

## SCENARIO PLANNING IN THE CIENEGA WATERSHED - PHASE ONE

Update 3 – Scenario narratives ready to use! July 2013

***As land managers, the toughest challenges come from changes we don't expect, and forces we can't control. We'll do better if we can prepare for a range of conditions that we can't predict or dictate.***

***– Karen Simms, Assistant Field Office Manager, Bureau of Land Management Tucson***

Phase 1 is complete! Four resource teams, with more than 25 people from 20 organizations, developed rudimentary scenarios at a busy workshop in April. They built out and refined their scenarios during May, combining key uncertainties related to climate and other forces of change affecting their local resources, and got feedback from stakeholders in June. The scenarios now are ready to use to screen management options, inform planning processes, and guide monitoring efforts.

### **Why Scenario Planning?**

The lands and communities we care about are facing a wide range of challenges—including an unpredictable future where climate, socio-political, and economic conditions may be different than we expect and are largely outside the control of local managers and residents. Many stakeholders continue to contribute to adaptive management enabling the BLM's Las Cienegas National Conservation Area to track and respond to changing conditions on the land. Watershed partners are now working to identify key new uncertainties and to improve decision-making in the face the next wave of rapid changes.

This Scenario Planning effort aims to understand what uncertain and high risk forces may impact the area most in the next 100 years, and prepare for the challenges they may bring to managers and residents. This collaborative and deliberate approach looks not only at key climatic factors but also at social, economic, ecological, and cultural changes. After exploring this approach in 2011 and 2012, partners began this effort in earnest in 2013, devoting staff and resources to Phase 1 creation of scenario narratives. Using the narratives, partners will move forward in the next phase to evaluate management strategies, adapt existing decisions, and develop new options to sustain the watershed's values through changing conditions.

The narratives explore ways in which the challenges facing managers and stakeholders within the Cienegas watershed may evolve over future decades. The scenarios are not forecasts or predictions of the future. They do not indicate a "most likely" future. They do not contrast "best case" or "worst case" possibilities. Rather, they simply present plausible future conditions that would challenge resource managers and communities in very different ways. Their purpose is to stimulate thinking and discussion, not to indicate any preferences for future conditions or management approaches.

### **Who was involved in Cienega Watershed Scenario Planning?**

The Cienega Watershed effort is being led by a team of scenario planning experts from the University of Arizona CLIMAS program, with steering committee members from BLM, CWP, and TNC. Phase 1 builds on the strong collaboratively partnership already in place but also adding new partners through the four teams formed for this work. Partners come from federal, state and local agencies; non-profit organizations and stakeholders of interested public, academic, resident, and other land users, including:

- University of Arizona - CLIMAS (Lead)
- Bureau of Land Management Tucson
- Cienega Watershed Partnership
- The Nature Conservancy
- US Fish and Wildlife Service
- National Park Service, Saguaro National P.
- USDA Agricultural Research Service
- Pima Association of Governments
- Pima County Regional Flood Control District
- Cuenca Los Ojos Foundation
- Pima County
- Natural Resources Conservation Service
- U. of Arizona - School of Natural Resources

*Many thanks to the over 50 individuals and over 20 organizations who have helped shaped this overall scenario planning effort, and especially to those who put additional time and creativity into the most recent phase of fleshing out scenario narratives for each resource area.*

- US Forest Service, Coronado National Forest
- Audubon Appleton-Whittell Research Ranch
- Sky Island Alliance
- Southwest Decision Resources
- FROG
- Colossal Cave Mountain Park
- Empire Ranch Foundation
- U. of Arizona - Water Resources and Research Center

### How were the scenarios developed?

After a training workshop in February, co-leads of four resource teams guided colleagues through a series of activities during a one-day intensive scenario development workshop in April. Each team independently identified their specific resource management issues and shared understanding about external non-climatic forces or “drivers” that specifically affect their Cienega resources and chose two with high impact and high uncertainty. These major drivers became the axes for developing rudimentary scenario narratives. Over the following two months, each team expanded and refined their four non-climate narratives, then selected three of these narratives to combine with three regional climate narratives.

Finally, resource groups presented their narratives at the 5<sup>th</sup> annual Science on the Sonoita Plain held June 8, 2013, to share results with each other and vet the narratives with the larger stakeholder group. Brief versions are reported in the Proceedings from this symposium, available at <http://researchranch.audubon.org/Library.html>. More complete narratives will be posted by September 2013 at: <http://www.cienega.org/cooperative-actions/> or here: <https://sites.google.com/site/lcncaadaptivemanagement/scenario-planning>

### What climatic scenarios did the teams use?

The regional climate narratives were developed using a similar workshop process that engaged climate and impacts scientists from the Climate Assessment of the Southwest (CLIMAS). Each regional climate scenario emphasizes the “grand uncertainties” of future Southwest climate, while also incorporating highly likely elements identified within the recent report, *Assessment of Climate Change in the Southwest*, prepared for the 2013 National Climate Assessment. The three regional climate narratives selected to combine with the Cienega resource team narratives are:



Dust storm near Scottsdale, AZ, July 12, 2012. Photo credit: R. Behnke

**The Habooby Trap—dry and dusty.** The Southwest becomes drier and dustier from a combination of drier winters and windier summers. The widespread nature of the winter rainy season means that low precipitation is a uniform feature across the region. Summer winds, on the other hand are more localized as dry and powerful downdrafts generated by monsoon thunderstorms act upon loose sand and soil kicking up clouds of dust that can attain heights of one mile and leading edges that can reach one hundred miles in length.

**The Tucson Good Old Days—greening.** The onset of the monsoon season shifts to an earlier start date but the end date remains unchanged, yielding an extended summer rainy season. An earlier start date of the monsoons could potentially offset, to some extent, the increasingly hot, dry conditions that would develop by June in a warming climate. A longer monsoon season means more rain, thus boosting the importance of the summer precipitation pulse across the region. The other component of this scenario is reduced activity of tropical Pacific cyclones that can generate intense storms during the late summer and fall, and result in extreme flooding.



Monsoon storm over Sabino Canyon with Tucson in background. Photo credit: J. Malusa.



2004-5 winter floods in Oak Creek Canyon near Sedona, AZ. Photo credit: FARK.com

**The No Analog—dry-wet extremes.** The onset of the monsoon season shifts to a later start date but the end date remains the same. In addition, Tropical Pacific cyclones increase in number and intensity. The dual effect of these changes is a longer, hotter pre-monsoon dry season and a more intense rainy season that extends into the fall. Temperatures in the dry season reach new extremes due in part by the delay of the monsoons but also by warming trends. Fire risk increases. An increased number of tropical Pacific cyclones in the

fall (September through November) result in more direct and indirect impacts to the Southwest in widespread, multi-day events, with an increase in extreme flooding risk in late summer and fall.

### What scenario narratives were produced by the resource teams?

Here, for each resource team, we present a description of the resources being affected, the non-climate scenarios and their combination with the regional climate scenarios, and the resulting management challenges they present.

**Cultural Resources** are historic sites or standing structures, archaeological sites, and historically significant places, and heritage values that represent the groups who have resided in, utilized or placed value to the Cienega Watershed. Our first axis and major driver was **Human and Natural Disturbance**. Examples of natural disturbance include erosion, headcutting, flood, wildfires, wind and intense storm events; examples of human disturbances include uncontrolled recreation, projects, and vandalism or pothunting. Our second axis and major driver was **Public Support for Preservation**. Heritage resources are heavily dependent upon public support for preservation of specific locations, for laws and regulations, for public engagement, and for funding. Under all scenarios, negative public support results in declines in all aspects of preservation. These axes, taken together, produce the four non-climatic scenarios illustrated in Figure 1.

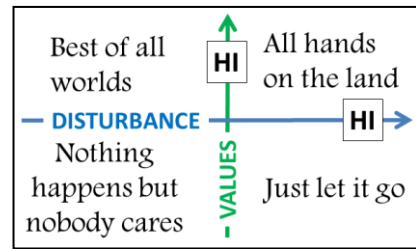


Figure 1. Four scenarios for cultural resources as defined by disturbance and values about cultural resource preservation.

The combined scenarios are: (1) **Just Let it Go + Habooby Trap**, (2) **Nothing Happens but Nobody Cares + Tucson Good Ol' Days**, and (3) **All Hands on the Land + No Analog**. Based on these final scenarios, managers of cultural resources may want to consider:

- How to manage under a drying climate with increased damage potential to resources but reduced public support, funding and engagement.
- How to deal with increased threats to cultural resources if given an apathetic and disconnected public.
- How to respond to increased damages from wet-dry climate extremes by capitalizing on high public engagement and support.

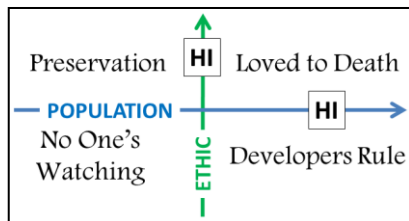


Figure 2. Four scenarios for riparian resources as defined by rates of population growth and environmental ethic.

**Riparian Resources** are highly sensitive and at risk: water, native frogs and fish, and the cottonwood and willow gallery forests. Without water, frogs, fish, and riparian forests will be lost. Our first axis and major driver was **Population Growth**, either a decrease or increase. Our second axis and major driver was **Environmental Ethic**. Environmental ethic refers to the value placed on the natural environment, including but not specific to riparian ecosystems. These axes, taken together, produce the four non-climatic scenarios illustrated in Figure 2.

The combined scenarios are: (1) **Preservation + Habooby Trap**, (2) **Developers Rule + Tucson Good Ol' Days**, and (3) **Developers Rule + No Analog**. Based on these final scenarios, managers of riparian resources may want to consider:

- How do we maintain riparian systems in a world of dry-wet extremes and development priorities?
- Riparian systems will be in trouble even with a seemingly benign climate, given societal pressures.
- What would it take for riparian systems to withstand a drying climate, even when societal priorities are highly favorable?

**Upland Resources** exist between the montane and riparian areas and include saguaros, desert scrub, and semi-desert grasslands. Our first axis and major driver was **Character of Governmental Funding**. Government funding could occur at consistently low levels, or with high variability in a 'boom or bust' pattern. Our second axis and major driver was **Environmental Laws**. Environmental laws could be repealed or be maintained at their current levels of use. These axes, taken together, produce the four non-climatic scenarios illustrated in Figure 3.

The combined scenarios are: (1) **Unfunded Mandates + Habooby Trap**, (2) **Follow the Money + Tucson Good Ol' Days**, and (3) **Opportunity Knocks + No Analog**. Based on these final scenarios, managers of upland resources may want to consider:

- How to facilitate the transition of vegetation types, no matter the species involved, while meeting regulatory obligations for protection of threatened and endangered species?
- How to ensure the expansion of native vegetation under the pressures of development, even under a productive climate, if development pressures continue to grow?
- How to use boom and bust funding—like budget cuts and new initiatives, sequesters and stimulus—effectively, to deal with continuous disruption and disturbance, especially from extreme events that have widespread impacts?

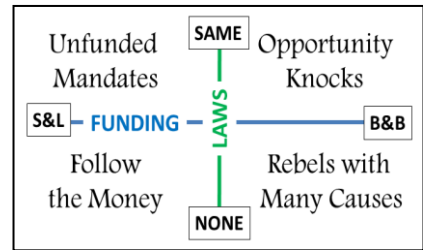


Figure 3. Four scenarios for upland resources as defined by Government Funding: Steady but Low vs Boom and Bust; and Environmental Laws: current laws unchanged (same) vs current laws abolished (none).

**Montane Resources** are comprised of vegetation types including oak woodlands up to mixed conifer forest. Our first axis and major driver was **Fire**, defined as the departure from current fire regime condition class. High departures indicate very different fire regimes than what we see today. Our second axis and major driver was **Insect Outbreaks**. These axes, taken together, produce four the non-climate scenarios illustrated in Figure 4.

The combined scenarios are: (1) **Descent into Decadence + Habooby Trap**, (2) **Land of Milk and Honey + Tucson Good Ol' Days**, and (3) **Dante's Beetlemania + No Analog**. Based on these final scenarios, managers of montane resources may want to consider:

- The montane system may undergo rapid changes that essentially amount to a re-shuffling of species, with new and surprising combinations and interactions
- Wholesale conversion of mixed conifer forests to oak woodlands, with increased spring fire risk, challenges the ability to sustain critical parts of the montane system.
- Many parts of the montane system may experience disturbance simultaneously, so that management resources will be spread thin.

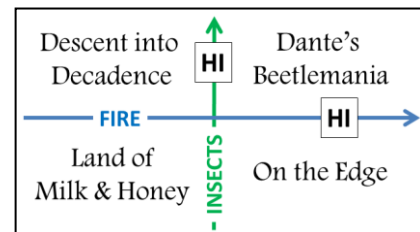


Figure 4. Four scenarios for montane resources as defined by insect outbreaks (many vs few) and departure from current fire regime.

### How will managers be using these scenarios next?

The Steering Committee is in the process of evaluating comments from the teams and stakeholders to refine the process and to detail the next phases. Some participants are already considering a wider range of possible conditions in management discussions; some feel they have additional tools to address complex and uncertain issues with their colleagues.

In Phase 2, the scenarios will be used to help evaluate which management strategies are best suited to maintaining land health and ecosystem services under this range of possible futures, develop contingency plans for shifting strategies when thresholds of change are passed, and design monitoring that can reveal these thresholds in time to make necessary shifts. Managers will explore the implications of the scenarios, looking for opportunities as well as vulnerabilities. Teams will consider interaction and conflict among their scenarios, such as how upland and montane stresses affect one another, or where conflicts might occur in developing adaptive options. We will explore translation of the qualitative narratives to quantitative assessments that use models to assess current and produce new management options. The steering committee and team members will continue to explore how to integrate scenario planning into land management plans or revisions of existing ones such as the Las Cienegas National Conservation Area Land Use Plan and the Coronado National Forest Management Plan.

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