Project completion report to the
Interagency Special Status/Sensitive Species Program (ISSSSP)
Financial Assistance Agreement No. L08AC13768 - Modification 4

Surveys to determine habitat utilization by the rare Siuslaw hairy-necked tiger beetle (Coleoptera: Cicindelidae: *Cicindela hirticollis siuslawensis* Graves, Krejci, and Graves, 1988*)* at extant sites on BLM and FS lands on the Oregon coast

Cicindela hirticollis siuslawensis Photo by Sarina Jepsen, Xerces Society, 2009

Cicindela hirticollis siuslawensis habitat at Tenmile Creek. Photo by Celeste Mazzacano, Xerces Society, 2010

Submitted to:
Kelli Van Norman
Inventory Coordinator
Interagency Special Status/Sensitive Species Program
OR/WA BLM & R6 Forest Service

Submitted by: Celeste Mazzacano, Sarina Jepsen, and Scott Hoffman Black
The Xerces Society for Invertebrate Conservation
4828 SE Hawthorne Blvd. Portland, OR 97215
www.xerces.org | 503-232-6639

THE XERCES SOCIETY
FOR INVERTEBRATE CONSERVATION

Abstract:
In August 2010, The Xerces Society re-surveyed 11 sites where the rare and imperiled Siuslaw hairy-necked tiger beetle (*Cicindela hirticollis siuslawensis*) was found on BLM and USFS land during presence/absence surveys of the Oregon coast conducted in 2009. Key habitat utilization areas for adult and larval beetles were mapped at each site, and counts were done to estimate population sizes. Adult populations at each site ranged from nine to 97, with the largest populations at two survey sites on BLM land along New River. A new population was found on the south bank of the Siltcoos River, but no *C. h. siuslawensis* were seen at Sutton Creek, a FS-owned site where two adults were found in 2009. Core habitat for adult beetles is on firm, flat, moist sand at and near the water's edge, close to the outflow but also upstream; and the sloping edges of dunes where the sand is dryer, just above the high water mark. Preferred microhabitat in these areas is dark sand flats in backwater or slackwater areas that have a slight coating of algae. Larval burrows are concentrated more densely in these areas, but are also scattered across a wider area of floodplain. This project is a key first step in developing site management plans to sustain and protect this species at the few sites on the Oregon coast where it persists.

Project Background:
The Siuslaw hairy-necked tiger beetle (*Cicindela hirticollis siuslawensis* Graves, Krejci, and Graves, 1988) is a rare species that is absent from most of its historic and potential habitat along the Oregon coast. This species is listed as Critically Imperiled by NatureServe, and is thought to be declining drastically due to recreational use, ATV traffic, and coastal development. Adult and larval beetles inhabit sandy areas around freshwater outflows onto the Pacific coast. Larvae and adults prey on other invertebrates. The grub-like larvae dig small burrows in moist sand and lie in wait for prey that wanders near the burrow mouth. Adults are extremely mobile visual hunters, running across the sand in fast bursts or moving in short hopping flights. They hold and chew their prey with long, sharp, toothed, sickle-shaped mandibles.

C. h. siuslawensis is thought to have been present historically on the Pacific coast from central WA to Eureka, CA (Graves *et al*. 1988, Pearson *et al*. 2006). Specimens were collected in Oregon prior to 1979 in Lincoln, Tillamook, Lane and Coos counties. In 2009, The Xerces Society conducted systematic surveys for *C. h. siuslawensis* along the Oregon coast. Prior to this, only a few unpublished informal surveys had been done, with reports of *C. h. siuslawensis* in the Bandon/New River area (R. Lyons, pers. comm. 2009), as well as in a few sites in Washington state (Grays Harbor County; W. Steffens, pers. comm. 2009). Xerces' surveys indicate that *Cicindela hirticollis siuslawensis* is now known to occur in Oregon at only 16 locations (Table 1), and is absent from 5 of 6 surveyed historic locations (Mazzacano *et al.* 2009). Seven of those sites occur on BLM-owned land, and are concentrated along a single river: New River and the associated Floras Lake. Four of the sites are on USFS-owned land: Sutton Creek, Siltcoos River, Tenmile Creek, and Tahkenitch Creek.

In 2010, Xerces performed detailed habitat mapping at BLM and FS-owned sites where *C. h. siuslawensis* was found in 2009, to assess site utilization by both adult and larval beetles. With greater time to focus on each site and a prior knowledge of site access, we were able to expand the area at each site in which we conducted observations. Also, because the 2009 surveys were presence/absence only, in 2010 we conducted walking counts of adults to gain a better understanding of the size of each population. All of these sites occur within or close to protected

critical habitat for the endangered snowy plover, so it was necessary to coordinate surveys with agency plover biologists in order to avoid disturbing the birds. Because we were able to survey slightly later in August in 2010 compared to 2009, more of the plover brood was off the nests, allowing us to survey areas that had been much more restricted in 2009. New areas surveyed in 2010 include a much larger span around Tenmile Creek outflow and the entire south side of the Siltcoos River outflow.

Table 1. Locations of extant *C. h. siuslawensis* populations in Oregon[1]

Site	**County**	**Land ownership**
New River breach 5 (Historic Breach)	Curry	BLM
New River breach 4 (Bono/Clay Island)	Curry	BLM
New River breach 3 (Hammond)	Coos	BLM
New River breach 2 (New Lake)	Coos	BLM
New River breach 1 (Croft Lake)	Coos	BLM
China Creek	Coos	OPRD
Devil's Kitchen (Crooked Creek)	Coos	OPRD
Floras Lake	Curry	BLM, OPRD
New River (from Lost Lake trail)	Coos	BLM
Twomile Creek	Coos	OPRD
Tenmile Creek (outflow & ~1 mi upstream)	Coos	FS
Tahkenitch Creek	Douglas	FS
Siltcoos River outlet	Lane	FS
Johnson Creek	Coos	OPRD
Sutton Creek	Lane	FS

[1] Based on Xerces 2009 surveys

Methods:

Site selection

Sites on BLM and Forest Service lands where *C. h. siuslawensis* was found during Xerces' 2009 surveys were selected to investigate habitat utilization by adult and larval beetles, and to assess population sizes (see Appendix A for complete site survey list). These sites included New River and Floras Lake (BLM), and Sutton Creek, Siltcoos River, TenMile Creek, and Tahkenitch Creek (FS). Because a full day could be spent at each site, at many of the sites it was possible to expand surveys into areas of suitable-looking habitat in which there was not sufficient time to survey in 2009.

Survey protocol

In 2009, Xerces conducted surveys for *C. h. siuslawensis* with the goal of covering as many potential and historical sites for the beetle as possible in a limited time; therefore, only rough presence/absence counts were done. Because one of the goals of this project was to assess the population size at each site where the species survives, it was necessary to modify the 2009 survey protocol. In addition, tiger beetles are extremely active; on warm, sunny days with low winds, the beetles are difficult to approach and track, as they are in constant motion, run and flying across the sand. They are easily spooked by moving observers, and it is not possible to obtain accurate population estimates by chasing and netting individual beetles. For this reason,

we adopted a standard visual index survey methodology for this project (Fenster *et al*. 2006, Knisley & Schultz 1997, Knisley 1984), based on the direct count method of Southwood (1978).

Large survey areas were divided into polygon transects and the corners were marked using a Garmin Dakota 10 GPS unit. The two-person survey team moved slowly and deliberately through the habitat, scanning the area ahead for approximately 5 meters. Adult beetles were observed individually using close-focus binoculars (Eagle Optics, Ranger model). With this method it was possible to view the insects clearly from a distance without disturbing them and to distinguish with certainty between *Cicindela hirticollis siuslawensis* and the two other *Cicindela* species that co-occur in these habitats (*C. bellissima* and *C. oregona*; Figure 1). Behaviors such as mating, ovipositing, and hunting were noted. In the few cases where a clear view was not possible using binoculars, insects were netted and placed in small glass vials for examination in hand.

In 2009, the Xerces survey team recognized and noted the presence of larval burrows (Figure 3), and confirmed their search image for burrows by "fishing" for larvae. This was done by slowly sliding a blade of grass into the burrow and pulling the larva out when it grabbed the grass with its mandibles. In 2010, Xerces counted the number of larval burrows in each transect polygon surveyed for adults. There are no keys that allow *Cicindela* larvae to be keyed out to species, so it must be noted that the number of burrows at each site where adult *C. h. siuslawensis* were counted reflects only the presence of immature *Cicindela*, and not *C. h. siuslawensis* larvae solely.

Figure 1. *C. h. siuslawensis* and co-occurring species. Note the distinguishing maculations on the elytra of each species.

A. *C. h. siuslawensis* mating pair

B. *C. oregona*

C. *C. bellissima*

photos by Sarina Jepsen, Xerces Society, 2009

Surveys generally did not commence before 9:30 am, to allow the sand to warm sufficiently for the beetles to exit the temporary burrows in which they shelter overnight (Figure 2) and become active. Our work indicates that a minimum sand temperature of 20°C is needed for adult beetle activity, and that even under chilly, windy, or foggy weather conditions adult beetles will be active once this sand temperature is reached. Surveyors walked slowly through the habitat and counted all *Cicindela* larval burrows and all adult *C. h. siuslawensis.* The presence of any co-occurring tiger beetle species was noted. Team members attempted to move so that the sun did not cast their shadows ahead of them, to prevent startling beetles into flight. Surveyors avoided recounting beetles that were flushed into unsurveyed habitat ahead. This technique was extremely effective and efficient, and is recommended for all future tiger beetle surveys.

Figure 2. Adult *Cicindela* burrows

A. empty burrow in sand **B.** *C. h. siuslawensis* excavating burrow
photos by Sarina Jepsen, Xerces Society, 2009

Figure 3. Larval *Cicindela* burrows

A. Multiple larval burrows **B.** *Cicindela* larva in burrow **C.** Larva "fished" from burrow
photos A & C by Sarina Jepsen, Xerces Society, 2009; B courtesy of Ron Lyons, 2009

Results:
Surveys were conducted across two weeks: August 9-12, 2010 (Sutton Creek, Tenmile Creek, Tahkenitch Creek, and Siltcoos River); and August 17-20, 2010 (Floras Lake and the length of New River). Due to the length of time required to access each site and the need to study larger areas of habitat more completely, one full day was required to survey each site. Weather conditions on all survey days were generally conducive to tiger beetle activity, especially during the first week of surveying, which was warm and sunny. The surveys along New River during the second week were accompanied by overcast mornings and constant gusting winds, but conditions became sunny enough each day to warm the sand and allow substantial beetle activity. While optimum tiger beetle survey conditions are warm, sunny, windless days, our observations indicate that the beetles will become active even under cloudier, windy conditions once the sand reaches a threshold temperature of 20°C. Indeed, while walking along Tahkenitch Creek on a cloudy chilly morning and waiting for the fog to burn off, the team observed tiger beetles bursting into flight out of their temporary burrows as the sand temperature rose.

Incidentally, although surveys in 2009 showed that *Cicindela* adults do in fact construct and use these temporary burrows, this was the first time we had observed adult beetles emerging from their burrows in the morning. It was interesting to note that without exception, the beetles we saw did not walk out of these shallow burrows; rather, they emerged in explosive flight. On particularly windy yet sunny days along the New River, we also observed adult *Cicindela* that were being tumbled in flight return to pre-dug burrows and repair (i.e. re-excavate) them in order to take temporary shelter.

Site surveys

Sutton Creek, 08/09/2010:

from N 44.068470° W 124.123980° south to N 44.049640° W 124.129730° : 0 C. h. siuslawensis adults and 421 Cicindela sp. larval burrows total

In 2009, Xerces surveys found two adult *C. h. siuslawensis* at this site ~0.35 mi north of the river mouth. In 2010 we resurveyed the site from the same access point off Sutton Beach Rd. (where the habitat is not optimum for *C. h. siuslawensis*, as it is more vegetated and receives heavier human use) all the way south to the outflow at the ocean (Figure 4). Weather conditions were ideal: sunny, dry, and warm (air temperature 20°C, soil temperature 26°C), and the open areas of firm moist sand surveyed appeared to be excellent *C. h. siuslawensis* habitat. However, although *C. oregona* and *C. bellissima* were common throughout the site, and up to 100 *Cicindela* larval burrows were counted in individual transects, no *C. h. siuslawensis* were observed. Given the low numbers of *C. h. siuslawensis* seen previously, it is possible that the population at Sutton Creek, if it still survives, is small enough that individuals may not be observed during a single day count, even under ideal weather conditions. Because Sutton Creek is the northernmost site along the Oregon coast where *C. h. siuslawensis* was found in 2009, and because the next nearest site (Siltcoos River) is 12 miles south, it would be valuable to survey this site again in future years to determine if the species persists.

Figure 4. Sutton Creek. 4A shows more vegetated habitat, which is not ideal for *C. h. siuslawensis*; 4B shows areas of firm moist sand at stream edge preferred by this species

A. upstream, near access point B. near mouth

photos by Celeste Mazzacano, Xerces Society, 2010

Tenmile, 08/10/2010:

Site A: from N 43.575150 W 124.210050 to N 43.579880 W 124.215410: 16 adult C. h. siuslawensis and >100 Cicindela sp. larval burrows total

The site was accessed via the Tenmile trailhead, and is upstream and inland from the creek outflow. This site had not been targeted initially during Xerces' 2009 surveys, but was encountered as the 2009 survey team hiked across the dunes to the creek outflow. Because the area looked like excellent habitat for *C. h. siuslawensis* (Figure 5A), we surveyed the site and found 9 adults. This was our first indication that in an area of pristine habitat, *C. h. siuslawensis* may be observed substantially upstream of a river outflow.

In 2010, we surveyed a transect that covered ~0.5 miles along the stream edge, greatly extending the 0.15 mile transect surveyed in 2009. Human use was evident as we followed the trail along the south bank of the river, with ATV tracks and scattered garbage, including an abandoned

mattress. The habitat in this area was more heavily vegetated with shrubs, forbs, and small trees and was unsuitable for *C. h. siuslawensis*. We crossed to the north side of the stream at N 43.579600 W 124.212230 and surveyed a long polygon, moving upstream to N 43.576570 W 124.208870. We counted 16 adult *C. h. siuslawensis* scattered throughout this transect, more than 100 larval burrows at the stream crossing and another dozen at the edge of the river at the southern limit of the transect. Numerous *C. bellissima* and *C. oregona* were also observed. Although this area is very close to the ATV recreation sites, it is on the opposite side of the river and requires a long and somewhat difficult hike to access, so there is much less human activity here, and it remains good habitat for *C. h. siuslawensis.*

Site B: hairpin loop of creek to outflow, from N 43.567190 W 124.221930 to N 43.573450 W 124.225780 to N 43.569210 W 124.228890: 35 adult C. h. siuslawensis and >250 Cicindela sp. larval burrows total

Xerces surveyed a much larger area in 2010 than was possible the previous year. In 2009, we accessed the site by hiking across the dune ATV area and walking north up the beach to the river. We had just entered the site and confirmed observation of one *C. h. siuslawensis* when we noted a male snowy plover with a chick becoming agitated, and immediately left the site. In 2010, we accessed this site by following the river downstream from site A, surveying for *C. h. siuslawensis* along the way.

No additional *C. h. siuslawensis* or larval burrows were observed in the span from the north end of the site A transect through ~1 mile downstream. *C. oregona* and *C. bellissima* were seen, and areas where trash was dumped were observed. This span covered the stream as it flowed south, then turned east and made another curve back to the north. At this point, the river turns sharply south again and empties into the ocean; above this hairpin we observed a sand flat that looked like ideal *C. h. siuslawensis* habitat (Figure 5B). Surveys confirmed abundant *C. h. siuslawensis* in this transect (35 total) along with hundreds of larval *Cicindela* burrows. *Cicindela bellissima* was also observed. The final transect along the firm sand at the edge of the stream and the more open surrounding sand close to and up to the creek mouth lacked *C. h. siuslawensis.*

Figure 5. Tenmile Creek

A. inland/upstream site B. moist sandflat near outflow to beach

photos by Sarina Jepsen (A), 2009 & Celeste Mazzacano (B), 2010, Xerces Society

Tahkenitch, 08/11/2010:

From N 43.803630 W 124.166720 to N 43.790760 W 124.171920: 53 adult C. h. siuslawensis and >1750 Cicindela sp. larval burrows total

In 2009, Xerces found five adult *C. h. siuslawensis* at this site in a 0.5 mile transect along the east bank of the creek; habitat on the west bank appeared even more suitable, but we were unable to survey in that area as there was an active plover nest. In 2010, there were no active plover nests in this area, and Xerces staff surveyed both the east and west banks of the river, doubling the overall transect length from the mouth to one mile upstream (Figure 6).

This site was accessed via the Tahkenitch Dunes trail at Tahkenitch campground. The campground appeared well-used, but the trail, which runs through a shore pine forest and then open dunes, does not seem to have heavy traffic. We did not see any other people at the river on the day we surveyed, although there were footprints and a small amount of trash, primarily immediately around the area where the trail opens onto the river bank. A 0.2 mi strip of habitat on the east bank of the creek that looked most suitable for *C. h. siuslawensis* was surveyed; this was the same region where the species was seen the previous year. No adult *C. h. siuslawensis* were observed in this transect in 2010, although larval *Cicindela* burrows were present at such density that they were too numerous to be counted. However, this was the first area surveyed in the morning upon reaching the site and the weather was still chilly and foggy with gusting winds.

Our suspicion that the temperature was not yet warm enough for the beetles to be active was confirmed when we crossed to the west bank of the river, and in the course of counting larval burrows observed adult beetles flying out of the burrows in which they had spent the night (air temperature = 15°C, sand temperature = 22°C). The survey team moved north along the west bank of the river until we reached the end of the suitable habitat, and both banks became more heavily vegetated. We were unable to re-check the east bank area for adult beetles later, however, due to the rising tide; by the time we waded back across the river, most of the east bank stretch surveyed in the morning was already under water.

Adult *C. h. siuslawensis* were found in all transects along the west side of the river, totaling 53 in the entire survey area. Numbers were highest in a strip running from ~0.3 mi upstream of the creek outflow to close to the northern limit end of the survey area, where the stream edge then becomes more heavily vegetated and unsuitable for *C. h. siuslawensis.* Many were seen emerging from their temporary burrows in dry sand on a shelf formed in a transition zone, where the wet sand at the edge of the floodplain meets the dryer sand above (i.e. above the high water line; see Figure 6A). Larval burrows were found throughout the survey area, with the highest numbers in this same transition zone above the high water line (100-300 burrows in each transect). However, larval burrows were also observed in lower numbers in the firm moist sand adjacent to, and surrounding, the river bank (5-55 in each transect), often in the lee of driftwood and woody debris piles. *Cicindela bellissima* adults were also seen in the survey area.

Figure 6. Tahkenitch Creek

A. habitat on west bank

B. sandbar habitat on east bank

photos by Celeste Mazzacano, Xerces Society, 2010

<u>Siltcoos River, 08/12/2010</u>:

Site A: south side of outflow, from N 43.875940 W 124.151490 to N 43.872310 W 124.151960: 59 adult C. h. siuslawensis and 2610 Cicindela sp. larval burrows total

In 2009, Xerces was unable to survey in this area due to the presence of an active plover nest. In 2010, there were no active nests at this site, and Xerces staff surveyed the entire large sand spit on the south side of the river outflow. The site was accessed from Waxmyrtle Campground via an apparently little-used trail. Again, the best habitat and highest numbers of adult *C. h. siuslawensis* were seen not at the river mouth, but in dark, marshy, algae-coated backwater sand flats set back ~0.2 miles from the ocean (17 and >41 adults at 2 different sand flats; see Figure 7). Larval burrows were present throughout the site, with the highest numbers (300 to >900) in these same marshy sand flats and in the immediately adjacent lightly vegetated areas, and at lower numbers (3-95 burrows) at the edges of the river and in the broad moist sand flats inundated at high tide.

Site B: north side of outflow, from N 43.880100 W 124.152500 to N 43.875440 W 124.153630: 55 adult C. h. siuslawensis and 359 Cicindela sp. larval burrows total

In 2009, Xerces found five *C. h. siuslawensis* on the north side of the Siltcoos River mouth, near a small marshy wetland channel that connects to the river at higher tide. Because there were no active snowy plover nests in this area in 2010, we extended our survey of this same wetland channel by an additional 0.2 miles north, and were also able to survey the large sand spit north of the river outflow. The site was accessed by climbing down from the side of the Siltcoos Recreation Area Rd. at a point ~0.2 miles south of the day use parking area for ORV recreation. Forty-seven adult *C. h. siuslawensis* were counted around the edge of this wetland channel, with an additional eight seen around a small pool at the south end of the wetland channel. Hundreds of larval burrows were observed throughout this area. No adult *C. h. siuslawensis* were seen in the dry sand spit adjacent to the marshy sand flat area to the west, but many adult *Cicindela* sp. burrows were observed.

Figure 7. Siltcoos River

A. marshy sand flat with algae, south bank B. sand flat at wetland channel, north bank
photos by Celeste Mazzacano, Xerces Society, 2010

<u>New River, 08/17/2010 – 08/20/2010:</u>
Our ability to access New River by kayak in 2010 gave us increased speed and efficiency that allowed us to thoroughly survey larger areas at the different breaches where *C. h. siuslawensis* was found in 2009. It also enabled us to find several areas of sandy beach on the west side of the river that were potential habitat, and to confirm that the east bank from the boat launch south to most of breach 5 was heavily vegetated and lacked suitable habitat.

From N 43.034980 W 124.443760 to N 42.900070 W 124.510279
In 2009, Xerces surveyed Floras Lake and each of the five breaches along New River in the BLM Area of Critical Environmental Concern (ACEC), plus a stretch further north where New River runs into TwoMile Creek (on OPRD land). In 2010, Xerces surveys covered ~10 miles total along New River, from Floras Lake at the south end to near the outflow at the north end. These surveys did not cover the continuous length of the river, as suitable habitat for *C. h. siuslawensis* is not present uninterrupted along the stream. However, because we had access to kayaks to paddle the length of the river and could thus observe the entire shoreline, we found and accessed additional habitat in 2010, expanding our surveys into large gaps not addressed in 2009.

Site A: Floras Lake, 08/17/2010; from N 42.903250 W 124.505450 to N 42.900070 W 124.510279: 0 C. h. siuslawensis and 0 Cicindela sp. larval burrows total
The site was accessed via Boice-Cope County Park, and the entire sandy part of the shore was surveyed (northwest portion of lake). This area receives high levels of human use; it is adjacent to a campground and boat launch, a foot trail runs through the sandy area, boating and parasailing are popular, and many foot and dog prints were seen. In 2009, Xerces found a single *C. h. siuslawensis* at this site. In 2010, no *C. h. siuslawensis* were present, and only a single *C. bellissima* was seen, although adult burrows were found adjacent to the dunes at the south end of the transect. No larval burrows were observed; this was not unexpected, as the sand around the lake is very coarse-grained and shifting and does not appear suitable for *Cicindela* larvae. Due to the high level of human activity at this site, and the lack of good larval and adult habitat, it is most likely that the *C. h. siuslawensis* individual observed here in 2009 flew in from the larger populations immediately north of the site along New River.

Figure 8. Floras Lake

photo by Celeste Mazzacano, Xerces Society, 2010

Site B: New River breach 5 (Historic Breach); from N 42.918830 W 124.498330 to N 42.912930 W 124.497710: 9 adult C. h. siuslawensis and 442 Cicindela sp. larval burrows total

This site was accessed via a rough trail leading from Floras Lake. In 2009, Xerces surveyed a 0.25 mile length along this breach and found 44 adult *C. h. siuslawensis*. In 2010, we surveyed this same area plus an additional L-shaped 0.65 mile section contiguous to and immediately south of the original transect, including a sandy wedge where Floras Creek runs into New River.

Two adult *C. h. siuslawensis* were counted in a transect at the southwest corner of the survey area, in a sand flat where Floras Creek turns and runs into New River. This wetland area became hard-packed cracked mud to the east and lacked beetles. Larval burrows were abundant on both banks of the creek in this region, ranging from 24 to 140 in four different transects. The habitat is heavily impacted by livestock, as there are no fences at the east bank of the creek here and sheep wander unrestricted in the area. An additional seven adult *C. h. siuslawensis* and 237 larval burrows were counted in the transect at the north end of this survey area, in the same region that was surveyed in 2009. Adult burrows were also abundant in this area, in places where the packed mud at the edge of the water yielded to coarse dry sand. *C. oregona* and *C. bellissima* were also observed in the survey area

Figure 9. New River breach 5 (Historic Breach)

A. sand flat at confluence w/Floras Creek B. habitat along west bank of New River

photos by Celeste Mazzacano, Xerces Society, 2010

Site C: New River breach 4/5 gap, 08/18/2010; from N 42.925220 W 124.494500 to N 42.920710 W 124.496450: *13 adult C. h. siuslawensis and 35 Cicindela sp. larval burrows total*

This site was accessed via kayak from the New River Education Center boat launch, and was not accessed during Xerces' 2009 surveys. The survey covered ~0.35 miles along the west bank of New River, between breaches 4 and 5. The north end of this survey area is at the point where Langlois Creek runs into New River. Only the west side of the river was surveyed, as the habitat on the east bank was not suitable. Thirteen adult *C. h. siuslawensis* were counted in the mid-region of the survey area, in the firmer sand adjacent to the river bank (Figure 10A). Larval burrows were present in all survey transects in moderate abundance (2 to 47), primarily in the same areas as the adult beetles. *C. oregona* and *C. bellissima* were also observed.

Figure 10. New River, between breaches 4 & 5

A. adult beetle habitat B. dryer sand with adult burrows

photos by Celeste Mazzacano, Xerces Society, 2010

Site D: New River, sand beach between breach 4/5 gap and breach 4, 08/18/2010; from N 42.944240 W 124.482510 to N 42.943110 W 124.483440: 0 adult C. h. siuslawensis and 47 Cicindela sp. larval burrows total

This site, noted while kayaking from breach 5 north to breach 4, is a small strip of sandy beach on the west bank of the river which appeared to be suitable habitat for *C. h. siuslawensis* (Figure 11). We surveyed the 0.1 mi transect but found no *C. h. siuslawensis*. Forty-seven larval burrows were counted, and many *C. oregona* were observed. One female was seen ovipositing into the moist sand at the immediate edge of the river, a region that would be inundated at high tide.

Figure 11. New River, sandy beach between breaches 4 & 5

photo by Celeste Mazzacano, Xerces Society, 2010

Site D: New River, breach 4 (Bono/Clay Island), 08/18/2010; from N 42.951640 W 124.479920 to N 42.946320 W 124.481440: 56 adult C. h. siuslawensis and 168 Cicindela sp. larval burrows total

This area on the west bank of the river was accessed by kayak; it has excellent habitat, and appears to receive little human use (Figure 12). In 2009 Xerces surveyed a 0.35 mile section of this breach and found 19 *C. h. siuslawensis*. In 2010 we extended the survey distance to cover 0.46 miles. The region was divided into 5 transects, each of which had *C. h. siuslawensis* (8, 13, 5, 6, and 24 adults, respectively) and numerous larval burrows (52, 20, 44, 22, and 30 burrows). *C. oregona* and *C. bellissima* were also observed.

Figure 12. New River, breach 4 (Bono/Clay Island)

A. unvegetated habitat at water's edge

B. lightly vegetated sandbar habitat

photos by Celeste Mazzacano, Xerces Society

Site E: New River, small sandy beach just north of breach 4, 08/19/2010; from N 42.952570 W 124.478320 to N 42.952090 W 124.478620: 0 adult C. h. siuslawensis and 189 Cicindela sp. larval burrows total

This area is a small strip (0.05 mi) of sandy shoreline on the west bank of the river immediately north of breach 4, which appeared to be potential habitat (Figure 13). No adult *C. h. siuslawensis* were observed, although 189 larval burrows were counted. This site may be too small, steep, and vegetated to be used by *C. h. siuslawensis*, but it was also the first site visited that morning, and the weather was not quite optimal, as it was overcast, moderately gusty, and the temperatures were still low (air temperature 18°C, sand temperature 20°C).

Figure 13. New River, sandy shoreline north of breach 4

photo by Celeste Mazzacano, Xerces Society, 2010

Site F: New River, breach 3 (Hammond Breach), 08/19/2010; from N 42.962850 W 124.473140 to N 42.961530 W 124.473890: 3 adult C. h. siuslawensis and 907 Cicindela sp. larval burrows total

Two *C. h. siuslawensis* were found at this breach by Xerces in 2009. In 2010, Xerces counted three adult *C. h. siuslawensis* in the sand adjacent to and slightly upland from the west bank of the river (Figure 14). The beetles were active here even though the air and sand temperatures were still relatively low (17°C and 19°C, respectively), and the weather was very overcast with strong gusting winds. Numerous adult beetle burrows were seen in the dryer sand, where *C. bellissima* were also abundant. Over 1000 larval burrows were counted, distributed ~evenly throughout the firm moist sand at the water's edge.

Figure 14. New River breach 3 (Hammond Breach)

A. Preferred larval habitat near water's edge B. dryer dune habitat with adult burrows

photos by Celeste Mazzacano, Xerces Society, 2010

Site G: New River, breach 2 (New Lake), 08/19/2010; from N 42.978219 W 124.466600 to N 42.975010 W 124.46740: 97 adult C. h. siuslawensis and 521 Cicindela sp. larval burrows total

Xerces' presence/absence surveys in 2009 along a 0.1 mi stretch of this breach on the west bank of the river found four *C. h. siuslawensis*. In 2010, we surveyed a longer expanse of 0.25 mi (Figure 15), including two transects in backwater areas with the dark, moist, algae-coated sand that seems characteristic of preferred habitat for this species. We counted a total of 97 adult *C. h. siuslawensis* in this area; each transect within the survey area had adult *C. h. siuslawensis* except for a small region at the north end that was further away from the water's edge. Larval burrows were present throughout the survey area, ranging anywhere from 10 to 180 per transect.

Figure 15. New River, breach 2 (New Lake)

photo by Celeste Mazzacano, Xerces Society, 2010

Site H: New River, breach 1 (Croft Lake), 08/19/2010; from N 42.985130 W 124.463270 to N 42.984120 W 124.463520: 45 adult C. h. siuslawensis and 7 Cicindela sp. larval burrows total
Xerces' 2009 presence/absence surveys at this breach on the west bank of the river found six *C. h. siuslawensis*. In 2010, a survey of the same area found 45 adult *C. h. siuslawensis* and seven larval burrows. Many of the *C. h. siuslawensis* were active on a mat of moist-to-dry algae near the water's edge, which was presumably deposited when the tide receded. *C. oregona* and *C. bellissima* were also seen in the survey area.

Figure 16. New River, breach 1 (Croft Lake)

A. water's edge and upland B. algal mat with many *C. h. siuslawensis*
photos by Celeste Mazzacano, Xerces Society, 2010

Site I: New River, 10 survey polygons within the total span of N 43.030880 W 124.445550 to N 42.998610 W 124.457660, 08/20/2010: 211 adult C. h. siuslawensis and 18 Cicindela sp. larval burrows total (gap 1 is at the north end of the span surveyed):

- *gap 1 = 97 adult C. h. siuslawensis, 0 Cicindela sp. larval burrows*
- *gap 2 = 26 adult C. h. siuslawensis, 0 Cicindela sp. larval burrows*
- *gap 3 = 35 adult C. h. siuslawensis, 0 Cicindela sp. larval burrows*
- *gap 4 = 11 adult C. h. siuslawensis, 0 Cicindela sp. larval burrows*
- *gap 5 = 9 adult C. h. siuslawensis, 0 Cicindela sp. larval burrows*
- *gap 6 = 23 adult C. h. siuslawensis, 0 Cicindela sp. larval burrows*
- *gap 7 = 8 adult C. h. siuslawensis, 0 Cicindela sp. larval burrows*
- *gap 8 = 0 adult C. h. siuslawensis, 0 Cicindela sp. larval burrows*
- *gap 9 = 0 adult C. h. siuslawensis, 0 Cicindela sp. larval burrows*
- *gap 10 = 0 adult C. h. siuslawensis, 18 Cicindela sp. larval burrows*

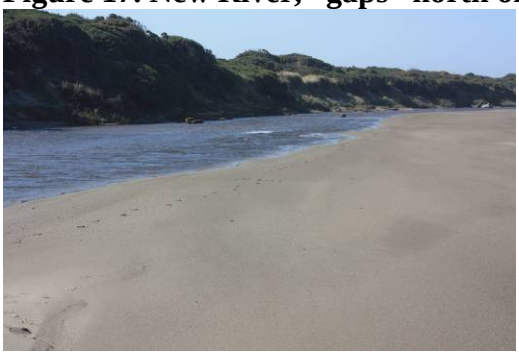
In 2009, Xerces could not access much of the west side of New River north of the BLM Storm Ranch boat launch due to the presence of snowy plover nests. This resulted in a gap in survey data along 2.8 miles of New River, except for a strip at the north end where the river is joined by TwoMile Creek and flows into the ocean. In 2010, we surveyed the majority of this gap, much of which is BLM land. Overall, we surveyed a length of 2.4 miles along the northern (downstream) end of New River. To cover as much of the gap as possible in the limited time available, the survey team "jumped" along the beach, examining 10 different transect polygons spaced along the gap. Habitat along most of the gap region was similar (Figure 17); in gap 6, dozens of *C. h. siuslawensis* were seen on an algal mat at the river's edge similar to that shown in Figure 17D.

Adult *C. h. siuslawensis* were present in each of the first seven survey transects (gap 1 through gap 7), at numbers ranging from 99 (gap 1, northernmost survey polygon in the gap area) to 8 beetles (gap 7). *C. h. siuslawensis* were absent from the three southernmost polygons surveyed (gaps 8-10); gap 10 is about 0.12 miles north of a point where *C. h. siuslawensis* was found by Xerces in 2009.

The weather on the survey day was sunny but with constant strong winds punctuated by substantial gusts. *Cicindela* prefer not to fly on days when the wind is strong enough to tumble them in flight, and move instead in short running bursts. However, winds were so strong on this day that beetles were tumbled even when they were resting on the sand. As a result, we observed many adult *C. h. siuslawensis* taking refuge in the more sheltered microhabitat in the lee of small ridges of sand on the open beach, as well as repairing and re-excavating existing empty adult burrows and darting in for shelter.

In contrast to the substantial numbers of adult *C. h. siuslawensis* as well as *C. bellissima* and *C. oregona*, we saw no larval burrows in any transect except at the southernmost end of the survey area (18 burrows in gap 10). We had noted larval burrows in the moist sand at the river's edge in the morning in the area of the gap 7 transect, as we hiked along the beach to begin surveys at the north end of the river. When we worked our way back to the site ~3.5 hours later, there were no larval burrows to be seen. The constant strong winds may have drifted over all the burrows in the area, as the habitat looked suitable for this life stage, and numerous adults were present throughout the gaps.

Figure 17. New River, "gaps" north of BLM ACEC boat launch



A. Gap 1

B. Gap 3

C. Gap 5

D. Gap 7. Note algal mat at upper left

photos by Celeste Mazzacano, Xerces Society, 2010

Discussion:
The Siuslaw hairy-necked tiger beetle is a rare species that persists in Oregon as scattered populations along the coast in an expanse of about 90 miles, from Sutton Creek near Florence south to Floras Lake near Bandon. *Cicindela hirticollis siuslawensis* populations are found in unvegetated sandy areas associated with freshwater outflows with little to no human activity, low levels of foot traffic, and an absence of vehicular traffic.

Distribution & Abundance
The Xerces Society targeted surveys at sites on BLM and FS lands where *C. h. siuslawensis* was found in our 2009 presence/absence surveys. At almost all sites, we were able to extend the survey area substantially beyond what was examined in 2009 while conducting detailed population counts and mapping both adult and larval habitat utilization areas.

BLM sites
All BLM-owned sites where *C. h. siuslawensis* persists are within a single expanse of about 10.5 miles along New River. Distribution along New River is patchy, as areas of suitable habitat along the river are limited. The east bank of the stream is too heavily vegetated for most of its length to provide habitat for *C. h. siuslawensis*, which prefers open or very sparsely vegetated sand, except near the river's source where it is joined by Floras Creek. However, the sand flats in this area are heavily impacted by livestock trampling and defecation, rendering the habitat much less suitable for *C. h. siuslawensis*. The absence of adult *C. h. siuslawensis* and larval burrows at the adjacent Floras Lake supports the idea that the lone adult beetle found in 2009 was an incidental visitor from the nearby population at breach 5 (Hammond Breach) on New River, and that the lake shore is much too heavily impacted by recreational use to provide habitat for beetle mating, hunting, oviposition, and larval development.

The west bank of New River from Floras Lake north to the BLM Storm Ranch boat launch is open periodically at the sandy breaches leading to the ocean dunes that were created to maintain habitat for the endangered western snowy plover. Each of these five breaches was surveyed thoroughly. In addition, Xerces found and surveyed three new regions of potential habitat for *C. h. siuslawensis* located between the breaches. Although the habitat in these new regions was similar to that at the breaches, *C. h. siuslawensis* was only present at the largest beach area (4/5, between breach 4 and breach 5), which covered about 0.35 miles. The two smaller sand beach areas, a 0.1 mile stretch between the breach 4/5 gap and breach 4 plus a 0.05 mile strip just north of breach 5, both lacked adult *C. h. siuslawensis.* This suggests that even in an area with scattered but stable populations, *C. h. siuslawensis* may require a minimum core habitat area.

Xerces surveyed several miles of additional new habitat on the west bank of New River, from the Storm Ranch boat launch north to the river's mouth. The northernmost end of New River, where *C. h. siuslawensis* was found in 2009, was not surveyed as it is on OPRD-owned land and thus outside this scope of work. The habitat in this survey gap was well-occupied by *C. h. siuslawensis;* abundances were highest at the northernmost transect (gap 1, with 97 adult beetles) and decreased gradually in each subsequent transect to the south (to gap 7, with 8 adult beetles). The three transects at the south end of this survey gap (gaps 8 through 10) lacked adult *C. h. siuslawensis.* The reason for this decrease in abundance is not known, as the habitat was similar

among all the gap transects, and there is a population of *C. h. siuslawensis* one mile to the south, at breach 1 (Croft Lake) on New River.

To date, New River remains the site in Oregon where this species is most abundant and inhabits the largest area. Population sizes were quite variable at the different habitat areas along the river, with the greatest numbers occurring at breach 4 (Bono/Clay Island), breach 2 (New Lake), breach 1 (Croft Lake), and the northernmost transect in the "survey gap" (gap 1) north of Storm Ranch. Single-site abundance for adult beetles was greatest at breach 4. Larval burrows were abundant at each transect, with some exceptions noted above, but it is not possible to distinguish between the larvae and burrows of the three co-occurring *Cicindela* species in these habitats (*C. h. siuslawensis, C, bellissima, and C. oregona);* since at least two *Cicindela* species are generally seen at sites where adults were present, a greater number of larval burrows is expected.

FS sites:
In 2009, Xerces found *C. h. siuslawensis* at four sites owned by the Forest Service: Sutton Creek, Tenmile Creek, Tahkenitch Creek, and Siltcoos River. The southernmost of these sites, Tenmile Creek, is located approximately 38 miles north of the northernmost New River site; *C. h. siuslawensis* is not known from any other intervening sites north of Bandon State Park. In 2010, *C. h. siuslawensis* was found at three of these sites. The species was not seen at Sutton Creek, although two adults were found there in 2009, the weather for surveying was ideal, and a substantial length of the river was surveyed (1.4 miles running parallel to the ocean down to the beach outflow). This suggests that either the population at this site has been extirpated or that the numbers are so low the likelihood of encounter on any single day is small.

As with the New River sites, we expanded our survey areas at the FS sites where this species is found. In 2009, the need to avoid disturbing active snowy plover nests rendered us unable to visit the south bank of the Siltcoos River, and to survey only a limited portion of the north bank. In 2010, the later survey dates meant that the plover brood was off the nest, and many of the areas we surveyed lacked active nests entirely. We were thus able to access the sandy expanse on the south bank of Siltcoos River and confirm that there were patches of excellent habitat for *C. h. siuslawensis* occupied by substantial numbers of adult beetles (59 total for the site). The number of *C. h. siuslawensis* in similar habitat patches on the north bank of Siltcoos was almost identical (55 adults total).

The expanded survey area at Tahkenitch River revealed a similarly-sized *C. h. siuslawensis* population, with a total of 53 adults. Tenmile Creek, a site remarkable for the fact that *C. h. siuslawensis* is found not only around the mouth but also at habitat about a mile further upstream and inland, had slightly smaller *C. h. siuslawensis* populations, with 16 at the inland site and 35 nearer the outflow at the ocean beach.

<u>Habitat utilization</u>
Relationship with snowy plover habitat
C. h. siuslawensis requires habitat that is relatively pristine and undisturbed by high levels of foot and ATV traffic. All of the sites on public land where populations of this species numbering more than 1-3 adults have been found are remote and/or within or adjacent to protected critical habitat for the endangered western snowy plover. Though plover nesting habitat is generally on

more open dunes and closer to the ocean than the habitat preferred by *C. h. siuslawensis*, plover fences and warnings to avoid fenced beaches have necessarily reduced or contained recreational activities to some extent in areas of tiger beetle habitat as well.

Adult beetles

The habitat for *C. h. siuslawensis* is stated generally as "at the mouths of rivers along the Pacific Coast" (Graves *et al*. 1988) and "on Pacific Ocean beaches at the mouths of rivers" (Pearson *et al*. 2006). Our studies indicate that this is something of an oversimplification, and omits what appear to be extremely important and often preferred areas of habitat both upstream/inland of coastal rivers, and in backwater/slackwater wetland and sand flat areas near the outflow but set well back from the river mouth. The most extreme example of this occurs at Twomile Creek, where a *C. h. siuslawensis* population occurs almost a mile upstream of the river mouth. This population is separated from a 2nd population at the site near the river mouth by an intervening stretch that is both less suitable habitat for this species and more heavily disturbed by ATV recreationists. At New River, which runs parallel to the ocean for over 10 miles, *C. h. siuslawensis* populations are scattered along the river's length, in addition to being present close to the mouth. Xerces is aware of unpublished verbal reports of *C. h. siuslawensis* records from around lakes or wetlands in dune habitat (including a historic Sand Lake record), and our observations support the fact that *C. h. siuslawensis* populations are not restricted solely to the mouths of Pacific coast rivers.

Adult *C. h. siuslawensis* exploit two main types of microhabitat within suitable habitat: the firm, flat, moist sand at and near the water's edge, close to the outflow but also upstream; and the sloping edges of dunes where the sand is dryer, just above the high water mark. They are most active in the former microhabitat, hunting, mating, and presumably laying their eggs in the moist sand flats. A *C. oregona* female was observed ovipositing at one moist stream edge, but oviposition behavior was not directly observed for *C. h. siuslawensis*, although mating was frequently seen in this microhabitat. The dryer upland microhabitat is used for shelter, as the beetles excavate their temporary overnight burrows in these areas.

Active adult *C. h. siuslawensis* exhibit further specialization within the moist sand microhabitat. Firm, dark, moist sand flats in backwater or slackwater areas that are somewhat "scummy" looking due to a coating of algae or biofilm appear to be preferred sites for adult *C. h. siuslawensis* activity (see Figure 5A and Figure 7A & B for illustration). We observed adults in greatest abundance at this type of microhabitat at Tenmile Creek, especially at the downstream site (closer to the mouth), and on the south bank of Siltcoos River. In addition, at some sites along New River, adult *C. h. siuslawensis* were concentrated at the edge of the stream in areas where the receding tide deposited mats of algae that were partially dried in the sun. Such stream edge and backwater microhabitats are in places that will be inundated at high tide.

The presence of a slight coating of algae and very dark, almost reddish sand is characteristic of the sand flat microhabitat preferred by adult *C. h. siuslawensis* . This preference is marked; at sites where there is a mixture of open dry flat sand, moist sand flats, and the dark slackwater sand flat habitat, *C. h. siuslawensis* are concentrated in the slackwater areas. Furthermore, at sites where *C. h. siuslawensis* co-occurs with *C. bellissima* and/or *C. oregona*, the other cicindelid species are not observed on these marshier flats. Different co-occurring species of

Cicindela in other regions have been shown to segregate according to different microhabitat preferences, including preferences for different soil types (Schultz 1989, Fenster *et al*. 2006). The reddish cast of the sand in these preferred microhabitats suggests the presence of some soil characteristic(s) preferred by *C. h. siuslawensis.*

Larval Cicindela sp. burrows

It is impossible to distinguish between the three species of larval *Cicindela*, so larval burrows may be occupied by any or all of the three *Cicindela* species that occur together at these sites. Larval burrows were found in a wider array of microhabitats than adult *C. h. siuslawensis*; burrows were usually more numerous and dense in the same regions that adult *C. h. siuslawensis* were seen, but were also frequently abundant at sites where no adult *C. h. siuslawensis* were counted.

Depending on the area of moist sand available, *Cicindela* larval burrows may be distributed over a wide area. The highest densities occur in the firm sand just above the visible line of tidal inundation around the stream, often at the wet/dry transition zone, especially near the outflows, as well as at the edge of the stream in areas that will be inundated by the rising tide. Larval burrows can also be scattered more broadly adjacent to the stream but further from the edge, with clustering seen around the edges of driftwood or in small patches of sparse vegetation. These scattered burrows are seen more often where the stream has a broad flat floodplain, and are subject to tidal activity. Where patches of the dark backwater sand flat microhabitat preferred by adult *C. h. siuslawensis* are present, larval burrows are also found at very high abundance (i.e. hundreds to >1000 on the south bank sand flats of Siltcoos River).

Many riparian and seashore species of tiger beetle can withstand flooding for a period of hours to days, including *Cicindela hirticollis* (Wilson 1974, Pearson 1988, Brust *et a*l. 2005). Larval burrow location is initially a function of female oviposition site preference; larvae can move to a new burrow site if disturbed or threatened, but most species use the same burrow throughout development and pupation (Pearson 1988, Cornelisse & Hafernik 2009). However, *Cicindela hirticollis* larvae are known to relocate their burrows more frequently than other tiger beetles (Brust *et al*. 2006), and generally prefer to do so during daylight hours. We never observed larvae moving on the open sand during our surveys. However, we saw larval burrows in the morning at some sites in 2010 that seemed to have a fresh crumbling of soil particles thrown out around the edges, as if a damaged or sealed burrow had been repaired. This was particularly noticeable because the typical burrow of a coastal *Cicindela* larva has a small saucer-shaped depression around the opening, where the head of the larvae sweeps to clear away debris. At New River breach 2, the mat of semi-dry algae at the river's edge where dozens of adult *C. h. siuslawensis* were active also appeared to have multiple small round holes punched through it, possibly indicating that larvae in burrows below that were buried under the deposited algae had punched an opening through the mat. The location of larval burrows combined with the above observations of possible burrow repair make it more likely that this coastal *Cicindela* species is adapted to tolerate periods of inundations as the tide comes in, and does not generally relocate in response to normal tidal activity.

Recommendations:

Habitat management

- The location of core habitat for *C. h. siuslawensis* and larval cicindelid burrows on public lands should be considered in existing site management plans. Paradoxically, although *C. h. siuslawensis* as well as snowy plover require open sand habitat for survival, activities conducted in the winter to combat invasive non-native beach grasses and maintain open beaches for snowy plover nesting could have dramatic negative impacts on the relatively small, scattered populations of *C. h. siuslawensis* that still survive in Oregon. With detailed knowledge of *C. h. siuslawensis* habitat utilization, it is possible for machinery and equipment needed for beach maintenance activities to avoid important habitat regions. In places where this is not feasible, different patches of core habitat could be protected from year to year, to maintain a stable beetle population that could re-colonize restored areas of habitat at the site.
- USFWS should address habitat management considerations for *C. h. siuslawensis* and incorporate these into any upcoming revisions to the snowy plover habitat management plans.
- BLM and FS should make a concerted effort to protect *C. h. siuslawensis* habitat at and near sites on public lands where this species persists. For example, Xerces staff has observed ATV tracks from snowy plover predator control vehicles running through areas of *Cicindela* larval habitat. Predator control is critical for successful western snowy plover recovery, but at sites where this rare tiger beetle species occurs, a focused effort could be made to avoid core habitat areas for *C. h. siuslawensis*. Predator control employees could also be trained to identify adult tiger beetles and to recognize larval burrows, so that the impacts from ATVs can be minimized (see Attachment I "Pocket field guide to *Cicindela hirticollis siuslawensis* (Siuslaw hairy-necked tiger beetle) & other Cicindela of the Oregon Coast").
- BLM and FS should develop specific management plans addressing habitat protection of *C. h. siuslawensis* for known sites where this species occurs on public lands, as well as for any applicable sites on USFWS lands where BLM and FS projects are planned or implemented. Once implemented, these management plans should be accompanied by regular surveys to assess their success in conserving *C. h. siuslawensis* populations at the site, and to allow for adaptive management if new or different conservation practices are needed.
- The needs of *C. h. siuslawensis* should be taken in to account as recreational ATV regulations on FS and BLM lands are developed and/or revised. Areas where *C. h. siuslawensis* occur should be protected from recreational ATV use.

Additional surveys:

- As part of this project, in 2011 Xerces will be surveying two historical sites that were not visited during our 2009 surveys for *C. h. siuslawensis*: freshwater lake edges within the Oregon Dunes NRA (near Hauser, Coos County) and Neskowin Beach/Nestucca River (Tillamook County).
- The Sutton Creek site should be surveyed again. The presence of two *C. h. siuslawensis* adults at this site in 2009 made Sutton Creek the northernmost site where the species is known in Oregon. It would be valuable to determine whether this population has been extirpated, or if a very small population in critical need of immediate additional protection and conservation attention remains.

- Because the largest known series of *C. h. siuslawensis* was collected at Waldport (from ~1925-1941), but no detailed locality was given beyond city and county, this region should be surveyed more exhaustively to know whether *C. h. siuslawensis* has been locally extirpated.
- In light of reports of *C. h. siuslawensis* from sandy lake shores (including a historic Sand Lake site), BLM/ISSSSP and USFWS should conduct additional surveys in areas of potential habitat on public and federal lands around lakes and seasonal wetlands with sandy shores and in dune habitat.

Acknowledgements:
Funding for *C. h. siuslawensis* habitat utilization surveys was provided by the Interagency Special Status/Sensitive Species Program (ISSSSP) and Xerces Society members. Tony Roberts provided invaluable support and effort as part of the Xerces survey team. A special thanks is extended to the BLM New River Education Center, which greatly facilitated our New River surveys by generously allowing us to use their kayaks and bunkhouse.

We also greatly appreciate the assistance of the following individuals:
Eleanor Gaines (OBIC)—Kelli VanNorman (BLM)—Carol Hughes (FS)—Dave Lauten & Kathy Castelein (OBIC)—Kip Wright (BLM)— Heather Lester (BLM)—Cindy Burns (FS)—Laura Todd (USFWS)—Kerrie Palermo (BLM)—Liz Kelly (USFWS)—Kim Garner (USFWS)

Numerous individuals assisted with this project, and we apologize to anyone who may have been inadvertently omitted from the acknowledgements.

References Cited:
Brust M. L. W. W. Hoback, K. M. Skinner and C. B. Knisley. 2005. Differential immersion survival by populations of *Cicindela hirticollis* Say (Coleoptera: Cicindelidae). Annual Review of the Entomological Society of America 98: 973-979.

Brust M. L., W. W. Hoback, K. F. Skinner and C. B. Knisley. 2006. Movement of *Cicindela hirticollis* Say larvae in response to moisture and flooding. Journal of Insect Behavior 19(2): 251-263.

Cornelisse T. M. and J. E. Hafernik. 2009. Effects of soil characteristics and human disturbance on tiger beetle oviposition. Ecological Entomology 34: 495-503.

Fenster M. S., C. B. Knisley and C. T. Reed. 2006. Habitat preference and the effects of beach nourishment on the federally threatened northeastern beach tiger beetle, *Cicindela dorsalis dorsalis*: western shore, Chesapeake Bay, Virginia. Journal of Coastal Research 22(5): 1133-1144.

Graves, R.C., M.E. Krejci, and A.C.F. Graves. 1988. Geographic variation in the North American tiger beetle, *Cicindela hirticollis* Say, with a description of five new subspecies (Coleoptera, Cicindelidae). Canadian Entomologist, 120(7): 647-678.

Knisley, C.B. 1984. Ecological distribution of tiger beetles (Coleoptera: Cicindelidae) in Colfax County, New Mexico. Southwestern Naturalist 29(1): 93-104.

Knisley, C. B. and T. D. Schultz. 1997. The biology of tiger beetles and a guide to the species of the South Atlantic States. Virginia Museum of Natural History. Special Publication Number 5. Martinsville, VA. 210 pp.

Lyons, Ron. 2009. Personal Communication with Celeste Mazzacano and Sarina Jepsen, The Xerces Society.

Mazzacano, C., S. Jepsen, and S. H. Black. 2009. Project Completion Report: Surveys to determine the status of two rare insect species on the Oregon coast: the Siuslaw hairy-necked tiger beetle (Coleoptera: Cicindelidae: *Cicindela hirticollis siuslawensis* Graves, Krejci, and Graves, 1988*)* and the Oregon plant bug (Hemiptera: Miridae: *Lygus oregonae* Knight, 1944). Submitted to Interagency Special Status/Sensitive Species Program (ISSSSP) U.S. Fish and Wildlife Service, Section 6 and The Oregon Zoo. The Xerces Society for Invertebrate Conservation. 39 pp.

Pearson, D.L., C. B. Knisley, and C. J. Kazilek. 2006. A Field Guide to the Tiger Beetles of the United States and Canada. Oxford University Press. Oxford, New York. 227 pp.

Schultz, T. D. 1989. Habitat preferences and seasonal abundances of eight sympatric species of tiger beetle, genus *Cicindela* (Coleoptera: Cicindelidae) in Bastrop State Park, Texas.

Southwood, T. R. E. 1978. Ecological Methods, 2nd ed. Chapman & Hall, London.

Steffens, Wayne. 2009. Personal Communication with Sarina Jepsen, The Xerces Society.

Wilson, D. A. 1974. Survival of cicindelid larvae after flooding. Cicindela 6: 79-82.

Appendix A: 2010 Site Survey List

BLM & FS sites with extant *C. h. siuslawensis* populations (based on Xerces 2009 surveys) for habitat utilization surveys. Sites are listed in order from south to north.

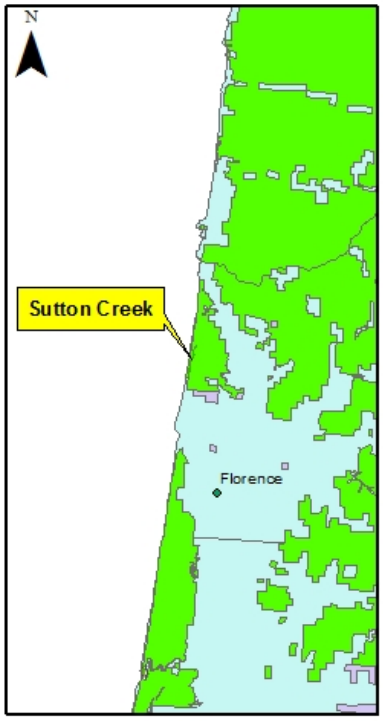
***C. h. siuslawensis* site**	**County**	**Land ownership**	**Coordinates[1]**
Floras Lake	Curry	BLM, OPRD	N 42.903250° W 124.505450° to N 42.900070° W 124.510279°
New River (multiple sites)	Curry	BLM	N 43.030880° W 124.445500° to N 42.912780° W 124.499910°
Tenmile (outflow)	Coos	FS	N 43.573450° W 124.225780° to N 43.567310° W 124.227220°
Tenmile (~1 mi upstream)	Coos	FS	N 43.579880° W 124.215410° to N 43.575150° W 124.210050°
Tahkenitch	Douglas	FS	N 43.803630° W 124.166720° to N 43.790760° W 124.171920°
Siltcoos (N side of outlet)	Lane	FS	N 43.880100° W 124.152500° to N 43.878460° W 124.152550°
Siltcoos (S side of outlet)	Lane	FS	N 43.875940° W 124.151490° to N 43.872310° W 124.151960°
Sutton Creek	Lane	USFS	N 44.068470° W 124.123980° to N 44.049640° W 124.129730°

[1]Coordinates represent entire linear distance surveyed at each site. See Appendix B for maps showing survey polygons and tiger beetle habitat utilization within each survey area.

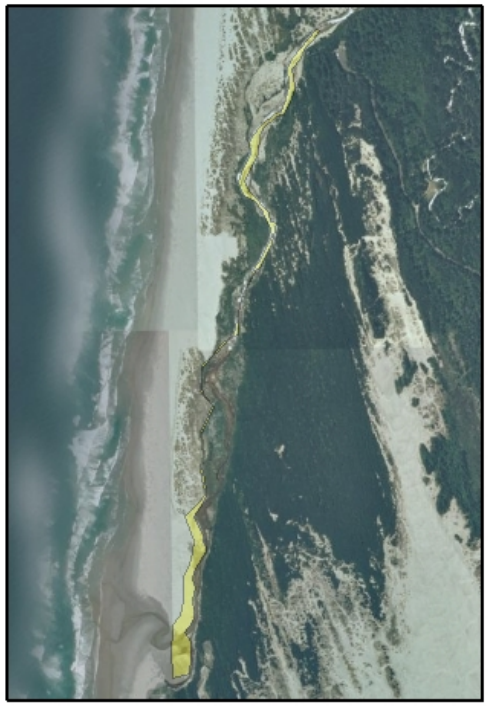
Appendix B. Habitat utilization maps

***Cicindela hirticollis siuslawensis* Sutton Creek habitat utilization**

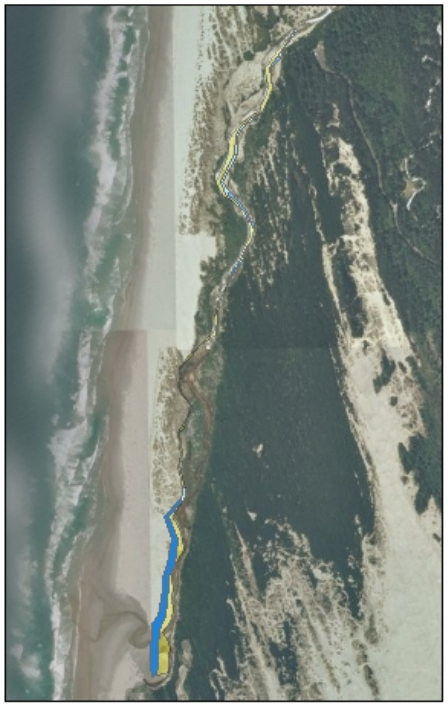
Visual index surveys were done on August 9, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). No adult C. h. siuslawensis were seen at Sutton Creek in 2010.



National Forest
Bureau of Land Management
Survey Area



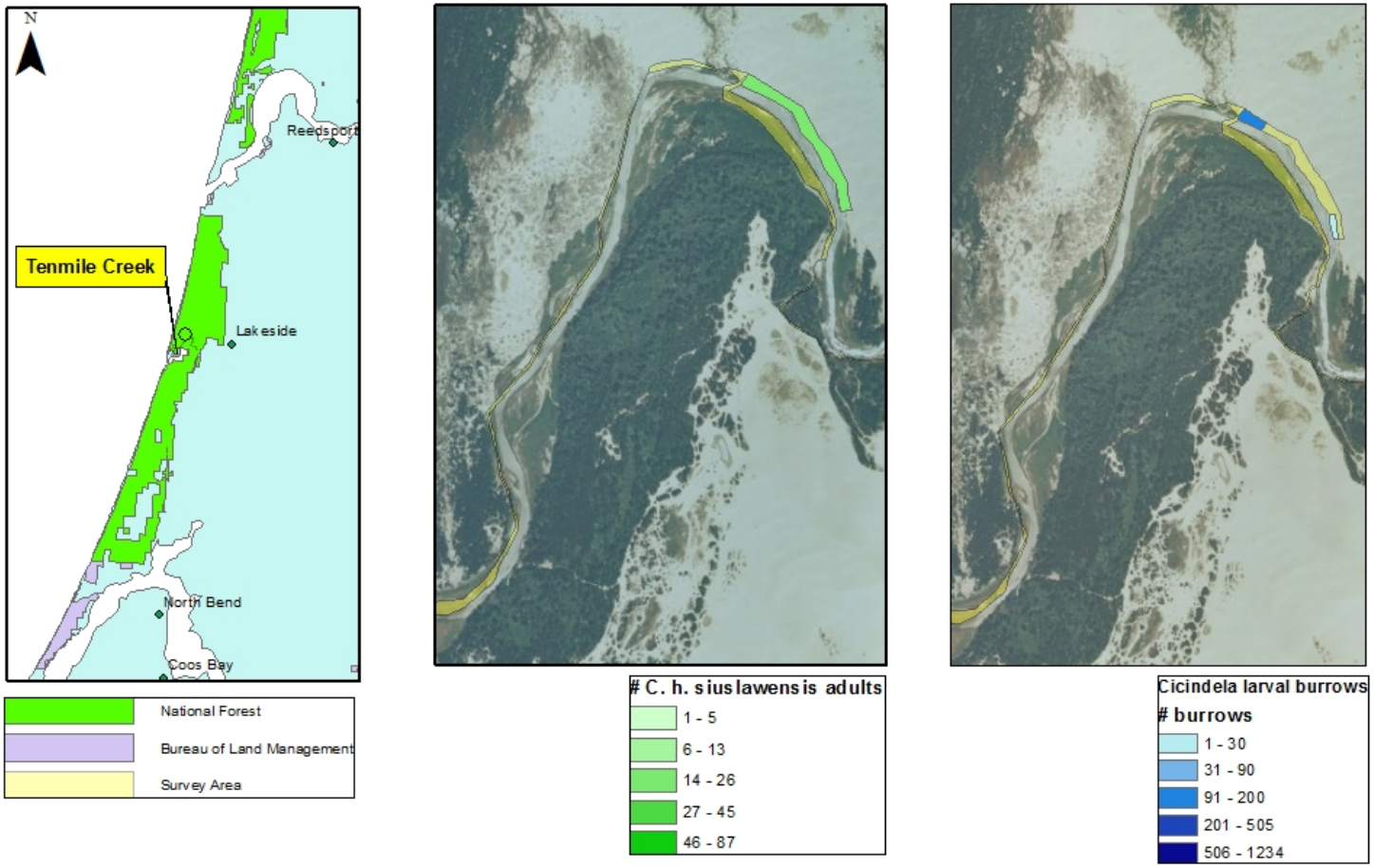
C. h. siuslawensis adults
1 - 5
6 - 13
14 - 26
27 - 45
46 - 87



Cicindela larval burrows
burrows
1 - 30
31 - 90
91 - 200
201 - 505
506 - 1234

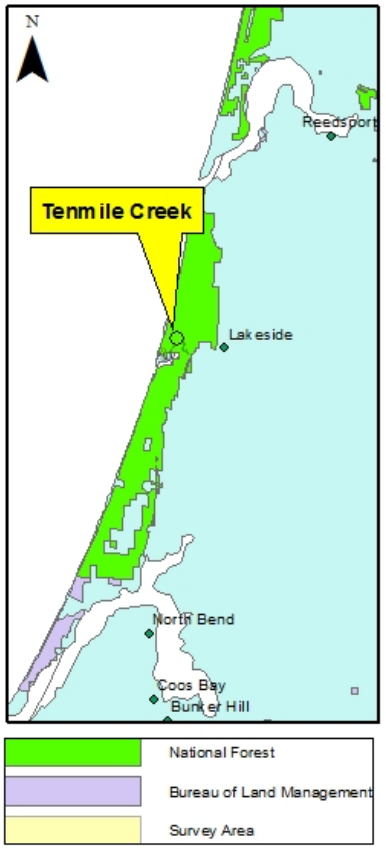
Cicindela hirticollis siuslawensis Tenmile Creek habitat utilization, inland site

Visual index surveys were done on August 10, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Sixteen adult C. h. siuslawensis total were found at this site.



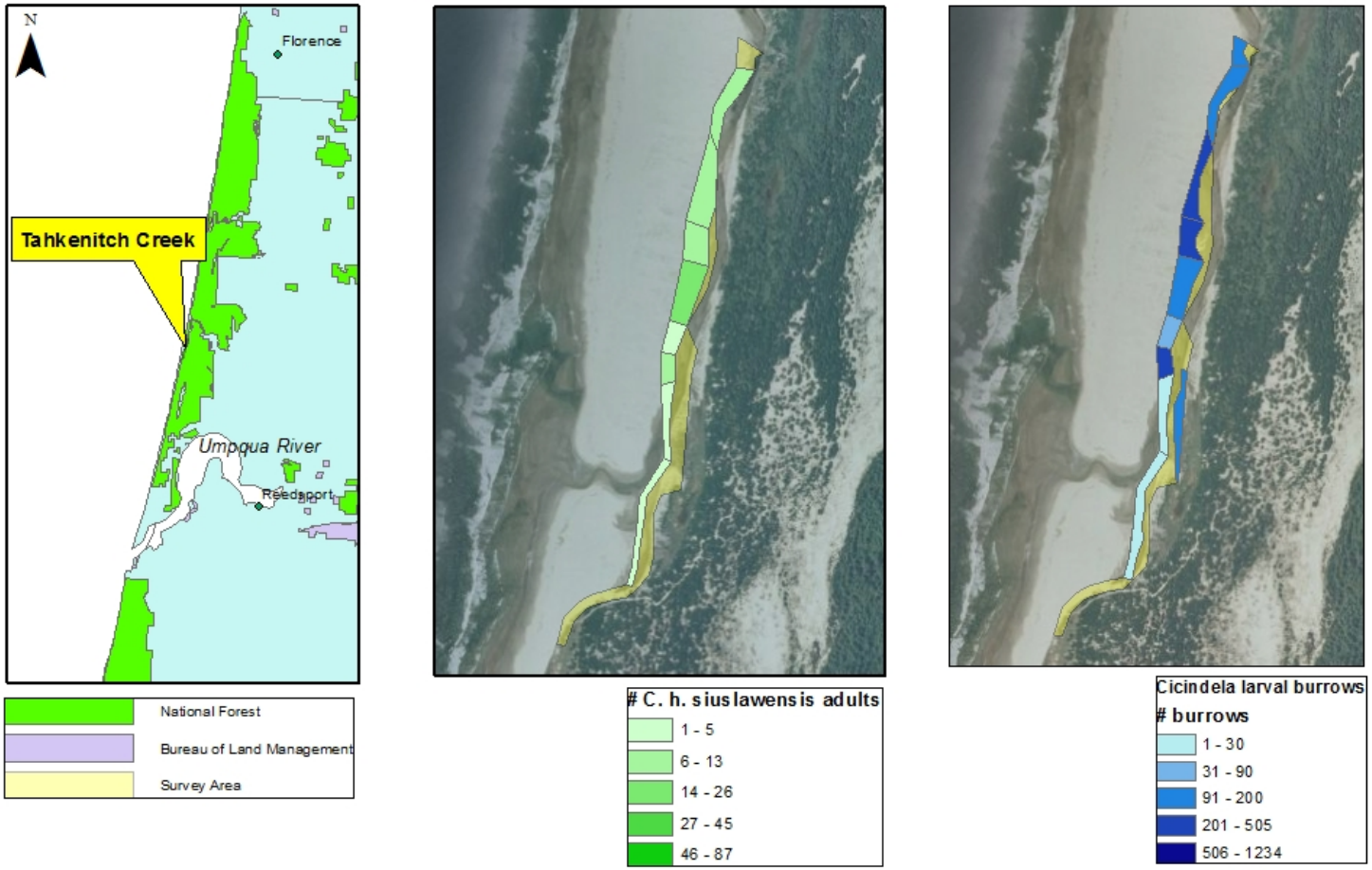
Cicindela hirticollis siuslawensis Tenmile Creek habitat utilization, outflow site

Visual index surveys were done on August 10, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Thirty-five adult C. h. siuslawernsis total were found at this site.



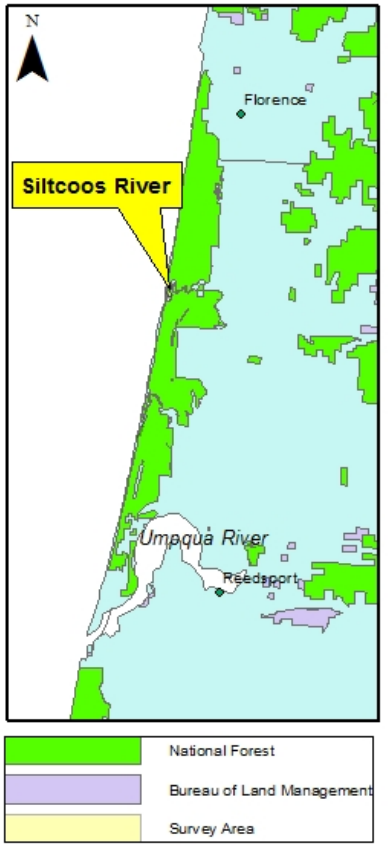
Cicindela hirticollis siuslawensis Tahkenitch Creek habitat utilization

Visual index surveys were done on August 11, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Fifty-three adult C. h. siuslawernsis total were found at this site.



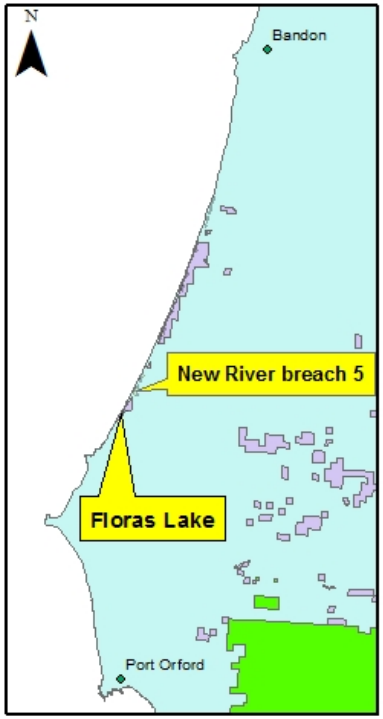
Cicindela hirticollis siuslawensis Siltcoos River habitat utilization

Visual index surveys were done on August 12, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Fifty-five adult C. h. siuslawernsis total were foundon the north bank and 59 on the south bank.



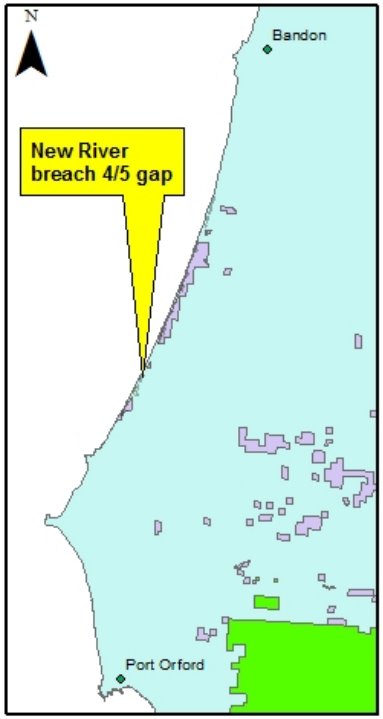
Cicindela hirticollis siuslawensis Floras Lake& New River breach 5 habitat utilization

Visual index surveys were done on August 17, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). No adult beetles or larval burrows were seen at Floras Lake; 9 adult C. h. siuslawensis were found at breach 5.



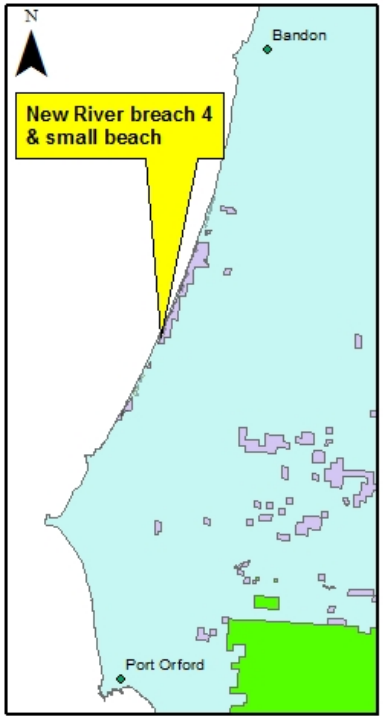
Cicindela hirticollis siuslawensis New River habitat utilization, between breaches 4 & 5

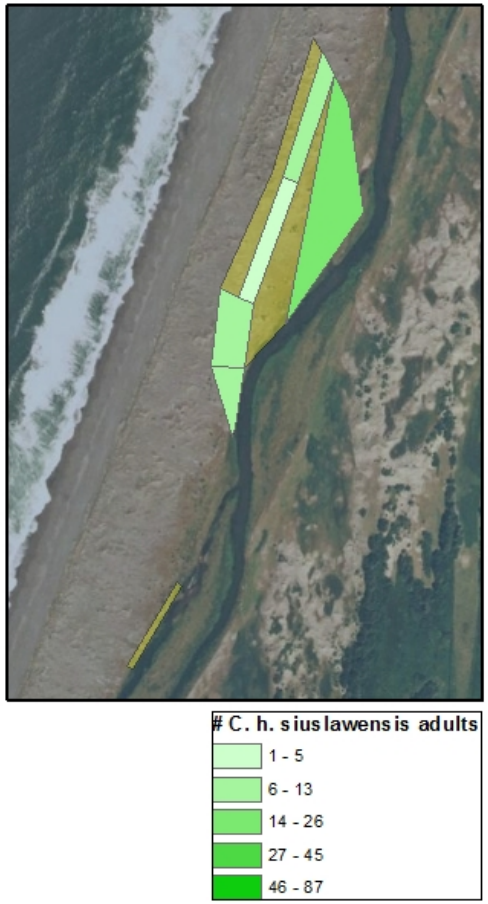
Visual index surveys were done on August 18, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Thirteen adult C. h. siuslawensis were found in this patch of habitat between breaches 4 & 5.

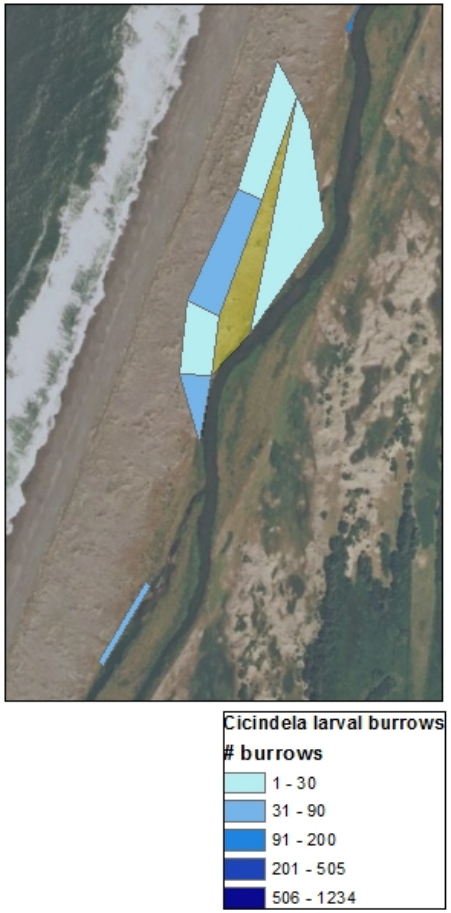


Cicindela hirticollis siuslawensis **New River habitat utilization, breach 4 & small sand beach**

Visual index surveys were done on August 18, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Fifty-six adult C. h. siuslawensis were found at breach 4, but no adults were seen at the small nearby sand beach to the south.

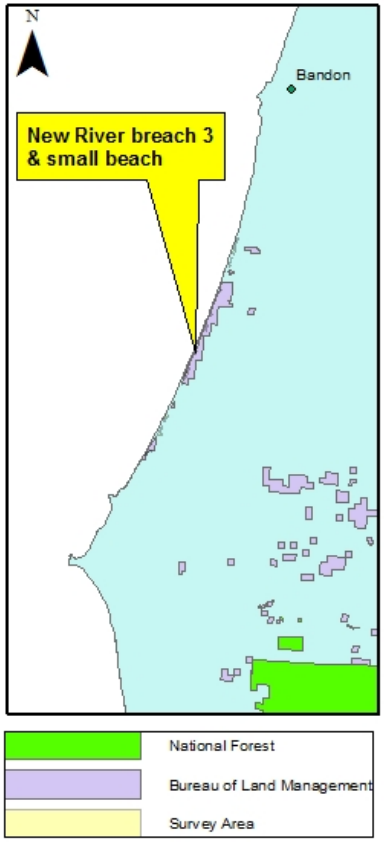






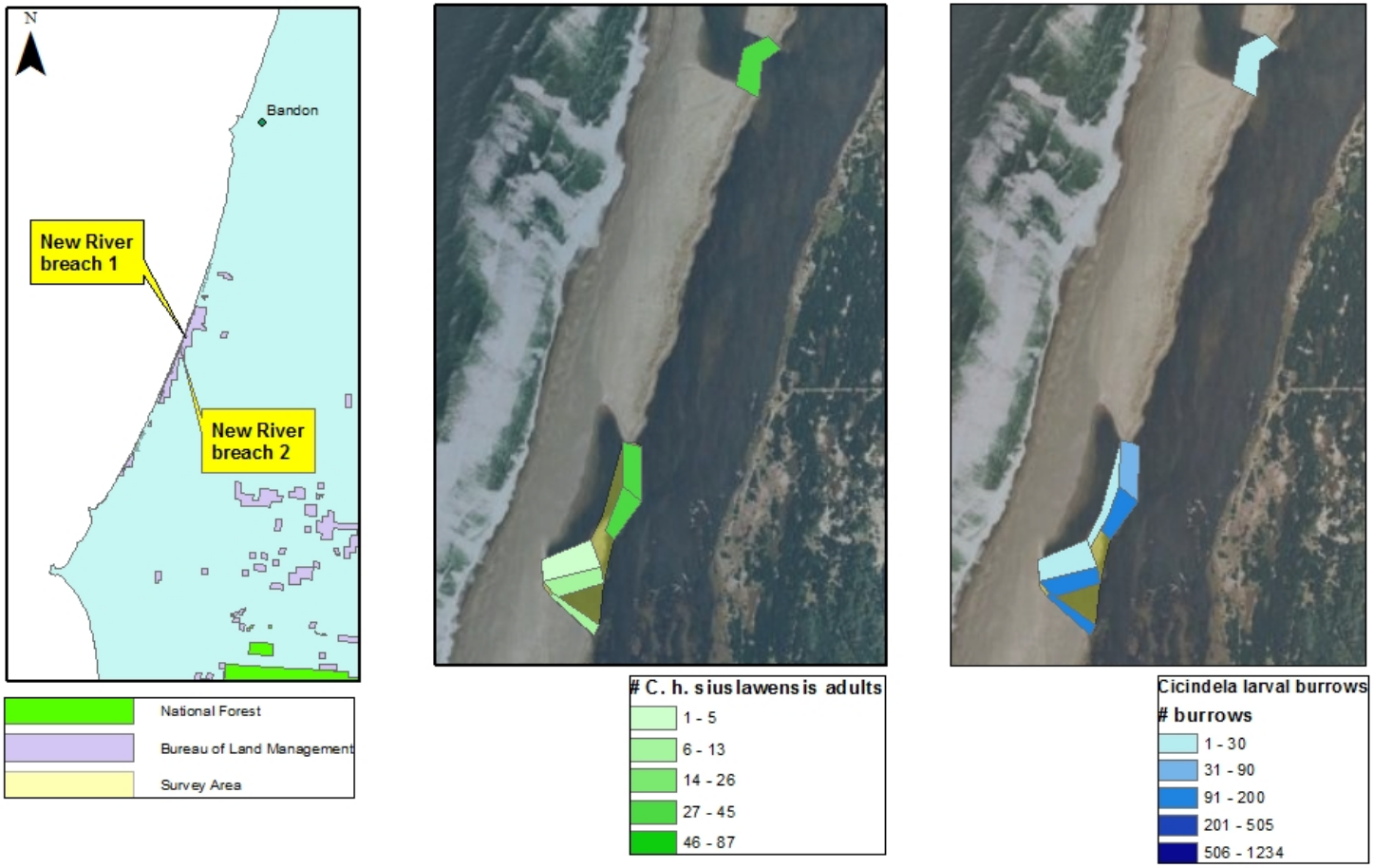
Cicindela hirticollis siuslawensis **New River habitat utilization, breach 3 & small sand beach**

Visual index surveys were done on August 19, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Three adult C. h. siuslawensis were found at breach 3, but no adults were seen at the small sand beach to the south (arrow).



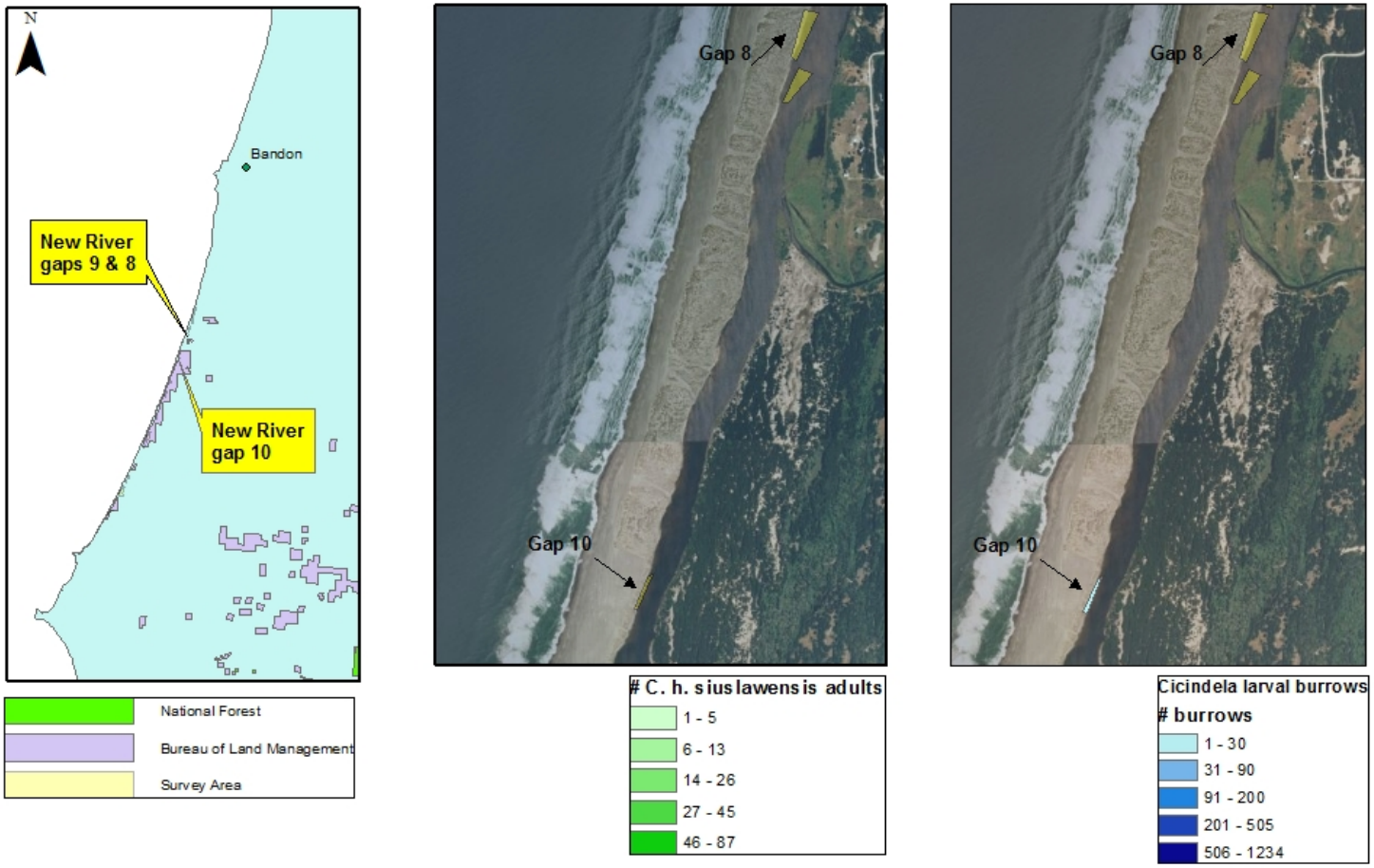
Cicindela hirticollis siuslawensis New River habitat utilization, breaches 2 & 1

Visual index surveys were done on August 19, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Ninety-seven adult C. h. siuslawensis were found at breach 2, and 45 adult C. h. siuslawensis were found at breach 1.



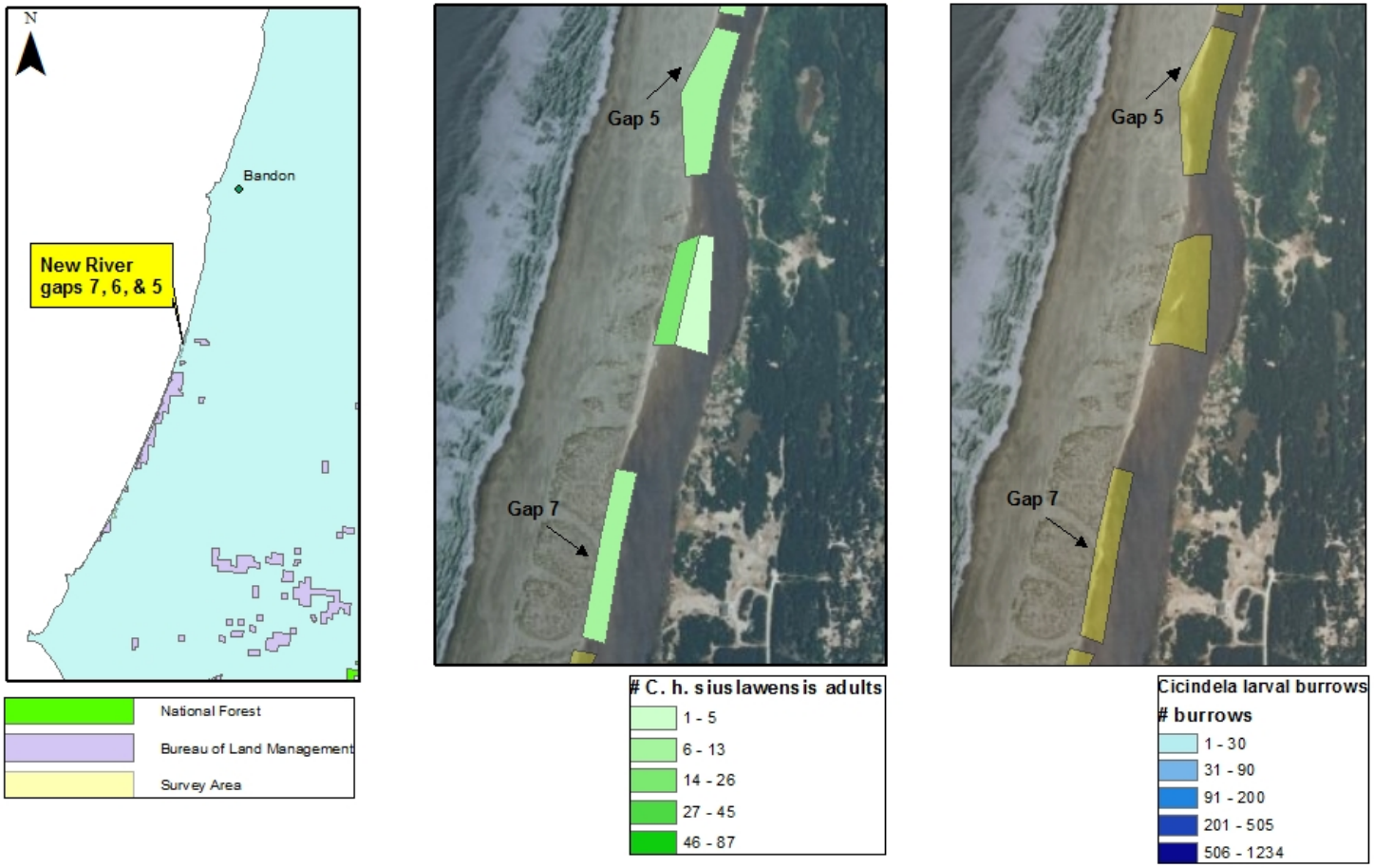
Cicindela hirticollis siuslawensis New River habitat utilization, gaps 10, 9 & 8

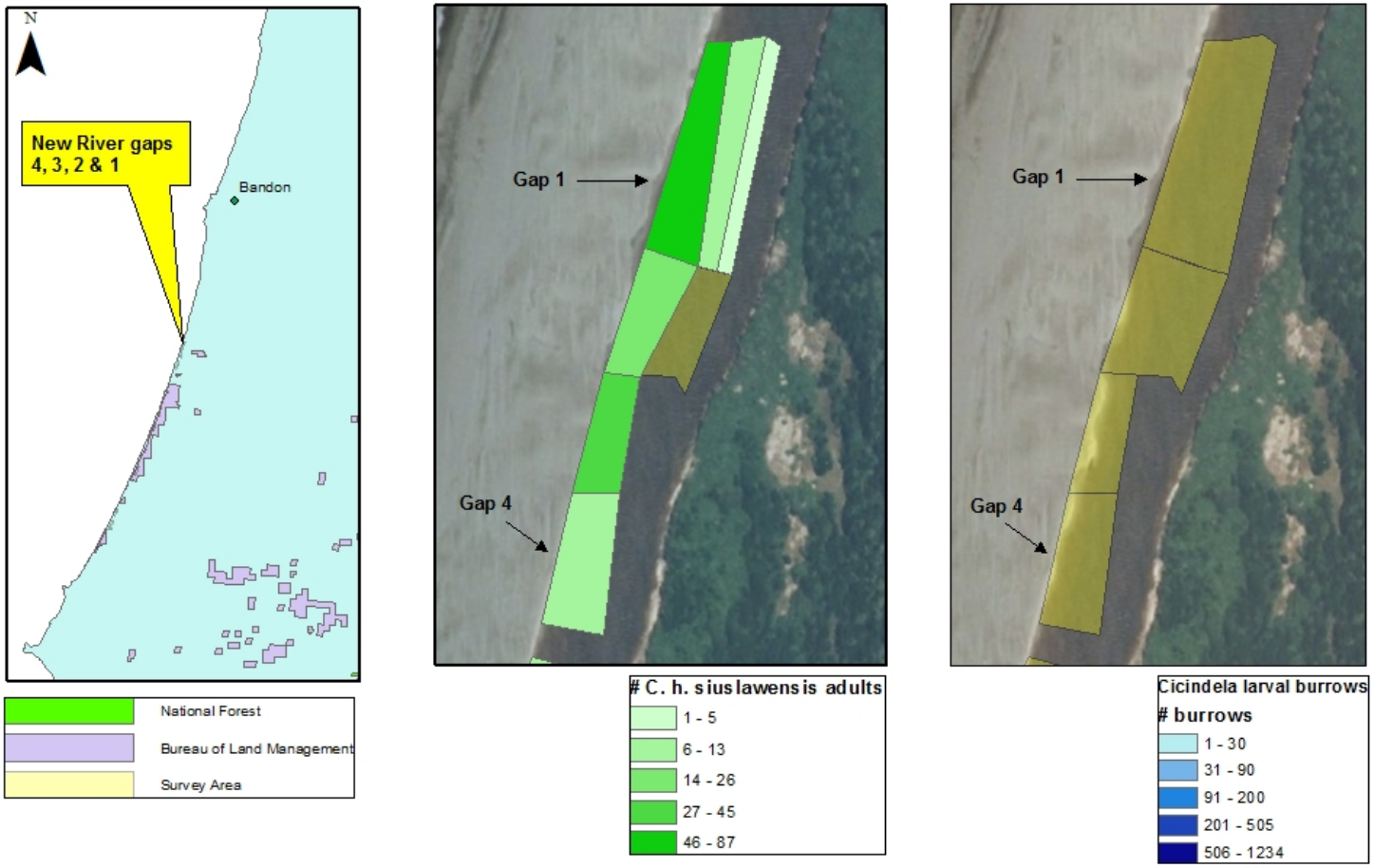
Visual index surveys were done on August 20, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). No adult C. h. siuslawensis were found at any of these three gaps.



***Cicindela hirticollis siuslawensis* New River habitat utilization, gaps 7, 6 & 5**

Visual index surveys were done on August 20, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Eight, 23, and 9 adult C. h. siuslawensis were found at gaps 7, 6 & 5, respectively.



Cicindela hirticollis siuslawensis New River habitat utilization, gaps 4, 3, 2 & 1

Visual index surveys were done on August 20, 2010. The panels below show survey area (pale yellow) and land ownership, along with counts of adult C. h. siuslawensis and Cicindela larval burrows. Color gradations in survey transects correspond to different numbers of adults (green) and larval burrows (blue). Eleven, 35, 26, and 97 adult C. h. siuslawensis were found at gaps 4, 3, 2 &1, respectively.