

Presqu'île Provincial Park Tree-Nesting Colonial Waterbird and Vegetation Monitoring 2010 Report

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The islands of Presqu'île Provincial Park host four tree-nesting colonial waterbird species: double-crested cormorant (DCCO, *Phalacrocorax auritus*), great blue heron (GBHE, *Ardea herodias*), great egret (GREG, *Ardea alba*) and black-crowned night-heron (BCNH, *Nycticorax nycticorax*). The latter three species are collectively referred to as “herons”. Cormorants and the three heron species nest in the remaining scattered areas of woody vegetation on the islands. Nesting gulls and terns, which are considered ground-nesting colonial waterbirds, are monitored on a longer-term cycle by the Canadian Wildlife Service and are not reported on here.

The purpose of monitoring tree-nesting colonial waterbirds and the woody vegetation that they rely on is to determine if habitat is being maintained for a variety of species, especially nesting GREG and BCNH, and to determine if DCCO management is required to maintain that habitat. In order to meet this purpose, the 2010 monitoring answers the following questions:

- How many DCCO are nesting in trees? How is this changing over time?
- Where are DCCO nesting? What is the condition of the vegetation where DCCO nest?
- How much roosting by DCCO is occurring?
- How successful is heron nesting? How is this changing over time?
- Where are herons nesting? What is the condition of the vegetation where herons nest?
- How much roosting by herons is occurring?
- How is the woody vegetation being used by other wildlife species?

Monitoring practices are being modified from previous years to meet the purposes of the Presqu'île Islands Resource Management Implementation Plan, which may be implemented for the first time in 2011. Additional information that may contribute to future management or to regional understanding of tree-nesting colonial waterbird population dynamics is also collected. For example, nest establishment dates, DCCO ground-nesting success, or use of the islands for roosting by tree-nesting colonial waterbirds will be important for future management.

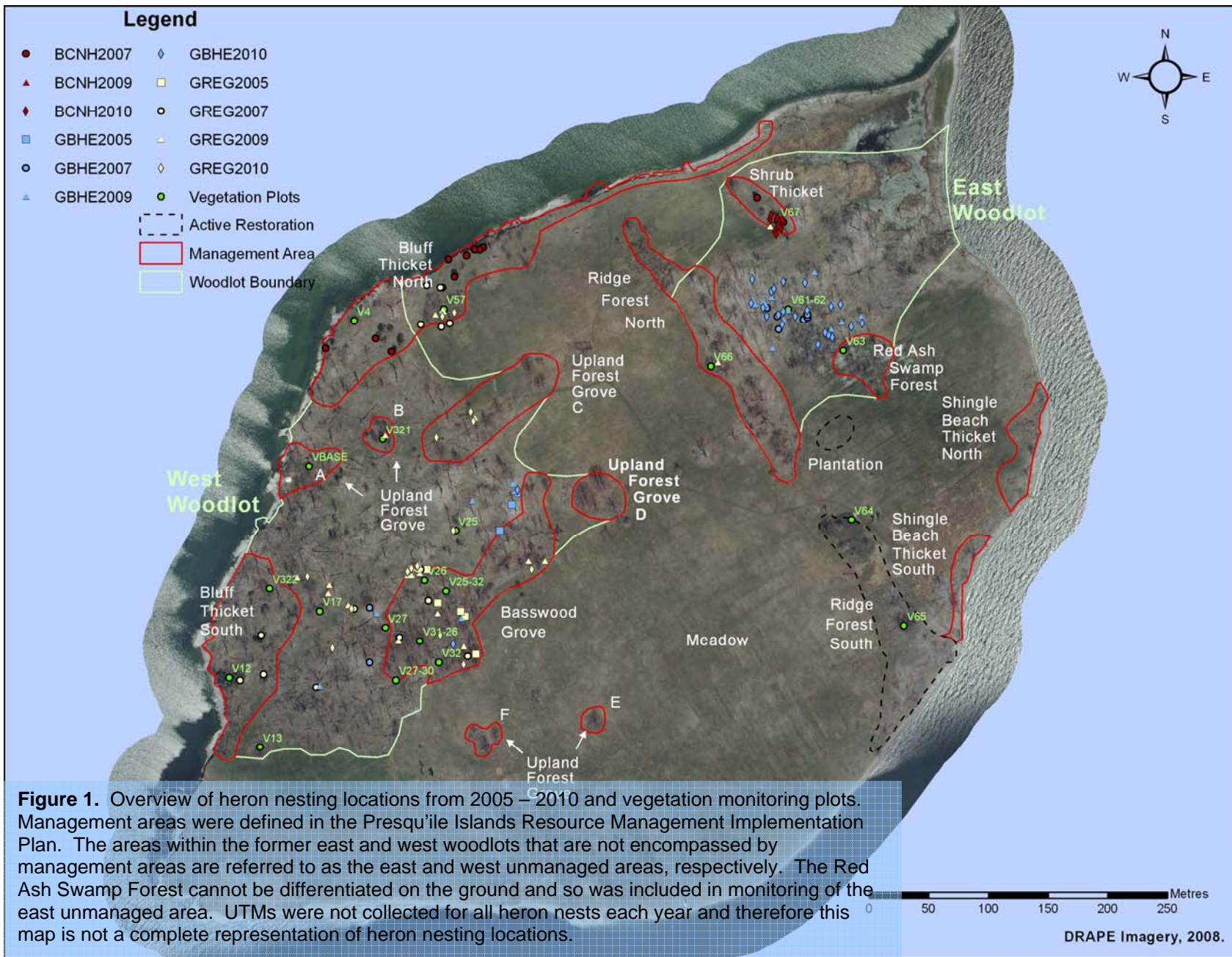
The nesting status of DCCO, GBHE, GREG, and BCNH on High Bluff Island and Sebastopol Point (part of Gull Island) has been regularly monitored using standardized procedures since 2003. In 2010 the same general procedures were followed. As in 2008 and 2009, no active management of DCCO was conducted in 2010. DCCO management occurred previously from 2003 to 2007, after which the previous cormorant management strategy expired.

The woody vegetation was monitored in 2010 using methods similar to those used from 2007 to 2009. Predator sightings and evidence were recorded as it is suspected that a predator might be affecting ground-nesting by DCCO. Deer sightings were recorded as deer have been known to affect regeneration of woody species. Monarch butterfly migration monitoring was conducted when the opportunity was available. Other bird species were recorded opportunistically throughout the season to track use of the island by a variety of wildlife.

Figure 1 is an overview of High Bluff Island identifying the “management areas” upon which monitoring is based, monitoring stations, and areas used by tree-nesting colonial waterbirds.

Monitoring methods, results, and a discussion of the results and recommendations are presented in the following sections for each component of the islands' biodiversity:

1. Double-crested cormorant
2. Herons – great blue heron, great egret, and black-crowned night-heron
3. Vegetation
4. Other wildlife – predators, deer, monarch butterflies, and other birds



1. Double-crested Cormorant Monitoring

1.1. DCCO Methods

DCCO nest counts and productivity

- The number of DCCO nests and the number of trees containing DCCO nests in the management areas on High Bluff Island (**Figure 1**) were counted twice in 2010.
 - Late-June (17th/18th/21st/22nd) – this is consistent with the timing of the Canada Wildlife Service surveys and previous surveys; this week is considered the average peak of nesting
 - Late-July to mid-August (July 19th/21st/30th, August 11th/13th/18th) – to capture some of the changes in the nesting colony over the breeding season
- After nests in an occupied tree were counted, the tree was marked with spray paint to avoid double counting.
- Trees were identified to species and assessed for health category (as described in **section 3**).
- In previous years, ground nests were counted. DCCO did not nest on the ground in 2010.
- Three trees on High Bluff Island were routinely monitored for DCCO nest productivity, and UTM coordinates were recorded for these trees (**Figure 2**). Two of these trees were also monitored for productivity in 2009.
- Nest productivity monitoring was generally conducted 1-2 times per week from May 19th to August 18th. Nest contents were observed using binoculars from approximately 50-100 m away from trees
- Since DCCO chicks within a given nest develop at the same time, the larger of the following measures was used to estimate the number of chicks fledged per nest:
 - Maximum number of chicks seen in the last month of nest occupancy
 - Maximum number of fully-grown chicks observed in the nest at any time

DCCO roosting

- The number of DCCO coming in to roost on High Bluff Island was recorded on September 1st, September 9th and September 15th.
 - Surveys were conducted from one hour to 30 minutes before sunset until 30 minutes past sunset
 - As in previous year, observers using binoculars were positioned on opposite ends of the island (**Figure 2**). All birds coming in to roost from the west, north, and east were clearly visible. Birds returning from the south were partially obscured from view. No two points on the island offer a clear view of all potential return angles.

1.2. DCCO Results

DCCO nest counts and productivity

- DCCO nested across High Bluff Island in several different habitats and management areas (**Figure 1**) in 2010 (**Table 1**).
 - Staff noted that DCCO did not previously nest in Shrub Thicket.
 - Approximately 60% of DCCO tree nests were in the areas that will not be managed, in accordance with the Resource Management Implementation Plan.
 - The highest average number of DCCO nests per tree was in Ridge Forest North.
 - DCCO did not nest on Sebastopol Point or elsewhere on Gull Island in either 2009 or 2010.
- DCCO did not nest on the ground in 2010, possibly due to the continued presence of terrestrial predators.
- DCCO used all tree species that are present on the island in 2010 except elm and beech, which are present in small amounts.

Table 1. 2010 management area use based on the late June count. DCCO nest counts were not done separately for the Red Ash Swamp Forest. Nests in this area were included with the east unmanaged area.

Management area	# nests in live trees	# live trees used	# nests in dead trees	# dead trees used	TOTAL DCCO NESTS	TOTAL TREES USED
Basswood Grove	712	218	73	18	785	236
Bluff Thicket North	0	0	10	4	10	4
Bluff Thicket South	57	18	19	9	76	27
Red Ash Swamp Forest	NA	NA	NA	NA	NA	NA
Ridge Forest North	679	52	128	26	807	78
Ridge Forest South	0	0	0	0	0	0
Shingle Beach Thicket	4	3	0	0	4	3
Shrub Thicket	39	20	0	0	39	20
Upland Forest Grove A	0	0	0	0	0	0
Upland Forest Grove B	0	0	0	0	0	0
Upland Forest Grove C	20	6	1	1	21	7
Upland Forest Grove D	0	0	0	0	0	0
Upland Forest Grove E	0	0	0	0	0	0
Upland Forest Grove F	0	0	0	0	0	0
“Unmanaged” area – East	1855	195	482	76	2337	271
“Unmanaged” area – West	120	44	324	34	444	78
Total	3486	556	1037	168	4523	724

- Nest numbers and number of trees used during both 2010 count periods are reported in **Table 2**. The second count includes nests from the first count as well as more newly established nests. Although the numbers of nests and trees used decreased between June and later in the summer, some of the later summer nests were in new trees (as determined through later vegetation monitoring, described in **Section 3**). This information can be used as a baseline for future years when management occurs, and shows that nest initiation continues past late June.

Table 2. Number of DCCO nests and trees used for nesting on High Bluff Island during both count periods in 2010.

	June 17 - June 21	July 19 - August 18
# of nests	4523	3393
# of trees	724	646
avg # nests/tree	6.2	5.2

- The total number of DCCO nests in June increased from 2009 to 2010 (**Table 3a**), and is now similar to tree-nest numbers in 2003, which was the first year of cormorant management.
 - The nest increase (17%) occurred entirely in the tree-nesting component of the population as there was no established ground colony in 2010.
- DCCO used more dead trees and fewer live trees in 2010 than 2009 (**Table 3b**)
- The average number of nests per tree in 2010 was slightly higher than the number of nests per tree in 2009, largely due to an increase in nesting density in dead trees. There is a lot of variability in the number of nests per tree. The maximum number of nests observed in a single tree was 63, in a large red oak in the west unmanaged area.

Table 3a. Cormorant nest numbers from 2002 to 2010. All data are from June nest counts.

Location	2002	2003	2004	2005	2006	2007	2008	2009	2010
Tree-nests	6893	4631	3656	1976	2108	2233	3478 ^A	3756	4523
HBI ground nests	3491	2948	1683	1305	498	1562	664	116	0
Gull I. ground nests	1698	1117	1601	1328	213	60	0	0	0
Total Nests	12082	8696	6940	4609	2819	3855	4142^A	3872	4523

^AThese numbers have been incorrectly reported as 3488 and 4142 in previous reports.

Table 3b. Number of DCCO nests and trees used for nesting on High Bluff Island from 2006 to 2010. Live and dead trees were not recorded separately until 2008.

Year	# live trees used	# nests in live trees	# nests/ live tree	# dead trees used	# nests in dead trees	# nests/ dead tree	Total trees used	# nests/ tree
2006							377	5.6
2007							432	5.2
2008	449	2743	6.1	121	735	6.1	570	6.1
2009	571	3408	6.0	84	348	4.1	655	5.7
2010	556	3486	6.3	168	1037	6.2	724	6.2

- Nest productivity for 89 active DCCO nests in the 3 trees that were monitored averaged 3.0 chicks per nest, which is slightly less than 2009 (3.3). The 3 trees that were chosen for monitoring productivity are large trees with good visibility and a high density of nests, due to their size and open-grown branching structure. The peak of nesting activity in these 3 trees occurred the first week of July.

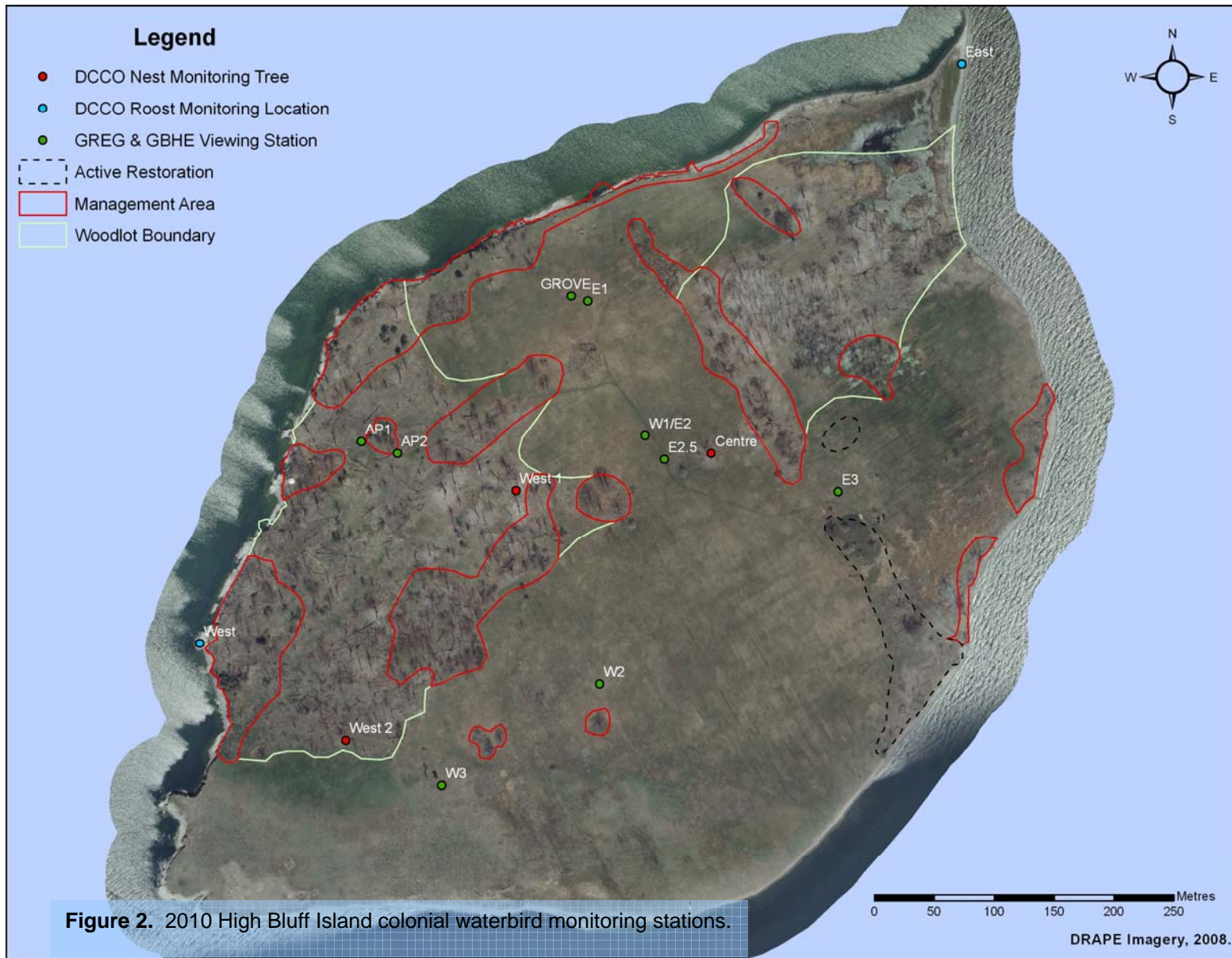
DCCO Roosting

- The number of DCCO returning to roost was higher on September 1st (632) than September 9th (602) and substantially higher than on September 15th (231) (**Appendix A**).
- Large influxes of DCCO occurred approximately 20-30 minutes before sunset on all three monitoring days. The largest influx on September 1st, however, occurred 6 minutes past sunset
- The primary direction of return was variable among the three monitoring days:
 - Northeast on September 1st
 - North on September 9th
 - East on September 15th
- In 2009 roost monitoring occurred earlier (August 11, August 31, September 1), and more cormorants were seen. The largest influx of cormorants came from the west on August 11 in 2009 (>1700).

1.3. DCCO Discussion

- DCCO continue to use a variety of habitats and areas on High Bluff Island. The areas used by DCCO each year vary based on behaviour and changes to habitat condition. DCCO are using more live trees than dead trees in all areas. This may be due to preference or to availability. New areas have been used by nesting DCCO since management ceased, with the Shrub Thicket area as the latest. More than half of DCCO tree-nests in 2010 were in areas where management will not occur.
- DCCO continue to initiate new nests, some of which are in new trees, into July.
- The number of DCCO nests on High Bluff Island in June has been increasing steadily since 2005. The number of tree nests on High Bluff Island is now similar to the number present in 2003, which is the first year that the previous management strategy was implemented.

- The number of ground nests declined considerably from 2007 to 2009 and the DCCO ground colony was completely absent during the June nest count in 2010. None of the ground nests in 2009 successfully raised chicks. DCCO attempted to nest in the traditional ground colony area early in the season but abandoned it by early June. The continued presence of terrestrial predators (reported in **Section 4.1**) is likely the cause of the loss of the ground-nesting component of the DCCO population.
- DCCO used more trees in 2010 than in any other year, some of which were ones that they had not previously nested in (described further in **Section 3**). Fewer live trees were used in 2010 than 2009, although this is likely due to the fact that there were fewer live trees available in areas preferred by DCCO.
- There was also a greater density of nests per tree 2010 than 2009; in fact, the highest density noted to date was in the live trees in 2010. Staff have noted that there are fewer of the large trees that can support dozens of nests, and more nests being packed into smaller trees. The increased numbers of trees with nests and higher densities of DCCO nests per tree is the result of two factors:
 - larger numbers of DCCO nesting
 - the loss of large trees from the overall forest structure. Large trees were preferentially used for nesting when DCCO first colonized the wooded areas of High Bluff Island. Now, staff have noted that many of these “preferred” large trees have died and fallen to the ground (described further in **Section 3**). As the larger trees disappear from the landscape, DCCO are moving into smaller trees, including chokecherry thickets.
- Average DCCO productivity was slightly less than in 2009, but still higher than that reported (1.2 – 2.4) in The Birds of North America DCCO account.
- DCCO roost in regional roosts, which may not be the same locations where they nested that year. There were fewer roosting cormorants recorded in 2010 than in 2009. This may be due to differences in monitoring dates, but it is also possible that High Bluff Island is becoming less important as a regional roost as DCCO choose other roosting areas on Lake Ontario.



2. Heron Monitoring

2.1. Heron Methods

GBHE nest counts and productivity

- Nests were initially located by surveying High Bluff Island with binoculars and spotting scopes on April 13th. New nests were located throughout the season. All nests were individually identified and tracked through the breeding season.
- Observations were made using spotting scopes from one of 9 viewing stations (**Figure 2**) to avoid disturbing the breeding birds. Viewing stations were >100 m from nests.
- Nests were monitored for contents and adult behaviour (e.g. incubating, standing, etc.) regularly throughout the breeding season to determine activity and fates of individual nests:
 - April 13th to July 19th – 2-3 times per week
 - July 19th to August 6th – once per week
- Since chicks within individual nests mature at different times, the maximum number of chicks seen in the last month of nest occupancy was used to estimate chicks fledged per nest.
- The UTM (Universal Transverse Mercator) coordinates for all active nests were recorded later in the season when sensitivity to disturbance was minimal or nests were no longer in use.

GREG nest counts and productivity

- Nests were initially located by surveying High Bluff Island with binoculars and spotting scopes on April 13th. New nests were identified throughout the season. All nests were individually identified and tracked through the breeding season.
- Observations were made using spotting scopes from one of 9 viewing stations (**Figure 2**) to avoid disturbing the breeding birds.
 - Viewing stations were >100 m from nests. Observers occasionally had to move closer (~50 m) to determine nest contents.
- Nests were monitored for contents and adult behaviour (e.g. incubating, standing, etc.) regularly throughout the breeding season to determine activity and fates of individual nests:
 - April 13th to July 19th – 2-3 times per week
 - July 19th to August 18th – once per week
- On May 26th and June 18th, nest contents of some nests were observed directly using a mirror attached to a pole in cases where nest contents couldn't be determined from a distance.
- Since chicks within individual nests mature at different times, the maximum number of chicks seen in the last month of nest occupancy was used to estimate chicks fledged per nest.
- The UTM coordinates for all active nests were recorded later in the season when sensitivity to disturbance was minimal or nests were no longer in use.

BCNH nest counts and productivity information

- Monitoring of BCNH nests is relatively limited compared to that of the other heron species and productivity was not monitored with the same frequency. BCNH adults are particularly sensitive to human disturbance before and during nesting. Their nests are often well-hidden within dense vegetation and thus are not able to be monitored from a distance. Nestlings are also prone to fleeing from nest sites when they are approached.
- Nests were initially located by searching sub-canopy woody vegetation on High Bluff Island and the remaining willow tree on Sebastopol Point, with opportunistic observations made throughout the season to collect additional data on individual nests.
 - Sebastopol Point was searched on May 26th
 - High Bluff Island was searched on May 25th/26th and on July 6th/8th/12th
- Nest contents were viewed directly using a mirror attached to poles during these searches.
- The UTM coordinates for High Bluff Island nests were recorded during the July count.

Heron Roosting

- The number of GBHE, GREG, and BCNH coming in to roost on or leaving to forage from High Bluff Island was recorded at the same time as the DCCO roost monitoring.

2.2. Heron Results

- All three heron species bred successfully in 2010. Details for each species are provided in the following sections.
- As in previous years, nesting attempts and establishment dates fluctuated throughout the breeding season for all species.
- Four measures of breeding activity and success are reported:
 - Maximum number of active nests – the largest number of individually identified nests known to be active during the breeding season (not all of these will produce young)
 - Number of successful nests – the number of nests that produced at least one chick that survived to fledging (ie. leaving the nest)
 - Number of fledged young – the number of hatched birds that survived to the point of fledging
 - Number of fledged young per nest – a measure of nest productivity (only successful nests were used to calculate the number of fledged birds per nest)
- Failed nests for these species generally fell into one of four categories (when cause could be determined):
 - Nest lost due to nest falling or tree falling
 - Nest abandonment in which case the nest is seen empty for one or more monitoring days before disappearing – these nests are generally disassembled soon after abandonment
 - Active nest disassembled by DCCO for nesting material
 - Nest taken over and nested in by DCCO
- Distribution of heron nests in the various management areas is summarized in **Table 4** and shown in **Figure 3**. As in 2009, herons used areas that are also occupied by DCCO. The exception is the remaining willow tree on Sebastopol Point, where BCNH nested and DCCO did not in 2010.

Table 4. Use of cormorant management areas by tree-nesting colonial waterbirds in 2010

Management area	DCCO 2010?	Herons 2010
Basswood Grove	Y	1 GBHE tree 6 GREG trees 1 BCNH tree
Bluff Thicket North	Y	2 GREG trees
Bluff Thicket South	Y	
Red Ash Swamp Forest	Y	
Ridge Forest North	Y	
Ridge Forest South	N	
Shingle Beach Thicket	Y	
Shrub Thicket	Y	10 BCNH trees
Upland Forest Grove A	N	
Upland Forest Grove B	N	
Upland Forest Grove C	Y	3 GREG trees
Upland Forest Grove D	N	
Upland Forest Grove E	N	
Upland Forest Grove F	N	
“Unmanaged” area – East	Y	21 GBHE trees
“Unmanaged” area – West	Y	1 GBHE tree 5 GREG trees

GBHE nest counts and productivity

- The maximum number of active GBHE nests on High Bluff Island increased in 2010 (**Table 5a**). The maximum number of active nests occurred between May 7th and June 17th in 2010, which is within the same range as 2009.
- Over the course of the season, more pairs successfully raised more young in 2010 than 2009.
- 4 nests did not fledge chicks:
 - One established nest was lost due to the tree falling – the fallen tree, nest remains and one dead chick were found at the site upon closer inspection
 - Two established nests were taken over and nested in by DCCO:
 - One nest was attended by a GBHE for one month before DCCO were observed occupying the nest on May 17th – it appeared as if DCCO had attempted to push a GBHE egg out of the nest as the egg was caught in the branches just outside the nest
 - One nest contained two small chicks just prior to DCCO being seen occupying the nest on May 19th
 - Two new successful nests were established late in the season (May 28th and June 14th) and may have been re-nests of the aforementioned failed nests
 - One nest lost its chick due to unknown causes – it contained chicks for over a month; however, the only chick that survived to become large was observed hanging dead from the nest on June 21st
- Most GBHE nested in the east unmanaged area in ash trees, with a few in or near the Basswood Grove in basswood trees (**Figure 3**)

Table 5a. Nesting activity and success of GBHE on High Bluff Island

Year	Maximum nest count	# successful nests	# fledged young	Mean # fledged per nest
2003	38	25	37	1.5
2004	63	38	75	2.0
2005	42	32	75	2.3
2006	36	22	51	2.3
2007	30	18	42	2.3
2008	26	23	46	2.0
2009	22	20	41	2.1
2010	29	28	66	2.4

GREG nest counts and productivity

- The maximum number of active GREG nests on High Bluff Island increased in 2010 (**Table 5b**). The maximum number of active nests occurred between May 21st and May 25th, which is similar to 2009
- Although the maximum nest count was higher in 2010, only one more GREG pair successfully raised young in 2010 than in 2009, and the same number of young were raised both years.
- Of the 41 active nests on May 21st and May 25th (maximum active nest count):
 - 25 nests successfully fledged chicks
 - 5 nests produced chicks but ultimately failed (no chicks fledged), as described below
 - 3 nests that had been seen with two attending birds failed before any chicks were observed
 - 8 nests that had been seen with only one attending bird were abandoned before any chicks had been observed. At least one of these was observed to be transient, built by a young, single bird

- There were many failed nesting attempts over the course of the season, including nests with and without chicks. The following cases of nest abandonment and failure were documented:
 - 1 was likely lost during a strong wind event on May 8th
 - 15 cases likely involved young transient birds building nests and promptly abandoning them to move elsewhere (based on behaviour observations).
 - 7 were presumably taken apart by DCCO for nesting material (based on DCCO behaviour that has been observed in the past)
 - Two nests disappeared early in the season
 - One nest that contained at least one small chick was suddenly absent, with no remaining nesting material but one dead chick found hanging in the tree
 - Two nests that contained chicks disappeared, with some nest remnants and egg shell fragments found on the ground at the nesting sites
 - One nest that had been attended by an incubating bird for over 6 weeks disappeared with no signs of eggs, chicks or nesting material on the ground below
 - One nest that contained two medium-sized chicks disappeared with no nest remnants found
- GREG nested in the Basswood Grove, Bluff Thicket North, and Upland Forest Grove C (**Figure 3**). Nests were located in chokecherry, basswood, hawthorn, and ironwood.

Table 5b. Nesting activity and success of GREG on High Bluff Island

Year	Maximum nest count	# successful nests	# fledged young	Mean # fledged per nest
2003	5	4	10	2.5
2004	10	10	26	2.6
2005	17	16	42	2.6
2006	16	14	35	2.5
2007	23	21	63	3.0
2008	27	23	62	2.7
2009	31	27	72	2.7
2010	41	28	72	2.6

BCNH nest counts and productivity information

- BCNH are more difficult to monitor than the other species as they are more secretive and easily disturbed from their nests. The information provided below is based on compilations of data collected opportunistically over the breeding season, rather than on regular and continuous monitoring of individual nests.
- The maximum number of confirmed active BCNH nests observed during the season increased in 2010 (**Table 5c**), due to a large increase in nests in the willow tree on Sebastopol Point.
- Nest productivity for BCNH cannot be monitored like it can be for other species as the nests cannot be observed regularly to determine their outcome. Instead, the number of chicks or eggs is monitored opportunistically.
 - On High Bluff Island nest contents were surveyed in early July where possible and chicks were opportunistically observed between early July and early August. The mean number of chicks/eggs per active nest was 2.4. This was based on 12 active nests, 4 of which contained eggs and 8 of which contained chicks.
 - On Sebastopol Point nests were surveyed on May 26th. The mean number of chicks/eggs per active nest was 2.9. 34 active nests were observed, 5 of which had chicks exclusively, 28 had eggs exclusively, and one had one of each.
 - The mean number of checks/eggs per active nest was similar to 2009.

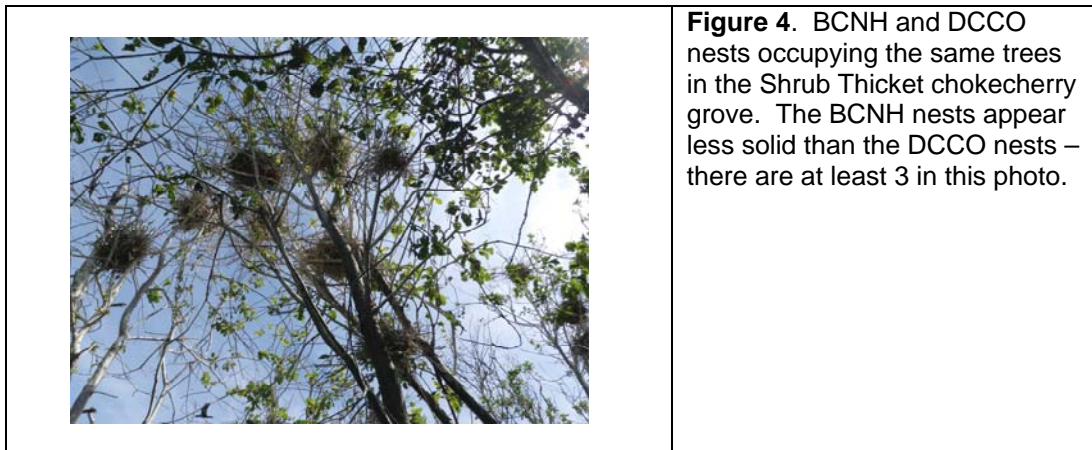
- Over the course of the season, a total of 63 BCNH nests were found on High Bluff Island and Sebastopol Point in 2010, 51 of which were confirmed as active.
 - Of the 29 nests located on High Bluff Island:
 - 17 nests contained chicks and/or eggs in 2010 (decrease from 27 in 2009)
 - 8 nests did not have chicks or eggs but showed other signs suggesting activity (e.g. nest appeared to be newly-built, guano deposits around the nest, etc.)
 - 4 nests were found late in the season scattered away from the main nesting areas and their status is unknown
 - Of the 34 nests located on Sebastopol Point:
 - All 34 nests were active (increase from 19 in 2009)
 - Sebastopol Point supported nests in 2006 and previous years but was not used in 2007 or 2008
- BCNH nests on Sebastopol Point were concentrated in one willow tree.
- On High Bluff Island, active nests were concentrated in a small chokecherry grove in the Shrub Thicket (**Figure 3**). On June 4th, there were also 35 DCCO nests in the chokecherry grove. Many of the DCCO nests were in the same trees as the BCNH nests (**Figure 4**).
- Bluff Thicket North supported empty nests from previous years. Bluff Thicket South supported at least 33 BCNH nests in 2008 but was not used by BCNH in 2009 or 2010.

Table 5c. Nesting activity of BCNH on High Bluff Island and Gull islands. NM = not monitored.

Year	Maximum nest count	# Active nests – Gull I.	# Active nests – HBI	# fledged young	Mean # fledged per nest
2003	80	26	54	NM	NM
2004	59	7	52	NM	NM
2005	71	14	57	NM	NM
2006	84	17	67	>=80 ^B	2.0
2007	77	0	77	NM	NM
2008	80	0	80	NM	NM
2009	46 ^A	19	27	NM	NM
2010	51	34	17	NM	NM

^A Maximum nest count for BCNH was reported as 69 in 2009; however, this amount incorrectly included inactive nests.

^B 51 nests were monitored for productivity in 2006; 41 of these successfully fledged 80 young



Heron Roosting

- No GBHE or GREG were observed arriving to or departing from High Bluff Island during roost monitoring in 2010 (**Appendix A**). Both species were observed returning to the island during all 3 monitoring dates in 2009, although staff suspect that they were “local” – individuals that had nested or were born on the island that year – rather than individuals from elsewhere using the island as a regional roost.
- Localized GBHE movement was observed during roost monitoring.
 - One juvenile GBHE attempted to land near the observer on the west side of the island but flushed and flew south along the shoreline
 - One juvenile GBHE was seen foraging on the southern end of the island on September 15th from just before to just after sunset for approximately 18 minutes
- GREGs in groups of up to 18 birds were observed in the western Bay of Quinte in September, 2010 indicating that a fall roost may have established there.
- No BCNH were seen arriving to or departing from High Bluff Island during roost monitoring on September 1st or September 9th.
- On September 15th, two juvenile BCNH left the northern tip of the island 26 minutes past sundown and headed north. One juvenile BCNH was observed foraging along the northern shoreline just after sunset for approximately 5 minutes but did not leave the island. In 2009 several were observed leaving during 2 of the monitoring periods.

2.3. Heron Discussion

- The increase in successful GBHE nests between 2009 and 2010 was accompanied by an increase in fledgling numbers, despite nest takeovers by DCCO. It is not known why nest numbers and productivity improved from 2009. Improved food resources or fewer weather events causing chick loss may be possible factors. Difference in levels of human disturbance between years is not considered to be a significant factor since the same monitoring approach was used both years. Despite relatively high GBHE nesting success in 2010, the number of successful GBHE nests is expected to diminish in future years as the largest trees continue to die and fall. Given that most GBHE nest in tall ash trees in the east unmanaged area of the island, which is area of highest DCCO nest abundance, it is possible that their nesting habitat will be lost from the island in the future.
- Despite an increase in nesting activity by GREG in 2010, the number of successful nests only increased by one nest between 2009 and 2010, and the number of chicks produced remained the same. This is likely partially due to nesting behaviour – approximately 20% of nests were single-bird nests with only one attending adult and no chicks. These nests were likely built by younger GREG (hatched in 2009 or earlier) which were trying to attract a mate or, possibly, adult birds that had lost their mate and were trying to attract a new one. GREGs have been nesting successfully on HBI on several years now and this has likely led to an increase in new breeding birds entering the population. There were also suspected cases of DCCO disassembling active nests, which would affect nesting success. GREG are showing flexibility in their habitat use on HBI, making use of the remaining areas of live vegetation. Nonetheless, one of the core areas they have traditionally used is Basswood Grove, which is also heavily used by DCCO.
- The number of active BCNH nests on the islands declined drastically from 2008 to 2009, and increased slightly in 2010 due to increased nesting in the remaining willow tree on Sebastopol Point. The number of BCNH nests found on High Bluff Island has consistently declined from 80 nests in 2008 to only 17 in 2010. The expansion of DCCO nesting on High Bluff Island is threatening BCNH nesting at Presqu'île. In previous years, Bluff Thicket South, a cedar thicket on the southwest shore of High Bluff Island, was an important nesting area for BCNH and was also used by GREG. In 2009, the area became heavily colonized by DCCO and the BCNH and GREG were entirely displaced. DCCO have also moved into the Shrub Thicket area where another significant congregation of BCNH nests exists. The thicket was not occupied by DCCO in 2009 but there were 35 DCCO nests at this location in June 2010. DCCO using thickets on High Bluff Island that once were exclusively used by BCNH causes major concern.

As BCNH are forced out of their traditional nesting thickets on High Bluff Island they are packing tighter into the one remaining tree on Sebastopol Point. In 2010 this one small tree on Sebastopol Point held two-thirds of the park's breeding BCNH. In 2007 over 100 DCCO nests were removed from this tree, and DCCO have not used it since. Without that removal effort it is likely the tree would not have survived or, at the very least its health would have been severely compromised. It appears that the future for breeding BCNH at Presqu'île is now very precarious.

- It does not appear that High Bluff Island is functioning as a regional roosting location for GBHE or GREG. Local BCNH continue to use the island into the late summer.

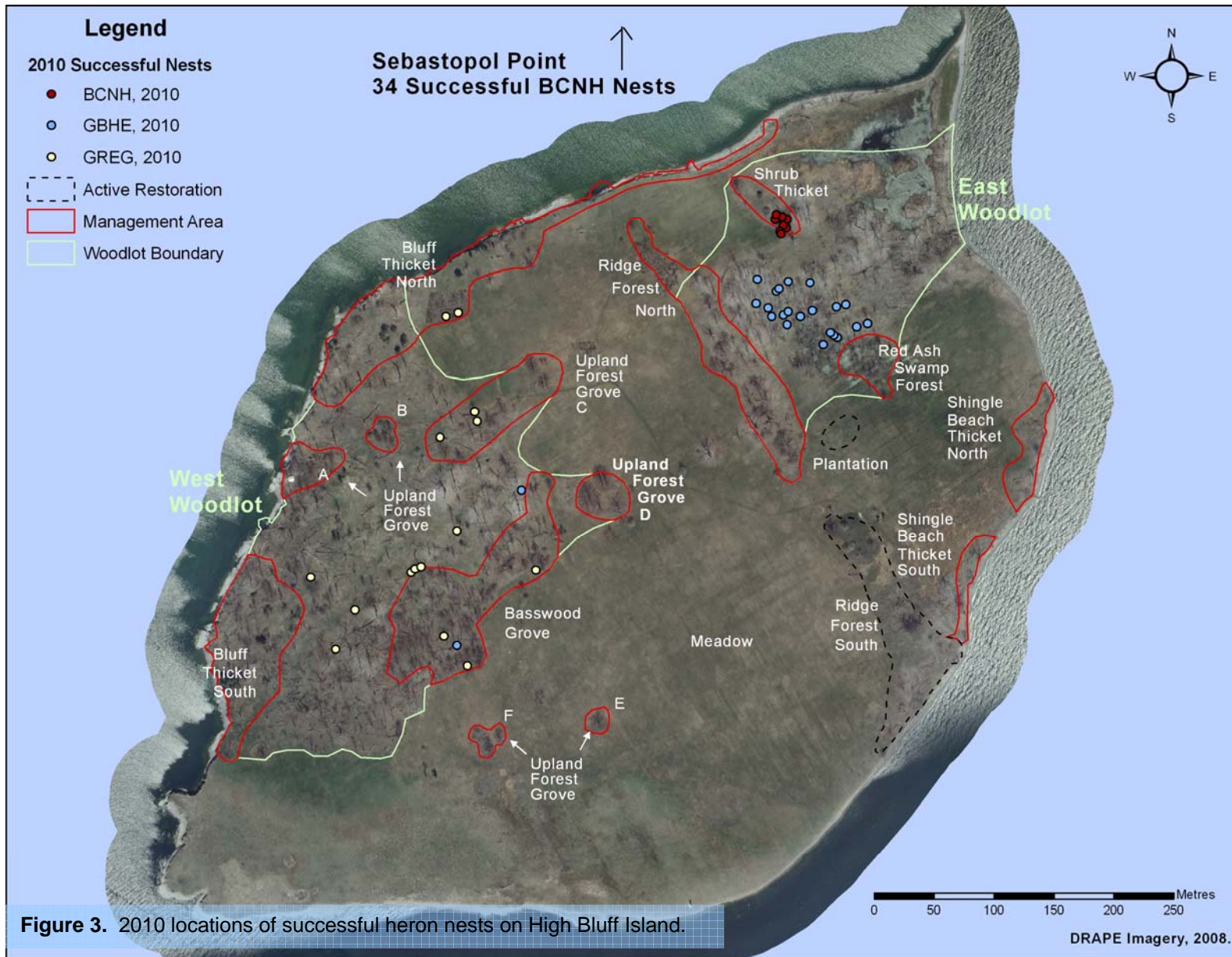


Figure 3. 2010 locations of successful heron nests on High Bluff Island.

3. Vegetation Monitoring

3.1. Vegetation Methods

- Detailed methods for surveying the vegetation on High Bluff Island are described in a protocol (**Appendix B**). An overview of the methods is below.
- In 2007 18 permanent plots were established in areas of woody vegetation. Of these, 15 have been surveyed most years and were surveyed again in 2010, and 3 will no longer be monitored. 5 new plots were added in 2010 to capture more of the specific woody habitat areas (“management areas”) identified in the Islands Plan (**Figure 1**). There is now a total of 20 plots that will continue to be monitored annually.
- Surveys were timed to be as early as possible without disturbing breeding herons and egrets. Unfortunately, this means that nests of all species may have been disassembled or blown to the ground by the time the vegetation survey is done and therefore cannot be accurately counted during vegetation monitoring.
- Survey dates have been:
 - August 31 to September 19, 2007
 - August 13 to September 5, 2008
 - September 9 to 30, 2009
 - August 26 to September 27, 2010
- All living trees within each 5m radius circular plot (area = 78.5 m²) were identified to species, measured (using standard Ecological Land Classification height categories and diameter at breast height), and marked with numbered metal tags. Tree health and presence of DCCO and heron nests is recorded for each tree. Dead trees were tallied but not marked with tags.
- In 2010 the methods for assessing the condition of live trees were modified in order to improve efficiency, consistency between years and observers, and to more accurately reflect field conditions, as recommended in the 2009 report. The previous methods were based on standard forestry practices; however, the effects of cormorants on trees are atypical and trees demonstrate unusual growth patterns on High Bluff Island as a result. Trees were assessed based on their structure (branching pattern) and the health of the remaining live branches.
- During the June and July DCCO nest count tree tag numbers are recorded, allowing the June nest counts to be cross-referenced to the vegetation survey plots. Other tree-nesting colony waterbird nests are recorded throughout the nesting season, but it is not always possible to record the tree tag number of their nesting trees as this could cause too much disturbance.
- Presence or absence of groundcover and canopy cover was recorded at nine locations within each plot. Sapling tallies were also completed for the total area of each plot.
- Information collected for plots may be incomplete each year for various reasons. Vegetation monitoring on High Bluff Island is hampered by the dense, tall growth of stinging nettle and thistles, and the fact that posts used to mark monitoring plots are often obscured by guano or knocked down and covered by falling trees and branches. Tags may disappear from live trees, perhaps due to bird activity or weather conditions. Trees die and fall quickly and downed trees become obscured by the nettle and thistle growth. Timing to complete this work is limited as it must occur after the breeding season but before seasonal changes in vegetation and before weather limits access to the island.

3.2. Vegetation Results

- All information reported below is for the 20 plots that were monitored in 2010 unless otherwise noted.
- Regular statistics cannot be calculated for the data collected from this kind of monitoring work, as each monitoring plot represents unique conditions (therefore, limited replication) and much of the information collected is qualitative/categorical. The plots were not selected randomly across the island – they were randomly located within representative patches of remaining woody habitat. It is therefore more instructive to examine the trends in tree health within the plot and relate those trends to the use of the plots by tree-nesting colonial waterbirds and the tree species within the plots.

- Information is available for June DCCO nest counts in individual monitoring plots for 2008, 2009, and 2010. The June nest counts do not fully represent DCCO occupation of trees, since nest establishment continues into July. DCCO nests were observed during the later summer vegetation survey in trees that did not have nests during the June count. The information also does not include use by roosting DCCO. So, trees may be affected by DCCO activity even if no nests are recorded in the tree during the June nest count.
- Some trees within the monitoring plots could not be found, likely because they had died and subsequently fallen or lost their tags.
- Distribution of vegetation monitoring plots and use by DCCO is presented in **Table 6**. There are no vegetation monitoring plots in Upland Forest Groves D, E, and F as these are essentially one or a few large healthy individual trees, with little growth below them. A new vegetation monitoring plot should be established in Shingle Beach Thicket. Shrub Thicket, a newly established plot, was used by DCCO for the first time in 2010. To date, 4 plots have been colonized by DCCO since they were first established in 2007. The plot that was abandoned by DCCO in 2009 (possibly due to disturbance from a nearby fox den) was re-colonized in 2010.

Table 6. 2010 vegetation monitoring plot use and distribution on High Bluff Island

Management area	# Veg Plots	# Veg Plots used by DCCO 2010
Basswood Grove	5	5
Bluff Thicket North	2	0
Bluff Thicket South	3	1
Red Ash Swamp Forest	1	1
Ridge Forest North	1	1
Ridge Forest South	2	0
Shingle Beach Thicket	0	0
Shrub Thicket	1	1
Upland Forest Grove A	1	0
Upland Forest Grove B	1	0
Upland Forest Grove C	1	0
Upland Forest Grove D	0	0
Upland Forest Grove E	0	0
Upland Forest Grove F	0	0
“Unmanaged” area – East Woodlot	1	1
“Unmanaged” area – West Woodlot	1	1
Total	20	11

Tree mortality – within plots

- At least 12 out of 80 live trees (15%) that were monitored in both years died between 2009 and 2010:
 - 4 were in a cedar thicket used by DCCO that was regularly used by BCNH and GREG until 2009 (Bluff Thicket South)
 - 1 was in a plot used by DCCO, GREG, and GBHE (East Woodlot)
 - 3 were in plots used by DCCO only (Basswood Grove)
 - 4 were in chokecherry thickets used by GREG only (Bluff Thicket North and Upland Forest Grove B)

Tree health – within plots

- The parameters that were used to assess tree health were modified in 2010. Therefore, the data collected this year will serve as a baseline for future years. A summary of the data collected this year is presented in **Figures 5 and 6**.

- These graphs show the proportion of trees within each health category for two groups of vegetation monitoring plots: those where DCCO have nested in at least 3 of the past 4 years, and those where DCCO haven't nested in the past 4 years. So, Figure 5 shows that approximately 45% of the trees in the plots that have cormorants nesting in them are now dead.
- 7 of the plots that were monitored this year are excluded from Figures 5 and 6: Five are composed of mostly chokecherry, 1 is within the area of newly planted trees, and 1 has an unknown DCCO use history. Chokecherry dies quickly. Most of the unhealthy chokecherries in 2010 were located in a Shrub Thicket plot which has traditionally been used by BCNH and was occupied by DCCO for the first time this year.

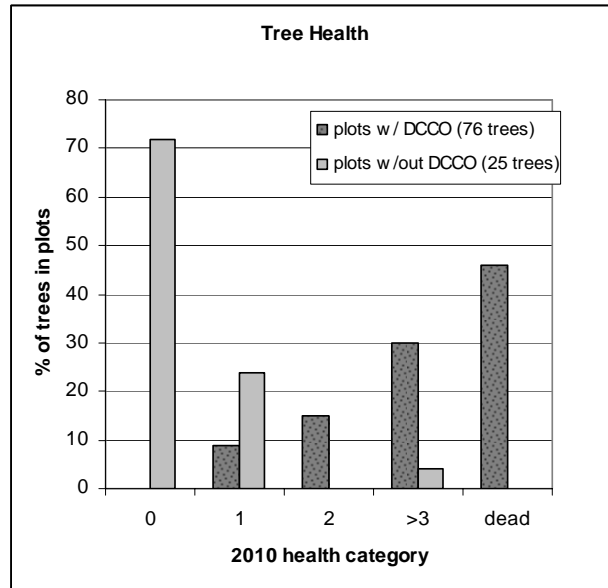


Figure 5. A comparison of tree health in 2010 between plots where DCCO have been nesting for at least 3 of the past 4 years (9 plots) and plots where DCCO have not nested for the past 4 years (4 plots) on High Bluff Island. Health categories range from 0 (healthy) to 3, 3+ (almost dead).

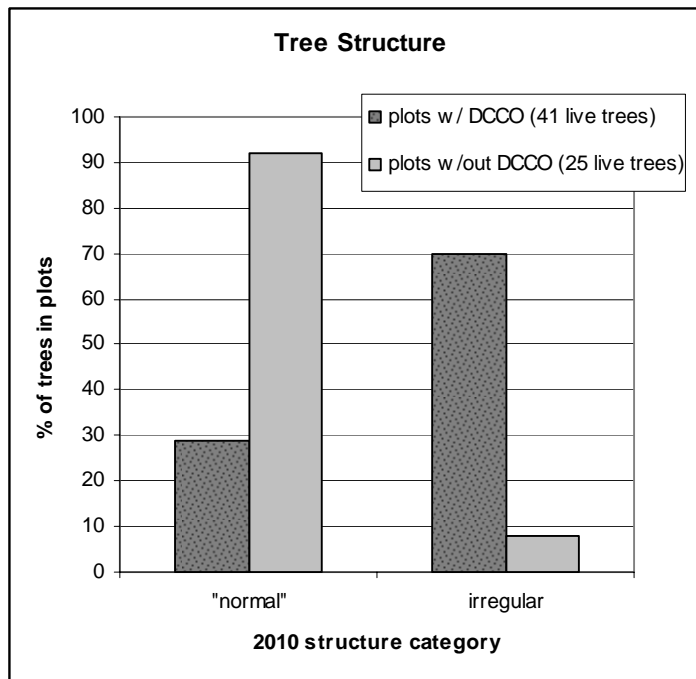


Figure 6. A comparison of tree structure in 2010 between plots where DCCO have been nesting for at least 3 of the past 4 years (9 plots) and plots where DCCO have not nested for the past 4 years (4 plots) on High Bluff Island. Structure categories include “normal”, top-dead, epicormic growth, and clumping of foliage. Trees that showed suckering only were included in the “normal” category since suckering is a common growth pattern for many tree species, especially basswood.

Tree use by cormorants – within plots

- **Table 7** shows the use of live trees by DCCO within the plots that have been monitored every year since 2007 (including trees that are now dead), as a proportion of the trees that were alive in a given year. Although the total number of nests in live trees decreased between 2009 and 2010, a greater proportion of the live trees are now occupied by DCCO as trees die and DCCO choose different areas of the island to nest.
- Of the 65 trees within the plots that survived from 2009 to 2010, 21 had DCCO nests in 2009 and 24 had DCCO nests in 2010 (based on June nest count), meaning new live trees were occupied in 2010.
- The number of live trees in these 13 plots has declined by 41% since the plots were established in 2007.

Table 7. Tree use by DCCO in plots that have been monitored every year since 2007 (13 plots).

Year	# live trees	# DCCO nests in live trees (June)	% live trees w/ DCCO June	% live trees with DCCO all season
2007	110	N/A	N/A	N/A
2008	100	59	10%	22%
2009	80	88	36%	39%
2010	65	75	37%	43%

- DCCO nested within the vegetation plots in live ash, basswood, cedar, chokecherry, and oak trees and in dead ash, basswood, and cedar trees in 2010 (**Table 8**).

Table 8. Tree species used by nesting DCCO in vegetation plots in 2010

Species	# trees present 2010	# trees used by nesting DCCOs 2010
Ash	8	7
Basswood	57	29
Cedar	6	3
Chokecherry	54	11
Elm	5 (plantation)	0
Ironwood	6 (near basecamp)	0
Oak	5 (near basecamp)	1
Dead	37	10
TOTAL	178	61

Plots and areas used by herons

- Historically, GREG and BCNH have regularly nested throughout Bluff Thicket South and Bluff Thicket North. BCNH have also nested in Shrub Thicket. GREG and GBHE have nested throughout Basswood Grove. GBHE have nested throughout East Woodlot. Several plots are located close to nesting areas used by herons. (**Table 9, Figure 1**)

Table 9. Plots that have been used by herons (plot ID numbers are in brackets)

Plot	2007	2008	2009	2010
Basswood Grove (25)	DCCO	DCCO		GREG DCCO
Bluff Thicket North (57)	GREG	GREG	GREG	GREG
Bluff Thicket South (12)	BCNH GREG DCCO	BCNH GREG DCCO	BCNH (failed) GREG (failed) DCCO	DCCO
Bluff Thicket South (322)				GREG
East Woodlot (61/62)	DCCO	DCCO	GBHE DCCO	GBHE DCCO
Shrub Thicket (67)	BCNH	BCNH	BCNH	BCNH DCCO
Upland Forest Grove C (68)	UNK	UNK	UNK	GREG

Other vegetation parameters

- Sapling data has not been collected consistently previously. Therefore, the data collected this year will serve as a baseline for future years and is not summarized here.
- Change in the number of points within the plot with ground and canopy cover was not analyzed in 2010; however, no clear trends are present based on observation of the data collected.
- No deer browsing was noted in the monitoring plots in 2010, although it was noted elsewhere on the island.

3.3. Vegetation Discussion

- DCCO have moved into new areas for nesting since 2007, and subsequently have affected tree health. Half of the vegetation monitoring plots, which were selected to represent the various habitats of the island in 2007, now have DCCO nesting in them. Several of those that don't have DCCO are in chokecherry groves or isolated patches of vegetation, which are areas that tend not to be preferred by DCCO, but may be used by GREG and BCNH. One vegetation monitoring plot is near the base station, where human activity likely discourages DCCO nesting.

- Tree mortality continues to be high as trees rapidly succumb to the effects of cormorant nesting. The remainder of the trees are dying in areas now being used by cormorants. These are the mid-aged trees (10 – 18cm DBH) that were beginning to recover during cormorant management (as reported on in the 4-year assessment of the previous cormorant strategy). Some of the chokecherry mortality (4 out of 12 trees) can be attributed to the natural growth pattern of chokecherry thickets or to the effects of GREG nesting.
- The new tree health measurements seem to be more consistent among observers and to provide more meaningful information. Tree health is clearly being affected by cormorant nesting activity, and 75% of the trees in the plots being used by cormorants are already or almost dead. Similarly, the structure of the remaining life trees has been strongly affected by cormorant nesting, with 70% of the trees in areas used by nesting cormorants showing clumping of leaves on branches, epicormic growth, or death of the top portion of the tree. There are differences in these patterns among species and plots that can be examined more closely in the future if necessary.
- Approximately one third of the trees in the plots are being used by cormorants. In 2010 cormorants expanded their use to some chokecherry thickets, which is a habitat type that is also used by GREG and BCNH. Cedars and basswoods have been heavily used in recent years.
- The number of nests in trees within the plots decreased between 2009 and 2010, even though the number of tree-nests on the island increased. This is likely due to the fact that there are fewer live and standing dead trees in the plots each year, and DCCO are expanding into new areas. Each year the proportion of remaining live trees that have DCCO nests in them increases.
- The number of live trees used across the island and in the plots decreased between 2009 and 2010 even though there were more tree-nests, likely because there are now fewer of the larger nesting trees, which are preferred, available. Correspondingly, the density of nests per tree increased.
- The habitat of the heron species continues to overlap with that of the cormorants, as shown by the vegetation monitoring plots. On High Bluff Island BCNH nested in chokecherry trees in 2010, which are now also being used by cormorants. One of the plots regularly used by both BCNH and GREG (Bluff Thicket South) has experienced rapid tree decline and death and is now used exclusively by cormorants. GREG are showing more flexibility in their nesting behaviour, using two new plots this year. GBHE continue to use the remaining standing trees in the east unmanaged area, including some in the vegetation monitoring plot at that site.

4. Other Wildlife

4.1. Terrestrial predator(s)

- Two stealth cameras (model: Stealth Cam STC-14301R) were set up to document the presence of predators on the island. The cameras took digital photos or videos of an area when triggered by movement
 - Cameras were checked opportunistically from May 19 to November 1
 - Viewing areas were baited with sardines either on the surface or buried slightly
 - On June 8 a dead fawn found on the mainland portion of the park was taken to High Bluff Island and tied down adjacent to a stealth cam as an attractant for terrestrial predators
- Other evidence of predator activity was recorded when observed (**Table 10**).
- Although a terrestrial predator was not captured on the stealth cams this year, other evidence was collected, suggesting the presence terrestrial predators on the island.

Table 10. Opportunistic sightings of predator activity on High Bluff Island

Date	Observation
April 30	<ul style="list-style-type: none"> ○ distinct path leading into the area traditionally used by DCCO and RBGU for nesting ○ ground colony was 90% less occupied than in previous years
May 19	<ul style="list-style-type: none"> ○ eaten DCCO carcass with its skin peeled back was found away from the colony area
mid-June	<ul style="list-style-type: none"> ○ ground-nesting DCCO and gull colony completely displaced
June 21	<ul style="list-style-type: none"> ○ beheaded ring-billed gull with removed wings in Bluff Thicket North
early July	<ul style="list-style-type: none"> ○ camper reported seeing a red fox on the north side of the island
July 8	<ul style="list-style-type: none"> ○ large area of flattened grassy vegetation along the north shore of the island. Within this area there were the carcasses of two juvenile ring-billed gulls that had been beheaded and had both wings ripped off.
throughout summer	<ul style="list-style-type: none"> ○ active den site in SE portion of the western woodlot area. It consisted of three den holes, a well-beaten path and an accumulation of gull and DCCO carcasses around the den-site. Although the residents were not seen it is suspected this den site housed a fox family ○ fox scats were seen at various locations on the island
August 24	<ul style="list-style-type: none"> ○ juvenile DCCO was found eaten by a terrestrial predator
November 1	<ul style="list-style-type: none"> ○ coyote scat near the large oaks in the island's middle

4.2. Deer

- Deer sightings were noted (**Table 11**), and were captured with the stealth cam (**Figure 7**).
- Extensive winter deer browsing was noted at the start of the season (April) on chokecherries and other small deciduous trees. In mid-summer deer browsing was observed on the lower branches of larger oaks.
- There were at least 3 deer present on High Bluff Island over the course of the summer, and at least one had her fawn on the island. Although deer are present, deer browsing was not noticed in the vegetation monitoring plots. There continues to be little regeneration of woody species due to the effects of cormorants, which are greater than the effects of deer.

Table 11. Deer sightings on High Bluff Island by Ontario Parks staff in 2010.

Date	Sighting type
April 13, 2010	3 deer
April 30, 2010	1 deer
May 19, 2010	1 deer
May 26, 2010	Browse and hair noted in chokecherry grove on north shore
May 26, 2010	3 deer beds located in west woodlot
May 28, 2010	1 deer
June 14, 2010	1 deer
August 14, 2010	1 fawn
August 18, 2010	1 doe
September 15, 2010	2 does and 1 fawn
September 29, 2010	2 does and 1 fawn
November 01, 2010	2 deer



Figure 7. Images of white-tailed deer captured by a stealth cam on High Bluff Island in 2010, including a young buck, a fawn and a doe.

4.3. Monarch butterflies

- Monarch butterfly monitoring is limited by ability to access the island in late summer and early fall. Monarchs migrate during specific weather conditions and staff may not be present on the island during the days with ideal migration or roosting conditions. Additionally, as migrating monarch roosting congregations are ephemeral and movement across the island is hampered by the dense and tall growth of stinging nettles and thistles, a limited amount of habitat can be monitored on any one day.
- Monarchs were monitored on 3 days by crossing the island from east to west along the marked path. Individual butterflies were counted whenever possible but if groups too large to be counted (such as roosting butterflies) then estimates were made (**Table 12**). On September 15, 2010 an extremely large monarch roost was noted on the mainland portion of the park adjacent to the islands at Owen Point. It is estimated that this roost consisted of around 10,000 butterflies. Very strong westerly winds (in excess of 50 km/hr) likely prevented butterflies from leaving Owen Point and flying to High Bluff Island on that date.

Table 12. 2010 monarch butterfly observations on High Bluff Island

Date Start/End Time	# Monarchs observed	Notes
August 19 12:30/ pm	approx 40	Clear, sunny day, approximately 26°C, moderate wind (SW). Approximately 20 in one clump in oak tree south of path, three roosting in hawthorn west of oak tree, 12 in oak tree on north side of path and approximately six in elderberries.
September 1 5:15/5:30 pm	approx 125	Approx 20 in oak tree on south side of path
September 15 4:00/4:40 pm	approx 555	Three roosts of approximately 20, 30 and 45 monarchs in plantation. Roost of approximately 200 (3 groups) on oak on south side of path (Upland Forest Grove D) and 250 (3 groups) on oak on north side of path (Upland Forest Grove C).

4.4. Other bird species

- Sightings of other bird species throughout the monitoring season are in **Appendix C**. Woody vegetation was heavily used during migration by migrating passerines and raptors. The open field areas were also frequented by raptors during spring and autumn migration. During the breeding season all of the habitats present on High Bluff Island were used by various bird species. Notably, the open field areas continued to support a breeding colony of Bobolink (Threatened).

5. Regional Trends in Tree-nesting Colonial Waterbirds

The following information comes from the 2009 and 2010 annual meetings of the Great Lakes Area Working Group on Colonial Waterbirds, an informal binational group of scientists and wildlife managers who share information relevant to colonial waterbirds nesting on the lower Great Lakes and associated rivers in Canada and the United States.

DCCO

- Lake Ontario - Have been increasing steadily since 2007, with fluctuations within individual colonies due to a variety of reasons including sanctioned and unsanctioned management
- Lower Great Lakes area – Have remained relatively steady since 2007 (decreases on Lake Erie, Niagara River, St. Lawrence River)
- Decadal census (Lower Great Lakes area) – doubled between Census 3 (1997 – 2001) and Census 4 (2007 – 2009)

GBHE

- Lake Ontario – Presqu'île is only colony
- Lower Great Lakes area – few colonies were monitored in 2010 and information is not available
- Decadal Census (Lower Great Lakes area) – More than quadrupled between Census 3 (1997 – 2001) and Census 4 (2007 – 2009), although Presqu'île was the only colony on Lake Ontario

GREG

- Lake Ontario – Presqu'île is still the largest and most thoroughly monitored colony on Lake Ontario
- Lower Great Lakes area - There are 2 similar-sized colonies on the Niagara River and the US side of Lake Erie
- Decadal Census (Lower Great Lakes area) – Tripled between Census 3 (1997 – 2001) and Census 4 (2007 – 2009), mainly due to increases at Presqu'île

BCNH

- Lake Ontario – In 2010 continued to decrease at largest Lake Ontario colony (Tommy Thompson Park) since 2007. Presqu'île was 3rd largest colony on Lake Ontario in 2010.
- Lower Great Lakes area – Continued to decrease at other monitored colonies
- Decadal Census – decreased by 20% between Census 3 (1997 – 2001) and Census 4 (2007 – 2009), mainly due to a crash at TTP in 2008

6. Conclusion

Cormorant use of the trees on High Bluff Island is continuing to increase, in terms of number of nests in the trees, number of trees used, and amount of area colonized. Cormorants have been increasing since management ceased in 2007 upon the expiration of the previous cormorant management strategy. The number of tree nests is now near the number counted in 2003, but there are fewer live and dead standing trees available, and many of those that remain are in poor health. Additionally, there are fewer of the large trees that could support dozens of nests – the nests are located in more, and smaller, trees across the island. This puts more pressure on the remaining vegetation, which is being shared by other species.

Heron species are continuing to breed successfully; however, their preferred and traditional habitat areas are being degraded by cormorant nesting activity. Additionally, direct competition between cormorants and heron species for nesting materials, resulting in the loss of heron nests

or chicks, has been observed. Great blue herons are continuing to use High Bluff Island as their only nesting site on Lake Ontario, although many other colonies exist across the province. It is difficult to prevent cormorants from nesting in the trees that GBHE prefer. Great Egrets appear to be expanding their range in Ontario and show some flexibility in nesting habitat; however, habitat is limited on High Bluff Island and elsewhere on the Great Lakes. Black-crowned night-heron nesting on High Bluff Island is declining dramatically, which is a concern for this species in Ontario since it is facing declines at other sites on the lower Great Lakes.

The remaining live trees are succumbing rapidly to the effects of cormorant nesting. Most trees in areas where cormorants have been nesting are unhealthy, dying, or dead. The amount of habitat where nesting cormorants are not established has been steadily decreasing since 2007.

The continued presence of a terrestrial predator on High Bluff Island is likely disrupting ground-nesting by cormorants, which increases the pressure on woody habitat. While white-tailed deer are present on the island and browsing some of the woody vegetation, their impacts on the trees and shrubs are currently minimal compared to that of cormorant nesting activity.

The woody habitats on the islands at Presqu'île are both unique and limited. Within the boundaries of these small islands are even smaller habitat areas (i.e. mature forest, shrub thickets, old fields etc.). The unique assemblage of these sub-habitats in their isolated island setting has led to the biological diversity of the Presqu'île Islands. However, this diversity is threatened by the continued loss of woody vegetation. These monitoring results show that at this time there remains enough woody vegetation to provide habitat for productive tree-nesting colonial waterbird populations as well as habitat for passerines, raptors and butterflies. However, the rapid and continued loss of this habitat type, which is attributable to on-going cormorant activity, is not sustainable. Although the amount of woody vegetation on High Bluff Island is decreasing, the continued presence of live trees indicates there is an opportunity to conserve these habitats for use by a variety of species.

Monitoring Recommendations

- A rapid assessment of the health of nesting trees during cormorant nest counts should be continued to allow for future comparisons with vegetation monitoring results.
- If management occurs, counts should continue to be conducted in individual cormorant management areas prior to beginning management, during the standard late June count period, and after management ceases, when possible.
- Cormorant productivity monitoring is not directly related to the questions being answered through monitoring and will continue in the future only as time allows, or if staff notice substantial changes in cormorant fledging rates.
- The addition of the new vegetation monitoring plots this year was useful, allowing more of the cormorant management areas to be surveyed. Another monitoring plot could be added to the Shingle Beach Thicket area to complete the vegetation monitoring coverage of the island.
- Additional monarch butterfly monitoring should occur in other management areas on High Bluff Island if possible.
- More information on the size of the breeding colony of the bobolink in the old field habitat should be collected and submitted to the Natural Heritage Information Center.

APPENDIX A

Arrivals and departures seen from the west and east sides of High Bluff Island on a) September 1, 2010, b) September 9, 2010 and c) September 15, 2010.

a)

SEPTEMBER 1, 2010 - START: 19:15 FINISH: 20:20 SUNSET: 19:49

	WEST		EAST	
	DCCO	GBHE/GREG/BCNH	DCCO	GBHE/GREG/BCNH
19:15	9	0	61	0
19:20	8	0	93	0
19:25	5	0	55	0
19:30	4	0	102	0
19:35	4	0	79	0
19:40	1	0	13	0
19:45	1	0	16	0
19:50	4	0	7	0
19:55	2	0	151	0
20:00	2	0	5	0
20:05	2	0	4	0
20:10	1	0	1	0
20:15	0	0	2	0
20:20	0	0	0	0
TOTAL	43	0	589	0

b)

SEPTEMBER 9, 2010 - START: 18:35 FINISH: 20:05 SUNSET: 19:35

	WEST		EAST	
	DCCO	GBHE/GREG/BCNH	DCCO	GBHE/GREG/BCNH
18:35	14	0	0	0
18:40	32	0	0	0
18:45	8	0	0	0
18:50	15	0	21	0
18:55	17	0	40	0
19:00	10	0	70	0
19:05	3	0	116	0
19:10	17	0	61	0
19:15	5	0	33	0
19:20	3	0	14	0
19:25	7	0	26	1 adult GBHE leaves
19:30	2	0	8	0
19:35	11	0	29	1 juv. GBHE leaves
19:40	0	0	11	0
19:45	0	0	18	0
19:50	0	0	6	0
19:55	0	0	6	0
20:00	0	0	0	0
20:05	0	0	0	0
TOTAL	144	0	459	2 GBHE leave

APPENDIX A

c)

SEPTEMBER 15, 2010 - START: 18:50 FINISH: 19:55 SUNSET: 19:23

	WEST		EAST	
	DCCO	GBHE/GREG/BCNH	DCCO	GBHE/GREG/BCNH
18:20	1	0	0	0
18:25	0	0	0	0
18:30	3	0	0	0
18:35	10	0	5	0
18:40	3	0	23	0
18:45	4	0	17	0
18:50	4	0	13	0
18:55	1	0	4	0
19:00	2	0	58	0
19:05	4	0	13	0
19:10	0	0	15	0
19:15	1	0	18	0
19:20	1	0	5	0
19:25	0	0	3	0
19:30	0	0	15	1 juv. BCNH leaves
19:35	0	0	4	0
19:40	0	0	4	0
19:45	0	0	0	2 juv. BCNH leave
19:50	0	0	0	0
19:55	0	0	0	0
TOTAL	34	0	197	2 BCNH leave

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High Bluff Island Vegetation Monitoring for Resource Management

*prepared by Corina Brdar, Zone Ecologist and Don Tyerman, Biodiversity Specialist
updated April 2011*

Introduction

Vegetation monitoring on High Bluff Island will be used to assess the outcomes of several resource management actions on the island and on the park mainland. The findings of this monitoring may be used to inform future management decisions. The following are possible desired outcomes for resource management on the island. They may serve as hypotheses for the purposes of monitoring and statistical analyses.

Deer

- 1a) measurable increase in the number of stems of native trees and shrubs*
- 1b) survival of young trees to sapling size*
- 1c) prevention of excessive browse damage to shrubs*

Cormorants

- 2a) maintenance of nesting habitat for great egrets and black-crowned night-herons, and roosting habitat for monarch butterflies*
- 2b) no loss of specific woody habitat areas, including the remaining willow tree on Gull Island*

Restoration

- 3a) restoration of existing specific woody habitat areas*
- 3b) improvement of woody habitat in previously wooded areas (prior to 1982) on High Bluff Island*

Conditions on High Bluff Island are unique. Vegetation monitoring is hampered by the dense, tall growth of stinging nettle and thistles, and the fact that posts used to mark monitoring plots are often obscured by guano or knocked down and covered by falling trees and branches. Metal tree tags have disappeared from live trees. It is possible that they are attractive to cormorants and have been removed. Trees die and fall quickly and may lose their tree tags when they fall or land in a way where the tag is not visible. Timing to complete this work is limited as it must occur after the breeding season but before seasonal changes in vegetation and before weather limits accessibility of the island. Surveys must be timed to be as early as possible in the growing season without disturbing breeding herons and egrets.

Several methods for monitoring the impacts of cormorants on vegetation have already been used for High Bluff Island and other protected sites. Ideally the same monitoring methods would be used at all sites, year after year. However, a review of the results of monitoring on HBI from 2000 – 2006 determined that methods used in the past needed improvement. They could not provide enough quality, consistent data to be useful in an adaptive management approach. Aspects of this new monitoring strategy are similar to the monitoring used previously and elsewhere, and the overall findings will be broadly comparable.

This method was tested in August of 2007 and an initial set of plots were surveyed between late August and late September in 2007. Photomonitoring was initiated in

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August of 2008. Measures of tree condition used from 2007 to 2009 were difficult to assess consistently and did not accurately reflect the patterns of tree decline on High Bluff Island. Therefore, this monitoring protocol was updated in 2010 with new tree health parameters.

Sampling Design and Methods

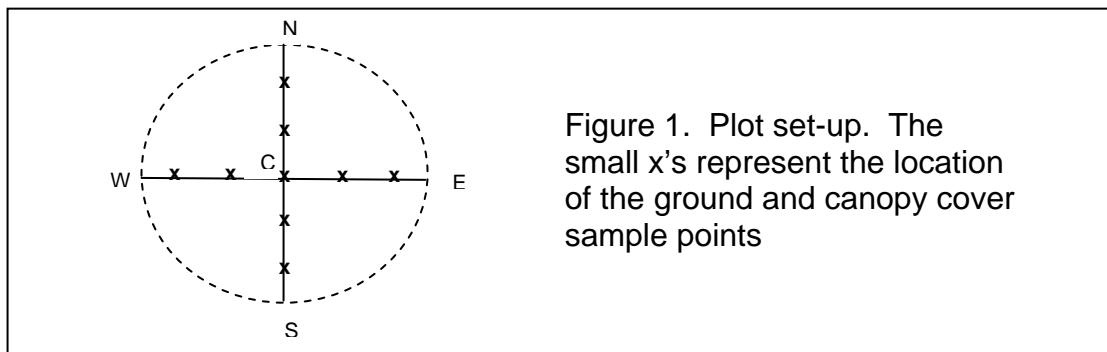
- Sampling plots have been established across the island in as many treed areas as possible. Some plots were initially established in areas where all trees have died to track natural regeneration, but these plots have been abandoned due to the difficulty of maintaining the plot marker.
- Some of the sampling plots overlap with trees from previous monitoring programs.
- UTM coordinates of centerpoints have been recorded with a Garmin Map76 CSX (300 pt. averaging), and marked permanently with a 2 m wooden stake or T-bar

Timing

- There is a narrow window of opportunity when the complete vegetation monitoring can take place, between the time that herons and egrets have completed rearing young and the onset of fall. By mid to late September many trees will start losing leaves either due to drought or fall winds, and weather may make access to the island difficult.
- Plots are surveyed between late August and late September.
- Tree condition variables (tree health and structure) are also estimated for all trees during the June cormorant nest counts if possible.

Plot Establishment

- establish center point and plot edge 5 m from center (10 m diameter circular plot)
- divide plot into 4 quadrants using two 10m ropes
- assess and mark with metal tree tags all trees and saplings within 5 m radius of center point



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Tree Measurements

- assessments described below will be done on tree species >7.5 cm dbh (diameter at breast height)
- woody stems of tree species < 7.5 cm dbh and shrub species are difficult to mark and will be assessed separately
- trees that split below breast height should be treated as 2 or more individuals

Tree damage from guano and nesting activities is unlike other types of damage and also differs among tree species, so the following variables were developed to represent the condition of the trees on High Bluff Island.

The following variables will be measured for each **live tree** that is assessed.

- species – use 8-letter species code
- height – assign to height class category
 - A = < 0.5 m
 - B = > 0.5 – 2 m
 - C = > 2 – 10 m
 - D = > 10 – 25 m
 - E = > 25 m
- dbh – at 1.3 m to assign to size class category
- health – based on current **live** area of the tree **only**
 - 0 – healthy, little or no apparent leaf loss or crown dieback
 - 1 – some foliage loss (roughly < 25%)
 - 2 – moderate foliage loss (roughly 25 – 75%)
 - 3 – most foliage lost (> 75%)
 - 3+ – tree will very likely die in following year (very little foliage left)
- structure – based on **whole** tree. Can be more than one category
 - N = normal (do not choose another category if this one is chosen)
 - C = clumping of foliage
 - E = epicormic branching from trunk
 - TD = top dead
 - S = suckering from base (only if tree appears to be unhealthy, not if normal growth pattern for that species)
- presence/absence of nests and whitewash – both DCCO and other colonial species

The following variables will be measured for each **dead tree**

- estimated dbh – if tag has gone missing to help identify tree
- presence/absence of nests and whitewash – both DCCO and other colonial species

Sapling measurements

- to be done on young individuals of tree species (<7.5 cm dbh, but > 50 cm height)
- includes larger individuals of Chokecherry (*Prunus virginiana*) when stems countable (dbh > 2 cm)
- tally numbers
- note deer browse or rodent damage
- where chokecherry saplings/seedlings are too numerous to count a sub-sampling protocol should be implemented in which the number (live and dead), average

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height and three tallest heights will be measured within 1m x 1m quadrats at 9 locations (1 at center point and 2 per quadrant, 1.5 m apart-see diagram) within the plot

Plot Measurements

- 9 cover estimates (presence/absence if looking straight up through a toilet paper tube) for ground and canopy (per West Sister Island methods) – 1 at center point and 2 per quadrant, 1.5 m apart (i.e. – along transects – see diagram)
- presence/absence of nests within plot – all nests hanging over the perimeter of the plot, regardless of origin of tree they are in
- one photo with photo board in each direction from center, with plot number and date clearly visible in photo
- soil samples may be taken at plot center in future

Restoration Monitoring – to be determined

- survival of planted trees and seeds

Equipment Needed

Set-up

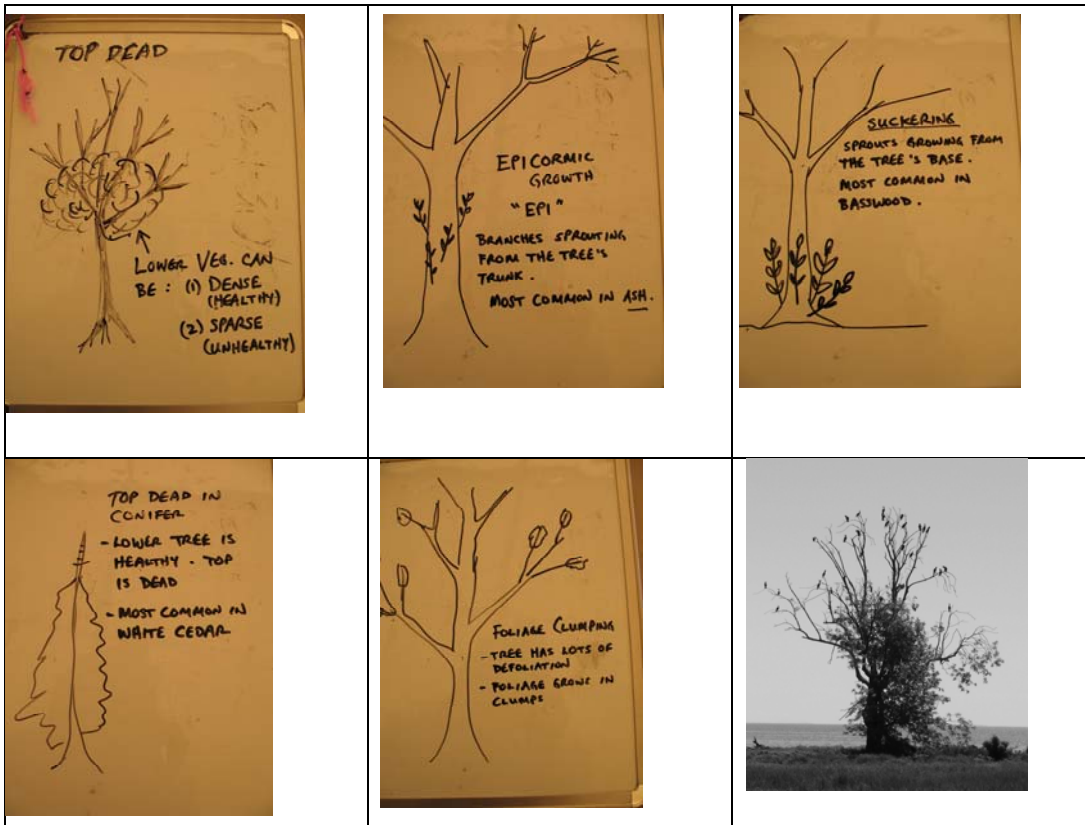
- GPS with point averaging capabilities
- compass, 100 m transect tape
- stakes and fluorescent paint, mallet, and Sharpie marker
- numbered metal tree tags & nails

Monitoring

- GPS
- datasheets and pencils
- binoculars
- camera, photomonitoring board, whiteboard, and dry-erase marker
- 4 x 5-m ropes (or 2 x 10)
- dbh estimator (callipers or tape)
- cover estimate tube
- extra tree tags, nails, paint, and stakes
- map and list of plot locations and descriptions
- species list
- field guides

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Tree structure diagrams. The tree in the bottom right corner is top-dead, with some clumping of the foliage in the lower right branches and some epicormic growth on the trunk.



Example photomonitoring pictures. The picture should be taken from the center post of the plot and capture as much of the quadrant as possible. The plot number, direction, and date including year should be written clearly on the whiteboard so that it can be read if zoomed in.



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Bird Sightings recorded by Don Tyerman on High Bluff Island in 2010. This is not an exhaustive list of species presence.

FAMILY	Species	12-Apr-10	13-Apr-10	14-Apr-10	16-Apr-10	20-Apr-10	26-Apr-10	30-Apr-10	03-May-10	05-May-10	07-May-10	11-May-10	19-May-10	26-May-10	30-Aug-10	01-Nov-10
LOONS	COLO							Y							Y	
CORMORANTS	DCCO	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
HERONS	GBHE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	GREG	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	BCNH				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
WATERFOWL	CAGO	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	BRAN												Y			
	GWTE								Y	Y	Y		Y			
	ABDU				Y	Y	Y	Y	Y	Y	Y	Y	Y			
	MALL	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	NOPI					Y										
	NOSH									Y			Y			
	AMWI					Y			Y				Y		Y	
	GADW	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y
	REDH				Y				Y							
	COGO	Y	Y	Y												
	LTDU	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y
	BUFF	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y		Y
	RBME	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y		Y		
BUTEOS + HARRIERS	OSPR									Y						
	RLHA															Y
	NOHA										Y					
	SSHA															Y
FALCONS	AMKE															Y
	PEFA						Y									
	MERL								Y							
PLOVERS	BBPL															Y
	SPPL															Y
	KILL								Y	Y	Y	Y	Y	Y		
SANDPIPERS	SPSA											Y	Y	Y		
	RUTU													Y	Y	
	DUNL												Y		Y	
	AMWO															Y
GULLS+ TERNS	BOGU	Y	Y		Y			Y								

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		12-Apr-10	13-Apr-10	14-Apr-10	16-Apr-10	20-Apr-10	26-Apr-10	30-Apr-10	03-May-10	05-May-10	07-May-10	11-May-10	19-May-10	26-May-10	30-Aug-10	01-Nov-10
FAMILY	Species															
	RBGU	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	HEGU	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	CATE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	COTE									Y	Y	Y	Y	Y		
DOVES	MODO	Y	Y			Y	Y	Y	Y	Y		Y	Y	Y	Y	
WOODPECKERS	YBSA				Y							Y				
	HAWO	Y	Y	Y				Y								Y
	NOFL				Y			Y				Y				
FLYCATCHERS	EAPH	Y	Y	Y		Y										
	EAKI										Y		Y	Y		
SWALLOWS + MARTINS	TRSW	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	BANS					Y			Y	Y	Y	Y	Y			
	BARS								Y	Y	Y			Y		
	NRWS										Y	Y				
	PUMA											Y				
JAYS	CORA															Y
TITMICE	BCCH				Y											Y
NUTHATCHES	RBNH											Y				
CREEPERS	BRCR					Y		Y		Y						
KINGLETS	GCKI	Y	Y		Y											
	RCKI				Y	Y										
THRUSHES	HETH							Y	Y							
	AMRO	Y	Y		Y	Y		Y	Y	Y	Y	Y	Y	Y		
CATBIRDS + THRASHERS	BRTH										Y					
WAXWINGS	CEWA														Y	
STARLINGS	EUST	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y
VIREOS	SOVI								Y							Y
WARBLERS	YEWA									Y	Y	Y	Y	Y		

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		12-Apr-10	13-Apr-10	14-Apr-10	16-Apr-10	20-Apr-10	26-Apr-10	30-Apr-10	03-May-10	05-May-10	07-May-10	11-May-10	19-May-10	26-May-10	30-Aug-10	01-Nov-10
FAMILY	Species															
	BTBW											Y				
	PIWA									Y		Y				
	YRWA					Y		Y	Y		Y	Y				
	CSWA											Y				
	MAWA											Y			Y	
	BAWA										Y	Y				
	WIWA														Y	
TANAGERS	SCTA										Y					
BLACKBIRDS ETC.	BOBO								Y	Y	Y	Y	Y	Y	Y	
	RWBB	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
	EAME	Y	Y					Y	Y		Y	Y				
	COGR	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	BHCO	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	BAOR									Y	Y	Y	Y	Y		
FINCHES + BUNTINGS	AMGO									Y			Y			Y
GROSBEAKS +CARDINALS	NOCA				Y											
	RBGR										Y	Y				
SPARROWS + TOWHEES	RSTO				Y			Y								
	CHSP				Y				Y							
	FISP							Y	Y	Y			Y			
	SAVS				Y	Y		Y	Y	Y	Y	Y	Y	Y		
	SOSP	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	SWSP									Y						
	WTSP				Y			Y			Y	Y				
	WCSP										Y	Y				
	SNBO															Y
JUNCOS	DEJU	Y	Y	Y	Y											Y