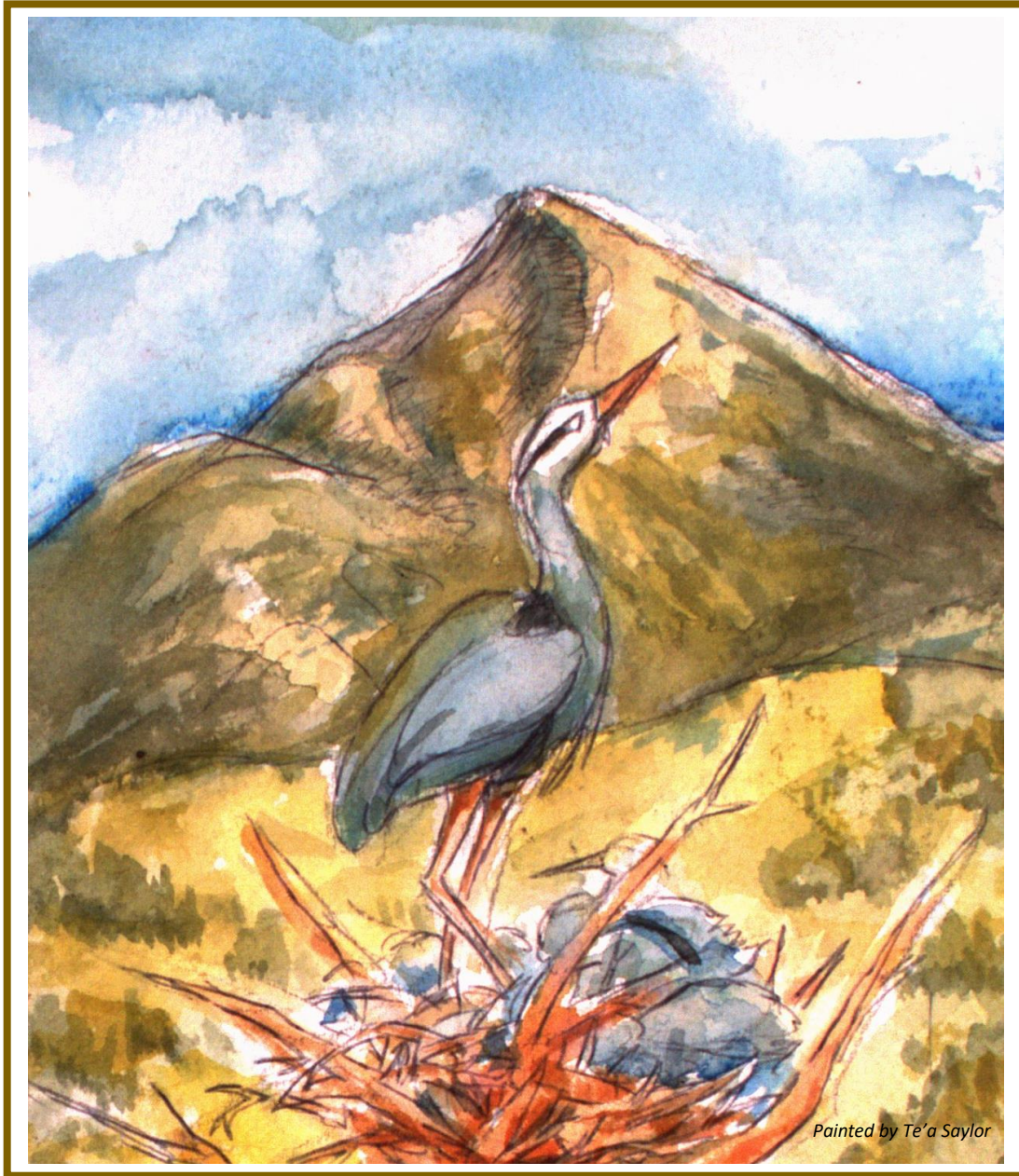


# Slate River Great Blue Heron Colony Report 2022



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**and**  
**Slate River Working Group**



# Great Blue Heron Colony Status and Dynamics in Relation to Human Disturbance in the Slate River Valley, Crested Butte, Colorado

## Executive Summary

The great blue heron (*Ardea herodias*) is a large, colonial waterbird that nests in the Upper Slate River Valley near Crested Butte, Colorado. The colony has probably existed for at least 25 years but its history is not well documented. Rangewide the species has a stable population, but some regional populations are in decline and the bird receives special conservation status. The great blue heron has several vulnerabilities as a top carnivore and a social breeder. The bird is adverse to human disturbance and impacts to their colonies include reduced reproductive success, reduced survival, increased stress, and nest or colony abandonment. The purpose of this study is to document the phenology and demography (including reproductive success) of the great blue heron colony on the Slate River, and to determine the effects of human activities on their behavior, phenology and demography.

This is the fifth year of a five-year study that began in 2018. The report focuses on the results of the 2022 season, and annual reports for 2018, 2019, 2020, and 2021 were also produced. In 2022, herons occupied 18 active nests in three sub-colonies. The new Middle Colony housed one nest. The Upper Colony had 5 nests, with one unsuccessful. The remaining 12 nests were in the Lower Colony. Of the 18 nests, 15 (83%) were successful (produced at least one chick). Two of the unsuccessful nests blew out of the tree canopies during incessantly strong winds throughout the 2022 spring. A third unsuccessful nest was harassed by a neighboring pair of adult herons and the nest was abandoned as the raiders pirated sticks for their nest. One nest produced two chicks but neither chick fledged. Overall, 42 chicks were produced and 39-40 fledged (93-95% fledgling success) from 14 nests (78% fledged success). Despite the high reproductive success of this heronry, the total number of active nests declined by 28% since 2018 (25 to 18 nests) and the number of nests that successfully fledged herons declined by 44% since 2018.

We documented 2,235 human activities within a 500-m radius of the colony in 2022 during 64 1-hour observation bouts, or about 35 events per hour (67% were cars). None caused significant heron disturbance as they were all spatially distanced from the heronry. In contrast, less than 1% of human activities was associated with the majority of heron disturbances. This 1% consisted of river recreationists who paddle through the colony in close proximity to the nests. We observed four river floater events in 2022 and all four caused herons to flush from the colony, leaving chicks vulnerable to predation or weather. Over the five-year study we observed 81 floater events involving 250 people mostly on SUP boards. These events flushed 111 herons and nearly 100% of events led to at least one heron flushing from their nests. Human activity in close proximity to the Slate River herons consistently caused herons to change behaviors to disturbance behaviors (flushing, alert and crouching).

Managing human disturbance of great blue herons at the Slate River colony rightly focuses on river recreation. From the point of view of the herons, an optimal solution is to provide a temporal and spatial safeguard for the birds during the nesting season (mid-March through mid- to late-August). The current framework for the voluntary no-float period in the upper Slate River section as defined by the Slate River Working Group Management Plan extends from mid-March to mid-July and provides a compromise in terms of heron protection. A more heron-centric protocol would extend to the end of the nesting season in late July to early September. Finding the right balance between the competing values of biodiversity conservation and outdoor recreation is challenging. Great blue herons require isolation from human disturbance and are unlikely to acclimate to activities near their nests.



# Great Blue Heron Colony Status and Dynamics in Relation to Human Disturbance in the Slate River Valley, Crested Butte, Colorado

## INTRODUCTION

Of all 10,900 species of birds, perhaps the Great Blue Heron (*Ardea herodias*) captures their theropod essence most acutely. It's 1.8-million-year tenure on Earth bespeaks an ancient being and way of life. Seasonally, they replay their sacred movements and rituals across the marshes of North America. His large body (largest of the herons) stoically stalks the margins of wetlands and ponds pursuing prey with grace and regality. Her long-legged gangly figure manages to delicately perch in the treetop branches with long grasping toes while the slanty evening light enlivens her plumes that elegantly wave in the wind. At dusk, his immense outstretched wings slowly carry him nestward across the darkening sky. He gifts the stick in his bill to his mate and she exuberantly accepts the precious resource than weaves it into the nest. More than just a building material, the stick represents the bond forged between the pair completely committed to the task of raising the next generation of great blue herons. Then the couple utters an eerie prolonged squawk that descends through the epochs to a Jurassic origin, a celebration of their dinosaur ancestry and identity.



*Figure 1. Great blue heron (Ardea herodias) takes flight off Nicholson Lake in the Slate River Valley in 2022. Herons often squawk upon take-off or when they arrive at their nests. Photo by Bella Biondini.*

In the Upper Slate River Valley, a colony of these modern day dinosaurs have nested in lodgepole pine trees above the river for at least 25 years and possibly longer. While this population has persisted for more than two decades, numbers vary across years and little is known about the colony prior to 2018 when our study was initiated. While great blue herons generally are doing well in many parts of their range, some populations have declined and others have been extirpated locally. This species and other colonial waterbirds are uniquely vulnerable because a large portion of their regional populations nest in

a single location in a colony (Kushlan et al. 2002) and even a single disturbance event, including human recreation, can cause disturbance including colony abandonment (Cavitt et al. 2014).

The purpose of this study is to document the phenology (seasonal chronology of life stage) and demography (population structure) of the great blue heron colony on the Slate River, and to determine the effects of human activities on their behavior, phenology and demography (Figure 2). We cataloged all human activities in the local area around the colony and targeted observations of river recreationists and documented and reported the heron response to these close proximity activities. The study started in 2018 and this report represents the results of the 2022 season, or fifth year of the study. Previous reports include Magee and Zareba 2019, Magee et al. 2020, Magee et al. 2021, and Magee 2022.

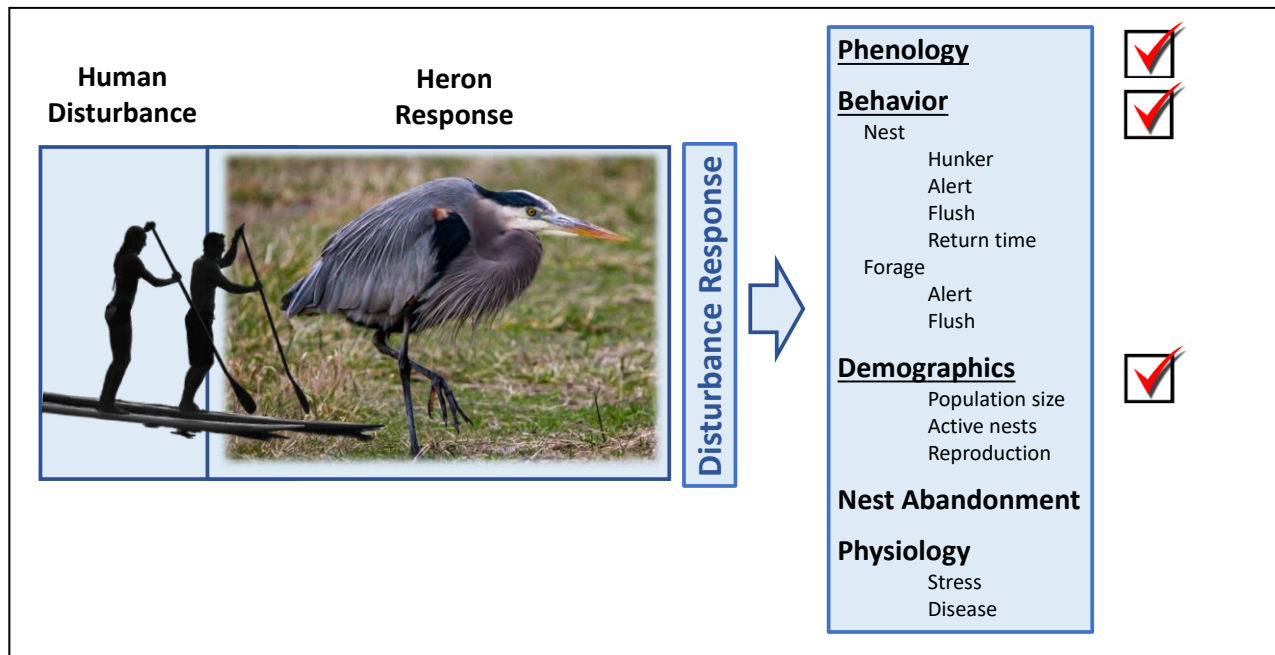
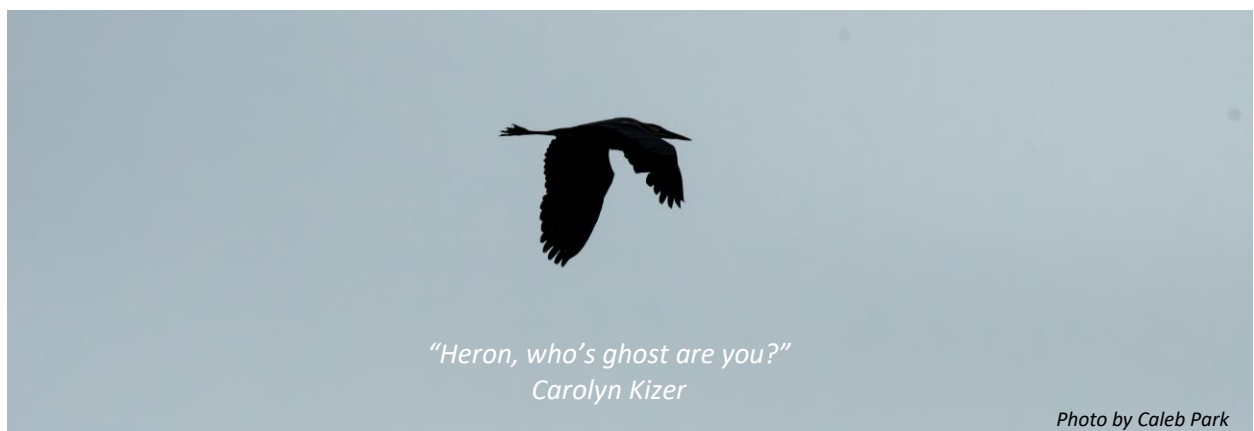


Figure 2. Human disturbance can cause a variety of responses by great blue herons including changes to their phenology, productivity, behavior, and physiology. Herons in nest colonies are particularly vulnerable but individual herons who spend hours stalking prey are also impacted by disturbances.



## METHODS

Our study area (Figure 3) consisted of three great blue heron sub-colonies approximately 3.2 km (2 miles) northeast of Crested Butte, CO, in the Upper Slate River Valley, at 2,700 m (8,900 feet) elevation above sea level. The wetlands owe their existence to the glacial history of this valley and the meandering Slate River. The heron colony consists of less than 20 nests perched at 60-80 feet above the wetlands in the canopy of lodgepole pines (*Pinus contorta*). Tree health in the sub-colonies varies but most the lodgepole pines in the Upper Colony are dead (Figure 4). The braided river channel, backwaters, oxbow ponds, beaver ponds and channels, among other topographic and hydrologic complexities that characterize the Slate River floodplain, provide numerous foraging opportunities for herons and habitat for a diversity of wildlife.

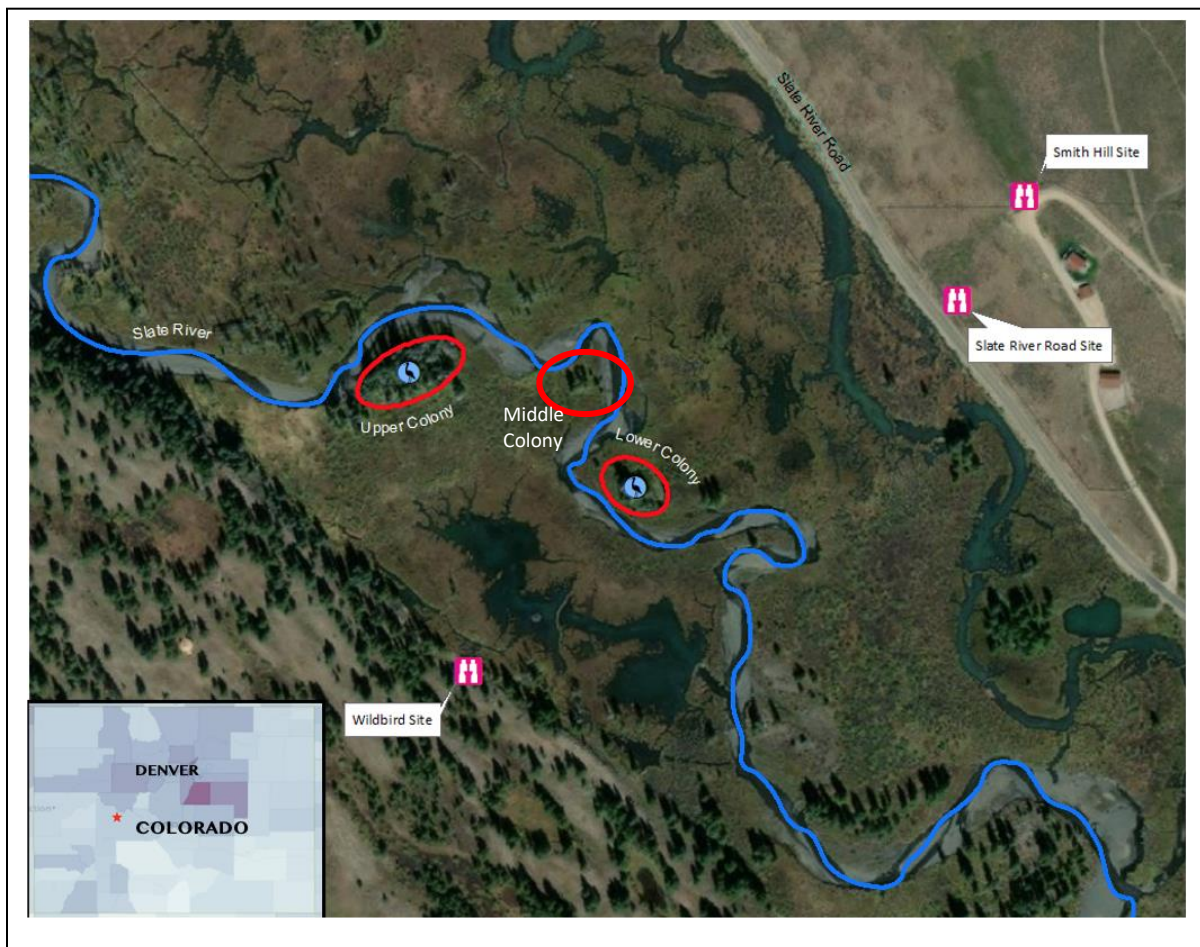
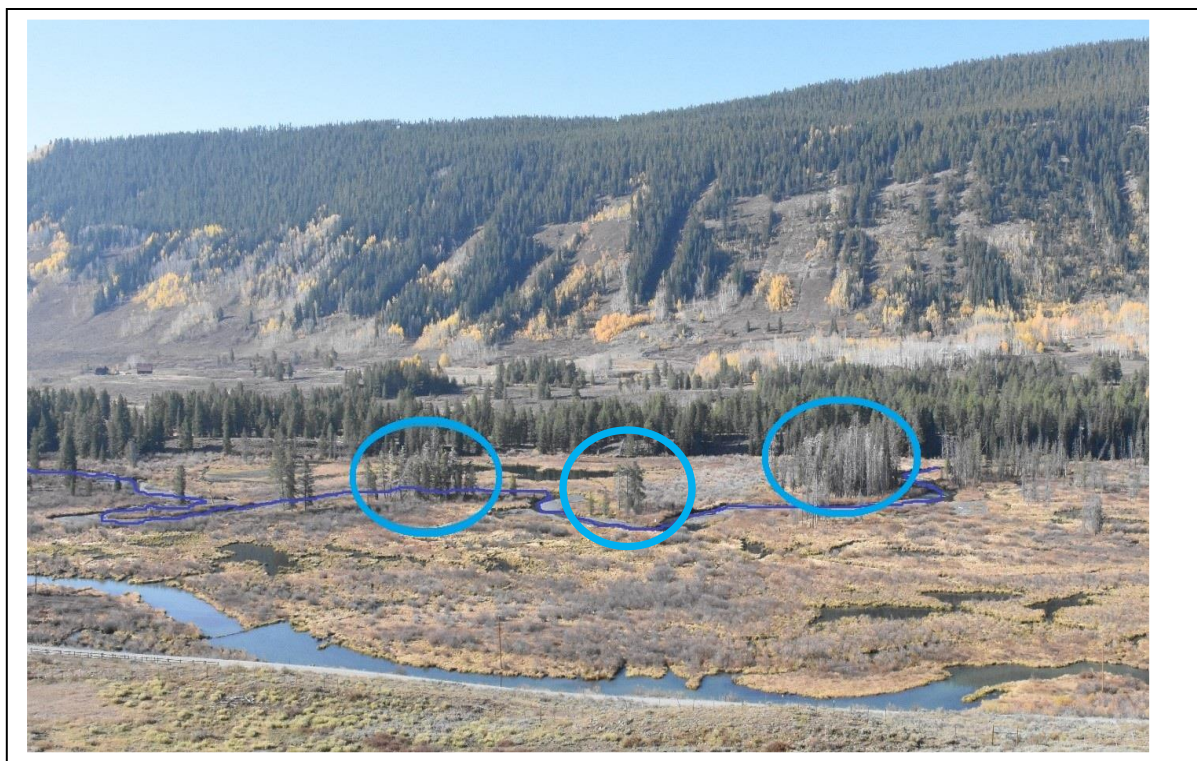


Figure 3. The heron stretch of the Upper Slate River below Gunsight Bridge and above the Coal Creek confluence. The great blue heron nesting colony consists three sub-colonies. The image also identifies the location of our three observation sites. The portion of the Slate River and wetlands that run through the heronry are owned and managed by the Crested Butte Land Trust.





*Figure 4. The Upper Slate River and location of the great blue heron nesting colony at 2,700 m (8,900 feet) above sea level. The colony consists of three sub-colonies: the Lower, Middle and Upper indicated by the light blue circles from left to right, respectively, in photo. The Middle Colony consisted of just one nest and was new in 2022. Note the extensive tree mortality in the Upper Colony. The main channel of the Slate River is traced in royal blue. Photo taken from Smith Hill Road in 2020.*

We conducted heron observations from three locations depending on time of day and weather conditions (Figure 3). The Slate River Road site was located on County Road 752 at a pull-off about 230 m east of the colony. The Elk Run site was located on the southwest-facing slope of Smith Hill, about 340 m east of the colony. The Elk Run site was advantageous for its height overlooking the colony, Slate River, and road traffic. The Wildbird site was located 190 m from the Lower Colony and 240 m from the Upper Colony on the southwestern side of the river atop an elevated, forested moraine.

### **Great Blue Heron Phenology and Demography**

For specific methods associated with 2018-2021 see past final reports. In 2022, using a spotting scope we observed and documented great blue heron breeding season phenology and demography from the season's initiation in mid-March until late August when the last heron chick fledged and no adults or juveniles consistently remained at the colony or adjoining habitats. During each observation, we recorded the date, time, and weather, as well as the number of nests occupied in the colony and the individual life cycle status for each nest based on the heron behaviors. We attempted to document spring arrival dates for individual herons, as well as dates of nest building, courtship displays, copulation events, incubation, chick hatching, brooding and provisioning, fledging, and post-fledge activities.

To gather demographic data for each individual nest in the colony, we observed each nest and recorded the number of individuals present. Repeated systematic scans of all nests in the colony enabled us to document nest success, brood size, fledging success, and fledgling success. Nest success was defined as

the number of nests to have at least one chick hatch. We recorded brood size for each nest once chicks were observed, and also attempted to document chick mortalities. When the number of chicks in a nest declined after a previously higher count, before the expected fledge date, we considered these to be chick losses. Fledging success was defined as the number of nests that had at least one chick fledge. Fledgling success was defined as the number of chicks that fledged relative to the total number of chicks hatched in a nest (and we calculated the mean fledgling success across all nests).

Our goal in 2022 was to document the heronry four days per week, but due to personnel availability we obtained data on average about 3.3 days per week. Our observations covered the period from 15 March to 29 August 2022 (169 days) and observers were present on 79 of those days.

### ***Great Blue Heron Disturbance***

We conducted 1-hour surveys to document human activities within 500 m of the heronry from 2018-2022. In 2022, human activity surveys begin on 18 March and continued until 19 August. We classified human activities into seven categories, including 1) vehicles, 2) bicycles, 3) hikers and runners, 4) motorcycles, 5) river recreation (watercrafts), 6) airplanes and helicopters, and 7) winter recreation. We tallied human activities by category and we observed heron behavior and documented disturbance behaviors (vigilance or alert posture, hunkering/crouch, and flushing) in response to human activity.

To document the impacts of river recreation on great blue herons we observed herons and passing watercraft using a spotting scope from the Smith Hill observation site – this site afforded a good view of the colony and the river and approaching river recreationists. Any group of floaters (consisting of one or more individuals and watercrafts) was called a "floater event". Each floater event was characterized by "floater characteristics." In 2022, floater characteristics included: float duration, stopping events (when floaters stopped or walked their craft beneath the colony), noise level, the distance between floaters, the profile of the floaters, and adherence to safety regulations, as well as the number and type of watercrafts, number of individuals, and number of dogs.

In 2022, we intended to use scan sampling to document heron behaviors before, during, and after a floater event. If watercrafts were detected upriver approaching the colony, we would conduct a "pre-disturbance" scan to quantify baseline heron behaviors. Then, as floaters entered the colony (defined as the first observation of a watercraft upstream of the location of the first or northernmost nesting tree in the upper colony), the observer would conduct a "disturbance" scan. As the floater group exited the colony (defined by a private property sign downriver from the lower colony), the observer would wait for 5 minutes and subsequently would conduct a "post-disturbance" scan. Scans would start with the northernmost nest in the Upper Colony. The observer would view the nest through the spotting scope and identify the instantaneous behavior of each heron in the nest. Then the observer would move the scope to the next nest and continue this until the behavior of every heron in every nest and those birds present in adjacent habitats was categorized. For analysis, we would group heron behavior into ten categories: foraging, self-maintenance, nest maintenance, courtship, incubation, brood rearing, agonistic, hunkering, vigilant, and flushing. We would quantify a colony time budget by summing each behavior category observed and dividing those by total herons included in the scan and reported behaviors as percentages. Note: in 2022 we were unable to obtain scan samples before, during and after floater events but we recorded floater event characteristics and observed heron responses qualitatively.



## RESULTS

### Great Blue Heron Nests in 2022

Great blue herons occupied a total of 18 nests in 2022 (Figure 5, Table 1). All of these nests presumably had a pair of adults and all laid eggs, indicated by observations of incubation behavior. The total number of active nests declined by 28% since 2018 and the total number of nests successfully fledging young declined by 44% since 2018 (Figure 6).

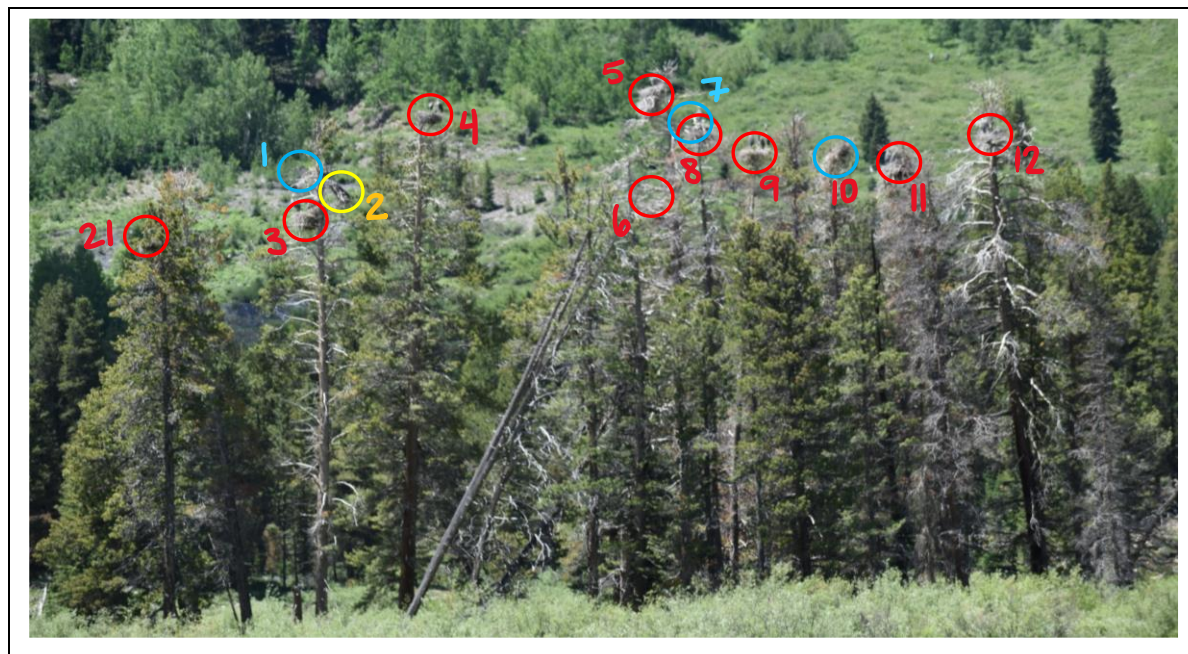


Figure 5a. Lower Colony

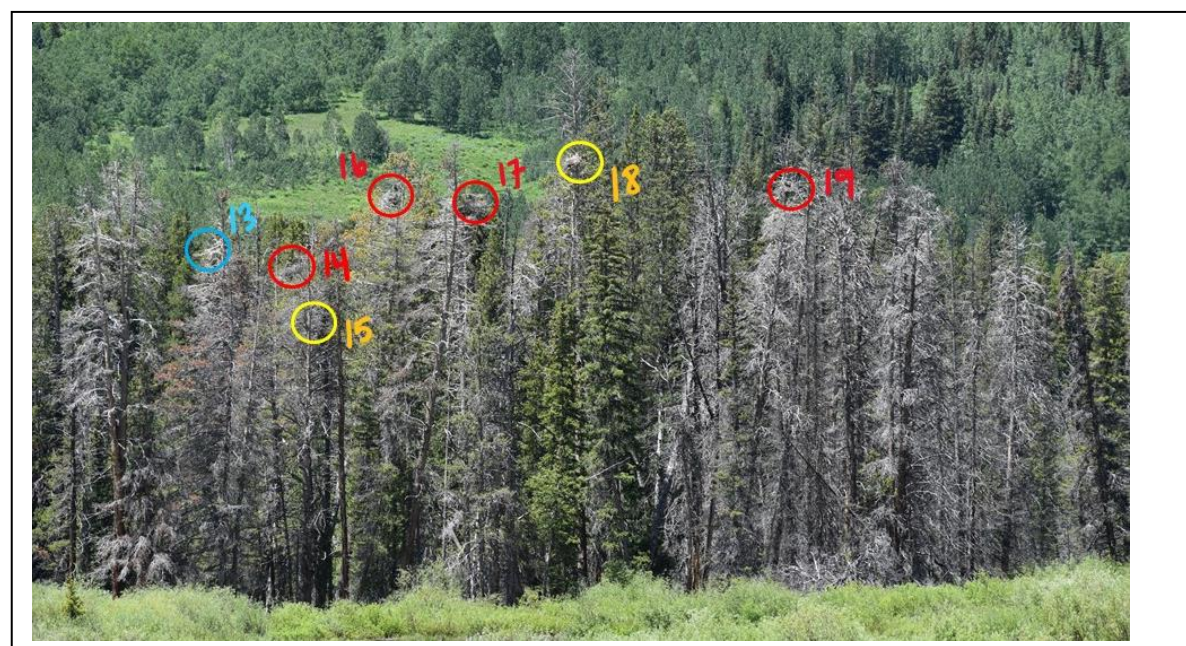


Figure 5b. Upper Colony



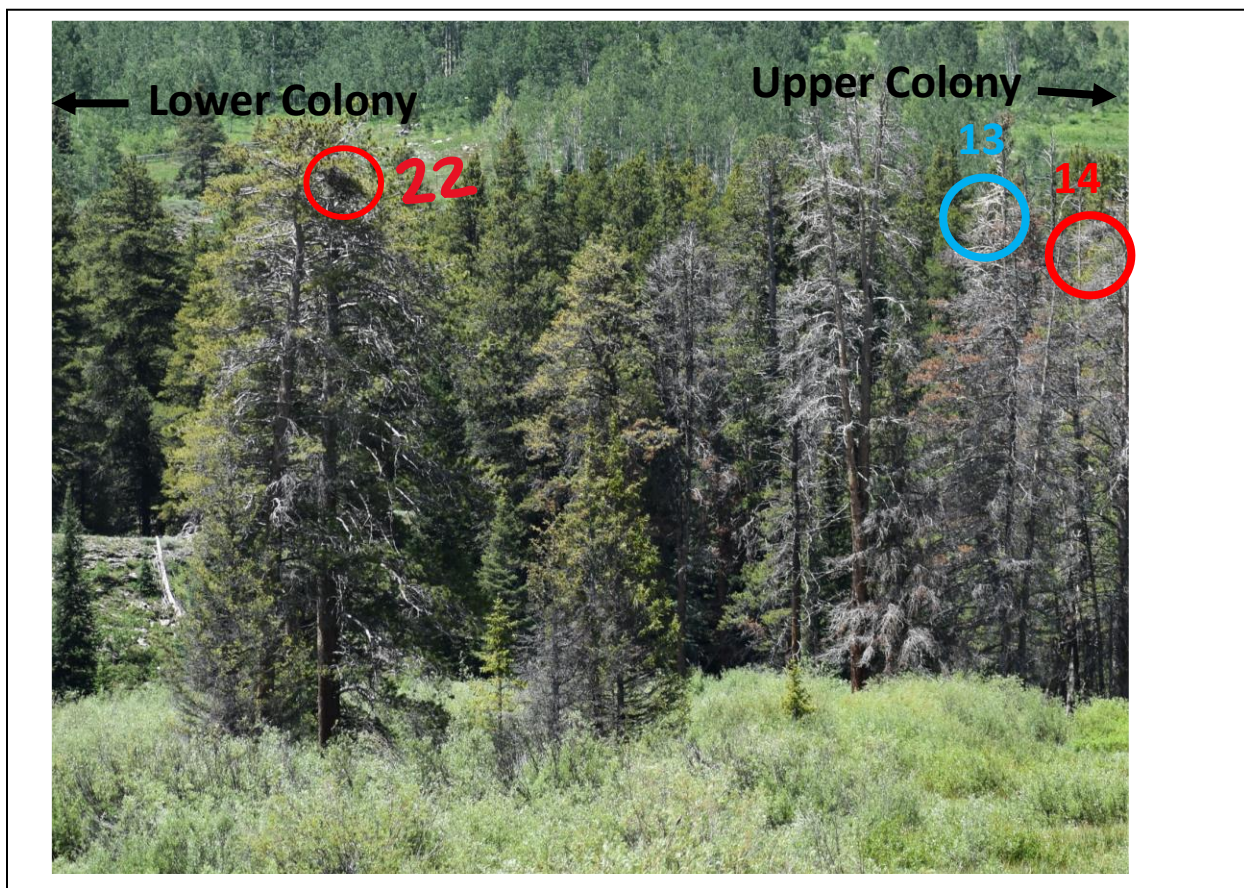


Figure 5c. Middle Colony

Figure 5. The 2022 great blue heron colony including three sub-colonies: Lower Colony (Figure 5a), Upper Colony (Figure 5b), and the (new in 2022) Middle Colony (Figure 5c). Nests 13 and 14 from the Upper Colony can be seen in Figure 5c to provide spatial context of the location of the Middle Colony. Nests are located in the treetops of lodgepole pine stands along the Upper Slate River and their locations are indicated by the circles. Red circles represent active and successful nests in 2022, blue circles represent nests that were active in 2022 but unsuccessful in producing chicks, and yellow circles represent nests that were inactive (unoccupied) in 2022. Nests 1, 7 and 13 did not produce chicks and nest 10 produced two chicks but neither of them fledged. The range of tree heights was 27-64 feet in the Lower Colony with a mean age of 160 years old, and 10-87 feet in the Upper Colony with a mean age of 134 years old. In the Lower Colony, 64% of the 50 trees were alive or dying, 34% were standing dead and 2% were fallen dead, whereas in the Upper Colony only 20% of the 145 trees were alive or dying, 27% were standing dead and 53% were fallen dead. Tree data come from Magee et al. 2020. The Middle Colony consisted of three lodgepole pine trees and all were alive or dying.

*Table 1. Great blue heron nest occupancy in the Slate River heronry near Crested Butte, CO, 2018 to 2022. X=active nest, N=inactive nest, R=dismantled nest (present in previous year(s) but dismantled). \* indicates unsuccessful nests in 2022. For the Lower Colony, the nest numbers for 2022 in parentheses represent the old nest numbers from previous years, and for the Upper Colony, the nest numbers for 2022 in parentheses represent the 2022 or new nest numbers because none of them match up with the old numbers.*

Nest ID	Lower Colony				
	2018	2019	2020	2021	2022
1	X	X	X	X	X (1)*
2	X	N	N	N	N (2)
3	X	X	X	X	X (3)
4	X	X	X	N	X (4)
5	X	N	N	N	X (7)
6	X	X	X	X	X (9)
7	X	X	X	N	X (28)*
8	X	X	N	N	X (8)
9	X	X	N	N	X (29)
10	X	X	X	X	X (11)
11	X	X	X	X	X (12)
12	X	X	X	X	X (31)
13	X	R	R	R	-
14	X	X	R	R	-
21	-	-	-	-	X (30)
27	-	X	R	R	-
28	-	X	X	X	-
29	-	X	N	X	-
30	-	-	X	N	-
31	-	-	X	X	-
32	-	-	X	X	-
Active nests LC	<b>14</b>	<b>14</b>	<b>12</b>	<b>10</b>	<b>12</b>

Nest ID	Upper Colony				
	2018	2019	2020	2021	2022
15	X	R	R	R	-
16	X	R	R	R	-
17	X	X	X	X	-
18	X	N	N	N	-
19	X	X	N	N	X (17)
20	X	X	X	X	X (16)
21	X	N	N	N	-
22	X	X	X	X	X (13)*
23	N	N	N	N	-
24	X	X	X	X	X (19)
25	X	X	X	X	N (18)
26	X	N	N	N	-
33			X	X	X (14)
Active nests UC	<b>11</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>5</b>



Table 1 (continued).

Nest ID	Middle Colony				
	2018	2019	2020	2021	2022
22	NA	NA	NA	NA	X
Active nests MC	-	-	-	-	1
Total active	25	20	18	16	18

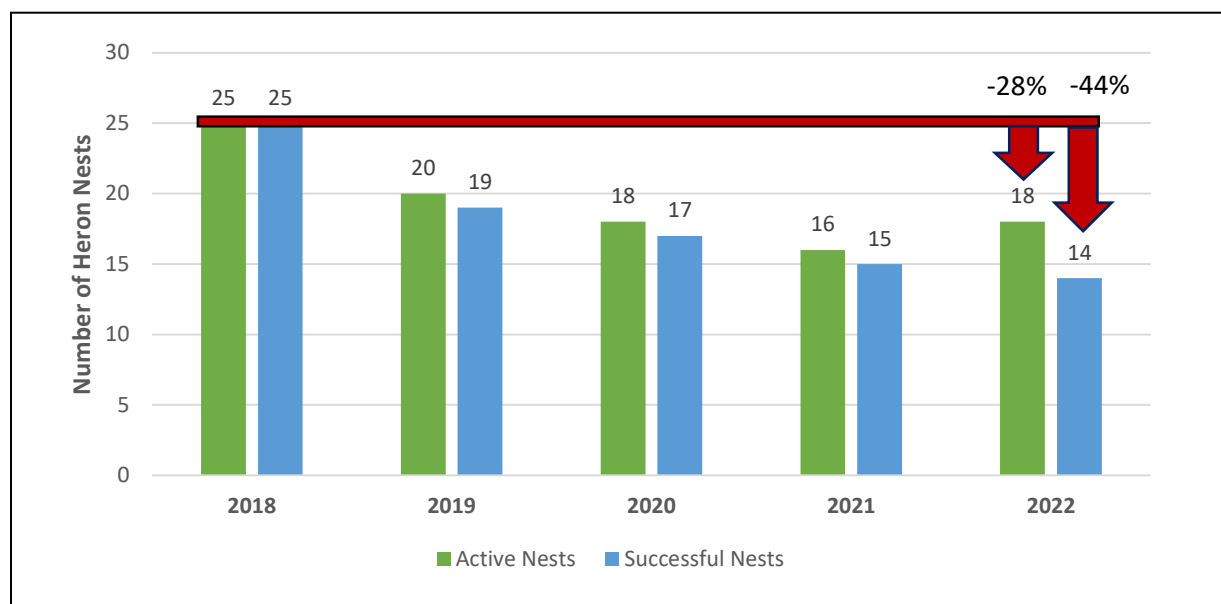


Figure 6. The number of active nests and the number of nests that successfully fledged young from 2018 to 2022 at the Slate River great blue heron colony. The number of active nests in 2022 was 28% lower than the 25 active nests present in 2018 and the number of successful nests was 44% lower than the 25 successful nests in 2018.

### Phenology and Demography

The first heron arrived on 13 March 2022 (Table 2). We do not know the date that the last heron arrived, but many nests were occupied by 28 March and two nests were not occupied until around 16 April. We didn't discover one nest until 16 May (Nest 22, the new nest in the Middle Colony) although the nesting effort of these herons was well underway by this date. Based on observations, it is likely that the first egg laying and incubation began 3-4 weeks after arrival, in early to mid-April. The first sign of incubation (adult heron sitting in nest) was observed on 2 April 2022 but back-dating the earliest hatch dates would place the start of incubation around 19 April. The first observed chicks peeked out of the nest on 19 May (but likely hatched a few days earlier). The chicks in Nest 21 were the last to hatch around 28 June and required two full months until they fledged by 29 August (Table 3).

Table 2. Phenology of heron activities at the Slate River great blue heron colony from 2018-2022.

Parameter	2018	2019	2020	2021	2022
Arrival	March 13	March 17	March 13	March 7	March 13
Egg Laying + Incubation	April 9	April 12	April 3	?	April 2+
Hatching + Broods	May 7	May 10	May 1	?	May 19
First Fledge	July 3	July 7	July 2	July 1-5	July 8
Last Fledge	August 15	September 2	August 12	July 14-18	August 29
Nest Occupancy (days)	155	170	151	130	169
Active nests	25	20	18	16	18
Nests Fledging Young	25	19	17	15	14
Total Adults	50	38	34	32	36
Total Chicks	67	47	45	46	42
Fledged Chicks	67	41	43	42	39-40
Mean Brood Size	2.7 $\pm$ 1.2	2.5 $\pm$ 1.0	2.7 $\pm$ 0.9	2.9 $\pm$ 0.23	2.8 $\pm$ 0.8
Brood Size Range	1-5	1-4	1-4	1-5	1-4

Four of the 18 active nests in 2022 did not fledge any young. Three of them did not produce chicks. The spring of 2022 was extremely windy, incessantly for two months. Nest 1 was occupied by herons on 18 March but was blown out of the treetops on 10 May. Chicks had not yet hatched. The adults returned to the site of Nest 1 on 11 and 12 May and began rebuilding the nest but by 13 May they were no longer observed at the colony. Nest 7 was occupied from 25 March until 16 June. On 14 June two adult herons from Nest 5 approached Nest 7 and the incubating adult flushed. Then the Nest 5 adults pirated sticks from Nest 7. A Nest 7 adult was back on 15 June but was gone on 16 June. Nest 7 was completed disassembled over the next few days (and wind may have contributed to its demise). No chicks were observed in Nest 7. Adults incubated eggs in Nest 13 at least until 8 June when the nest became very unstable, and by 14 June the nest had fallen and we never observed chicks, although it was an active nest. Nest 10 was occupied from 20 March to 31 July. From 15-27 June, Nest 10 had two chicks. On 30 June, Nest 10 had only 1 chick. This chick persisted in Nest 10 until at least 29 July but on 31 July the nest was empty, but the chick was still small and probably did not fledge (based on approximate hatch date of 15 June, it would have fledged around 15 August).



Photo credit: Audubon 2023



Table 3. 2022 great blue heron nests at the Slate River colony. Number of chicks and hatch dates reported for each nest. \* indicates unsuccessful nest

Occupied Nests Lower Colony	Previous Nests Numbers	Nest Occupancy	Hatch Dates	Brood Size	Number of fledged chicks	Fledge Dates	Fledging Success (%)
1	X (1)*	3/18-5/10	None	0	0	NA	-
3	X (3)	3/21-7/31	6/9	2	2	7/31	100%
4	X (4)	3/25-7/21	6/3	3	3	7/27	100%
5	X (7)	3/28-7/20	5/31	2	2	7/21	100%
6	X (9)	3/20-7/8	5/19	3	3	7/8^	100%
7	X (28)*	3/25-6/16	None	0	0	NA	-
8	X (8)	3/28-8/4	6/16	3	3	8/4	100%
9	X (29)	3/20-7/14	5/19	3	3	7/14	100%
10	X (11)	3/20-7/31	6/15	2	0	NA	0%
11	X (12)	3/20-7/9	5/26	4	4	7/11	100%
12	X (31)	3/25-7/13	5/19	3	3	7/12	100%
21	X (30)	5/21-8/29	6/28	3	3	8/29	100%
Active nests LC	12			X = 2.8±0.6	X = 2.5±1.1		
Upper Colony							
17	X(19)	3/28-8/2	6/8	3	3	8/4	100%
16	X(20)	3/15-7/29	6/3	4	4	7/29	100%
13	X(22)*	3/25-6/14	None	0	0	NA	-
19	X(24)	4/16 – 8/4	6/15	3	2-3	8/9	66-100%
14	X(33)	4/16-7/14	6/14	1	1	7/14	100%
Active nests UC	5			X= 2.8±1.3	X = 2.6±1.2		
Middle Colony							
22	X	5/17-8/9	5/17	3	3	8/9	100%
Active nests MC	1						
Total active	18			X = 2.8±0.8	X = 2.6±1.0		

^ The last chick in Nest 6 fledged by 8 July, but the first chick likely fledged on or before 5 July 2022

*Table 4. Daily heron nesting activity at the Slate River great blue heron colony in 2022. For viewing location, SRR = Slate River Road, SHR = Smith Hill Road, and WB = Wildbird. \*indicates poor visibility. On a given observation date not all nests, adults or chicks are observed, so these numbers reflect the pulse of occupancy across the season, but do not reflect the total number of active nests (18), adults (36) or chicks (42) in the colony.*

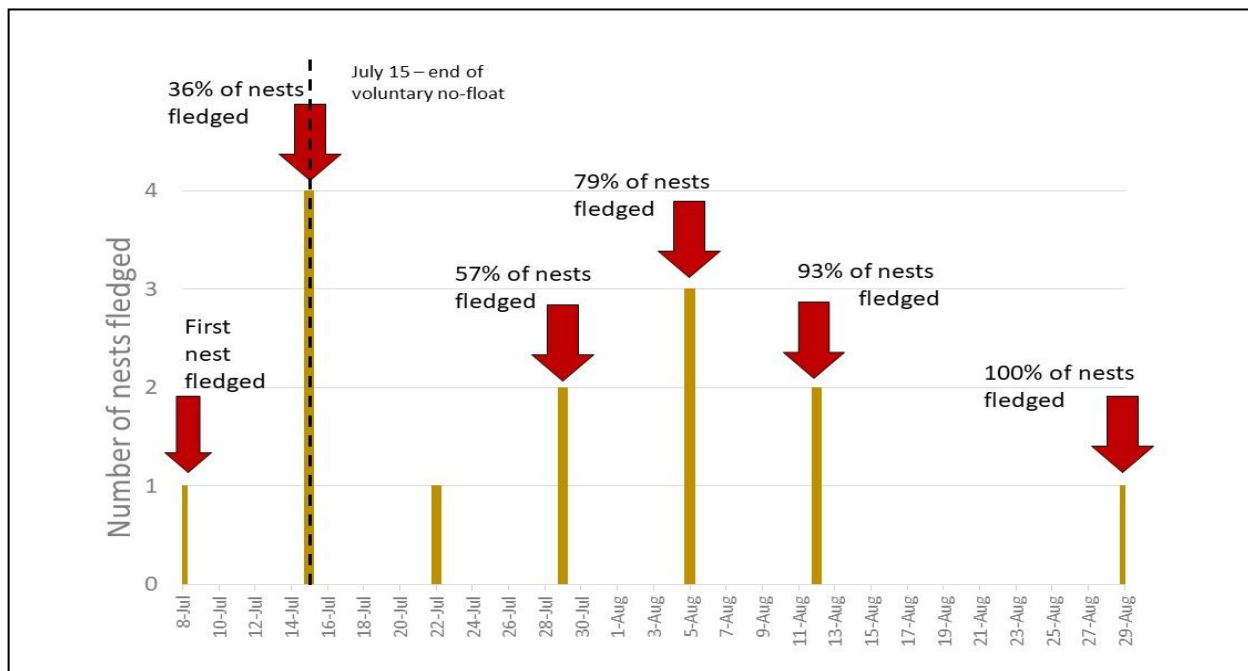
Date	Number of active nests	Number of adult herons	Number of heron chicks	Viewing location
15 March	1	1	0	SRR
18 March	3	4	0	SRR
20 March	4	6	0	SRR
21 March	5	9	0	SRR
25 March	7-8	8-11	0	SRR + WB
26 March	7	8-12	0	SRR
28 March	7-10	8-12	0	SRR + WB
31 March	8	9	0	SRR
2 April	9-10	10-13	0	SRR + WB
4 April	10	12	0	SRR
6 April	10	13	0	SRR
7 April	4	4	0	SRR*
9 April	10-12	10-18	0	SRR + WB
10 April	9	11	0	WB
11 April	10	12	0	SRR
14 April	10	15	0	SRR
16 April	9-11	13-15	0	SRR + WB
17 April	12	18	0	WB
18 April	10	10	0	SRR
21 April	10	11	0	SRR
25 April	11	11	0	SRR
27 April	12	17	0	SRR
28 April	11	12	0	SRR
30 April	13	17	0	SRR
1 May	13	15	0	WB
2 May	11-13	11-14	0	SRR + WB
3 May	15-17	16-20	0	SRR + WB
6 May	14-15	16-18	0	SRR + WB
8 May	16	19	0	WB
9 May	15	19	0	WB
10 May	13-14	15-19	0	SRR + WB
11 May	14	14	0	SRR
12 May	15	20	0	WB
13 May	14	16	0	SRR
17 May	15	15	0	SRR + WB
19 May	13	13-16	2-4	SRR + WB
21 May	14-16	15-16	2-3	SRR + WB
24 May	11	11	?	SRR*
26 May	14	15	6	WB
27 May	14	14	8	SRR



Table 4 (continued).

Date	Number of active nests	Number of adult herons	Number of heron chicks	Viewing location
28 May	14-15	15-16	8-11	WB + SHR
29 May	11	11	7	SRR
31 May	15	15-16	6-8	WB + SHR
2 June	14	15	14	SHR
3 June	16	18	10	WB
6 June	14-15	15-17	18	SRR + WB
7 June	13	13	6	SRR
8 June	14	13	14	SRR
9 June	15	15-16	13-14	WB + SHR
14 June	12-15	12-15	12-17	SRR + WB
15 June	15	13	21	SRR
16 June	14	9	27	SRR
17 June	14	9	23	SRR
21 June	13	6	24	SRR
22 June	13	17	24	SHR
24 June	13	7	24	WB
27 June	15	4-8	25-31	SHR + WB
30 June	14-15	4	36	SRR + WB
1 July	14	0	35	SRR + WB
8 July	13	0	33	SRR
11 July	12	0	26	WB + SHR
13 July	11	1	26	WB
14 July	10	0	25	SHR
15 July	10	0	25	WB
18 July	10	3	25	SRR + WB
19 July	10	1	23	SRR + WB
20 July	10	0	24	SRR + WB
21 July	8	0	19	WB
22 July	8	0	20	SRR
26 July	8	0	18	SRR
27 July	7	1	17	SRR
28 July	7	0	14	SRR
29 July	7	1	16	SRR + WB
31 July	5	0	12	SRR + WB
4 August	2	3	6	WB
5 August	2	1	6	WB + SHR
9 August	1	1	3	SRR
12 August	1	0	3	SRR
16 August	1	0	2	SRR
19 August	1	0	3	SRR
21 August	1	0	3	SRR
24 August	1	0	2	SRR
29 August	0	0	0	SRR

The first chick fledged from Nest 6 on or before 8 July and the last chick fledged (from Nest 21) on 29 August 2023. The peak fledge week was between 8-15 July with 4 nests fledging young, but on 15 July only 36% of nests had fledged – this date coincides with the end of the voluntary no-float period, and this date was chosen to align with the date when 50% of the nests had fledged. The 50% threshold wasn't reached until 29 July when 57% of nests had fledged. By 5 August, 79% of nests had fledged, and 93% had fledged by 12 August, leaving one nest active for more than two additional weeks (Figure 7).



*Figure 7. Number of great blue heron nests fledged per week beginning with first fledged nest on 8 July 2023 progressing through final nest that fledged on 29 August 2023. Only 36% of nests had fledged by the end of the voluntary no-float period. The goal is that 50%+ of nests have fledged by this date. The last nest fledged by 29 August, the second latest fledge time in the five year study.*

The 18 active nests in 2022 were attended by 36 adult herons, we assume 18 breeding pairs (Table 2). We did not observe unpaired adults or yearlings at the colony. Of the 18 active nests, all 18 appeared to have produced eggs but only 15 of the 18 hatched at least one chick (83% nest success). Of the 18 active nests, 14 successfully fledged at least one young (78% fledging success).

The total number of chicks produced by the 18 nesting pairs was 42 (Table 2). Of these, 39-40 chicks fledged which represents a colony fledgling rate of 93-95%. Nest 10 had two chicks until late June and then only one chick occupied the nest through July, but the chick had not reached fledge age and physically appeared small at the time it disappeared from the nest. Nest 13 had 3 chicks and we questioned whether all three chicks fledged, but because of the missing dates of observation we could not conclude whether 2 or 3 chicks successfully fledged.

The mean brood size for the 15 heron nests that produced chicks was  $2.8 \pm 0.8$ . Brood size ranged from 1-4 chicks per nest with the most common brood size of 3 chicks. We observed two 4-chick nests (13% of nests), nine 3-chick nests (60% of nests), three 2-chick nests (20% of nests), and one 1-chick nest (7% of nests). We did not observe any 5-chick nests in 2022.



### Human Activities and Heron Disturbance

From 18 March to 19 August 2022, we documented 2,235 human activities in 64 1-hr sampling bouts, about 35 human activities per hour within a 500-m radius of the heron colony and in the skies above. Passenger vehicles on the Slate River Road accounted for two-thirds (67%) of all activities (Table 5). About 4.5 airplanes, 3.5 bikes and 1 runner/hiker per hour flew over or used the Slate River and/or Smith Hill roads. During these 64 sampling bouts, we did not observe river recreation. No skiers or snowmobilers were observed near the heronry. These numbers are lower than in past years of the study (which could be an artifact of less sampling in July): the number of human activities per hour was 90 in 2021 (N = 20), 45 in 2020 (N = 187), 52 in 2019 (N = 136), and 60 in 2018 (N = 59). For every category of human activity, the peak number of events occurred in July. The three classic summer months (June, July and August) accounted for 81% of passenger vehicles, 92% of commercial vehicles, 90% of trailers and campers, 99% of motorcycles, 85% of bikes, 47% of hikers and runners, and 42% of airplanes.

We only observed 4 floater events in 2022, on 28 May, 6 June, 23 June, and 14 July (Table 7). These 4 events occurred at 6:20 am, 10:40 am, 1:30 pm and 4:40 pm and included a total of 8 people on 8 water crafts (all SUP boards). None of the groups stopped beneath the nests during floating but they varied in other behaviors. Two of the groups floated close together, whereas one group was more spread out and the fourth group consisted of a single floater. Three groups were quiet but the fourth was audible at more than 300 m. One group stood upright on their SUP boards, two groups knelt and the fourth group sat or laid prone on the craft (Table 7).

*Table 5. The number of human activities and percent of overall activities in the vicinity of the great blue heron colony in the Slate River valley. Data from 64 1-hour surveys from 18 March to 19 August 2022.*

Type of Activity	Number of Occurrences	Number of Occurrences per hour	Percent of Occurrences
Passenger Vehicles	1,497	23.4	67%
Commercial Vehicles	25	0.4	1%
Trailers, Campers, RVs	79	1.2	3.5%
Motorcycles, ATVs	70	1.1	3.1%
Bikers	227	3.5	10%
Runners, Hikers	47	0.7	2%
Skiers	0	0	0%
Snowmobiles	0	0	0%
Airplanes	282	4.4	13%
Other	8	0.1	0.4%
River Recreation	0	0	0%
<b>Total</b>	<b>2,235</b>	<b>34.7</b>	<b>~100%</b>

*Table 6. Floater events and characteristics on the Slate River documented by heron researchers in 2021 and 2022. Percentages refer to the number of floater events that did not follow floating protocols. For posture, the numbers refer to the number of people in each floater event that sat, knelt or stood on their craft and the percentages in the bottom row refer to the percentage of people in each posture.*

Event	Date	Time	Humans	Crafts/ Type	Stopping	Grouping	Noise	Posture SIT- KNEEL- STAND	No PFDs
Great Blue Heron disturbance data from 2021									
1	6/6/21	1337	6	5/ SUP	None	<10 feet	Moderate	4-0-2	4
2	6/6/21	1421	4	4/ SUP	None	>10 feet	Quiet	0-3-1	2
3	6/6/21	1540	2	2/ KAYAK	None	<10 feet	Quiet	2-0-0	0
4	6/12/21	1428	5	2/ DUCK	None	<5 feet	Moderate	5-0-0	5
5	6/13/21	1507	3	2/ SUP	1 minute	<5 feet	Quiet	1-2-0	0
6	6/19/21	1440	2	2/ SUP	None	<10 feet	Moderate	0-1-1	0
7	6/19/21	1604	3	2/ DUCK	6.5 minutes	<10 feet	Moderate	3-0-0	0
8	7/5/21	1643	2	2/ KAYAK	2.5 minutes	>10 feet	Loud	2-0-0	0
Total	Range: 6 June to 5 July	Range: 1:37 – 4:42 pm	27	21 13 SUP 4 KAYAK 4 DUCK	38%	75%	62%	18-6-4 66%- 21%- 14%	11 41%
Great Blue Heron disturbance data from 2022									
1	5/28/22	0620	3	3/SUP	None	<10 feet	Quiet	3-0-0	?
2	6/6/22	1040	2	2/SUP	None	>10 feet	Quiet	0-0-2	2
3	6/23/22	1640	2	2/SUP	None	<10 feet	Talking	0-2-0	?
4	7/14/22	1330	1	1/SUP	None	NA	Quiet	0-1-0	?

We observed four floating events in 2022 opportunistically when the researcher was not set up for these observations, so the pre-disturbance, during disturbance and post-disturbance time budget scans were not possible. Nonetheless, the researchers observed the response of the herons and during all four events, herons flushed from their nests and temporarily left the colony. On 28 May, “several” herons flushed, on 6 June 3 adult herons flushed from their nests, and on 23 June 2 adult herons flushed from their nests. On 14 July a chick flushed when the single SUP board floated beneath Nest 19 in the Upper Colony; on this date the Slate River flow was 68 cfs. Many of the other herons during each floater event changed behavior and took on alert postures or attempted to hide in their nests.

## DISCUSSION AND MANAGEMENT IMPLICATIONS

In 2022, great blue herons continued their 20+ year nesting occupancy at the traditional colony along the Slate River. While the number of active nests increased from 2021, overall active nests declined by 28% since 2018 and the number of nests that fledged young declined by 44%. While heron numbers naturally fluctuate, a five-year downward trend is concerning. Timing of heron arrival to the colony in spring remained consistent with previous years, however, some herons arrived and initiated late nests. For example, Nest 21 hatched around June 28 and fledged on August 29. In some populations, herons congregate at pre-breeding sites and move to the colony in synchrony (Butler 1995). With less synchronization, the Slate River herons may not congregate locally before arrival at the colony.

Despite declining nest numbers, herons established a new nest in 2022 in the Middle Colony and this possibly represents heron plasticity and adaptability to nesting in new locations. The Middle Colony consisted of three healthy lodgepole pines, that should remain suitable for nesting for many years.

Fledge dates were later in general with only 36% of nests completed by 15 July. Snow pack was not likely a driver of late nest initiation and fledging, as 2022 was a fairly normal snowfall year. Winds were incessantly strong throughout spring in 2022 and at least two nests were blown out of the trees by strong winds. Wind may have reduced nesting success, but may not have impacted the phenology of nesting. Late fledging potentially impacts the herons because 15 July is the date when the voluntary no-float period ends and river recreationists can access the heron stretch of the Slate River. However, in 2022 river flows fell below the 110 cfs threshold for floating on 8-9 July, thus floaters could no longer float without touching bottom and trespassing on private land (although one did on 14 July).

Number of active nests has generally declined over the last five years, as has reproductive success but it remains relatively high with 83% nest success (15 of 18 nests produced at least one chick). The average brood size for successful nests was  $2.8 \pm 0.8$ , which is within the range of heron brood sizes across North America (1.5-3.3 chicks per nest; Vennesland and Butler 2020). The number of nests that fledged at least one chick was 78% and the mean fledgling rate was 93-95% with 39-40 of the 42 chicks fledging from their nests successfully. To put the Slate River nest success into perspective, in British Columbia, 59% of 1,247 nests failed, and failed nests occurred in 90% of the 31 colonies observed (Vennesland and Butler 2004). The major cause of nest failure in British Columbia was predation by bald eagles. Human activity was associated with reduced productivity as well (Vennesland and Butler 2004).

At the Slate River heronry, bald eagles do not nest nearby and are rare visitors to the valley, so predation by eagles is not a major concern. On the other hand, human presence and activity are high, especially from June through August. We documented 2,235 human activities in 64 1-hour observation bouts, none of these were river recreation. This equates to 35 human activity events per hour from March through August 2022. All of these activities occurred at a distance of approximately 250 m or more away from the colony and caused minimal impact to the breeding birds. We only observed four river recreation events in 2022, all consisting of SUP boarders (Table 7). In contrast to the over 2,000 human activities at a distance that rarely incited a response from herons in their nests, herons responded to each of the SUP board events by flushing from their nests and/or changing behavior to alert or hiding/crouching in their nests. Over five years we observed 81 floater events involving 250 people mostly on SUP boards. These events flushed 111 herons and nearly 100% of events led to at least one heron flushing from their nests. When herons escape their nest due to a threat it is an extreme option as they leave their chicks vulnerable to predator or corvid attacks or inclement weather (COSEWIC 2008).



*Table 7. Floater event and Great Blue Heron disturbance summary from 2018-2022 at the Slate River colony in Crested Butte, CO.*

<b>Characteristic</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
Climate conditions	Dry year	Wet year	Dry year	Dry year	Dry Year
River flow	Low water	High water	Low water	Low water	Low water
Approximate end date of floating on Slate	25 June	10 August	1 July	5 July	8 July 111 cfs
Voluntary no- float (VNF) period	VNF was not established	1 March - 15 July	1 March - 15 July	1 March - 15 July	1 March – 15 July
Float period comments	VNF was not established	River closed due to high water 6/6-7/14	River too low to float after VNF	River too low to float after VNF	River too low to float after VNF
Observations of floating events	26 May – 25 June	14 July – 10 August	29 May – 1 July	6 June – 5 July	28 May – 14 July
Number of events observed	20	43	6	8	4
Number of days events observed	9	15	6	5	4
Number of people	76+	123	16	27	8
Maximum group size	17 people on 16 crafts	6 people	4 people	6 people	3
Number of watercrafts	59	104	16	21	8
Percent SUP boarders	58%	80%	81%	62%	100%
Percent of events that produced noise	15%	19%	0%	63%	25%
Percent of events that stopped under colony	NA	15%	NA	38%	0%
Number of heron flushes	37	31	19	16	8+
Heron flushes per event	1.9	0.7	3.2	2.0	2.0+
Percent of events that led to heron flushing	No data	No data	100%	100%	100%
Percent of flushes associated with watercraft	95%	100%	100%	100%	100%
During disturbance percent of herons in disturbance behaviors	NA	NA	81%	52%	No data

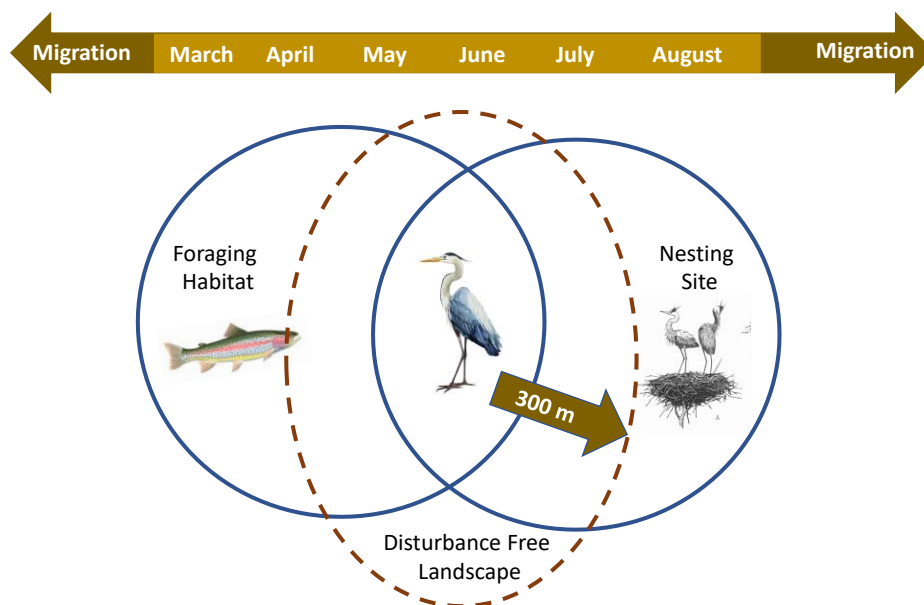
A clear and consistent pattern has emerged when river floaters enter the heronry stretch of the Slate River. The herons do not tolerate human activities in close proximity and they enter disturbance behaviors (flush, alert or crouch). These findings are supported overwhelmingly by the literature and indicate herons are highly vulnerable to human activities and these disturbances alter behaviors, reduce reproductive success, and cause colony abandonment. Colonial nesting makes them even more vulnerable, and a single event could cause a colony to abandon and terminate nesting (Azerrad 2012). But smaller repeated human disturbances have also been linked to nest abandonment (Rogers and Smith 1995, Vennesland 2000, Vennesland and Butler 2004). A number of studies observed a decline in the number of fledglings raised with increased human disturbance (Butler et al. 1995, Carlson and McLean 1996, Vennesland and Butler 2004). Several researchers demonstrated that human activity caused nest abandonment (Bjorklund 1975, Mark 1976, Werschkul et al. 1976, Simpson and Kelsall 1978, Kelsall and Simpson 1979, Forbes et al. 1985, Leonard 1985, Vennesland and Butler 2004, Essinger 2007). Herons at the Slate River negatively respond to human activity throughout the nesting season, but at certain times herons are especially vulnerable. They are perhaps the most vulnerable to human disturbance between nest initiation and hatching (Soots and Landin 1978) with young chicks most at risk if parents flush from their nests. Nest abandonment occurred along rivers in Montana where human disturbance occurred early in season (Parker 1980). During the first two-weeks of brood rearing, chick survival is highly dependent on provisioning rates and disturbance to adult foraging herons can reduce their feeding success and rate of returning to the nests (Auclair et al. 2015).

While acclimation to human activity is possible (Vennesland 2010), we saw no evidence of this at the Slate River colony and it is not commonly documented in the literature.

Great blue herons choose nesting sites based on energetic profitability related to food supply (Gibbs 1991) and relative isolation (Watts and Bradshaw 1994). They require three primary habitat elements during the nesting season: nesting site, foraging habitat, and a disturbance-free landscape (Figure 8). Based on a habitat suitability model, great blue herons nest colonially and seek open canopy tree stands greater than 0.4 ha and greater than 5 m tall, adjacent to water, with little to no human activity within 150-200 m, and the nesting trees must be adjacent to (within 1 km) foraging sites (Corley-Martinez 1995). For foraging, herons require habitats within 1 km of nests (although they extend foraging outward and the mean distance is 2.3-6.5 km, Dowd and Flake 1985; up to 30 km from nests, Parris 1979 and Butler 1991), in shallow (<50 cm), clear water, and the substrate is firm (Corley-Martinez 1995). Foraging areas require adequate prey density and the optimal prey are less than 25 cm in length (Corley-Martinez 1995). As with the nesting site, the foraging site requires little to no human activity within 100 m and no vehicles within 50 m (Corley-Martinez 1995). Other scientists extend the buffer to 65-300 m (Lowsky 2018). Numerous researchers recommend spatial buffers of 300 m (Vos et al. 1985, Butler 1991, Carlson and McLean 1996, Gebauer and Moul 2001).

In addition to the physical properties of the nesting location, herons have strong attachment to site (site fidelity) and many great blue herons return to the same nesting colony for many years or even decades (Vennesland and Butler 2020). The colony on the Slate River has probably persisted for at least 25 years. This drive to return when a current colony exists can persist even if trees are declining in health or other habitat characteristics are deteriorating including an erosion of disturbance free habitat (Henny and Kurtz 1978, Blus et al. 1980). As habitat quality deteriorates herons can splinter into smaller colonies (Parker 1980). And smaller, but more numerous, colonies tend to have shorter persistence time of less than 10-15 years (Parker 1980).

Another factor that could impact the heron population at the Slate River colony is survival of juveniles over winter and recruitment to the colony two years post-hatch. In British Columbia, <25% of juveniles survive their first winter, whereas adults have 75% annual survival (Butler 1997). Further, one-year-old herons do not return to their natal colony, but they do return in their second year (Butler 1997). For the British Columbia herons, at least, there is a 2-year lag in recruitment of new adults to the colony. If these demographics apply to the Slate River herons, of the 40 herons that fledged in 2022, 10 might survive the first winter, these don't come back to heronry in 2023. Over the next winter, 7 of these will still be alive by two years old. Possibly 7 of 40 herons from 2022 would return to the Slate River colony in 2024. Clearly reproductive success must be high to maintain a colony given this uphill battle of survival especially for migratory herons and if, upon fledging, the juveniles are not in top body condition.



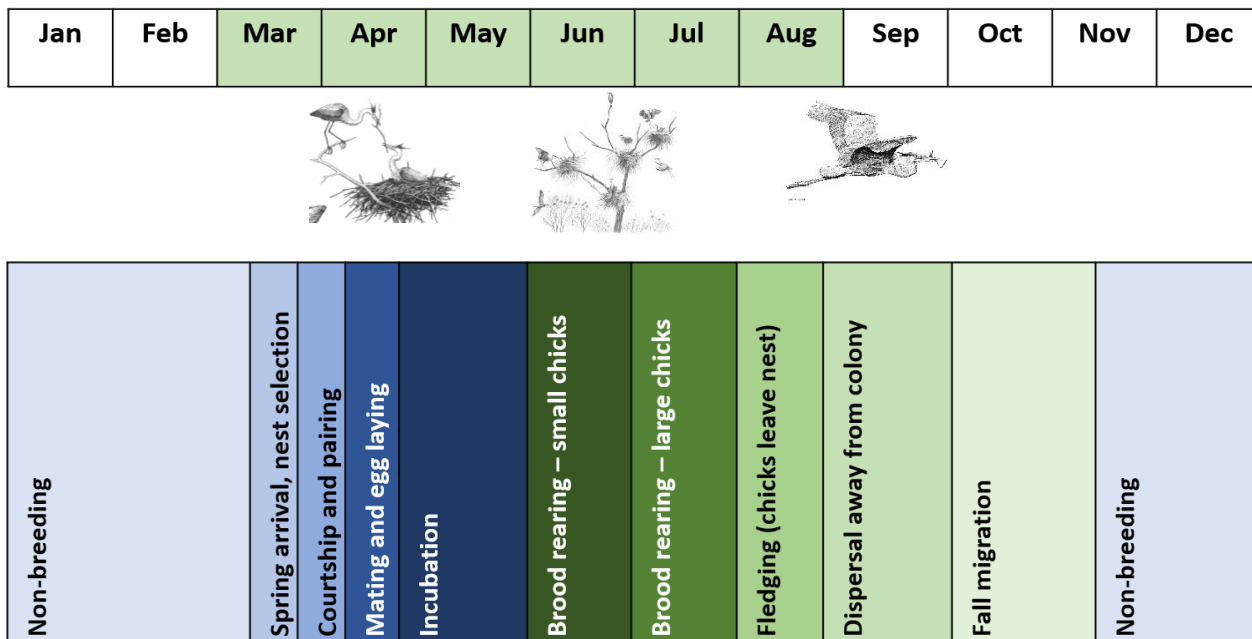
*Figure 8. Optimal great blue heron habitat elements include: appropriate nesting site often in open canopy treetops, adjacent foraging habitat often in clean water with adequate prey size and density, and both of these surrounded by a disturbance free landscape.*

As the Slate River great blue heron colony seems to be heading in a downward direction, what opportunities for management and conservation exist? Most importantly, managers must have an enlightened understanding of the habitat requirements of the great blue heron (Figure 8 and see text above) and the bird's annual cycle (Figure 9).

Creating spatial and temporal buffers around the space use and season use of the herons provides effective protections from anthropogenic factors (Vos et al. 1985, Butler 1992, Rogers and Smith 1995, Vennesland 2004, BC Ministry of Environment 2006). Spatial buffers of 300 m around nests provide an adequate disturbance-free zone (Vos et al. 1985, Butler 1991, Carlson and McLean 1996, Gebauer and Moul 2001). An extended spatial buffer of 3-6 km out from the nesting colony is necessary to protect primary foraging locations of most colony populations (Dowd and Flake 1985). We have little information about where the Slate River herons forage, so more information is needed to discern the appropriate buffer size. Many herons gather during the day at the Roaring Judy fish hatchery 17 km



south of colony site where they forage in the hatchery raceways (up to 20 great blue herons at once) but it is unknown if these are herons that nest along the Slate River.



*Figure 9. Great blue heron phenology and annual cycle at the Slate River Colony in Crested Butte, Colorado. Great blue herons arrive annually in mid-March and reside in their treetop nests and in surrounding foraging habitats for 5+ months. Typically, half the chicks have fledged (left their nests) by 15 July. Each year the timing of events shifts to some degree but the general pattern is predictable.*

If a spatial buffer is not feasible (e.g., for river recreation, the river flows directly under the nesting colony), a temporal buffer from spring arrival to the end of the nesting season in late July to late August would minimize human disturbance to the colony. The period from mid-March to mid-April coincides with the most vulnerable period during nest initiation, and herons are less likely to abandon nests after eggs are laid (Bowman and Siderius 1984, Kelsall 1989, Rogers and Smith 1995, Vennesland 2010). The Slate River Working Group established a voluntary no-float protocol in 2019 and asked boaters to not float the heron stretch from mid-March to 15 July. This voluntary temporal buffer has reduced the number of floaters significantly over the last four years. The end date of the voluntary no-float on 15 July represents a compromise between biodiversity conservation and human recreation values (Figure 10). A more heron-centric policy would extend the no-float period to the end of the nesting season which varied from late July to early September. In 4 of the 5 last years, water levels dropped below the 110 cfs threshold (at Baxter Gulch flow station) before 15 July. This water level triggers the end of the floating season due to low water that not only makes floating difficult but at this level floaters would likely touch the bottom of the river and trespass on private land. Therefore, while the herons are still nesting, river floating is mostly prevented by low flows. In 2022, herons were behind schedule and only 36% of nests had completely fledged on 15 July, leaving 2/3 of the nests still active when the voluntary no-float ended. Had the water levels been adequate for floating, the colony would have experienced greater disturbance. As the colony continues to shrink, the Slate River Working Group will address the adaptive management plan and decide (with new data) whether changes to existing floating protocols are desired and/or justified in the context of the competing values of the community (Figure 10).

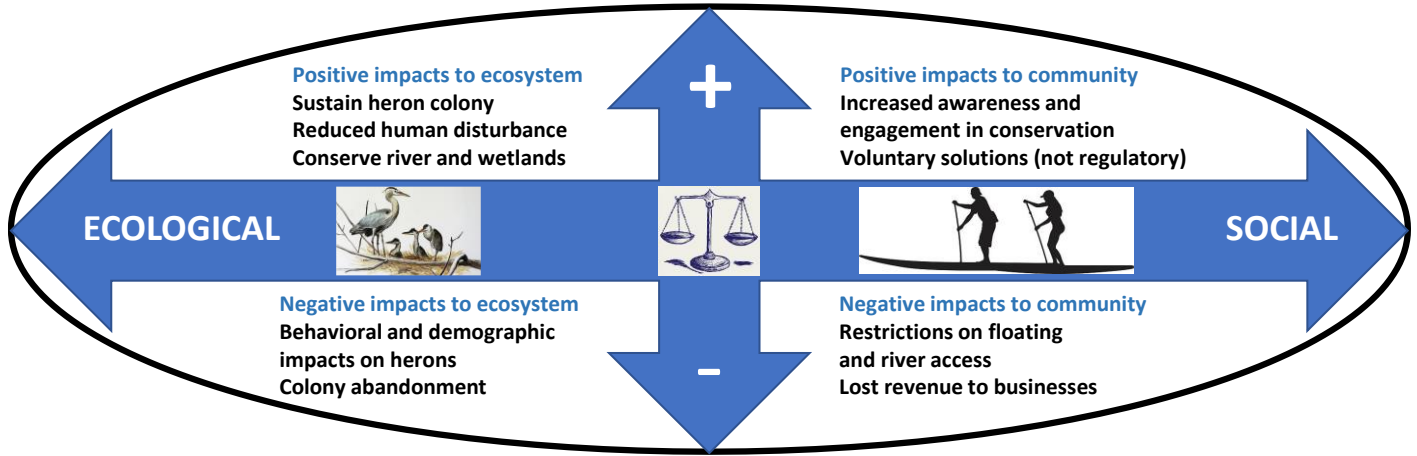


Figure 9. Ecological and social trade-offs along the Upper Slate River, in Crested Butte, Colorado. Our study generated data and observations to develop a scientific foundation of adaptive management and conservation planning with a diverse stakeholder group, the Slate River Working Group. The figure shows a gradient of ecological to social values held by the community and positive and negative trade-offs associated with river management decisions. The Slate River Working Group and the Crested Butte community will continue to engage in a conversation about the appropriate balance between these values.

*“The heron uses the shallows as I cannot. I give them up to the heron”*  
 Henry David Thoreau

### Great Blue Heron Conservation along the Upper Slate River Valley

The Slate River Working Group formed in 2018 and developed a collaborative and adaptive management plan in 2019. Among the topics covered is the balance between protecting biodiversity (with emphasis on the long standing great blue heron colony) and providing access for river recreation (Table 8). The main tool developed in 2019 was a voluntary no-float period to create a partial temporal buffer to minimize the close contact between the herons during their nesting season and river recreationists. The voluntary no-float established a time period from mid-March to mid-July where recreationists were asked to refrain from floating the heron stretch of the Upper Slate River between Gunsight Bridge (put-in) and Recreation Path bridge (take-out and now moved to a new more fully developed river access point). The voluntary no-float recommendation was put into effect in 2019 and has been implemented each year since then. The voluntary no-float restriction has dramatically reduced the volume of floaters on the Upper Slate River and minimized interactions with the herons during most of their nesting season. The recommendation represents a compromise between competing values of protecting the heron colony and proving river access. It is not clear what level of disturbance the herons will tolerate before they abandon a site, and while the current voluntary no-float policy benefits the herons, it may not save this disturbance intolerant species from the impacts of recreation. Impacts include declining productivity, declining population size, or abandonment. The Slate River Working Group might consider developing criteria for when a change of protocol is necessitated by further drop in heron vigor.

It is clear that of all the human activities in the Upper Slate River Valley, less than 1% of them have the most negative impact on the herons – those are all associated with activities that occur in close proximity to the colony (much less than 300 m). A partial safe distance may not provide adequate protection for the declining colony. In addition to continuing the voluntary no-float, development of ethical standards of floating behavior could be further developed. Other close proximity activities like nordic and crust skiing and fishing should also be monitored and proactive efforts to reduce the potential for these activities should continue (e.g., the CB Nordic Center closes one of their trails in mid-March as the herons begin to arrive).

It isn't clear why the heron nest numbers are declining but other causes besides human recreation are likely at play, including the health and vigor of the nesting trees. Threats to the colony should be identified and monitored (Table 8).

In addition to recreation, other activities in the Upper Slate River valley potentially impact the heron colony. The Slate River Working Group should identify and update all threats and consider options to mitigate or remove threats (Table 8). The most proactive management recommendation is to maintain and bolster the habitat with focus on enhancing the three key habitat features (nesting, foraging, and isolation from human disturbance). The maintenance of the forest cover on the west side of the colony that screens the colony from the Lower Loop Trail system is an example (Table 8). Road and home construction also represent threats. While most of these activities would be greater than 300 m from the current location of the heronry, loud noise magnifies the potential impact on the nesting birds. Temporal considerations could be considered such as restricting road construction on the Slate River Road to September and October. Another dimension of proactive management for herons would be to reduce potential future development in the Upper Slate River Valley in the vicinity of the heronry. Future construction in Wildbird or along Smith Hill Road could negatively impact the colony. Developable land could be identified and efforts made to protect it in perpetuity (conservation easements) (Table 8).

### **Future Monitoring**

The 2018-2022 study was a formal agreement between Western Colorado University and the Crested Butte Land Trust, and beyond 2022 continued monitoring of the heron colony is desired to inform the Slate River Working Group adaptive management plan. This monitoring could be scaled back to one visit per week with focus on phenology and demography. Key information includes: counting and mapping active nests, quantifying the number of chicks hatched and the number of fledged young. Keeping records sequentially from mid-March to the end of the nesting season provides the phenological data and demographic data at regular intervals to capture the dynamics of the season. Western Colorado University is willing to continue to oversee the monitoring. Additional funds are needed to compensate students/researchers for time and travel. Reporting would entail a one-page synopsis (plus a nest map and table documenting each nest) of the heron season delivered to the Slate River Working Group at the October annual meeting.

In addition to continuing colony monitoring, an effort to train local volunteers in a heron citizen science project could be helpful to have more eyes on the colony, for more days per week. This might involve the CBLT or others purchasing a spotting scope and having that available for "Heron Watches" or some sort of weekly citizen effort to visit the colony, document the nests, and collect data on hatching and fledging. A data sheet could be developed that would allow citizen scientists to fill out the information and then submit it to Western or some other entity. Developing a clear communication strategy so volunteers know what Western students are observing and vice versa would be helpful.



The future of the great blue herons in the Upper Slate River is unknown and uncertain. The trend of fewer active nests and fewer successful nests is concerning. The number of active nests in the Upper Colony declined in 2022. Does this indicate the tree stand is becoming less suitable and herons are beginning to not use it? The establishment of a new nest in the Middle Colony might indicate the herons are adaptive enough and find the site suitable enough to pioneer new sites and continue to maintain a presence in the Upper Slate River Valley. If the herons abandon the colony, some scientists suggest protecting the colony site for 10 years because the birds may return (Azerrad 2012).

### **Celebrating the Great Blue Heron**

The Town of Crested Butte might consider designating the great blue heron as a species of conservation concern and elevate its stature in the community. This designation could be symbolic or the Town could develop criteria for this listing and actions associated with the designation. Perhaps designating a heron habitat management zone, funding for conservation or research, incentives for citizens to promote heron conservation, and opportunities to celebrate the unique bird. One idea would be for the Town to partner with the CBLT and the Slate River Working Group and other partners to develop an annual Great Blue Heron Days celebration – perhaps when the first chick hatches or the last chick fledges. A community event could help nurture a conservation ethic in the community that is defined, in part, by progressive conservation action (e.g., Red Lady, Coal Creek, Slate River, Wildflower Festival, climate action planning, sustainable tourism, to name a few). In addition to reveling in the ecology and conservation of the great blue heron, the event could also delve into the spiritual and cultural significance of the bird as a totem and representation of qualities humans often seek (e.g., patience, wisdom, regality, determination, keen observation and standing firm) – great blue heron medicine can be given freely and generously, especially if they remain perched in the treetops of the Slate River Valley!



Table 8. Recommendations for Great Blue Heron conservation and management along the Upper Slate River, in Crested Butte, Colorado.

Management Action	Explanation	Timeline	Responsible Party
<b>Conservation Planning</b> Slate River Working Group Management Plan	Maintain and update, collaborative, adaptive management approach	Ongoing	Slate River Working Group
<b>Identify Threats</b>	Threats to the colony change over time and potentially include: human recreation, construction and road maintenance, climate change (impacting snowpack, river flows, and habitat quality), health and vigor of nesting tress, water quality, predation, among others.	Ongoing	Slate River Working Group
<b>Monitoring and Research</b> Identify and monitor threats to colony	Threats include predation by bald eagles, osprey and ravens; colony tree stand health and vigor (monitor individual nests and trees -- are herons moving from dead and dying trees to healthier trees and expanding the colony footprint); water pollution; drought and climate change (drying of wetlands, reduced food supply and access); human disturbances	Ongoing	Slate River Working Group partner with researchers
<b>Threat Mitigation</b> <u>Spatial Buffers</u> Maintain 300 m disturbance “free” spatial buffer around colony	Great blue herons require a spatial buffer during the nesting season to successfully occupy nests, lay eggs, brood young, and provision young to fledging	Annually	Slate River Working Group and Crested Butte Community
<b>Threat Mitigation</b> <u>Spatial Buffers</u> Maintain 300 m disturbance “free” spatial buffer around colony	Stay vigilant regarding other uses such as nordic skiing, fishing, Lower Loop Trail use from March through August	Annually	Slate River Working Group, CB Nordic Center
<b>Threat Mitigation</b> <u>Spatial Buffers</u> Prioritize protecting any adjacent lands within ½ mile (or more) of colony that do not have conservation easements or potentially could be developed	Herons require nesting trees, foraging habitats and disturbance free landscape that connects the nesting site to the foraging areas	Ongoing	Land conservation organizations (CBLT) and private landowners

<b>Threat Mitigation</b> <u>Spatial Buffers</u> Forest screening between colony and Wild Bird development and Lower Loop Trail system	Maintain forest cover, prohibit tree removal (except for tree health applications, i.e., removing diseased trees that might infect adjacent trees) and monitor tree health on west side of colony and consider tree planting to maintain and bolster vegetation screening between colony and Wildbird and the Lower Loop Trail system	Ongoing	CBLT, CB Nordic, Town of CB, Slate River Working Group, Wildbird
<b>Threat Mitigation</b> <u>Temporal Buffers</u> Maintain a disturbance “free” temporal buffer, voluntary no-float	Continue the voluntary no-float recommendation from Mid-March through July 15 from Gunsight Bridge to Recreation Path Bridge	March 15-July 15 annually, Re-evaluate annually	Slate River Working Group, Crested Butte community
<b>Threat Mitigation</b> <u>Temporal Buffers</u> Slate River Road maintenance and housing construction	Loud noises within 300 m of the heron colony can elicit flushing events and can increase heron stress levels. Avoid road and housing construction from March through August within 1 km of the colony on Smith Hill, in the Slate River wetlands, in Wild Bird, or elsewhere	Ongoing	Slate River Working Group, Crested Butte community, Gunnison County Public Works, Colorado Department of Transportation
<b>Education and Outreach</b> River user education	River steward program promotes awareness about voluntary no-float and educates users on heron colony	Annually	CBLT and partners
<b>Education and Outreach</b> Low impact floating	Further develop recommendations for low impact floating This might require additional research	Ongoing	Slate River Working Group, Crested Butte and Gunnison schools
<b>Education and Outreach</b> Great Blue Heron Days	Develop an annual educational outreach celebration that includes viewing of the herons open to community, schools learn about heron ecology and conservation, produce art and poetry for community display	Mid-May to early July	Slate River Working Group
<b>Monitoring and Research</b> Heron monitoring	Develop an on-going, low intensity monitoring plan for the heronry	Annually	Western Colorado University, partners
<b>Monitoring and Research</b> Citizen Science	Engage public in heron monitoring and conservation	Annually	Slate River Working Group and Crested Butte community



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The great blue heron returns year after year to the Slate River valley and adds a special essence to the wetlands with their graceful foraging posture, their elaborate displays with wind flowing through their plumes in the treetops, and their raucous croaks summoning deep time. Our valley is the valley of the herons.

