



Human Dimensions Chapter

December 20, 2016

Ashley Dayer, Ph.D.
Ron Meyers, Ph.D.

Table of Contents

Abstract	1
Introduction	1
Methods	4
Priority Topics	5
Hunters	6
Farmer Behavior and Programs	7
Non-hunting Recreationists	8
Urban Residents	9
Ecosystem Services	9
Environmental Justice	10
Multiple Benefits	11
Recommendations	12
Human Dimensions Research Agenda	14
Conclusion	17
Bibliography	17
Introduction	17
Hunters	18
Farmer Behavior and Programs	19
Non-hunting Recreationists	20
Urban Residents	21
Ecosystem Services	23
Environmental Justice	24
Multiple Benefits	25

Abstract

The Central Valley Joint Venture (CVJV) has taken the bold step to develop a human dimensions chapter for the 2016 Implementation Plan revision. To accomplish this, we reviewed CVJV guiding documents and met with the CVJV staff and partners to assess the priority areas for human dimensions inquiry for the CVJV. The priority topics focused on human dimensions aspects of four key stakeholder groups (hunters, farmers, non-hunting recreationists, and urban residents) and three key issues (ecosystem services, environmental justice, and multiple benefits). We conducted an extensive literature review to identify and succinctly summarize findings from the human dimensions research relevant to wildlife conservation. We concentrated on literature from the Central Valley and California, but presented regional or national results if relevant and important. Finally, based on what was found, we provided recommendations that informed the content of other strategy chapters in this Plan. In this chapter we recommended next steps for human dimensions research to fill important gaps in knowledge, relevant to the work of the CVJV.

Introduction

Human dimensions, defined broadly, is: “everything in conservation that is not about wildlife and habitats” (adapted from Decker et al. 2012). More specifically, human dimensions is “a field of study that **applies the social sciences** to examine human-wildlife relationships, and, in doing so, provides information that contributes to effective wildlife conservation efforts” (Manfredo, 2008). This definition guided the approach to identifying the human dimensions needs of Central Valley Joint Venture in this chapter.



Figure 1. Human dimensions is everything in conservation (represented in blue circle) that is not about wildlife and habitat (represented in the pintail/wetland image).

Human dimensions includes many disciplines, including psychology, sociology, anthropology, economics, communications, education, geography, social marketing, recreation and leisure, political science, and planning. (For more information on the various disciplines in human dimensions, see Bennett and Roth 2015). Yet, much of the research in human dimensions is interdisciplinary within the social sciences (Bennett and Roth 2015). For example, a human dimensions of wildlife study might simultaneously employ theory and methods from social psychology and policy. Increasingly though, socio-ecological interdisciplinary research is conducted, bringing together social and biological sciences and

scientists to address conservation challenges. Often a coupled human-natural systems approach is used in this research. Yet, while there is interest in more collaboration, this field is still developing and barriers to integration of the social and natural conservation sciences exist (Fox et al. 2006).

Human dimensions research is often thought of as only conducting surveys or polls to acquire necessary data and information about the people or issues of interest. Indeed, human dimensions researchers employ mail, phone, web, and face-to-face surveys. But interviews, observation, document or web review, and focus groups are also commonly used. Mixed methods, incorporating both quantitative and qualitative research, are growing in popularity to allow for both breadth and depth of results. (For more information on these methods, see Connelly et al. 2012).

Human dimensions can be applied in conservation in an adaptive management (or strategic habitat conservation) type approach, similar to the biological sciences. In doing so, we study what people think and do related to conservation, understand why, incorporate that understanding into policies and programs using best practices for engaging people, and evaluate results (Brown et al. 2001). Human dimensions research informs applied work such as education, outreach, and communications. For example, strategic communications and social marketing use human dimensions research results as the basis for recommendations and strategies. The practical applications also extend to conservation planning (e.g., developing ecologically and socially informed goals), stakeholder engagement, conflict management, monitoring and evaluation, and collaborative conservation (Sexton et al. 2013).

When the field of human dimensions of natural resources emerged in the 1970s and 1980s, it initially focused primarily on recreationists, wildlife conflict, and harvest management by agencies. Broader applications of human dimensions to bird conservation have been more recent. Within the past few years, the national bird conservation initiatives have released conservation plans that call for more extensive human dimensions research. Partners in Flight's *Saving Our Shared Birds: A Tri-national Vision for Landbird Conservation* highlights social science research needs. Likewise, the 2012 North American Waterfowl Management Plan (NAWMP) Revision (entitled *People Conserving Waterfowl and Wetlands*) refers to the three-legged stool of conservation as including people, habitat, and birds. To implement the NAWMP revision's goal of "Growing the number of waterfowl hunters, other conservationists, and citizens who enjoy and actively support waterfowl and wetlands conservation," the NAWMP Plan Committee and the National Flyway Council are jointly organizing a Human Dimensions Working Group to address the human dimensions research needs in waterfowl and wetlands conservation. Similarly, the North American Bird Conservation Initiative, U.S. Committee, has created up a Human Dimensions subcommittee, which fundraised for the initiation of a National Bird Conservation Social Science Coordinator position to aid in building social science capacity of the bird conservation community. This position will be based in the Dayer Human Dimensions Lab at Virginia Tech, starting January 2017.

This growing interest in human dimensions is largely due to the recognition of three important aspects of bird conservation:

1. The solutions to our conservation challenges don't require changes in bird behavior: they require changes in human behavior. For example, to address habitat loss, a goal

could be to have more land under conservation easement (an action by landowners) or change land use policy (an action by local planning boards). In order to effect positive changes in human behavior, we must understand the behavior and what causes it, just as we aim to understand bird behavior or population dynamics to inform our conservation design strategies.

2. Conservation isn't something we do to people, it's what we do for and with people. This idea is familiar to government agencies that manage land and wildlife for the public and also to non-profit organizations that undertake activities supported by their boards and members. In order to serve our publics or our members, we must understand their interests.

3. Every day we make numerous conservation decisions based upon our beliefs about what people think and what influences their behavior. As we understand people better, our knowledge, and thus our decisions, are better informed. It has become clearer to the field that science-based decision making for conservation must be informed by both the biological and social sciences. Human dimensions offers theories, methods, and information to better understand people's perceptions and behaviors, the driving forces behind them, and how people's behaviors can benefit or serve as barriers to conservation success. Thus, human dimensions can inform conservation strategies best suited to address the breadth of perceptions and behaviors influencing conservation.

Joint Venture Coordinators have called for further human dimensions integration as part of their vision for the future of bird habitat joint ventures. Yet, most Joint Ventures have limited experience with human dimensions to date. Although there are multiple insertion points for human dimensions information into the Strategic Habitat Conservation based work of Joint Ventures (see Figure 2 below), Joint Venture efforts have been largely biological science-based. Some Joint Ventures have conducted landowner research, partnership surveys, and/or integrated social data layers into their planning efforts. To the best of our knowledge, no Joint Venture has yet developed a human dimensions research agenda or strategy.

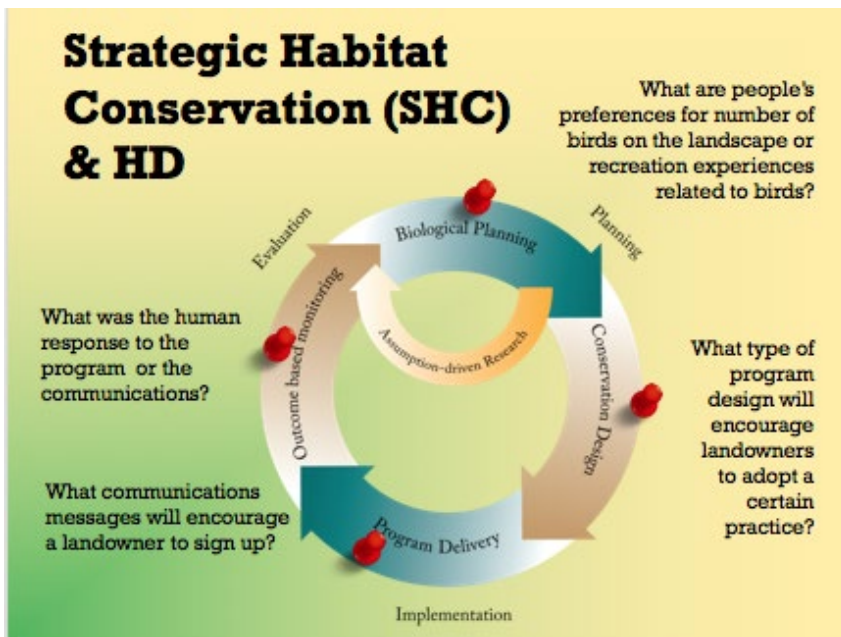


Figure 2. Human dimensions research can help improve all aspects of the work of a Joint Venture. For example, in the case of private lands conservation, human dimensions research questions are important to consider in every phase of a Joint Venture's work, including biological planning, conservation design, program delivery, and monitoring.

The Central Valley Joint Venture (CVJV) Management Board and staff recognized the centrality of human dimensions research to their work, particularly in informing a new communications plan. For example, they recognized that their knowledge of their audiences and how to engage them was based largely on assumptions or anecdotal information, rather than the best available science that might be available in the literature or need to be conducted in the future to improve their work. In 2015 a Human Dimensions Working Group formed to develop a Request for Bids for a human dimensions contractor to develop the CVJV's (and, to our knowledge, all migratory bird Joint Ventures') first human dimensions chapter of their Implementation Plan. This purposeful approach for identifying and understanding human dimensions needs and creating a research agenda has been described as essential for conservation organizations to better engage the social sciences (Bennett & Roth, 2015).

The purpose of this human dimensions chapter was: 1) to identify the most important human dimensions research topics for the CVJV; 2) to review existing literature that can shed light on those topics; 3) to develop recommendations for conservation strategies, policy, and communications based on the literature; and 4) to identify future human dimensions research needs to guide and improve the conservation work of the CVJV partnership.

Methods

To identify the topics of interest to the CVJV, a needs assessment was conducted. We solicited feedback from staff and partners. We also met with the Lands Committee to discuss the social landscape and human dimensions of habitat conservation issues in the Central Valley. We then talked by phone with staff, Implementation Plan chapter authors, board members, and other partners to gather their thoughts on human dimensions needs of the CVJV. Additionally, we reviewed guiding documents for the CVJV, such as the 2006 Implementation Plan and draft chapters of this Implementation Plan. Thirteen topic areas emerged from our discussions and document review. With feedback from the staff and the Implementation Plan Update Committee, we determined the top seven topics to address in this chapter.

For each of the topics, we conducted a literature review by identifying key terms used in the human dimensions research for each topic. We then used library online catalogues and Google Scholar to find abstracts and the full text of peer-reviewed articles, other scientific publications, books, and polling data on the topic. Within each identified research topic, we sought publications that directly addressed the CVJV region first, then broadened to California, then the western U.S., then elsewhere in the U.S. For topics of interest to the CVJV that had little research conducted in the U.S., research from other nations was included where it seemed applicable. We identified the most salient publications (~15-20/topic) with insights on human behavior related to conserving wildlife habitat. The full

literature review, including up to ten lessons learned/topic, is available online [[LINK](#)]. A short summary of the literature is provided in this chapter.

Priority Topics

The priority topics focused on human dimensions aspects of four key stakeholder groups (hunters, farmers, non-hunting recreationists, urban residents) and three key issues (ecosystem services, environmental justice, and multiple benefits). A short summary of the topics is listed here with more information below.

1. Waterfowl hunting recruitment, retention and reactivation, and how to maintain hunt club ownership of land
2. Farmer behavior related to wildlife habitat and how to engage and support them
3. Non-hunting wetland recreationists' attitudes toward waterfowl and how to foster support
4. Urban residents' thoughts about water, wetlands, and wildlife conservation, and determinants of support for water allocations for wetland birds
5. Incorporating social information into ecosystem services research and how to message about ecosystem services
6. Socio-demographic differences in the Central Valley, environmental justice issues and how to communicate/engage
7. Effectiveness of methods for developing strategies for multiple benefits

For hunters, we identified trends in the number of waterfowl hunters in California (on public and private lands), predictors of these trends, and how to best support/create programs for recruitment, retention and reactivation of them. We also looked for insights on how to maintain/increase hunting club ownership of land as a potentially important strategy to increase waterfowl habitat.

For farmers, we examined farmer beliefs, attitudes, and behavior related to wildlife habitat and how to best support/create programs for habitat. We also investigated what motivates rice farmers (and to a lesser degree grain and non-grain farmers with access to water) to: implement wildlife-friendly practices and enroll in habitat incentive programs. We also explored how to best support farmer conservation practices that benefit waterfowl.

For non-hunting recreationists (e.g., birdwatchers, photographers) we researched their attitudes toward waterfowl and wetlands and potential mechanisms to engage them in supporting (through financial and other means) wetlands conservation. We also considered how the NAWMP HD survey currently underway might be used at the CVJV scale to help fill information gaps on this topic.

For urban support of wetlands, we synthesized the literature pertaining to urban residents' beliefs about water, wetlands and associated wildlife conservation (particularly in Central and Southern California), predictors of those beliefs, and what determined if they supported allocation of limited water resources for wetland birds.

For the topic of ecosystem services, we focused on comprehensive ecosystem service evaluations, including the human dimensions of ecosystem services of wetlands/habitat for birds. We also addressed how to effectively message about ecosystem services to a variety of audiences (e.g., policy makers, decision makers, public).

For the topic of environmental justice, we summarized socio-demographic and socio-political differences within the CVJV boundary and how this relates to environmental justice issues. We considered how this would influence communications and engagement strategies with these communities. We included information about the federal guidelines for assessing environmental justice issues for federally-funded projects.

For multiple benefits of wetlands, we reviewed best practices for developing multiple benefits (“co-benefits”) of water - including the importance of flood control, urban use, recreationists, wildlife (including fisheries), and rice growers. We sought 'win-win' multiple benefits scenarios and strategies for organizations and the public to identify and agree upon the solutions.

Hunters

The number of duck hunters in California declined 63% from 1971 to 2015 (CDFW 2016). This group is primarily composed of rural residents (75%), males (91%), and whites (88%) (USFWS 2013) – a significantly different demographic profile from the population of the region (see Environmental Justice section). According to wildlife value orientation research, increasing urbanization is associated with a value shift away from utilitarianism and hunting. Therefore, these declines are likely to continue unless new approaches to hunter recruitment, retention and reactivation (HRRR) are developed and utilized (Teel et al. 2005). Recommendations have been made to better understand growing segments of non-traditional ethnic groups participating in waterfowl hunting to reverse these trends (Hunt 2016). Innovative approaches to design HRRR programs, such as Vermont’s stakeholder conference to identify strategies to increase the number of hunters and improve habitat management, are needed and hold some hope to slow these declines (Vermont Fish and Wildlife Department 2007).

Thorough HD frameworks offer insights into the multi-faceted nature of HRRR – and the need for complex solutions. According to a recent comprehensive framework, “social habitat model” (Larson et al. 2014), hunters need quality social habitat to flourish, just as animals need quality habitat to survive. Three types of social habitat are needed: the micro level (the hunter, their family, hunting friends, and hunting mentors); the meso level (community support networks, including extended family and peers, and local access to hunting opportunities); and the macro level (demographic changes, urban areas expansion, habitat fragmentation, and agency policies).

A particularly problematic research gap for HRRR and hunter support for waterfowl habitat is the dearth of information about duck hunting clubs (hunt clubs) in the Central Valley. Hunt clubs have long protected wildlife habitat, especially for waterfowl (Hall 2011). Brown (2008) identified 351 hunt clubs in California whose management practices have significantly improved wetlands protection/restoration. However, we found that little to no research has

been conducted on how to best support these clubs and their members in the face of declining hunter populations and growing costs of maintaining clubs.

While the issue of limited information about hunt clubs is not being addressed by the North American Waterfowl Management Plan (NAWMP)/Flyways Study, the survey of waterfowl hunters in California (and nationally) that is being conducted in 2016 could be useful to the CVJV. The study is expected to provide valuable information on waterfowl hunters' behaviors, preferences for recreational experiences, conservation behaviors, and perceptions of ecosystem services of wetlands. The CVJV would likely benefit from conducting additional analysis of the data.

Farmer Behavior and Programs

HD research provides valuable insight into how to encourage farmer creation of wetland habitat and wildlife-friendly practices. Prior behavior is the strongest predictor of whether or not a farmer will conduct a conservation behavior (Klößner 2013, Moses 2013, Sheeder and Lynne 2010). Many other factors play a role in decisions to create habitat, such as farm size (Moses 2013), perceived ability to create habitat (Klößner 2013), social norms (Sheeder and Lynn 2010), and length and restrictiveness of contracts (Parkhurst 2011, Klößner 2013, Moses 2013, Canales et al 2015). One of the most consistent and important motivational factors for adopting conservation measures is an ethos/attitude of believing that it is important to protect/conservate natural resources and to put social good above profits (Erickson and De Young 1994, Ryan et al. 2003, Chouinard et al. 2008, Sheeder and Lynne 2010, Czap et al. 2012). Surprisingly, some researchers have found that some farmers are willing to pay to continue conservation practices once they have invested time and money to start them – suggesting that carefully designed research and education programs to support continued farm conservation may work in the absence of financial incentives (Hayley et al. 2008). Yet, the extent to which this is the case for farmers in the CVJV is unknown.

The research on conservation program design suggests the following steps would be ideal: identify farmers who have previously taken conservation actions and who are Environmental Stewards (see below), provide them with shorter-term contracts that support large scale conservation work (with opt-out options for significant commodity price declines or adverse weather conditions), show farmers how their specific practices will lead to social and environmental benefits for specific wildlife species in specific areas (especially their on their lands) and to specific people, and recognize their work with their peers (Parkhurst 2011, Canales et al. 2015, Klößner 2013, Moses 2013).

Segmenting farmers into like-minded groups, according to different types of beliefs and behaviors, can be valuable for developing effective, targeted approaches to working with them. Some farmers need larger economic incentives and information to adopt wildlife management practices and less information about the practices, while others need fewer economic incentives but need to know the link between their specific practices and specific wildlife and human benefits (Ryan et al. 2003, Ahnstrom et al. 2009, Sheeder and Lynne 2010, Czap 2012, Baumgart-Getz et al. 2012). Three potentially useful segments were based on types of management styles (Klonsky et al. 2004). Environmental Stewards put higher priority on natural resources conservation and an ethos of social good than higher profits.

Production Maximizers prioritized producing the highest possible yields and focusing their attention and resources on the farm. For them, the economic benefits of wildlife conservation activities should be emphasized and sign-up and educational programming provided concisely. Networking Entrepreneurs had a business-like attitude but with a broader social network, so economic and environmental benefits should also be clearly described to them, but they may do more educational programs than Production Maximizers.

Non-hunting Recreationists

Non-hunting recreationists have provided significant economic impact from visiting wetland habitat and birding in the Central Valley and California, and are willing to financially support wetland preservation (Creel 1992, Colby and Smith-Incer 2005). For example, in Merced County, habitat management and wildlife-associated recreation contributed \$53.4 million and 1,100 jobs to the economy (Weissman 2001). Visitors to the Kern River Preserve were willing to pay an additional \$77 (2001 dollars) to preserve that habitat, totaling about one-half million dollars (Colby and Smith-Incer 2005). Although dated information, this apparent level of funding is a well of support to draw upon.

Research indicates that wetlands have value for wildlife viewing, and wildlife viewers will support water allocation to them. When recreational users understood that diverting water from wetlands reduced bird watching and wildlife viewing opportunities, support for water allocation for wetland habitat increased (Teisl and O'Brien 2003, Berns and Simpson 2009). Creel and Loomis (1992) found that water diverted to wetlands in the San Joaquin Valley was worth \$78 million in waterfowl hunting, fishing, and wildlife viewing (1989 dollars) while the same quantity of water sold for municipal and industrial users was worth \$19 million. Using this information with other economic data such as the value of flood reductions gained by preserving wetlands, may increase support by the public and policymakers for water allocations for wetlands.

Research on conservation behavior of birdwatchers also illustrates the potential for this audience to be a strong constituency for conservation. Cooper et al. (2015) found that wildlife recreationists in New York -- both hunters and birdwatchers -- were four to five times more likely than non-recreationists to actively support conservation efforts. Those who both hunt and birdwatch -- a group that has not previously been considered in research and rarely considered in practice -- had the greatest conservation behavior. Thus, hunters, birdwatchers, and especially hunter/birdwatchers could be valuable constituents for the CVJV and its partners. In terms of media to use to reach these audiences, while the public has tended to want their information from television, newspapers, and direct mail, wildlife watchers have wanted their information provided from conservation organizations like the parks they visit (McDuff et al. 2008).

The NAWMP survey currently being conducted (mentioned above under Hunters) is also studying birdwatchers in California and nationally. This information will be very useful to the CVJV in understanding this audience in California and their relationship to wetland and waterfowl conservation.

Urban Residents

California voters in 2015 described the state's water shortage as extremely serious (67%) (Field Poll Release #2503, May 2015); 86% believed that water supply issues were going to be an ongoing problem (Fairbank, Maslin, Maullin, Metz & Associates, March 2015); and 80% understood that residential water use reductions were very important (Field Poll, Release #2518, May 2015). The strongest arguments for reducing household water usage were: 1) water shortages are here to stay (97% found this very or somewhat convincing), 2) collective responsibility (93%), and 3) responsibility to future generations (87%) (Gomberg et al. 2015). These beliefs can be drawn upon for messages concerning the importance of conserving water so it can be used for wetlands.

The public was split concerning support for policies that would protect the environment versus protecting water supplies. In 2014, 46% of California voters said we “need to protect the environment, even if it hurts the water supply,” compared to 36% who said the opposite, while 55% were opposed to suspending environmental regulations that protect fish and wildlife (Greenberg Quinlan, Rosner, and American Viewpoint 2014). The mixed support for environmental protection suggests that the three arguments for water conservation be adapted and used for public information campaigns that show how water use reductions in the city, and allocations for wetlands, are part of a necessary collective responsibility to conserve wetlands for society and our children, to reduce flooding now and in the future, and to improve water supplies for now and the future.

To increase the public’s political and financial support for wetlands, innovative policy initiatives also hold promise. When water quality improvements completed by farmers and other private land owners can be measured, they are called performance-based improvements. Urban residents have been willing to pay for performance-based water quality improvements by agricultural producers. In exchange, agricultural producers were willing to accept payment for performance-based water quality improvements (Baird Belcher and Quinn 2011). This approach should be evaluated to assess if it can be modified so agricultural producers and other others who conduct wetlands restoration can have contracts with urban areas to reduce downstream flooding in the CVJV region. Given that California residents (95% urban) (ICIP c2016), were willing to pay \$87 per hectare per year to protect wetland quality and salmon fishing in the San Joaquin Valley (1989 dollars), and strongly supported funding for wetland protection and salmon fishing (Pate and Loomis 1997), there may be support for funding performance-based flood reduction programs that restore wetlands.

Ecosystem Services

Best practices for conducting ecosystem services studies identify the market values (e.g., flood protection, recreational, et al.) and non-market values (e.g., aesthetic appreciation, existence value, option value, et al.) of biophysical and socio-cultural aspects of ecosystems. The goods considered in various ecosystem valuations vary greatly. De Groot et al. (2006) used three general types of value (ecological, sociocultural, and economic) to calculate Total Economic Value (TEV) of wetlands, finding each acre of wetland in the world provided an average value of \$3,274/ha/yr. The World Resources Institute’s (2005) TEV method

included four categories for ecosystem services: direct use values, indirect use values, option values, and non-use values.

Three common methods for ecosystem valuation included: (1) direct market valuation (DMV), (2) indirect market valuation (IMV, or Avoided Cost), and (3) contingent valuation (CV) (de Groot et al 2006). The first, DMV, identified the exchange value of ecosystem services in markets, as when conservation programs “buy” conservation easements by paying landowners to not develop wetlands. The second method, IMV, is used when there are no explicit markets for ecosystem services. It identified “revealed preferences” by estimating costs that would have been incurred without those services (de Groot et al. 2006) such as the value that using conservation techniques to avoid silting in a wetland, saving the cost of restoring the silted in wetland. The third method, CV, asks respondents to state their preference (hence, “stated preference”) for what they would be willing to pay for some ecosystem service, such as conserving a particular wetland for wildlife watching (de Groot et al. 2006). Proponents of a fourth method argue strongly that using group decision-making is a more appropriate method to identify the ecosystem value of a service (de Groot et al. 2006, Wilson and Howarth 2002, McDaniels and Roessler 1998 Sagoff 1998).

De Groot et al. (2006) also found that planners and decision-makers were frequently not fully aware of the connections between wetland conditions, the provision of wetland services, and the economic and non-economic benefits for people, concluding that this led to ill-informed decisions to develop wetlands. A best practice for performing an ecosystem service valuation to inform decision-making was developed by the U.S. Fish & Wildlife Service’s National Wetlands Inventory (NWI) (Stelk et al. 2014). It included these steps: 1) identify the context, 2) define the boundaries, 3) identify stakeholders, 4) develop a functional analysis, 5) perform ecosystem services valuation, 6) develop trade-off analysis, and 7) communicate results.

Concerning communications, “language surrounding ecosystem services projects is a jargon-rich, dense amalgam of scientific, financial, regulatory and conservation parlance” (Bullitt Foundation 2012), and the term “ecosystem services” has been shown to confuse members of the public and management experts alike. A national voter survey found that voters strongly preferred the terms “nature’s value”, or “nature’s benefits” (Metz and Weigel 2010).

Environmental Justice

Demographically, the Central Valley has been growing quickly with about 50% of the residents white, 32% Latino, 9% African American, and several percent identified as American Indian. The poverty rate varies from 8% in Sacramento to 13% in the State and 20% in the Central Valley (Public Policy Institute of California 2006).

The environmental injustices in the Central Valley are well-documented and present an opportunity for collaboration with the environmental justice communities (EJC’s) to address mutual interests. Environmental justice communities tend to be well organized, highly aware of environmental issues, involved with climate change activists, politically astute, and effective (California Environmental Justice Alliance Strategic Plan 2015). Given these qualities, they may be open to partnering to decrease flooding and restore riparian zones in

EJC's as part of efforts to increase waterfowl habitat. Resources are available to support these partnerships and include the Environmental Justice Grants program funds for recreational or other community amenities, perhaps in restored riparian or wetland zones in EJC's (CEJA 2015). Spatial planning tools, such as CalEnviroScreen Version 2.0, can potentially identify EJC's, and overlay those with watershed, flood zone, and land use maps to identify where restoration of riparian zones might reduce EJC flooding impacts, while providing wildlife habitat and recreational spaces.

To build collaborations, the social and political qualities of environmental justice organizations (EJO's), which are organizations that represent EJC'S, need to be considered. They have defined meaningful public participation as getting *results* on their environmental justice issues, not just discussing the issues (London 2008), especially not in a "top-down" transfer of information (Grorud-Colverta et al. 2010). One approach to building effective collaboration in environmental justice contexts has been Community-Based Participatory Action Research (CBPAR) (Bacon et al. 2013). CBPAR brings organizations together with communities to collaborate on a research and implementation project. The communities provide specialized, local knowledge, such as the most important flood reduction zones in their communities, based upon their knowledge of who is most vulnerable and what is most valuable in their communities. Flood control planning by restoring wetlands and riparian zones, for example, could then be integrated with carefully designed flood control measures in the communities to protect their most valued areas, benefitting both groups. The communities then become partners in advocating for flood reduction efforts that benefit wetlands, riparian areas, and EJC's.

Multiple Benefits

Multiple benefits (MB) approaches to conservation and planning seek to balance more than two types of benefits. The benefits might include environmental, economic, and/or human welfare benefits when addressing a water and/or habitat management challenge (Postel 2000, Chan et al. 2006). Early approaches to Benefit-Cost analysis (BCA or CBA) reduced the benefits into dollar values where possible, and selected those projects that provided the highest returns, or the top choice(s) from each type of benefit (Hanley and Splach 1993). The Corps of Engineers (COE) "Green Book" used this approach to "multiple objectives" planning in 1950 for water resources projects, as have other federal and state agencies since then.

The importance of meaningful public participation and collaboration has been demonstrated and discussed extensively in the HD literature. Integrated Resource Management (IRM) conducts MB planning through collaborative processes among localities, state, and federal resource groups (California Natural Resources Agency 2010). In 2010, California made it policy that the Natural Resources Agency use IRM for environmental assessments, mitigation planning, etc. Early, frequent, and meaningful community engagement and participation in planning riparian restoration projects has been identified as absolutely critical in building community support for, and increasing the likelihood of successful restoration projects (Golet et al. 2006, London et al. 2008, Grorud-Colverta et al. 2010, Bacon et al. 2013).

Early engagement has also helped planners identify what research needs to be conducted to address community concerns. This understanding then helps shape an overall research agenda needed to identify and select proposed alternatives. When communities are meaningfully involved, they have advocated for additional lands and recreational opportunities (such as fishing access) to be included in riparian restoration projects, and asked for larger restoration projects, understanding that these recreational amenities would increase economic opportunities from tourism generated from multi-benefit projects (Golet et al. 2006, London et al. 2008, Grorud-Colvert et al. 2010, Bacon et al. 2013).

Recommendations

A companion document, “Recommendations: Human Dimensions Literature Review”, was written to identify the most important research-based recommendations applicable to the CVJV’s work. In that document the top ~100 research-based recommendations are provided, prioritized from 217 recommendations provided to the JV staff, Board President, and Tech Committee Chair. Here, we list just the 17 top recommendations, organized into themes:

Cross-cutting

- Human dimensions activities, like all other activities, should be done within an adaptive management framework, a broader system of management that includes an integrated language of management that is: (1) adaptive, (2) perspectival, (3) multi-scaled, (4) operationalizable, (5) normative in content, and (6) communication enhancing (Norton 1998).

Hunters

- Use regional results from the NAWMP survey of waterfowl hunters related to preferences for waterfowl and wetlands objectives.
- Create an inventory and mailing list of the duck clubs of the Central Valley, assess what support they need to maintain/restore waterfowl habitat (Hall 2011), and assess the findings from the Suisun Marsh Human Dimensions Recreational Study (California Department of Water Resources 2015).
- Identify the core elements of how hunters are socialized into hunting for diverse groups (youth, women, racial and ethnic identities) of hunters (Larson et al. 2014).

Farmer behavior and programs

- Consider using opt-outs based on weather and market conditions for private lands conservation programs, as restrictiveness of contracts has been found to be a key barrier to farmers signing contracts (Canales et al. 2015).
- Test farmer willingness to adopt wildlife habitat management practices based on: providing opt-outs for weather and market conditions; willingness of new adopters to adopt practices at different price points (including zero cost); willingness of those who have already adopted practices to continue practices at different price points; how knowledge of the benefits to the public changes the price points for adoption for new and experienced adopters; willingness to adopt conservation practice when the farmer

understands in detail how to do the practice; and willingness to do “comprehensive/intensive conservation” if “bundles of benefits” are offered (Chouinard et al. 2008, Ahnström et al. 2009, Klöckner et al. 2013, Reimer et al. 2014, Canales et al. 2015).

Non-hunting recreationists

- Identify the environmental concerns that can most directly affect non-hunting recreationists and communicated to them about how an environmental issue, such as diverting water from wetlands, can adversely affect their recreational experience (Newhouse-Berns and Steven Simpson 2009).
- Use regional results from the NAWMP survey of birdwatchers related to preferences for wetlands.
- Message to decision makers that birdwatching is an enormously popular activity in CA, about 14% of the population (4.8 million) does it, with 2.3 million taking trips away from home to do it (U.S. Fish and Wildlife Service et al. 2011).

Urban residents

- Build alliances with broad based citizen organizations and urban groups to influence water allocations and to advocate for providing adequate water allocations for wetlands, riparian zones, wildlife and fisheries, since they strongly support protecting the environment (Fairbank et al. 2015).
- Policy initiatives to restore wetlands and riparian areas should emphasize, where appropriate, that wetlands and riparian areas are natural water storage and supply infrastructure since they store water that would be wasted in floods (The Field Poll #2501 February 2015).

Ecosystem services (including economics)

- Bypass jargon for plain English. Instead of markets and credits, talk about paying land managers to manage their land in a way that provides benefits to the community. Instead of natural capital, talk about benefits provided by healthy natural systems (Bullitt Foundation 2012).
- When arguing to protect wetlands, use the argument that sound economic development and environmental policy supports the protection of wetlands, as in Merced where their total economic impact was calculated to be \$53.4 my per year, and 1,100 jobs (Weissman 2001).
- Conduct a land use and economic study like in Merced County for a larger portion of the Central Valley to identify the economic values of wetlands in all counties, and their impact on the local economy (Weissman 2001, U.S. Fish & Wildlife Service 2013). Modify it to explore participant’s willingness to pay for conservation of the areas.

Multiple benefits

- Involve the public very early in planning studies for multiple benefits. This needs to be done to: identify the public’s concerns for potential projects, identify their preferences for how to address those concerns, incorporate the local knowledge that they have, and inform planners of what studies need to be done to address public concerns while achieving project goals (Golet et al. 2006).

Environmental Justice

- Where appropriate, frame flood protection and habitat protections as a benefit for Environmental Justice Communities (London et al. 2008).

Human Dimensions Research Agenda

We reviewed the literature to identify priority human dimensions research recommendations provided by other researchers. Some of these recommendations were prioritized as top recommendations overall and listed above. In this section, we provide a more complete list of human dimensions priorities and suggest possible approaches for the CVJV to address them.

Hunter recruitment, retention and reactivation

- Identify the core elements of socialization into hunting for diverse groups (youth, women, racial and ethnic identities) of hunters (Larson et al. 2014).
- Identify the role of clubs and organizations for hunting socialization at the community level, and how to increase connections between hunters and landowners (Larson et al. 2014).
- Assess the feasibility of a Client Licensing and Survey System like the one that Alberta Canada has for California. Identify what social-psychological characteristics should be included in the sign up form (Boxall et al. 2001).
- Create an inventory and mailing list of the duck clubs of the Central Valley, assess what support they need to maintain/restore waterfowl habitat (Hall 2011), and assess the findings from the Suisun Marsh Human Dimensions Recreational Study (California Department of Water Resources 2015).
- Understand the public image of what hunting is, what it does, and understanding of hunting as conservation-oriented recreation (Larson et al. 2014).

Private lands

- Test farmer willingness to adopt wildlife habitat management practices based on: providing opt-outs for weather and market conditions; willingness of new adopters to adopt practices at different price points (including zero cost); willingness of those who have already adopted practices to continue practices at different price points; how knowledge of the benefits to the public changes the price points for adoption for new and experienced adopters; willingness to adopt conservation practice when the farmer understands in detail how to do the practice; and willingness to do “comprehensive/intensive conservation” if “bundles of benefits” are offered (Chouinard et al. 2008, Ahnström et al. 2009, Klöckner et al. 2013, Reimer et al. 2014, Canales et al. 2015).
- Understand rice growers’ involvement in conservation programs and implementation of practices before and after program involvement (Moses 2013).
- Conduct research to establish what type of private landowners (i.e., hunters, non-hunting recreationists, farmers, duck clubs, etc.) have habitat that’s important to the CVJV; what percentage of them hunt, view wildlife, do both, etc.?

Non-Hunting Recreationists

- Conduct a land use and economic study like in Merced County for a larger portion of the Central Valley to identify the economic values of wetlands in all counties, and their impact on the local economy. Modify it to explore participant's willingness to pay for conservation of the areas. (Weissman 2001, U.S. Fish & Wildlife Service 2013).
- Utilize the dataset from the NAWMP survey of hunters, birdwatchers, and the public to better understand recreation behavior, interest in wetlands and conservation, the role of ecosystem services in support for conservation, preferences for attributes of wetlands to conserve, conservation behaviors, etc. It may be possible to analyze the dataset for those individuals within the CVJV region, although it will require analyst time (Human Dimensions Working Group Survey Proposal 2018).
- Conduct a rigorous study on the recreational behaviors of non-hunting recreationists in the Central Valley, their attitudes towards various conservation programs and policies (including preferences for water allocation priorities) for various types of wildlife habitat (i.e., wetlands versus riparian zones versus woodlands). Identify the relationship between outdoor recreation participation and wetland and riparian-specific conservation activities (or utilize results from the NAWMP survey that will explore this issue) (Teisl and O'Brien 2003, (Torpen and Hearne 2008).

Urban Residents

- Conduct a contingent valuation study in the Central Valley to identify how much Central Valley residents are willing to pay for wetlands providing flood protection, water supply, and water pollution control (Stevens et al. 1995). Explore how willingness to pay varies with adding enforceable performance criteria that are enforced for wetlands restoration (Baird et al. 2011). Also identify what wetlands can be purchased restored at the price the public is willing to pay (Boyer and Polasky 2004).

Ecosystem Services

- Develop a well-structured decision-making process to identify the ecological and social information the organization, decision-makers, and the public need to make a decision, and how the information will be used in decision-making that involves the public (Bingham et al. 1995, de Groot et al. 2006).
- Replicate Metz and Weigel's (2010) national voter survey on ecosystem services for the Central Valley to identify local values and compare to national values. Combine that survey with the part of the Bullitt Foundations 2012 "Ecosystem Services Needs Assessment" to explore the public's attitudes towards green infrastructure and terminology for communicating about it. Both of these research projects also have significant benefits for communications messaging (Metz and Weigel 2010).
- Assess the usefulness of the information gathered through research and the educational materials designed to share it, with the representatives of the public and conduct additional research and/or revise educational materials. This may be an iterative process (Bingham et al. 1995).

Environmental Justice

- Work with environmental justice communities to identify opportunities for CBPAR to identify riparian zones of interest for restoration, and upstream wetlands, and how that will improve their communities if flooding is reduced. Work with them to identify if they are interested in having access to restored areas, what support they need for that, and what amenities they would value in them (Bacon et al. 2013).
- What kinds of recreational, educational, or other benefits would EJ communities and organizations in the Central Valley want in riparian or wetland habitat restoration in their communities? Do EJO's need support to access these lands for recreational/educational access (London et al. 2008)?
- Identify the kind support that EJC's and EJO's in the Central Valley need in order to have meaningful participation in environmental planning (London et al. 2008).

Multiple Benefits

- Assess the willingness of organizations in the Central Valley to be flexible in achieving their goals. More promisingly, try to identify the conditions under which organizations would be more willing to be flexible. Assess if there could be some type of economic/environmental accounting system set up that would allow organizations to see that if they give up X, they will receive more of Y, so organizations could see that there is a benefit to giving up X. And, if done in a transparent way, organizations could see what others are giving up and receiving as well (Hanak et al. 2011).
- Establish, for all habitat restoration projects, a consistent framework for design, monitoring, and reporting, which includes the human dimensions of the projects, such as the type of public input/participation processes used and other metrics of human impacts (Kondolf et al. 2005).

Addressing Human Dimensions Priorities

The recommendations for the human dimensions research agenda can be approached in one of three ways. One way would be to hire a full or part-time human dimensions researcher for the CVJV to conduct and/or coordinate the implementation of a research agenda. In 2016, the Playa Lakes Joint Venture was the first joint venture to hire a human dimensions researcher for this purpose. Another approach would be to support an annual competition for CVJV-related human dimensions research. An RFP could be provided for HD researchers to address priority topics (based on the list above). Or, CVJV could prioritize the research agenda items and put a bid for just the specific research project(s) it wants to support at any given time. It is highly recommended that all research should be conducted in collaboration with CVJV staff and partners to ensure its relevance and successful application to the conservation activities of the CVJV.

Conclusion

The CVJV has taken an important first step to increase the effectiveness of conservation planning for waterfowl in the Central Valley by supporting the development of this first – ever Human Dimensions chapter of a Joint Venture Implementation Plan. In it, we have synthesized the most salient points from over 100 HD research articles. Interested readers can find a more detailed summary of our literature review findings in the document, “Highlights of Lessons Learned and Recommendations from Human Dimensions of Wetland Habitat Protection Literature Review”, available on the CVJV website (www.centralvalleyjointventure.org).

The HD research synthesized in these two reports provides a strong foundation to guide CVJV work. We also hope it helps to inspire new integrated social and biological research-based approaches to address conservation challenges. By building partnerships with new constituencies that will strongly support the CVJV efforts and strengthening existing relationships with constituencies, the JV will better be able to conserve and restore habitat for birds throughout the Central Valley.

Bibliography

Introduction

Bennett NJ, Roth R. 2015. Introducing the Conservation Social Sciences. In: Bennett NJ, Roth R, editors. 2015. *The Conservation Social Sciences: What?, How? and Why?* Vancouver (BC): Canadian Wildlife Federation and Institute for Resources, Environment and Sustainability, University of British Columbia.

Brown TL, Siemer WF, Decker DJ. 2001. *Human Dimensions of Wildlife Management in North America*. The Wildlife Society. 447 pages.

Connelly, N.A., Siemer, W.F., Decker, D.J., & Allred, S.B. 2012. Methods of Human Dimensions Inquiry. In D. J. Decker, S. J. Riley, & W. F. Siemer (Eds.), *Human dimensions of wildlife management* (pp. 139-156). Baltimore: Johns Hopkins University Press.

Decker DJ, Riley SJ, Siemer WF. 2012. Human dimensions of wildlife management. In D. J. Decker, S. J. Riley, & W. F. Siemer (Eds.), *Human dimensions of wildlife management* (pp. 139-156). Baltimore: Johns Hopkins University Press.

Fox HE, Christian C., Nordby JC, Pergams ORW, Peterson GD, Pyke CR. 2006. Perceived barriers to integrating social science and conservation. *Cons Bio* [Internet]. [cited 2016 Oct 29];20(6). <http://doi.org/10.1111/j.1523-1739.2006.00598.x>

Manfredo MJ. 2008. *Who cares about wildlife?: Social science concepts for exploring human-wildlife relationships and conservation issues*. New York: Springer. 228 pages.

Sandbrook C, Adams WM., Büscher B, Vira B. 2013. Social Research and Biodiversity Conservation. *Cons Bio* [Internet]. [cited 2016 Oct 30];27(6). Available from: <http://dx.doi.org/10.1111/cobi.12141>.

Sexton, N. R., Leong, K. M., Milley, B. J., Clarke, M. M., Teel, T. L., Chase, M. A., & Dietsch, A. M. (2013). The State of Human Dimensions Capacity for Natural Resource Management : Needs , Knowledge , and Resources, 30(2), 142–153.

Hunters

Alessi MG, Miller CA, Harper EE. 2013. Content analysis of three waterfowl hunting DVDs. *Human Dimensions Wildlife Manag* [Internet]. [cited 2016 March 7];18(2):152-158. Available from: <http://dx.doi.org/10.1080/10871209.2013.745103>.

Brown MG. 2008. Assessing California's wetlands: A comprehensive survey of management techniques and a new rapid assessment method. [M.S. Thesis]. [Davis(CA)]: University of California Davis. 139 p.

CDFW: California Department of Fish and Wildlife. (Sacramento, CA). License Statistics. [Internet]. [cited 2016 August 11]. Available from: <http://www.wildlife.ca.gov/Licensing/Statistics>.

Hall F. 2011. They came to shoot: A history of California duck clubs and wetland conservation. Sacramento (CA): California Waterfowl. 512 p.

Hunt KL. 2016. Who are our future stakeholders? The implications of a changing social landscape for achieving North American Waterfowl Management Plan goals. Paper presented at: 7th Annual North American Duck Symposium; Annapolis, MD.

Larson LR, Stedman RC, Decker DJ, Siemer WF, Baumer MS. 2014. Exploring the social habitat for hunting: toward a comprehensive framework for understanding hunter recruitment and retention. *Human Dimensions Wildlife Manag* [Internet]. [cited 2016 March 7];19(2)105-122. Available from: <http://dx.doi.org/10.1080/10871209.2014.850126>.

Teel TL, Dayer AA, Manfredo MJ, Bright AD (2005). *Wildlife Values in the West*. Fort Collins, CO: Colorado State University, Human Dimensions in Natural Resources Unit. Project Report for the Western Association of Fish and Wildlife Agencies. (Project Rep. No. 58).

(USFWS) United States Fish & Wildlife Service (2013). *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation California*, revised. Washington, DC: US Department of the Interior, US Fish & Wildlife Service. Retrieved from: <http://digitalmedia.fws.gov/cdm/singleitem/collection/document/id/1535/rec/4>.

Vermont Fish and Wildlife Department (Montpelier, VT). 2007. Future of hunting in Vermont Plan. 2007. [Internet]. [cited 2016 March 7]. 20 p. Available from: http://www.vtfishandwildlife.com/library/Reports_and_Documents/Hunting_and_Trapping/Future_of_Hunting_book.pdf.

Farmer Behavior and Programs

Ahnström J, Höckert J, Bergeå HL, Francis CA, Skelton P, Hallgren L. 2009. Farmers and nature conservation: What is known about attitudes, context factors and actions affecting conservation? *Renew Ag Food Sys* [Internet]. [cited 2016 March 7];24(1); 38–47. Available from: <http://digitalcommons.unl.edu/agronomyfacpub/361>.

Baumgart-Getz A, Prokopy LS, Floress K. 2012. Why farmers adopt best management practice in the United States: A meta-analysis of the adoption literature. US Army Research. [cited 2016 March 7]. Paper 179. Available from: <http://digitalcommons.unl.edu/usarmyresearch/179>.

Canales E, Bergtold CE, Williams JS, Peterson J. 2015. Estimating farmers' risk attitudes and risk premiums for the adoption of conservation practices under different contractual arrangements: A stated choice experiment. [Internet]. [cited 2016 March 7]. Paper presented at: 2015 Agricultural & Applied Economics Association and Western Agricultural Economics Association Annual Meeting, San Francisco, CA, July 26-28, 2015. Available from: <http://ageconsearch.umn.edu/handle/205640>.

Chouinard HH, Paterson T, Wandschneider PR, Ohier AM. 2008. Will farmers trade profits for stewardship? Heterogeneous motivations for farm practice selection. *Land Econ* [Internet]. [cited 2016 March 7];84(1):66-82. Available from: <http://le.uwpress.org/content/84/1/66.full.pdf>.

Czap NV, Czap HJ, Khachatryan M, Lynne GD, Burbach M. 2012. Walking in the shoes of others: experimental testing of dual-interest and empathy in environmental choice. *J Socio-Econ* [Internet]. [cited 2016 March 7];41:642– 653. Available from: <http://dx.doi.org/10.1016/j.socec.2012.05.005>.

Erickson D, De_Young R. 1994. Management of farm woodlots and windbreaks. *J Env Sys* [Internet]. [cited 2016 March 7];22(3):233-247. Available from: [https://deepblue.lib.umich.edu/bitstream/handle/2027.42/83707/Erickson, D. & R. De Young \(1993-1994\) Management of farm woodlots and windbreaks, JES, 22, 3, 233-247.pdf?sequence=1](https://deepblue.lib.umich.edu/bitstream/handle/2027.42/83707/Erickson,_D._&_R._De_Young_(1993-1994)_Management_of_farm_woodlots_and_windbreaks,_JES,_22,_3,_233-247.pdf?sequence=1).

Klößner CA. 2013. A comprehensive model of the psychology of environmental behaviour – a meta-analysis. *Global Environ Chang* [Internet]. [cited 2016 March 7];23(5): 1028-1038. Available from: <http://dx.doi.org/10.1016/j.gloenvcha.2013.05.014>.

Moses R. 2013. California rice grower participation in the Conservation Security Program and wildlife conservation behavior on working land. [M.S. Thesis]. [Davis(CA)]: University of California Davis. 83 p.

Mulvaney DR. 2008. Identifying vulnerabilities, exploring opportunities: reconfiguring production, conservation, and consumption in California rice. *Ag Hum Values* [Internet]. [cited 2016 March 7];25(2):173-176. Available from: <http://dx.doi.org/10.1007/s10460-008-9123-3>.

Nassauer JI. 1989. Agricultural policy and aesthetic objectives. *J Soil Water Conserv* [Internet]. [cited 2016 March 7];44(5):384-387. Available from: <http://www.jswnonline.org/content/44/5/384.full.pdf+html>.

Parkhurst, B. 2011. An evaluation of ranch and farm operator attitudes towards emerging ecosystem service markets in California and Eastern North Carolina [M.E.M. Degree]. [Durham NC] Nicholas School of the Environment at Duke University [Internet]. [cited 2016 March 7]. 66 p. Available from: http://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/3689/Ben_Parkhurst_MP_Final_2011.pdf?sequence=1.

Ryan RL, Erickson DL, de Young R. 2003. Farmers' motivations for adopting conservation practices along riparian zones in a mid-western agricultural watershed. *J Environ Plan Manag* [Internet]. [cited 2016 March 7];46(1):19-37. Available from: <http://www.tandfonline.com/doi/pdf/10.1080/713676702>.

Sheeder R, Lynne GD. 2011. Empathy conditioned conservation: "Walking-in-the-shoes-of-others" as a conservation farmer" *Land Econ* [Internet]. [cited 2016 March 7];87(3):433–4. Available from: <http://le.uwpress.org/content/87/3/433.short.pdf>.

University of California Cooperative Extension. 2011. Forage crops and migratory birds workshops: exploring challenges and opportunities to expanding migratory bird benefits from forage production: summary report. Woodland (CA) UC Cooperative Extension, June 6th, Bowles Farm, Los Banos, CA, June 17th, 2011. 8 p.

Non-hunting Recreationists

Colby B, Smith-Incer E. 2005. Visitor values and local economic impacts of riparian habitat preservation: California's Kern River Preserve. *J. Am Water Resour Assoc* [Internet]. [cited 2016 March 7];709-717. Available from: <http://onlinelibrary.wiley.com/doi/10.1111/j.1752-1688.2005.tb03765.x/full>.

Cooper CC, Larson L, Dayer A, Stedman R, Decker, D. 2015. Are wildlife recreationists conservationists? linking hunting, birdwatching, and pro-environmental behavior. *J Wildlife Manage* [Internet]. [cited 2016 March 7];79(3):446–457. Available from: <http://dx.doi.org/10.1002/jwmg.855>.

Creel M, Loomis J. 1992. Recreation value of water to wetlands in the San Joaquin valley: linked multinomial and count data trip frequency models. *Water Resour Res* [Internet]. [cited 2016 March 7];28(10):2597-2606. Available from: <http://dx.doi.org/10.1029/92WR01514>.

McDuff, M.M., G.S Appelson, S.K. Jacobson and G.D. Israel. 2008. Watershed management in Florida: public knowledge, attitudes, and information needs. *Lake Reserv Manage* [Internet]. [cited 2016 March 7]; 24(1):47–56. Available from: <http://dx.doi.org/10.1080/07438140809354050>.

Newhouse Berns G, Simpson S. 2009. Outdoor Recreation Participation and Environmental Concern: A Research Summary. *J. Experiential Educ* [Internet]. [cited 2016 March 7];32(1):79–91. Available from: <http://jee.sagepub.com/content/32/1/79.full.pdf+html>.

Sexton NR, Dietsch AM, Don Carlos AW, Koontz L, Solomon S, Miller HM. 2012. National Wildlife Refuge visitor survey 2010/2011: individual refuge results for Lower Klamath and Tule Lake National Wildlife Refuges. Arlington (VA). U.S. Fish and Wildlife Service Division of Visitor Services and Communications Headquarters Office. [Internet]. [cited 2016 March 7]. 26 p. Available from: <http://pubs.usgs.gov/ds/643/>.

Teisl MF, O'Brien K. 2003. Who cares and who acts? outdoor recreationists exhibit different levels of environmental concern and behavior. *Environ behav* [Internet]. [cited 2016 March 7];35(4):506-522. Available from: <http://dx.doi.org/10.1177/0013916503035004004>.

Torpen DR, Hearne RR. 2008. Stakeholder preferences for water management alternatives in the Red River basin. Fargo (ND). Department of Agribusiness and Applied Economics Agricultural Experiment Station North Dakota State University. Agribusiness and Applied Economics Report No. 629. [Internet]. [cited 2016 March 7]. 31 p. Available from: <http://dx.doi.org/10.1080/02508061003663437>.

U.S. Department of the Interior, U.S. Fish and Wildlife Service, U.S. Department of Commerce, U.S. Census Bureau. Washington (DC). 2013. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: California. [Internet]. [cited 2016 March 7]. 82 p. Available from: <https://www.census.gov/prod/2013pubs/fhw11-ca.pdf>.

Weissman KG. . Land use and economics study grassland ecological area Merced County, California. Los Banos (CA) Grassland Water District. 35 p. Available from: Weissman@Traenviro.com.

Urban Residents

Baird J, Belcher K, Quinn MS. 2011. A performance-based approach to agri-environmental policy in Canada: Development and Comparative Assessment. University of Alberta Department of Resources Economic and Environmental Sociology. [Internet]. [cited 2016 March 7]. Research Project number: PR-02-2011 Project Report

201. 31 p. Available from:

http://learnnetwork.rees.ualberta.ca/en/PublicationsCommunications/~media/learnnetwork/Publications%20and%20Communication/Documents/PR-02-2011_Baird-Belcher-Quinn.pdf.

California Water Boards. February 2016. California meets governor's conservation mandate for seventh straight month. [Internet]. [cited 2016 March 7]. 3 p. Available from:

https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/docs/2016feb/pr2216_dec_conser.pdf.

Davenport MA, Bridges CA, Mangun JC, Carver AD, Williard KW, Jones EO. 2010. Building local community commitment to wetlands restoration: A case study of the Cache River wetlands in Southern Illinois. Springer Science+Business Media. Wetlands [Internet]. [cited 2016 March 7];45:711–722. Available from:

<http://dx.DOI.org/10.1007/s00267-010-9446-x>.

Eisenhauer B, Nicholson B. 2005. Using stakeholders' views: a social science methodology for the inclusive design of environmental communications. Applied Environmental Education & Communication [Internet]. [cited 2016 March 7];4(1)19-30. Available from: <http://www.tandfonline.com/loi/ueec20>.

Metz D, Below C. 2015. Key findings from a recent survey on water conservation in California. Los Angeles (CA): Fairbank, Maslin, Maullin, Metz & Associates (FM3). [Internet]. [cited 2016 March 7]. 9 p. Available from: <http://waterfoundation.net/wp-content/uploads/2015/07/CA-Water-Foundation-Survey-Memo-7-29-15.pdf>.

Field Poll. 2015 Feb. Nearly unanimous view that State's water shortage is serious. Growing concerns about the adequacy of the water storage and supply. San Francisco (CA): Field Research Corporation. Release #2501. [Internet]. [cited 2016 March 7]. 6 p. Available from: <http://www.field.com/fieldpollonline/subscribers/Rls2501.pdf>.

Field Poll. 2015 May. Californians support Governor's urban water reduction plan three to one, But many homeowners say it will be difficult for their household to cut back on their own water use. San Francisco (CA). Field Research Corporation Release #2503. [Internet]. [cited 2016 March 7]. 7 p. Available from: www.field.com/fieldpollonline/subscribers/Rls2503.pdf.

Gomberg M, Maestu R, Oppenheimer E. 2014. Urban water supplier drought response survey results and observations. Sacramento (CA). Office of Research, Planning, and Performance. California State Water Resources Control Board. PowerPoint. July 17, 2014. [cited 2016 March 7]. 13 p. Available from: ca.gov/Drought/pdf/.../Drought_Survey_Presentation_Final.pdf

Greenberg Quinlan Rosner and American Viewpoint (Washington DC, Alexandria VA). 2014, May. Drought freaks out more California voters: Poll. [Internet]. [cited 2016 March 7]. Available from: <http://www.futurity.org/drought-poll-california-voters/>.

ICIP: Iowa Community Indicators Program [Internet]. C2016. Ames (IA): Iowa State University; [cited 2016 August 8]. Available from: <http://www.icip.iastate.edu/tables/population/urban-pct-states>.

Pate, Loomis J. 1997. The effect of distance on willingness to pay values: a case study of wetlands and salmon in California. *Ecol Econ* [Internet]. [cited 2016 March 7];20:199 - 207. Available from: http://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/people/economics/12_wetlandsSalmonCa_pate_paper.pdf.

Polasky BT. 2004. Valuing wetlands: a review of non-market valuation studies. *Wetlands* [Internet]. [cited 2016 March 7];24(4):744–755. Available from: <http://environmentportal.in/files/file/URBAN%20WETLANDS.pdf>.

Ecosystem Services

De Groot R, Stuij M, Finlayson M, Davidson N. 2006. Valuing wetlands: Guidance for valuing the benefits derived from wetland ecosystem services. (Gland Switzerland, Montreal Canada) Secretariat of the Convention on Wetlands, Secretariat of the Convention on Biological Diversity. [Internet]. [cited 2016 March 7]. Ramsar Technical Report No. 3. CBD Technical Series No. 27. 46 p. Available from: <https://www.cbd.int/doc/publications/cbd-ts-27.pdf>.

Ducks Unlimited (Memphis TN). 2010. Assessing waterbird benefits from water use in California ricelands. Sacramento (CA). California Rice Commission. [Internet]. [cited 2016 March 7]. 8 p. Available from: <http://calrice.org/pdf/DucksUnlimited.pdf>.

De Groot RS, Wilson MA, Boumans RMJ. 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecol Econ* [Internet]. [cited 2016 March 7];41:393–408. Available from: [https://dx.doi.org/10.1016/S0921-8009\(02\)00089-7](https://dx.doi.org/10.1016/S0921-8009(02)00089-7).

McDaniels, TL, Roessler, TL, 1998. Multiattribute elicitation of wilderness preservation benefits: a constructive approach. *Ecol Econ* [Internet]. [cited 2016 March 7];27:299–312. Available from: [http://dx.doi.org/10.1016/S0921-8009\(98\)00005-6](http://dx.doi.org/10.1016/S0921-8009(98)00005-6).

Metz D, Weigel L. 2010. Key findings from recent national opinion research on ecosystem services. Los Angeles (CA), Alexandria (VA). Fairbank, Maslin, Maullin, Metz & Associates and Public Opinion Strategies. [Internet]. [2016 March 7]. Unpublished polling data. 12 p. Available from <https://www.conservationgateway.org/Documents/Summary/Memo/Polling.pdf>.

Resource Media (Seattle WA). 2012. Ecosystem services messaging: needs assessment and initial messaging recommendations. Seattle (WA). Bullitt Foundation. [Internet]. [cited 2016 March 7]. 23p. Available from: www.ucanr.edu/sites/RangelandES/General/?uid=600&ds=577.

Sagoff M. 1999. Aggregation and deliberation in valuing environmental public goods: a look beyond contingent pricing. *Ecol Econ* [Internet]. [cited 2016 March 7];24:213–230. Available from: [http://dx.doi.org/10.1016/S0921-8009\(97\)00144-4](http://dx.doi.org/10.1016/S0921-8009(97)00144-4).

Stelk, MJ, Christie J. 2014. Ecosystem service valuation for wetland restoration: what it is, how to do it, and best practice recommendations. Windham (ME). Association of State Wetland Managers. [Internet]. [cited 2016 March 7]. 74 p. Available from: <http://bibliotecavirtual.minam.gob.pe/biam/bitstream/handle/minam/1832/BIV01603.pdf?sequence=1>.

Wilson MA, Howarth RB. 2002. Discourse-based valuation of ecosystem services: establishing fair outcomes through group deliberation. *Integrat Econ Ecol Perspec* [Internet]. [cited 2016 March 7];41(3):431–443. Available from: [https://dx.doi.org/10.1016/S0921-8009\(02\)00092-7](https://dx.doi.org/10.1016/S0921-8009(02)00092-7).

World Resources Institute. 2005. Ecosystems and human well-being: wetlands and water: Synthesis Global assessment of ecosystem services. Washington (DC). World Resources Institute. [Internet]. [cited on 2016 March 7]. 69 p. Available from: www.millenniumassessment.org/documents/document.358.aspx.pdf

Environmental Justice

Bacon C, deVuono-Powell S, Frampton ML, LoPresti T, Pannu C. 2013. Introduction to empowered partnerships: community-based participatory action research for environmental justice. *Env Justice* [internet]. [cited 2016 March 7];6(1):1-8. Available from: <https://dx.doi.org/10.1089/env.2012.0019>.

Balazs C, Morello-Frosch R, Hubbard A, Ray I. 2011. Social disparities in nitrate-contaminated drinking water in California's San Joaquin Valley. *Env Health Perspect* [Internet]. [cited 2016 March 7];119(9):1272-1278. Available from: <http://dx.doi.org/10.1289/ehp.1002878>.

California's Central Valley groundwater study: a powerful new tool to assess water resources in California's Central Valley. San Diego (CA) U.S. Geological Survey. California Water Science Center. [Internet]. [cited 2016 April 29]. Available from: <http://pubs.usgs.gov/fs/2009/3057/>.

California Environmental Justice Alliance. 2015. Strategic Plan 2015-2018: Powering up healthy hoods throughout California. Oakland (CA). [Internet]. [cited 2016 March 7]. 22 p. Available from: http://caleja.org/wp-content/uploads/2015/07/CEJA_strategicplan_9.pdf.

California Environmental Justice Alliance. 2015. Green zones across California. Transforming toxic hotspots into healthy hoods. Oakland (CA). [Internet]. [cited 2016 March 7]. 36 p. Available from: <http://caleja.org/wp-content/uploads/2015/09/GREENZONES.2015.30MB.pdf>.

De Albuquerque C. 2011. Report of the Special Rapporteur on the human right to safe drinking water and sanitation: Mission to the United States of America United Nations. Addendum. New York (NY) United Nations. Human Rights Council Eighteenth session, Agenda item 3, Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development. A/HRC/18/33/Add.4. 21 p. (cited 2016 March 7). Available from: <https://daccess-ods.un.org/TMP/9500821.82884216.html>.

Grorud-Colverta K, Lester SE, Airamé S, Neeley E, Gaines SD. 2010. Communicating marine reserve science to diverse audiences. *Proc Natl Acad Sci* [Internet]. [cited 2016 March 7];107(43):18306–18311. Available from: <https://www.pnas.org/cgi/doi/10.1073/pnas.0914292107>.

Huang G, London JK. 2012. Cumulative environmental vulnerability and environmental justice in California's San Joaquin Valley. *J Environ Res Public Health* [Internet]. [cited 2016 March 7];9(5):1593-1608. Available from: <https://dx.doi.org/10.3390/ijerph9051593>.

London JK, Sze J, Lievanos RS. 2008. Problems, promise, progress, and perils: critical reflections on environmental justice policy implementation in California. *J Environ Law and Policy* [Internet]. [cited 2016 March 7];26(2):255-289. Available from: <http://escholarship.org/uc/item/2hb823dd>.

Public Policy Institute of California. 2006. Just the Facts: California's Central Valley. San Francisco (CA). [Internet]. [cited 2016 March 7]. 2 p. Available from: <http://www.ppic.org/main/publication.asp?i=566>.

State of California. 2013. The human right to water bill in California: an implementation framework for state agencies. Sacramento (CA) International Human Rights Law Clinic. University of California, Berkeley, School of Law. [Internet]. [cited 2016 March 7]. 19 p. Available from: https://www.law.berkeley.edu/files/Water_Report_2013_Interactive_FINAL.pdf.

State of California EPA. Office of Environmental Health Hazard Assessment. (Software). CalEnviroScreen Version 2.0 [Internet]. [cited 2016 April 29]. Available from: <http://oehha.ca.gov/ej/ces2.html>.

State of California. 2016. Draft Sacramento River basin-wide feasibility study and associated appendices. Sacramento (CA). The Natural Resources Agency. Department of Water Resources. [Internet]. [cited 2016 April 29]. 205 p. Available from: http://www.water.ca.gov/cvfmp/bwfs/docs/SacBWFS_Main-Document_Mar_2016.pdfhttp://www.water.ca.gov/cvfmp/bwfs/docs/SacBWFS_Main-Document_Mar_2016.pdf.

Multiple Benefits

An Overview of the Draft Conservation Strategy for the Bay Delta Conservation Plan. Sacramento (CA). California Dept. of Natural Resources. [Internet]. [cited 2016 March 9]. Available from: <http://baydeltaconservationplan.com/Home.aspx>.

Bacon C, deVuono-Powell S, Frampton ML, LoPresti T, Pannu C. 2013. Introduction to empowered partnerships: community-based participatory action research for environmental justice. Environ Justice [Internet]. [cited 2016 March 8];6(1):1-8). Available from: <https://dx.doi.org/10.1089/env.2012.0019>.

California Natural Resources Agency. The future of natural resource management: a white paper and action plan. 2010. Sacramento (CA). 8 p. Available from: http://www.resources.ca.gov/docs/IRM_Action_Plan12-10.pdf

California Department of Water Resources. U.S. Department of Interior. California Natural Resources Agency. 2016. Bay delta conservation plan. [Internet]. [cited 2016 March 13]. Available from: <http://baydeltaconservationplan.com/Home.aspx>.

Chan KMA, Shaw MR, Cameron DR, Underwood EC, Daily GC (2006) Conservation planning for ecosystem services. PLOS Biology [Internet]. [cited 2016 March 14];4(11)2138-2152. Available from: <http://dx.doi.org/10.1371/journal.pbio.0040379>.

Cowin MW, Bardini GB. June 2012. State of California's Central Valley flood protection plan. California Department of Water Resources. [Internet]. [cited on 2016 March 10]. ADD PAGES. Available from: http://www.water.ca.gov/floodsafe/fessro/docs/flood_tab_cvfpp.pdf.

Golet GH, MD Roberts, Larsen EW, Luster RA. 2006. Assessing societal impacts when planning restoration of large alluvial rivers: A case study of the Sacramento River project, California. Environ Manage [Internet]. [cited 2016 March 9];37(6)862–879. Available from: <http://dx.doi.org/10.1007/s00267-004-0167-x>.

Grorud-Colverta K, Lester SE, Airamé S, Neeley E, Gaines SD. 2010. Communicating marine reserve science to diverse audiences. Proc Natl Acad Sci [Internet]. [cited 2016 March 13];107(43)18306-18311. Available from: <https://dx.doi.org/10.1371/journal.pbio.0040379>.

Hanak E, Lund J, Dinar A, Gray B, Howitt R, Mount J, Moyle P, Thompson B. 2011. Managing California's water from conflict to reconciliation. San Francisco (CA). Public Policy Institute of California. [Internet]. [cited 2016 March 9]. 482 p. Available from: http://www.ppic.org/content/pubs/report/R_211EHR.pdf.

Kondolf GM, Anderson S, Lave R, Pagano L, Merenlender A, Bernhardt ES. 2007. Two decades of river restoration in California: what can we learn? Restor Ecol [Internet]. [cited 2016 March 9];15(3):516–523.. Available from: <http://dx.doi.org/10.1111/j.1526-100X.2007.00247.x>.

London JK, Sze J, Lievanos RS. 2008. Problems, promise, progress, and perils: critical reflections on environmental justice policy implementation in California. *J Environ Law and Policy* [Internet]. [cited 2016 March 9];26(2):255-289. Available from: <http://escholarship.org/uc/item/2hb823dd>.

Migratory Bird Conservation Partnership. Homepage [Internet]. c2016. [cited 2016 March 10]. Available from: <http://www.camigratorybirds.org/>.

Multi-Benefit Water Management Project. Homepage. c2016. [Internet]. A multi-benefit approach to flood protection in California's Central Valley. [cited 2016 March 9]. Available from: <http://www.multibenefitproject.org/what-is-multiple-benefit/>.

O'Donnell, TK, DL Galat. 2008. Evaluating success criteria and project monitoring in river enhancement within an adaptive management framework. *Environ Manag* [Internet]. [cited 2016 March 9];41:90–105. Available from: <https://dx.doi.org/10.1007/s00267-007-9010-5>.

Pincetl SS, Alagona P. 2005. The Coachella Valley multiple species habitat conservation plan/natural community conservation plan. Compliance with the federal Endangered Species Action and land use planning considerations. Department of History. University of California, Los Angeles. A Report to the California Policy Research Center. 43 p. [cited 2016 March 9]. Available from: http://www.history.ucsb.edu/projects/histpublications/files/08236-alagona_pincetl_2008.pdf.

Postel S. 2000. Entering an era of water scarcity: the challenges ahead. *Ecol Appl* [Internet]. [cited 2016 March 11];10(4):941–948. Available from: [http://dx.doi.org/10.1890/1051-0761\(2000\)010\[0941:eaewows\]2.0.co;2](http://dx.doi.org/10.1890/1051-0761(2000)010[0941:eaewows]2.0.co;2).

Salcido R. 2012. The success and continued challenges of the Yolo Bypass Wildlife Area: a grassroots restoration. *Ecol Law Quart* [Internet]. [cited 2016 March 20];39:1085-1134. Available from: <http://dx.doi.org/doi:10.15779/Z38B541>.

U.S. Army Corps of Engineers. c2016. Planning SMART guide. Washington (DC). [Internet]. [cited 2016 March 17]. Available from: <http://planning.usace.army.mil/toolbox/smart.cfm?Section=1&Part=a>.

U.S. Army Corps of Engineers. c2016. Central Valley integrated flood management study. Washington (DC). [Internet]. [cited 2016 March 17]. Available from: <http://www.spk.usace.army.mil/Missions/CivilWorks/CentralValleyIntegratedFloodManagementStudy.aspx>.