

## Sonoita Creek in PLSP – 2016-2021 RSRA Score Comparison

### RSRA timeline

- 10/24/16 ten people in two teams were trained in RSRA on Sonoita Creek upstream from Patagonia Lake and downstream from the current headcut. For this comparison the scores of those two teams have been averaged together.

-4/21/17 a team of seven people already trained in RSRA did the first survey above the headcut.

-4/14/19 nine people in two teams were trained in RSRA with one team working below the headcut and the other team working above the head cut.

- 2020 No RSRA due to Covid-19

- 5/1/2021 – A team of 8 people, most already trained, surveyed Sonoita Creek above Patagonia Lake and downstream from the headcut.

Date	10/24/16	4/14/19	4/14/19	4/21/17	5/1/21
<b>Reach</b>	Below headcut	Below headcut	Above headcut	Above headcut	Below head cut
<b>UTM coordinates</b>					
Upstream – study reach	12R0515187E 3485112N	12R 0515378E 3485093N	12R 0515842E 3485468N	12R0515837E 3485469N	12R0515378E 3485093 N
Downstream – study reach	12R0514733E 3484922N	12R 0514750E 3484939N	12R 0515378E 3485093N	12R0515350E 3485096N	12R0514769E 3484901N
<b>Transect</b>		12R 0514812E 3485006N down	12R 0515378E 3485093N down		12R0515356E 3485101N
<b>Indicator</b>					
1. Algal Growth:	3.5	5	4 (2%)	2 (26%)	3 (11-25%)
2. Channel Shading:	3	3	4 (50%)	5	4 (31-60%)
<b>Water Quality Mean Score:</b>	<b>3.3</b>	<b>4</b>	<b>4</b>	<b>3.5</b>	<b>3.5</b>
3. Floodplain Connection	1 (ratio 4.4)	1 (ratio 2.9)	1 (ratio 1.9)	2 (ratio 1.6)	1 (ratio 1.7)
4. Vertical Bank Stability	1 (91% unstable)	4 (9% unstable)	5	5	5 (<5% unstable)
5. Hydraulic Habitat Diversity	5	5	5	5	4
6. Riparian Area Soil Integrity	1 (see notes)	5	5	1 (see notes)	1 (> 25% disturbed)

7. Beaver Activity	1	1	1	1	1 debatable
<b>Hydrogeomorphology Mean Score</b>	<b>1.8</b>	<b>3.2</b>	<b>3.4</b>	<b>2.8</b>	<b>2.5</b>
8. Riffle-Pool Distribution	1	1	1	3	NA (see notes)
9. Underbank Cover	2 (5%)	2	2	1	NA
10. Cobble Embeddedness	3.5	3	3 (30%)	5 (15%)	NA
11. Aquatic Macroinvertebrate Diversity	2.5	4	3	5	NA
12. Large Woody Debris	4.5	3	5	4	4 (6-10 LWD)
13. Overbank Cover	4.5	5	5	5	5 (> 50% overbank cover)
<b>Fish/Aquatic Habitat Mean Score</b>	<b>2.8</b>	<b>3.0</b>	<b>3.2</b>	<b>4.7</b>	<b>3.6</b>
14. Riparian Zone Plant Cover:	3	3	4	3	3
Avg. all layers	34%	40%	57%	48%	43.25%
Ground Cover	48%	68%	83%	91%	84%
Shrub Cover	33%	27%	21%	37%	41%
Middle Canopy Tree	29%	34%	62%	39%	20%
Upper Canopy Tree	27%	30%	40%	23%	28%
15. Native Shrub Demography and Recruitment	4 – Seep Willow 3 classes	3	4	5	5 - all age classes present
16. Native Tree Demography and Recruitment	4 – Goodding's Willow 3 classes	4	4	3	2 - 1 age class present
17. Non-native Herbaceous Plant Species	1 = 90% Bermuda Grass	1	1	1	1 (> 50% Bermuda grass)
18. Non-native Woody Plant Species	5	5	5	4	4 (5-10% non-native)
19. Mammalian Herbivory (Grazing) on Ground Cover	3	5	5	1	1 (> 50% plants grazed)
20. Mammalian Herbivory (Browsing) on Shrubs and Small Trees	1 = 63%	2	2	4	1 (> 50% plants browsed)

<b>Riparian Vegetation Mean Score</b>	<b>3.0</b>	<b>3.3</b>	<b>3.6</b>	<b>3.0</b>	<b>2.33</b>
21. Shrub Patch Density	3.5	4	4	4	5
22. Mid-canopy Patch Density	3.0	3	3	3	2
23. Upper Canopy Patch Density	2	4	3	2	3
24. Fluvial Habitat Diversity	3.5	1	3	4	5
<b>Terrestrial Wildlife Habitat Mean Score</b>	<b>3.0</b>	<b>3.0</b>	<b>3.3</b>	<b>3.3</b>	<b>3.75</b>
<b>Overall Score:</b>	<b>2.7</b>	<b>3.3</b>	<b>3.5</b>	<b>3.5</b>	<b>3.1</b>

NOTES FROM 2016-2021

**10/24/16 - Overall observations Sonoita Creek Above Lake Patagonia & Below circle Z Ranch**

Algal growth (Indicator 1) - A flood on 8/9/16 scoured the streambed of much of the filamentous algae that we assumed is normally found in this reach.

The historic floodplain of this reach extends to steep banks and rocky cliffs of desert terrain on either side. Deposition of large woody debris throughout this area indicates that the entire floodplain has been inundated repeatedly within the last decade. The primary channel has shifted from one side to the other and is currently toward the middle. Along the north boundary of the floodplain we found ponds and oxbows.

The exact legal status of our study reach is uncertain. It is either State Trust land or it is part of Patagonia Lake State Park. The entire area is heavily grazed by cattle, whether they are there legally or not. The banks are broken down by cattle as well as by horses on trail rides from the Circle Z Ranch just upstream. Soil throughout the floodplain is disturbed and heavily compacted by cattle.

Over the last eight years a headcut has been moving upstream. The author of this report remembers it being below the lower end of our study reach. It is now above our study reach at UTM 12R0515357E 3485106N. Large floods associated with summer monsoon rains are the immediate cause of this erosion. (Heavy winter rain can also fill the floodplain as observed by the author in January 2010.) Above the headcut there is little entrenchment of the creek. The creek flows in braided channels and the water spreads out over the floodplain whenever the level rises. Immediately below the headcut the banks are already two to three feet high and actively eroding. A future survey of this

upstream area using this RSRA protocol could provide a more scientific comparison, but photographs taken immediately above and below the headcut make the devastation underway here obvious.

**Areas of greatest concern:**

Hydrogeomorphology (Indicators 3, 4, and 6) and Riparian Vegetation (Indicators 19 and 20)

Due to the recent upward erosion of the headcut mentioned above, the stream is severely entrenched. Ninety one percent of the bank is unstable and crumbling into the stream. The resulting sediment is being moved down to Patagonia Lake. This sedimentation threatens the future use of the lake for fishing and boating and, thereby, the economic viability of the state park. The heavy grazing of cattle in the area aggravates this situation by breaking down the banks even more quickly and browsing riparian vegetation both forbs and shrubs that might otherwise help stabilize the banks.

**Team members:**

Bob Brandt, John Hughes, Kathy Pasierb, Anne Townsend, Jason Botz, David Ellis, Carolyn Livensperger, Sandy Borthwick, and Julius Bedoni with some help from Andy Gould.

**Author:** Andy Gould

Possible reasons for discrepancies between 10/24/16 and 4/14/19 surveys:

The 10/24/16 study reach includes two 100 meter transects instead of one. This applies in particular to indicators 1, 4, 8, 9, 12, 13 14, 19 and 20.

Indicator 6, riparian area soil integrity: On the 10/24/16 survey we took the ubiquitous presence of cattle hoof prints and broken-down banks as evidence of soil disturbance. On the 4/14/19 survey we Pete Stacey's interpretation that for soil to be considered disturbed it must be so impaired that nothing will grow there.

**04/2017 Overall Observations Sonoita Creek survey by indicator**

**3 & 4 – Floodplain connection and vertical bank stability** in the study reach above the headcut appear to the observer to be far better than in the reach below the headcut. One obvious sign is the almost total absence of unstable banks crumbling into the creek bed in this upper section. The average ratio of the height of annual peak flow (bankfull) compared to the level of the historic floodplain is 1.6 in the upper reach. This is almost three times better than the ratio of 4.4 below the headcut. Nevertheless, the scoring scale gives a score of only 2 for floodplain connection. At the same time indicator 4, vertical bank stability scored a 5 above the headcut as compared to a 1 below.

**5 – Hydraulic Habitat Diversity** was very good both above and below the headcut. A few large trees fallen into the creek have caused much of this diversity.

**6 – Riparian Area Soil Integrity** was equally compromised both above and below the headcut. The soil is trampled and compacted by cattle almost everywhere.

**11 – Aquatic Macroinvertebrates** – Cadisfly, Stonefly, Mayfly, Semiaquatic toad bug, Aquatic worm, Water scavenger beetle, water striders, egg sacs

**14 – Riparian Zone Plant Cover** – Readings were taken on the southern bank (river left) as was done in October.

**15 – Shrub Demography** – Seep Willow is quite dominant and all classes are present. We are still investigating a woody shrub-like plant that some of us took to be tamarisk at first. Jason Botz originally called it Baccharis, but he now thinks that it must be some other plant in the same family (Asteraceae), probably Artemisia sp. (a kind of sagebrush).

**16 – Tree Demography** – Gooding’s Willow is the most evident tree cover but we did not see any saplings or immature trees. There are also mature cottonwoods, sycamore, hackberry, elderberry, a few non-native mulberries, and mesquite (mostly on the dry uplands but also some large trees in a bosque between the present course of the creek on the south side of the floodplain and the previous channel of the creek on the north side).

**17 – Non-native Herbaceous Plants** – Bermuda Grass is everywhere and grazed so closely that it seems like lawn. It does help to stabilize banks of the creek trampled by cows. Watercress lines much of the banks of the creek, but, unlike the Nature Conservancy where it grows quite tall and covers the entire creek in many places, it seems that grazing actually keeps it in check. We also saw poison hemlock and a mysterious plant called Nicotiana sylvestris known by the common names woodland tobacco, flowering tobacco, and South American tobacco. It has large fuzzy leaves with a noxious sticky coating on the backs that traps insects. Its white trumpet flowers look like tree tobacco.

**18 – Non-native Woody Plants** – Tree tobacco, Mexican bird of paradise, and a couple of mature mulberry trees.

**20 – Mammalian Browsing of shrubs and small trees** was much less than browsing of grass. We noted a number of hackberry shrubs that had never developed into trees due to repeated browsing.

### **05/01/2021 Observations and Human Impacts**

RSRA did not take place in the spring of 2020 along Sonoita Creek due to Covid -19 virus concerns. 2021 is the second year of severe drought in a two-decade era of drought in Southern Arizona.

**Water Quality** of the creek concerned all of the participants. Within the study reach there was a dead cow in the creek, odiferous, bloated and in stages of decomposition. This may add species of e-coli to the creek which drifts into Patagonia Lake downstream of the cow where families are swimming. The manager of the state park was notified by one of our members.

Surprisingly, there was about 25% **algal growth** in the creek. We expected more coverage. However, **channel shading** was high keeping the creek on the cooler side.

**Hydrogeomorphology** scored lower than 2017 and 2019. In spite of a number of cows owned by Rancher, Robert Noon's grazing along and, in the creek, we found a low % (5-30%) of **vertical bank unstable**.

**Hydraulic habitat diversity** was moderately high considering the lack of volume of water flowing down the creek.

There was a debate about **Beaver Activity**. Some members believed that historically there were beaver along Sonoita Creek based on records from family members observing beaver. This was contrary to the records in science based studies that show there were no beaver naturally occurring along the creek. The debate goes on.

**Fish/Aquatic habitat** scores were diverse. No **Riffle pools**, **Underbank cover**, **Cobble embeddedness** nor **Aquatic Macroinvertebrates** were observed. There was a high occurrence of **Large Woody debris** and **Overbank cover**.

**Riparian Vegetation Plant cover** averaged 26 to 50% and **Shrub demography** was high. **Non-native herbaceous** plants scored above 50% and **Non-native Woody plants** dominated the riparian habitat. Bermuda Grass dominated the edges of the creek as seen in all previous years. **Grazing and Browsing** was very high.

**Terrestrial Wildlife Habitat** was mixed. **Shrub patch density** was high yet **mid and upper canopy** was below average.

**Human Impacts** were discussed at length. Current impacts have changed the nature of the creek to a large extent from historic records. Dams, railroad, overgrazing, human activities and climate change have altered the quality of the riparian habitat along Sonoita Creek. Overgrazing has severe impacts.

The upland areas of the watershed has been altered by human development and recently South 32 mining activity has furthered the alteration.

To date there are no plans by the Park Service to create an ecological project to keep livestock in place. Since 2005 there have been a number of visitors to the Patagonia Lake State Park that have complained about the muck and mire created by Robert Noon's cows. No meaningful action by the park service has ever been taken.

There are no adjacent roads nearby on the study reach of Sonoita Creek. Upstream is a different situation. Highway 82 follows the creek for some miles. The impacts on wildlife crossing or flying across the road is severe.

Upstream of the study reach is circle Z ranch. There are old railroad abutments and Lake Patagonia dam downstream. The possible impacts of these human activities has not been studied.