

# Sierra Nevada Science Symposium: Policy and Institutions Synthesis<sup>1</sup>

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The policy and institutional dimensions addressed in this symposium were diverse and somewhat diffuse. Each panel was developed to include a political, policy, and institutional perspective. Some of these perspectives were shared from a policy-maker's point of view, others from the view of scientific and technical managers with responsibility for integrating science into planning and management. Others represented a science practitioner's view on how and under what conditions the policy world might absorb, integrate, and respond to new information.

In this short synthesis, we draw from several of the themes expressed in the symposium concerning the nether margins between science and policy, in which science shies away from oversimplifications and policy fears the arcane and complex. We do not claim to represent accurately or to summarize the individual presentations given by Baggett, Murphy, Nechodom, Ruth, Stewart, or any of the various keynote speakers. In fact, what we do say below may even run counter to the intentions of the other policy and institutions speakers. For that, we apologize and hope we have correctly captured the dominant themes. Our purpose is to summarize the perspectives and responses that managers and policy-makers have presented to the natural sciences at this symposium and to explore themes that come from the common threads presented by the policy and institutions speakers.

## On Wickedness

Hal Salwasser's keynote address framed the ongoing conflict in the Sierra Nevada as part of a more general problem of "wickedness" in conservation policy and management. To be clear, "wickedness" does not refer to nasty or intransigent agencies or interests. The term has become virtually a technical term, born in the public policy arena in the 1970s, during which some specialists in the political and policy sciences were trying to comprehend the repeated failures of a broad range of public policies similar to those of the seemingly endless revisions and amendments to the Sierra Nevada Framework.

In their seminal article, "Dilemmas in a General Theory of Planning," Rittel and Webber (1973) identified 10 characteristics of problems that seemed to elude successful solutions in public policy and planning. Although we will not repeat them in detail here, the underlying characteristic of wicked problems is that "problems" seem to elude "solutions," according to Rittel and Webber, "because there is no consensus on what the problems are, let alone how to resolve them." In other words, those who hold power and prerogative or actively pursue their interests through political processes do not agree on the very characterization of the problem at hand.

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<sup>1</sup> This paper summarizes policy and institutional dimensions addressed at the Sierra Nevada Science Symposium, October 7-10, 2002, Kings Beach, California.

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Whereas Rittel and Webber were focused on public policy problem-solving, during the same period, Alvin Weinberg was interested in the ways the utility of science itself became limited by debates about underlying values. Coining the term “trans-scientific,” Weinberg (1972) called into question the ability of science to resolve key conflicts on its own terms, because those trans-scientific problems were fraught with the kinds of value conflicts on which science must necessarily remain silent.

Salwasser cited several authors who have recently carried the concept of wickedness forward into conservation planning and decisionmaking. And he accurately, we believe, captured how wickedness manifests itself along the long, arduous, and circuitous path of Sierra Nevada land and resource management decisions. However, we wish to suggest that the wickedness Salwasser identified is complicated and compounded by some deeper currents. We classify the deeper currents into two themes: resource valuation and institutional capacity. Each theme has notable manifestations in the Sierra Nevada region, which we will briefly discuss below.

It is arguable that the United States enjoyed a brief period of non-wickedness in its forestry and public land management policies. This is not to say that public land management has ever been very easy. We are only suggesting that, at some time in our history, there was a broad “social consensus” about the purposes and disposition of the Federal estate. The beginning of this period might be marked roughly by the early days of the Progressive Conservation era and the establishment of the Forest Service under the Department of Agriculture. It probably came to a gradual, sliding halt after passage of the National Environmental Policy Act, the National Forest Management Act, and the 1983 amendments to the Endangered Species Act. In that three-quarters of a century, forestry, mining, water development, and other resource management concerns were underpinned by a broad consensus (again, we emphasize, not perfect agreement) about the public benefits that were to accrue to society by resource exploitation at unprecedentedly large scales. It is also soundly arguable that, in fact, those benefits had accrued to the public, perhaps in orders of magnitude greater than Gifford Pinchot, Teddy Roosevelt, or even William Mulholland ever imagined.

This is not an apologia for development in general, nor do we mean to excuse public agency intransigence or failure. The fundamental consensus that defined public land management through extraction and commodity production has profoundly and irrevocably changed its direction. Therein arises the new era of decisionmaking and problem solving in the Sierra Nevada and elsewhere—without the ability to define problems correctly or establish a common range of risk and uncertainty, it is impossible to pursue solutions that will “take” politically. We argue that the profound shift in public trust—not in the public trust doctrine itself, but in its focus and content—has contributed to a long chain of frustrated decision processes, which reflect primarily and relentlessly on the judgments of the trustees (Sax 1984; Sax 1993).

One can interpret the repeated conflicts between public land beneficiaries and trustees as a public and private renegotiation of the dynamic balance between two major social needs. On the one hand, property rights and the limited private capture of public values are built into our constitutional understanding of the relationship between private property and citizenship. On the other hand, resource management agencies have a fundamental obligation to maintain ecological integrity (and other non-market public values) as a public trust responsibility. In practice, these two requirements are often at odds with one another.

We would argue that this fundamental tension is irresolvable; further, it is designed to be irresolvable under our current form of government. To resolve this tension in favor of private property rights would condemn our Sierra Nevada region to a massive “tragedy of the commons.” To resolve in the direction of a complete “locking up” of the public lands would likely leave us with long-term ecological and economic consequences that many would find intolerable. Therefore, we have placed ourselves in a position in the Sierra

Nevada region where we cannot *not* manage. Much of the region is sufficiently altered from an ecological perspective that to “walk away” would invite wholly unwelcome consequences. This dilemma forces the trustees into a serious discussion about how much to manage and for what purposes, rather than *whether* to manage at all (and, it is well known that some interests think the risks of any management are higher than the risks associated with not managing at all). To recognize the need for some kind of management, we must also be prepared to answer the following questions: What are the desired future conditions of the region and its landscapes? And, who should be held accountable and responsible for achieving those conditions?

## Resource Values

Inherent in the struggle to define a “desired future condition” in the Sierra Nevada is a more fundamental conflict over values. By “values” we do not intend a vague definition of ethics or preferences. We mean to focus on what people and interests actually value, how they go about expressing those values, and how they try to ensure that those values are captured in assets to be preserved through public trust doctrine by public trustees. In shorter terms: What is it? What is it worth? and Who is responsible for protecting it?

The resource valuation problem in the Sierra Nevada is an institutional mis-match between wealth-generating and asset-protecting activities and how current institutions focus their resources. Much is made about the declining timber industry and the deleterious economic and social impacts of the dramatic fall-off in board-foot production during the 1990s. But as Stewart (1996) points out, the more significant sources of economic wealth in the Sierra Nevada have little to do with, and may actually be impaired by, timber production. Most higher-value economic activities in the region come from impounding water and providing recreational opportunities. Hydroelectric generation, developed water delivery, and a wide range of recreational and amenity activities contribute billions of dollars to California’s Gross Domestic Product (GDP) and far outstrip the contributions of the forest products industry. (This is not to say that forestry and forest products are not important or appropriate. In fact, there is a need for a very critical discussion regarding the forest products processing infrastructure needed to deal with the waste products from millions of acres of hazardous fuels reduction treatments. However, we leave that discussion to another venue.)

The point here is simply that we do not have methods or mechanisms through which we can adequately reflect the relative values of assets that we *de facto* consider of very high value. In perhaps the most technically sophisticated and intellectually honest attempt to date, the California Fire Plan (California Department of Forestry and Fire Protection 2004) has captured, in the Sierra Nevada region, the relationship between assets and values at risk from wildfire compared with the levels of protection allocated to them. Combining spatial analysis of land use and asset value data with local involvement, the Fire Plan compares what people say is valuable with what they actually allocate to protect those values, in terms of fire protection. Whereas “level of service” (that is, how many engines and initial-attack resources) in the Fire Plan may be a narrow reflection of how the public values its assets, in concept it is right on target. If we put a high value on these homes, watersheds, cell phone towers, transportation routes, sensitive habitats, and so forth, we will put resources in place to protect them from wildfire. This ignores, of course, the political problem inherent in any allocation of burdens and benefits. In several California wildland and resource protection cases, urban constituents often question the equity of having to pay for all their own fire services at home, while also being tapped to subsidize fire protection for rural and exurban dwellers elsewhere in the state.

A key problem that must be overcome is to select methodologies that allow public participants to recognize what they value and to compare their relative values under different trade-off scenarios. Not only do well-managed forests produce a variety of non-timber

products valued by the public, including predictable and clean runoff, trapping of pollutants, and recreational amenities, they also provide quality-of-life amenities—the classic “non-market values”—including open space, uncluttered viewsheds, and wildlife. The public is willing to pay huge, if difficult-to-measure, sums to secure many of these amenities, and they produce genuine markets that foster economic growth, including travel and tourism, restoration and wildlife protection, water marketing, and potentially carbon sequestration and other forms of individually transferable quota markets. There are several ways to establish common measures of value of non-market amenities. Some methods require fairly sophisticated research tools, such as contingent valuation surveys, in which respondents are prompted to reveal comparative values, willingness to pay, and willingness to accept. Very few studies of this nature have been conducted in the Sierra Nevada.

In another context, dozens of Sierra Nevadan hydropower facilities will go through relicensing procedures over the next decade, involving hundreds of millions of dollars in operational and non-power values. In every recent major relicensing process, several million dollars worth of studies have been ordered. Very few of them have included a full accounting of environmental and social values, particularly non-power or non-market values.

How might we account for the broader public interests in valuing Sierra Nevadan resources? Resource mobilization theory (RMT), a common method of analysis in the policy sciences, is an effective way to measure *de facto* public choice and values. Although the RMT analytical methods grew from attempts to understand the development and efficacy of social movements (McAdam and others 1996, McCarthy and Zald 1987), the approach is useful in examining how multiple interests use a range of resources to achieve political and economic goals. When applied in the Sierra Nevada context, an analysis of the resources mobilized to protect and enhance amenity and public safety values reveals an enormous investment landscape. We have not completed the analysis necessary to present precise numbers, but a thumbnail estimate puts the values of the resources mobilized in the billions of dollars.

How does this square with the mere millions of dollars invested by public agencies in forest and ecosystem management? Fairly poorly, in our estimation. Although the Forest Service is constantly harangued to manage vegetation in the Wildland Urban Intermix (WUI), urban and exurban development proceed apace, with attendant expectations that services are to follow and amenity values will be protected by someone. Current projections show the resident population in the Sierra Nevada growing from approximately 660,000 in 1990 to more than 1.3 million by 2020 and to more than 2 million by 2040.<sup>5</sup> These conservative estimates are based on *existing permitted development* and are therefore not at all speculative. The demand for emergency response, transportation of goods and services, water, electricity, fire protection, and so forth will only continue to grow in the next few decades, creating additional pressure to manage the public lands in the Sierra Nevada in accordance with exurban demands for amenity and safety values. All this is occurring within a context of a landscape that historically burned every 10 to 15 years. Fires of the past were generally of moderate to low intensity. As we have seen at this symposium, current fire conditions, with higher risks of severe and extensive fires, pose significant challenges to future managers and service providers.

One way to understand the demand for services is through a “public markets” lens. Quinn and Quinn (2000) maintain that simply looking at actual market exchanges (in other words, payments for goods and services) misses the more important picture. The trading of goods

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<sup>5</sup> Population estimates vary widely for the region. Some of the larger variances come from counting total population in the 23 California and Nevada counties in which the Sierra Nevada range lies. This method renders projections of up to 6.8 million residents “in” the Sierra Nevada region by 2040. A more conservative estimate uses the regional boundary established for the purposes of the Sierra Nevada Ecosystem Project (SNEP 1996) at 1,000 feet above sea level, excluding much of the valley and low foothill development. These projections foresee approximately 2 million residents by 2040 (see Duane 1996; Duane 1999).

and services falls into the category of “tradable property rights.” The most obvious form of tradable property is simply buying something like real estate. Property values are relatively easy to establish (generally what the market will bear); however, creating markets for environmental goods is more challenging. Good examples would be “cap-and-trade” or pollution trading mechanisms for criteria air pollutants in some air basins. A power plant in Arizona, for example, may find it more economical to continue to put several tons of SO<sub>4</sub> into the atmosphere by purchasing SO<sub>4</sub> credits from someone who has “banked” the pollution rights in California by SO<sub>4</sub> reductions, rather than invest in additional scrubbers on their stacks. Conservation easements function in largely the same way: a value is placed on the ecosystem services provided by not developing the land and keeping it in a condition closer to a natural habitat. Dozens of land trust transactions are negotiated annually on precisely this premise, wherein a landowner is paid a negotiated amount for leaving a given portion of his or her land in an undeveloped condition for a predetermined period of time. In many cases, conservation easements play critical roles in development mitigation banking, further emphasizing their roles in markets for goods and services.

Three other mechanisms for the expression of value are not generally analyzed to understand how the public values its common assets. First, there are regulatory mechanisms, such as any number of environmental quality requirements that are mobilized on behalf of the public or narrower private interests. For example, if one were to pay 15 lawyers to intervene in a procedure to relicense a hydropower dam, in order to realize non-power benefits from the impoundment of water, one would be investing in the protection and enhancement of a certain suite of values inherent in the water and its uses. Similarly, mobilizing resources to achieve the listing of a given species is an expression of value through regulatory mechanisms.

Insurance-like mechanisms are a second form of pursuing values. These mechanisms structure trade-offs under uncertain circumstances, such as a Habitat Conservation Plan (HCP) under section 10 of the Endangered Species Act. Negotiating “incidental take” of a species is a way of hedging impacts. If, for example, a developer can specify a given level of risk he or she is willing to take in order to derive wealth from a new resort, an HCP enables public and private interests to negotiate a trade-off value for the species in question and hedge each others’ risks. These hedging strategies can be monetized, although one needs to proceed with caution in this regard. One may be able only to establish differences in monetary equivalents at orders of magnitude, but they are still potentially significant indicators.

Finally, “targeted taxation” functions as another indicator of value. This mechanism is used frequently to express public value or protect public goods and is different from taxation in that it creates general revenues (such as an income or a property tax), unit fees, or charges that are designed to offset the externalities or impacts associated with a given activity. This is an effective way to aggregate demand for a service or good that cannot be sold or traded at a specific level. For example, allowing biomass power plants to reduce their Federal tax rate by using forest thinnings for fuel to offset wildfire occurrence has been under legislative consideration for some time. Governments are uniquely positioned to encourage or discourage certain behaviors by creating tax incentives to achieve public purposes. As Quinn and Quinn observe:

*Unit charges set at a level where total revenues just offset total externalities make the total market more efficient and provide added incentives for producer innovations and voluntary consumer choices of more cost-effective products or services. Assessing fees or taxes on those who are currently or potentially charging the society for their support (for example, energy, water, fertilizer, or gasoline consumers) makes more economic sense than do general sales or income taxes, which affect those selling services or products at full cost.*

In the Sierra Nevada context, all four of these mechanisms are already used to shape the landscape and decision spaces of public agencies and private interests. Using this lens, we find a tangled web of values, each expressed through multiple lines of interventions and market-like mechanisms, at varying scales. A comprehensive analysis of public choices and competition for benefits would reveal clear separation among actors and interests in pursuing a broad range of resource exploitation and conservation goals. Nechodom and Quinn have attempted to capture this by mapping the broad categories of commodities and amenities against the scale at which a range of interests pursues their goals. This mapping exercise is still under development and is presented here to suggest ways the configuration of institutions and policy in the Sierra Nevada might change to respond to actual pressures in the human and ecological systems in the region.

Figure 1 illustrates ways in which purchasers (a general term for consumers, investors, and voters) act on their interests from entirely different scales of concern. The global purchaser, for example, may be more interested in where carbon sequestration credits can be procured most efficiently and has very little interest in locational amenities. His or her interest is substitutable and can highly complement other consumers' interests (for example, carbon sequestration is potentially very efficient in many parts of the world and can contribute substantially to locational amenity values while creating local employment). In contrast, if a purchaser's primary interest is in locational amenities, substitutability is limited (for example, one seeking a parcel in an eastside pine forest for a retirement home is unlikely to be equally satisfied with a parcel in sagebrush steppe). We believe that understanding the system in which values trade-offs occur at various scales, using the above measures of value-seeking, will help explain where there are high degrees of complementarity and low levels of conflict among purchasers seeking amenities. This approach will also help identify where conflicts are likely because of lack of substitutability or complementarity among purchasers and amenities. The thickness of the lines in the diagram (fig. 1) suggests the extent to which these pathways are currently implemented in the Sierra Nevada region.

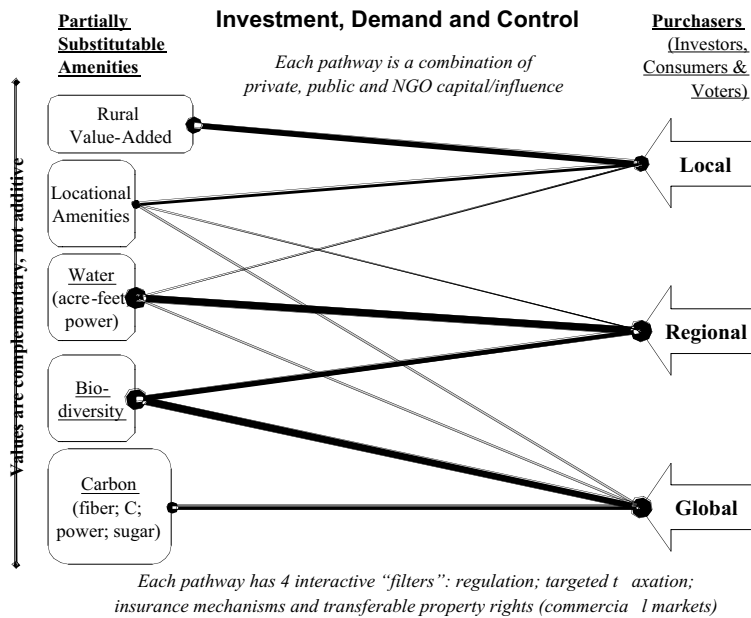


Figure 1— Mapping amenities, demand and investment at local, regional and global scales. NGO, nongovernmental organization.

Each of these forms of expressing value is preceded by political processes. One cannot simply create a new tax or monetize the value of a species by fiat. A political process must take place by which the premises and the values are negotiated. This naturally begs the question of access, transparency, and power. Who gets to determine what combination of market-like mechanisms to use? Who participates in placing values on a given asset? The power to participate, influence, and derive benefit depends largely on capacity among institutional and individual actors. Political science and sociology have long focused on measuring institutional capacity and human capital. The literature is too broad to cite here. We focus on institutional capacity in our summary below to highlight how appropriate venues might be established for negotiation among conflicting values in the context of conservation and natural resources decision making.

## Capacity

We define capacity as the ability to respond to opportunities or to accomplish something. Institutional capacity refers to the ability of any given organization or institution to respond to demands and mandates through use of its authorities, resources, and prerogatives.

Where and how humans derive wealth and benefit from Sierra Nevada ecosystems do not “map” adequately onto how institutional prerogatives and jurisdictions are arranged. Duane (1996, 1999) has shown that patterns of development and the demographics that follow are likely to be more important drivers of institutional investment than any other force in the Sierra Nevada. As exurban populations begin to populate the region, demands for roads, schools, sewers, water, fire protection, and a whole host of amenities increase dramatically.

The jurisdictional “footprint” that controls development patterns (largely land-use planning at the county level and transportation planning at the State level) is not well equipped to deal with the landscape-scale impacts of housing, water, transportation, and other infrastructure development. The California Environmental Quality Act (CEQA) focuses on the project level, and rarely does a case require mitigation or even analysis beyond immediate environmental or transportation impacts (despite a requirement in the language of CEQA that cumulative impacts be examined). This piecemeal pattern is parallel to the “nibbled to death by NEPA” problem described by Federal land managers in the Sierra Nevada. From the interim California spotted owl (CASPO) guidelines through the Sierra Nevada Framework, decisions have been driven by an increasing need to focus analysis and decisionmaking at the landscape level. The scale of planning and analysis is expanding, whether the concern has been driven by a concern for metapopulations of a given species or for meeting the challenges posed by wildfire at manageable geographic scales. Institutional resources have been slow in catching up. Although analytical technology may have improved by leaps and bounds, the decision space has not caught up with the scale of the problems to be addressed. Nechodom and Leisz (2000) found in a study of county capacity that local planning organizations have neither the mandate, the resources, nor the will to participate in planning and decisionmaking beyond the immediate confines of CEQA scale projects (Nechodom and Leisz 2001).

## Who Is Minding the Landscape?

Landscape-level planning and management are required to achieve desired results for fire behavior, species conservation, and watershed protection. However, the institutional constellations of mandates, prerogatives, authorities, and responsibilities are not well suited to accomplish those goals. Institutions are rewarded for accomplishing goals and solving problems that fall largely within their own jurisdictions. Many of the landscape-level problems that are driving decisionmaking are multidisciplinary and multijurisdictional. This fundamental problem has become increasingly manifest in the Sierra Nevada region.

Wildland fire suppression is probably the most highly developed form of interagency planning and management. The incident command system, on the whole, works extremely well to integrate Federal, State, and local fire suppression resources. And yet, wildfire suppression is roughly the equivalent of martial law: many rules are suspended, or exigency rules take over. The goal is to put the fire out (notwithstanding the occasional “wildland fire use” burn, which in itself requires enormous planning and suppression capability). The efficiencies of the incident command system and wildland fire-fighting techniques do not translate well to preventative management strategies or long-range planning requirements.

The most important differences between the rarified atmosphere of fire fighting and the complexities of planning and management lie in how we assess, plan, and act under conditions of risk and uncertainty. Clearly, wildfire is rife with high risk and uncertainty. But in the wildfire situation, risk, and uncertainty are managed under relatively strict protocols: protect life and property; preserve ecological assets where possible; and do as little damage as possible in the course of suppression. Very little time and energy are spent wondering about stochastic ecological processes or whether strategically placed thinning operations change fire behavior at the landscape level while the fire is burning. The more difficult questions arise between occurrences of fire (for there will always be fires on Sierra Nevada landscapes). Addressing the more difficult questions of where and how much to thin, what impacts are acceptable (or desirable) on select suites of species and their habitats, or the economic impacts of different management regimes requires appropriate and constructive venues of discussion, analysis, and decisionmaking.

Adaptive management has been the answer of choice to the question of appropriate venues and processes for addressing complex landscape-scale problems. Although there is considerable debate over whether adaptive management can be implemented at large scales, we leave the discussion of design and efficiency to other investigations. However, the institutional capacities to host, convene, oversee, and implement adaptive management are of key concern. Adaptive management, even in its most rudimentary forms, requires consensus on relative risk and uncertainty. For example, pesticide impacts on mountain yellow-legged frogs might be deemed to be of such high risk and uncertainty that adaptive management of Sierra Nevada grazing allotments and Central Valley pesticide use over a 10-year period is warranted. Immediately, one sees the likely points of controversy in this example: Who decided that survival of mountain yellow-legged frogs represented high risk or management uncertainty? Who is responsible for ensuring that monitoring is correctly designed and implemented? Who interprets the monitoring data? Who is obligated to do anything if the data show increased risk or harm?

In their very form and nature, these are political and institutional questions. Who decides? Who is responsible and accountable? In short, to perhaps misappropriate Robert Dahl’s classic study of democracy: Who governs? (Dahl 1961). Adaptive management is an essentially political process, despite the fact that a high degree of technical and scientific knowledge must be engaged for it to work. If one of the intended outcomes of adaptive management is to require an obligatory response to new information, there must be adequate transparency, accountability, and political will in the system to ensure that it does not stop dead when unpleasant facts are found.

When well executed, adaptive management represents a form of institutional learning and equips managers to use the outcomes of past and present decisions made under conditions of uncertainty to decrease uncertainty in future decisionmaking. However, in order to do so, both experimental design and follow-up monitoring need to be sufficiently coordinated so that analysis can be conducted. This requires a certain degree of institutional control. In reality, because most ecosystem level problems occur across multiple jurisdictional lines, institutional control of the adaptive management process requires a high degree of inter-institutional collaboration; therefore, reducing management uncertainty over large landscapes through transparently accessible analysis and adaptation necessarily means that a

number of institutions and agencies have to work closely together. They must create meta-institutions among several disparate institutions.

To our knowledge, no institutions are currently in place, with processes currently under way, that are capable of taking on anything more than the narrowest problems under an adaptive management regime in the Sierra Nevada region. It is highly unlikely that any one institution is capable of or willing to take on system-wide issues. And yet, these kinds of issues are currently considered impediments to active public land and resource management in the Sierra Nevada region.

In this light, if our assumptions are correct, we propose that adaptive management offers three key opportunities. First, if the adaptive management regime is designed with openness and transparency, it is highly likely to offer legitimate seats at the table for those who will otherwise pursue their interests by other means. In other words, will we deal with our conflicts in a court before a judge or across a table covered with maps and flipcharts? This is the structural dimension of adaptive management that is still yet to be confronted by Sierra Nevada institutions and actors.

Second, adaptive management gives dissenters an opportunity to collect information to assess the outcomes and, therefore, the future appropriateness of management decisions with which they disagree. Although it is not a risk-free strategy, adaptive management processes can increase the likelihood that decisions will be based on facts and not brute political force. Of course, it is important to acknowledge that the dissenters may be just plain wrong.

Finally, adaptive management offers a powerful vehicle for moving past wickedness. If limited experimental management actions are taken and monitored by legitimate, peer-reviewed protocols, the results become available to all. We assume that, over time, a “library” of collective experience focused on implementation of vegetation, fire, and habitat management experiments will lend itself to greater and greater public confidence in the public trust agencies. But that is a superficially political result. On a deeper level, adaptive management can be a way of resolving endemic and persistent wickedness for the reasons we describe below.

## **Conclusion: Whither Wickedness?**

Wickedness, we recall, is characterized by not being able to agree on the very premises or definition of the problem—all solutions are confounded by interminable conflict. In the Sierra Nevada context, the inability to agree on the nature of the problem arises, as we argue above, from fundamental differences of opinion and perception about the disposition of the Federal estate. Salwasser argues that wickedness can often be resolved by better science. We propose that wickedness is not resolved simply by better science, but in the way science is linked to deeper political processes. Good politics, generally speaking, takes conflict seriously enough to place facts and values on an equal footing and ensures sufficient exposure of assumptions and positions. It is one of the ways that trans-scientific problems can be addressed.

If adaptive management regimes are designed as if politics mattered, they will naturally cause the participants to visit the first principles that lie behind their assumptions. Adaptive management becomes, therefore, a venue of political negotiation of incommensurable values in a controlled, rule-bound environment whose purpose is to accomplish management outcomes.

Our conclusion, if somewhat speculative, is that we will find new purposes and an emergent social consensus by reverse engineering adaptive management. Conducted in a transparent and scientifically informed way, adaptive management will produce a series of outcomes that will focus us on our fundamental purposes. We will eventually be forced to agree, even if the common decision space is initially quite narrow, on the nature of the problems we are

trying to solve. Without adaptive management, as we have described it, the alternative is clearly visible. The default position of any public trust agency is to act according to its own interpretation of the mandate or charter given to the trustees. Without some kind of democratic checks on the interpretation of the agency's charter, agencies will tend to confuse their charter with the operational imperatives that keep them in business. Eventually the need to survive will merge with the public trust mandate, resulting in a circular mandate simply to survive.

We believe that adaptive management in the Sierra Nevada could break that endless loop and encourage a political environment adequate for the ecological environment. One might even posit that, if the Sierra Nevada's ecological health is worth fighting to save, perhaps its political ecology is equally worthy of struggle and sacrifice to ensure its health and integrity.

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