflict resolution?

While its meaning might seem obvious, formal conflict or dispute resolution can be defined as a range of processes aimed at alleviating or eliminating sources of conflict.

Conflict resolution systems can be thought of as a spectrum (Figure 2). On one end is direct negotiation, where the outcome is controlled entirely by the stakeholders or interested parties based on mutually determined criteria. On the other end are court adjudications, where a judge makes a decision for the parties based on evaluation of their respective rights. Between these two are a range of processes which focus to varying degrees on helping parties uncover their interests and/or determine their rights. All the methods of resolving conflicts share certain basic functions, however: determining the issues in dispute, drawing boundaries of who will be included, determining a final outcome, etc.

In the California groundwater context, the most formal method for resolving allocation disputes is basin-wide adjudication in a court. When it comes to determining how groundwater will be allocated, the court system has a number of perceived weaknesses, including long timeframes to resolution, high costs, and the potential inability to find fair or sustainable outcomes, as decisions by definition are based on rights-based criteria (Enion, 2013). However, William Blomquist's work comparing past basin adjudications found that the most "successful" adjudications (e.g. Raymond, Central, and West basins) occurred when the court acted in a more fluid manner and parties had greater control over the eventual settlement (Blomquist, 1992; Blomquist, 2006). In other basins such as the Sonoma Valley and Santa Rosa Plain, collaborative processes were used to develop groundwater plans and allocate groundwater outside the context of a formal adjudication. This suggests both the drawbacks of adjudications carried out in adversarial contexts as well as the potential for making fluid agreements about allocation before the conflict has deteriorated to the point where a basin-wide adjudication has been filed. The hope of the conference is to identify common elements of the most successful adjudications and negotiations accomplished without adjudication in order to improve the chance for success in future cases.



**Figure 2.** Spectrum of Dispute Resolution Processes. (c) Copyright 2014 Lisa Amsler, Janet Martinez and Stephanie Smith, *Dispute System Design*, Stanford University Press.

## Collaborative Processes

In a variety of other arenas such as ocean and coastal planning, forest management, and surface water resources as well as in some groundwater basins, managers have successfully used collaborative processes to prevent or resolve conflicts over managing resources. These processes can serve to both reduce the costs of conflict, and also may produce more sustainable resolutions. Collaborative processes may take a range of forms, but generally share a number of characteristics. First, a professional third-party mediator or facilitator or an agency who can play a neutral role serves as an impartial figure, helping design the process and aiding parties in finding solutions they can all live with. (In the successful adjudication cases Blomquist studied, it seems the judge played an analogous role.) Second, the definition of the parties may be broader than within a traditional court process, where only water users have a role. Instead, a collaborative process may seek to involve those affected by the eventual decision. Third, the focus is on collaborative problem solving that meets all (or as many as possible) parties' interests, not on determining who has the "right" to water legally. This problem solving often uses the principles of interest-based negotiation, a framework that seeks to uncover the underlying things people care about (interests) rather than the things they initially say they want (positions). By moving to discussing interests rather than positions, parties may find there are ways to simultaneously meet many of their respective interests.

## How do neutral-third parties help those in conflict find agreement?

The toolkit that mediators and facilitators use is diverse. We are using “tools” as a broad term to refer to techniques or actions taken within a process that can encourage settlement of a dispute.

One category of tools is aimed at encouraging parties to develop trust and build relationships. Third party neutrals often focus on creating a safe space where parties feel heard and eventually develop a deeper understanding of the perspective of one another by, for example, encouraging storytelling about a natural resource or field trips to locations being managed. Similarly, mediators must help parties manage often strong emotions and eventually build trust. They might do this by building in unstructured social time at breaks and shared meals and set ground rules that require respect.

Another category of procedural tools relate to how the process is run while continuing to build parties’ trust in both the process and the facilitators. Parties will generally accept an outcome that is less desirable to them if they feel the process that was used to reach it was fair (Lind & Tyler, 1988). Examples of things mediators do to make a process feel fair include establishing ground rules about who will speak and when, and maintaining their own position of neutral very carefully.

Finally, third party neutrals draw on tools to help parties process information and grapple with the substance of the dispute. Especially in environmental disputes that have a lot of technical information, creating a shared understanding of the problem and the scientific facts is often a major challenge. There can be a tendency in environmental disputes for parties to use the complexity or uncertainty surrounding the facts or processes at issue to support their individual position, and for parties to stake out inconsistent positions on the facts or science. Tools that mediators might use to address these dynamics include joint-fact finding (where the parties decide together what is known, what information is missing and how it might be obtained, such as jointly commissioning a study), or developing a shared problem definition, which shifts parties from working against one another to working jointly to solve the same challenge. Similarly, agreeing what criteria will be used to evaluate alternatives can provide a joint way of looking at possible solutions.

## Using Information Technology in Conflict Resolution

In recent years, as information technology has become increasingly ubiquitous in daily life, mediators, managers, scientists, and government officials have become increasingly interested in using software to augment this existing conflict resolution toolkit. On one hand, environmental managers observe the potential of technology to transform the nature of cooperative work in environmental management as has happened in business, education, and other arenas (USIECR, 2009). Proponents claim that integrating software applications can create more efficient processes, greater accessibility for more stakeholders, social learning, better integration of local knowledge, and improved ability to process technical information. At the same time, the public increasingly brings sophisticated expectations when interacting with government, which means citizens are pushing agencies to adopt new technologies.

Interest in collaborative technology for environmental decision making is now widespread, spanning resource domains from land planning to transportation (Malczewski, 2006). Software types range from support for facilitation (e.g. polling or brainstorming software) to tools that help people work across distances (e.g. collaborative document editing or large-scale conference calls) to sophisticated tools used to directly support decision making. Successful pilot projects encompass a range of software types used for decision support, including collaborative modeling (e.g. Bourget, 2011), participatory use of



geographic information systems (GIS) (e.g. Wright, Duncan, & Lach, 2009), and multi-criteria geospatial decision support tools (DSTs) (e.g. Watts et al., 2009).

Collaborative technology can play a variety of roles in conflict resolution processes, making it important to consider potential impacts upfront, as mediators have long done for other elements in their toolkit (Cravens, 2014). For instance, the organization or interface design of models or decision support tools can privilege certain information, shaping the conversation in ways that make certain interests easier or harder to discuss. The social context in which software is implemented is also important. Those who build and implement technology may be perceived as part of a process, and their actions may influence whether the process is perceived to be fair or not. As this is still an emerging field, those integrating software into processes need to pay attention to the role software is playing, how it is helping meet process goals (or not), and how it is influencing social dynamics (for better or worse).

## Processes, Tools and Technologies for Groundwater Management

One of our hopes for the workshop is to consider how specific policies, processes, approaches and/or tools could streamline groundwater allocation decisions (either in negotiated processes pursued as an alternative to adjudication, as part of groundwater planning under the new statute, and/or as part of an adjudication settlement). Some of the questions we seek to address include:

- Under what circumstances would negotiated conflict resolution be preferable to other means of addressing groundwater conflict in a given basin?
- What barriers prevent the use of conflict resolution approaches?
- Which processes, approaches, tools, and/or technologies have you seen work effectively in basins with which you are familiar?
- What opportunities might software create in groundwater dispute resolution? What kinds of barriers do you see to using information technology in groundwater allocation decisions?

## Towards a Research Agenda

The overall purpose of the workshop is to inform the development of a research agenda that can help address these issues. Therefore, the final set of questions we aim to address relate to the role that research might play in improving groundwater allocation decisions. Specifically:

- What do we need to know that we do not currently know?
- What research or study designs might best be used to answer these questions?
- In which groundwater basins might it make sense to pilot or investigate particular approaches, processes, tools, and/or technologies?

We look forward to your input on November 5<sup>th</sup> and 6<sup>th</sup>. If you have suggestions, concerns, or thoughts you would like to share before the conference, please send them to Tara Moran (Program Lead, Sustainable Groundwater, Water in the West) at [tamoran@stanford.edu](mailto:tamor@stanford.edu) or Amanda Cravens (Fellow, Gould Center for Conflict Resolution) at [acravens@stanford.edu](mailto:acravens@stanford.edu).

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