

Conservation Efforts and Possibilities for Increased Collaboration in the Santa Cruz River Watershed

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Abstract—Attendees of the annual Santa Cruz River Researchers' Day meetings have identified a need to expand collaboration, partnership, and sharing of lessons learned across the watershed. To help guide this interest, Sonoran Institute organized a symposium on 2 May 2012 entitled "Santa Cruz River Conservation." The symposium had simultaneous Spanish/English translation and featured (1) presentations of work being done within the watershed in Mexico, (2) a binational mapping session to inventory current knowledge of conservation efforts in the watershed, and (3) a discussion and invitation to consider forming an interim watershed-wide steering committee. Featured themes included: the importance of strong community engagement and relationship building for conservation success, highly valued areas are often located in highly threatened areas, and increased watershed-wide collaboration could provide numerous benefits and help ensure greater collective impact. Participants were actively engaged and many will volunteer to form an Interim Santa Cruz River Steering Committee to begin brainstorming if and how to form a larger watershed-wide collaboration.

Introduction

Rivers and riparian areas in semi-arid regions support an abundance of life. The Santa Cruz River of southeastern Arizona and northwest Mexico supports tremendous diversity with nearly 600 species of plants and animals documented from a small stretch of the river at the Tumacácori National Historical Park (Powell and others 2005). The river has also supported human communities for thousands of years with evidence of human settlement dating to 9500-9000 B.C. (Logan 2002). In the past 60 years however, increasing demands for freshwater have led to significant groundwater pumping, dropping of water tables, and drying of many reaches (Glennon 2002), thus threatening the river's ability to sustain abundant biodiversity and provide ecosystem services that benefit human communities.

Numerous conservation efforts are underway throughout the Santa Cruz Watershed to promote watershed health and protect and restore these important riparian areas. In order to share results of research and lessons learned, an annual Santa Cruz River Researchers' Day was initiated in 2009. While initially focused solely on research and monitoring in the Upper Santa Cruz River, in Santa Cruz County, Arizona, partner interest in the event has grown and attendees have identified the desire to expand collaboration, partnerships, and sharing of lessons learned throughout the watershed, both binationally and across subwatersheds.

To help guide this growing interest in watershed-wide collaboration, the Sonoran Institute organized a featured symposium on Santa Cruz River Conservation on May 2, 2012. This symposium consisted of three sessions featuring (1) presentations of projects conducted in the Mexico portion of the watershed, (2) an inventory of conservation efforts throughout the watershed, and (3) a discussion and invitation to consider forming a watershed-wide steering committee. To reduce language barriers, simultaneous translation of English and Spanish was available throughout the day.

Santa Cruz River Through Mexico

Most Mexican partners have been unable to attend the annual Santa Cruz River Researchers' Day due to expense and challenges associated with the long distance travel. To begin increasing binational collaborations and sharing of lessons learned, Sonoran Institute invited researchers, managers, and individuals working on diverse conservation efforts within the Mexican part of the watershed to share their work during the first session of the symposium. Presentations included monitoring and restoration within the rural areas along the main stem of the river and efforts to improve watershed health within the city of Nogales, Sonora.

Rural Monitoring and Restoration

Upon leaving the headwaters in the San Rafael Valley in Arizona, the Santa Cruz River flows 25 miles (40.2 km) through several small ejidos or rural communities (Arizona-Sonora Desert Museum 2003). In addition to being the primary water resource for these small towns, the Santa Cruz River comprises a dominant portion of the water portfolio for the cities of Nogales, Sonora, and Nogales, Arizona, or "Ambos Nogales" (Sprouse 2003). Thus the river is recognized as an important resource, while simultaneously facing numerous concerns including

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overgrazing of rangelands, increased groundwater pumping, recurrent drought, and mining, among others (Solis and others 2012). To better understand changing river conditions, the University of Sonora led several studies over 15 years that examined surface and groundwater quality, surface water flows, and riparian vegetation (Solis and others 2012).

Water samples from the river and from wells that supply drinking water were periodically tested between 1996 and 2009 for many parameters including nutrients, agrochemicals, heavy metals, and microbial indicators (Solis and others 2012, 2011). Though many parameters met water quality standards, total coliforms, fecal coliforms, and *E. coli* were present in both surface and groundwater, with levels in the river exceeding the standards for many uses such as drinking water, recreation, and agriculture (Solis and others 2012). Microbial contamination of wells may be responsible for diarrhea in children, which represented 6.3% of illnesses along the Santa Cruz River in San Lázaro, Sonora (Solis and others 2012). Composition and abundance of riparian vegetation along the river were studied in 2000 (Solis and others 2012, 2002). The study documented 335 plant native species and 38 non-native species, with Cottonwood (*Populus fremontii*) and Gooddings' willow (*Salix gooddingii*) as the dominant species.

In addition to research, environmental education programs taught local students about water quality monitoring among other topics (Solis and others 2012). More funding is needed to continue these workshops, as well as to continue monitoring efforts along this stretch of the river. Continued sharing of lessons learned will increase research and conservation success.

Restoration efforts near San Lázaro, in the southern most portion of the Santa Cruz River watershed, have consisted of slowly building collaborations with local community members that eventually led to the installation of over 200 simple rock gabion structures in the mid-2000s (Murrieta and Hare 2012). These gabions slow water, build up soil, and create a "sponge" that will capture and slowly release the run-off, helping to restore degraded grazing lands (Murrieta and Hare 2012). Community involvement and celebration of all achievements, even the small ones, was emphasized as a critical element to restoration success. Sky Island Alliance is leading the preliminary planning phases of a new restoration project that will involve a collaborative effort with 4 to 5 local ranchers. The project would install fencing around riparian areas and establish pole plantings of cottonwood and willow to help mitigate erosion (Murrieta and Hare 2012). The fencing would exclude cattle and cross the river in some areas, requiring repair following large flood events.

Urban Watershed Health Improvements

Equally important for river health is managing and mitigating the quality of stormwater runoff generated in urban areas within the watershed. The impermeable surfaces associated with roads and other surfaces in urban areas quickly shed flows downstream and reduce infiltration of rainfall into the surrounding soil (Shipek and others 2012). Surface runoff in urban cities often carries pollutants that then flow directly into local rivers, impacting water quality. Rainwater harvesting and installation of other green infrastructure can reduce contamination, improve stormwater quality, and increase local infiltration (Shipek and others 2012). Local demonstration projects, completed with the community, simultaneously promote community awareness, train local leaders, and improve local stormwater quality.

Watershed Management Group has led the development of several demonstration sites in the Santa Cruz Watershed, including one at Instituto Tecnológico de Nogales (Shipek and others 2012). The

Instituto Tecnológico de Nogales campus is large and composed of many steep surfaces that quickly drain stormwater into major washes that eventually lead to the Santa Cruz River. Active and passive rainwater harvesting systems were installed to better utilize rainfall, while reducing and slowing stormwater runoff (Shipek and others 2012). Rainwater from the roof of a campus building was actively directed into a large cistern for landscape irrigation. Earthworks and berms slowed stormwater runoff allowing water to infiltrate and contaminants to be filtered out locally rather than flowing downstream. Together these rainwater harvesting features can capture 2.75 inches (6.99 cm) of rainfall in a 100-year storm (Shipek and others 2012). Community involvement is vital with these projects. The bulk of the volunteers participating in the construction were from local school groups, mainly students from the Instituto Tecnológico and students from schools involved in a grassroots effort called Asociación de Reforestación de Ambos Nogales (ARAN). In addition, partnership with Comisión Estatal de Agua, the state water agency, involves other levels of the community. Next steps for this project include development of evaluation and monitoring protocols as well as community workshops on maintenance of rainwater harvesting features.

Inadequate wastewater infrastructure can also lead to contamination of stormwater runoff. U.S. and Mexican economic policies have caused industrialization and rapid urban growth along the border, often with insufficient time and resources to build adequate public infrastructure (Lipnick and others 2012). Latrines and septic systems can overflow during flood events and directly contaminate washes and rivers through stormwater runoff, as well as cause health problems on both sides of the border. Limited water resources and insufficient wastewater infrastructure suggest the use of household composting toilets in Nogales, Sonora (Lipnick and others 2012). Composting toilets use little or no water to treat human waste and provide benefits including pollution control, production of compost, and reduced spending on water.

Building on a 2002 effort in Colonia Bella Vista, a collaborative multiphase project began in 2008 to install composting toilets within Colonias del Sol in Nogales, Sonora. University of Arizona's Bureau of Applied Research in Anthropology (BARA), has led this current effort with partnership from municipal officials and other community groups (Lipnick and others 2012). Community outreach and education is essential to the success of the project. Evaluations of the initial phase of toilet construction found that toilets were used properly (frequent use of toilet, sufficient sawdust) when people received outreach; those receiving inadequate outreach had toilets that were poorly maintained (e.g. smelly, not enough sawdust; Lipnick and others 2012). Community perception of composting toilets varies. Some members view composting toilets positively, while others think they are unpleasant. Several community members will connect to wastewater infrastructure and convert to flush toilets when that option is available, while others enjoy their composting toilet and have the secondary benefit of compost for their plants. Ideally, with continued outreach and education, a greater percentage of the community will choose composting toilets (Lipnick and others 2012). Current demand for composting toilets exceeds project capacity, with few resources to build new toilets and continue the monitoring of toilets from earlier project phases.

Community Participation Brings Success

A common theme identified, whether working in rural ranching communities or in densely populated urban settings of Mexico, was the importance of collaboration with local communities. Establishing relationships with community members by taking time to gauge their

interest, identify local problems, and develop collaborative solutions generated greater project success; however, finding adequate time and resources to build relationships is often a challenge. While achieving greater 'buy-in,' more importantly community involvement helps develop local skills and leadership that will be vital for long term success. Though a synthesis discussion primarily focused on the Mexican portion of the watershed, participants agreed that these ideas would apply within the U.S. portion of the watershed.

Binational Mapping

Mapping and inventory of current conservation efforts is an important tool and first step to help increase collaboration both binationally and across subwatersheds. The binational mapping session had several goals: 1) review draft maps of known conservation efforts, and 2) map and describe other conservation efforts, high value areas, and threatened areas. The mapping exercise focused on the upper half of the Santa Cruz River watershed and was further subdivided into four regions (fig. 1). The draft maps highlighted areas in the United States known to be either permanently protected for conservation or managed for conservation (e.g. Arizona State Trust Land that is managed for conservation use). As land ownership differs in Mexico, the existence of permanently protected areas is uncertain and could not be mapped. The draft maps also included general polygons identifying monitoring and restoration efforts. Each polygon was marked with a number that corresponded to a general description of the conservation effort and the lead organizations involved. Participants were asked to comment on existing polygons and descriptions, as well as draw

additional polygons associated with other conservation efforts. While primarily monitoring and restoration projects were identified in the draft map, the inventory of conservation efforts included the following: land protection, monitoring, research, restoration, coalition or partnership, or some other effort.

The 90-minute mapping session was an effective starting point to what will likely be a larger mapping effort in the future. There was good representation from all four subregions and numerous additions were made to the maps. Results of the mapping will be reviewed and eventually made available, with the idea that the datasets will be an active resource that is periodically updated.

Initial review of the mapping datasheets highlighted common themes among the different regions. High value areas included one or more of the following: perennial water, important ecosystems (i.e. grasslands, riparian), good wildlife habitat, and undeveloped areas or protection from development. Threatened areas often overlapped with areas of high value if there were known activities that may impact the high value area, such as loss of perennial flow to ground water pumping or mining activities. Other threats common to two or more of the sub-regional maps included mining, grazing, non-native species, and development.

Action Planning

The last session of the day was a facilitated discussion about increasing binational and subwatershed collaboration and the growing idea of forming a larger watershed entity for this purpose. Participants were asked to identify 1) the benefits and values associated with increased collaboration at the watershed level, and 2) the initial actions or first steps that would need to be taken.

Benefits to increased collaboration were numerous including: diversity of partnerships and perspectives; sharing of resources and lessons learned; leveraging of skills and expertise; greater knowledge of funding opportunities; continuity of conservation efforts; and greater efficiency of work so that duplication is avoided and projects are coordinated. In addition, a watershed-wide collaboration could provide greater recognition and visibility than single projects could on their own. A watershed-wide collaboration comprised of diverse groups and perspectives would demonstrate community buy-in for conservation efforts, which is vital to the region's long term conservation success.

Energy was high with the interest clear and excitement palpable during the brainstorm session of possible actions for a watershed-wide collaboration to complete. The mission of a watershed-wide collaboration would need to be clearly defined and would likely be a first step should such an endeavor be undertaken. Defining the structure would also be important, as increased collaboration could range from a general alliance to a formal group. A watershed-wide strategic evaluation could examine long-term watershed health given current threats and issues faced, as well as identify the long-term stakeholders—the 'hubs' and 'nodes' of conservation efforts that will maintain the momentum. A strategic evaluation could additionally identify priorities, data gaps, and opportunities. Goals and benchmarks of success could be developed in order to measure long-term progress and collective success in the watershed. Other actions could include an annual celebration that could be based on existing events, not necessarily new ones. Community involvement is very important; utilizing existing events would likely be more successful than creating new ones.

Interest in a watershed-wide collaboration primarily stems from discussions at the annual Santa Cruz River Researchers' Day. Though initially focused on the Upper Santa Cruz River, this event has expanded

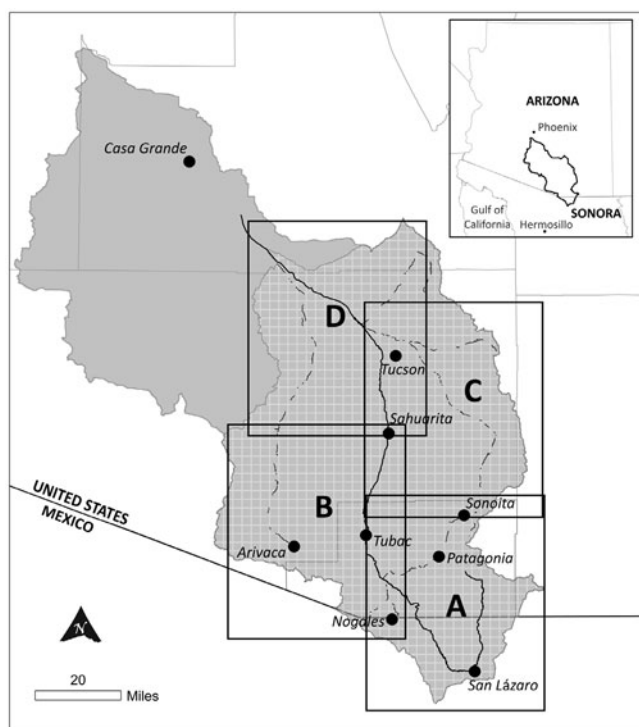


Figure 1—Orientation map depicting the locations of the four sub-regional maps (A-D) that were used to inventory conservation efforts within the upper half (hatched area) of the Santa Cruz River Watershed (grey area), Arizona and Sonora (Santa Cruz River = solid line, major tributaries= dashed line).

to include other regions and could perhaps contribute to a watershed-wide collaboration. Participants were asked if they were interested in forming an Interim Santa Cruz River Steering Committee to continue discussions of how to increase collaborations and brainstorm if and how a watershed-wide collaboration might function. Sixteen attendees responded that they may be interested in participating in an interim committee; an additional 19 attendees of this year's Researchers' Day also expressed interest. Initial follow-up meetings and the formation of the interim committee will occur sometime in the summer or fall of 2012.

Conclusion

Organizing a symposium on Santa Cruz River Conservation within the Madrean Archipelago III conference provided numerous benefits including (1) elevating the importance of the conservation efforts in one of the Archipelago's binational watersheds, (2) providing an opportunity to highlight and discuss Santa Cruz River issues with an audience that may not participate in the annual Researchers' Day meeting, and (3) facilitating many logistical details such as simultaneous translation, venue, food, and audio-visual equipment. There were over 37 attendees of the symposium throughout the three sessions. More than 60% of attendees, including five from Mexico, did not attend this year's annual meeting on 29 March 2012. In evaluations completed at the end of the day, participants listed the collaboration discussions and opportunities to network and meet others working throughout the watershed as an important highlight of the symposium. Hearing presentations of work in Mexico was a big interest and much appreciated.

In preparation for this event, cost of attendance (single day registration \$110 U.S. or \$1,517 Mexican peso) was often given as a reason for not being able to participate. While there were numerous benefits to having the symposium within the Madrean Conference, future meetings will need to be free or much reduced in cost to maximize participation. Additionally, while travel stipends helped defray travel costs of some participants coming from Mexico, last minute schedule conflicts and presumably the cost of travel time amidst busy schedules, prevented several Mexican partners from attending. Fortunately, respective U.S. partners were able to present these binational conservation efforts, but participation by all partners is desired. Facilitating binational participation will continue to be a challenge to increasing watershed level collaboration. As presence of Mexican partners is still highly desired for future events, hosting meetings that alternate between the U.S. and Mexican venues, are closer to the border, or use video conference technology (i.e. Skype, GoToMeeting, or Google+) may need to be considered — suggestions that were also made during the final wrap-up session of the entire conference.

The Santa Cruz River Conservation symposium provided an initial inventory of conservation efforts and numerous ideas of how to increase collaborative efforts. Most importantly, the symposium helped build new and existing relationships that will advance the collective impact of conservation efforts watershed-wide.

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