ER 390 : ENVIRONMENTAL RESTORATION PROJECT
University of Victoria, BC
Spring 2016

Sidney Island's teardrop Restoration Project (Gulf Islands National Park Reserve)

Photo : Dune Ecosystem Sidney Island , Victoria BC, October 2014 (photo: Josh Mc Culloch)

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ABSTRACT

Located in the Gulf Island National Park Reserve, Sidney Island is the foremost example of the region's complex cultural and natural heritage value and represents the greatest opportunity to make an ecological difference and engage visitors, stakeholders, and partners.

End of 2015, the park staff was preparing a restoration project proposal for the Coastal Sand Ecosystem of Sidney island and several Species at Risk that depend on this ecosystem.

To support the elaboration of the strategic plan, an open standard software created by the Conservation Measures Partnership (CMP, 2013) was used.

Based on CMP methodology, a conceptual model of the restoration project has been first developed to capture the relationships among conservation targets, threats and opportunities.

The scope, the vision and the conservation targets of the project were first defined. Two human wellbeing targets have been included in the conceptual model. Then the current status of each conservation target was established and critical threaths to the conservation target were identified. Afterwards, threats have been evaluated and compared so as to determine the ones that are most important to address.

In order to create a common understanding of the project's context, relationships between the biological environment and the human factors that affect the conservation targets have also been identified.

Understanding better the context helps to clarify the best strategy that will achieve the conservation goals and objectives. It involves identifying the key factors that drive the direct threats and ultimately influence the conservation targets.

When the basic parameters for the project have been described, the next step was to elaborate the Action Plan by defining and developing goals, objectives, and strategies.

Once goals have been set it was important to identify where and how to intervene. A first decision was to prioritize on which factor in the conceptual model it was more relevant to take action. A threat rating has been undertaken to identify the factor showing the most important threats.

Researching existing strategies and discussing new strategies adapted to the context has enabled to develop a range of potential solutions.

Once selected, a results chain was developed for each strategy to portray all the steps necessary to lead to the conservations results. Result chains were also very useful for setting short-term objectives that lead to long-term outcomes. The results chain component became the principal measure against which it was possible to gauge the progress of the project and establish a formal Work Plan and a Monitoring Plan.

ACKNOWLEDGEMENTS:

I would like to thank the Parks Canada staff who helped me during this project.

In particular, I would like to thank Emily Gonzales, Ecological Restoration Specialist, who proposed me the project and accepted to supervise my work.

I would like to thank Nathan Cardinals, the Resource Conservation Manager, who allowed me to visit the island and who provided precious information from the managerial point of view.

And finally, I would like to express my great gratitude to Pippi Lawn, the active ecosystem leader who brought a lot of her expertise during the elaboration of this project.

Sidney Island's Spit Restoration Project
(Gulf Islands National Park Reserve)

1. Introduction

The regional context

The Gulf Islands National Park Reserve (GINPR) is located in the Strait of Georgia Lowlands Natural Region (see map Annex 1), the smallest and at the same time the most urbanized natural region in Canada.

The combination of different particulare ecological conditions created by the Vancouver Island rain shadow, the influx of nutient-rich marine waters from the Strait of Juan de Fuca , and the freshwater outflow of the Frazer River have produced unique ecosystems in the region. Although the ecosystems in this region are far from pristine and contain introduced species, the park protects some of the best examples of Canada's most threatened ecosystems.

Sidney Island (see map Annex 2) is the foremost example of the region's complex cultural and natural heritage value and represents the greatest opportunity to make an ecological difference and engage visitors, stakeholders, and partners.

Coast Salish Nations have been present on Sidney Island for millennia, as indicated by numerous archaeological sites, and they continue to harvest on the island, hunting deer in the winter months.

Today, Sidney Island is the most visited place in GINPR, welcoming more than 15,000 visitors annually (GINPR, 2009). The island is a popular boating, day use, and camping location and plays a critical role in visitor experience and revenue generation for Parks Canada.

The challenges

While Sidney Island is crucial for protecting species at risk and maintaining ecological integrity as well as providing vital opportunities for First Nations and visitors, the island's ecosystems are under threat as a result of historic and current anthropocentric disturbances.

The vision

The vision adopted for this project is the Parks Canada vision for the Gulf Islands National Park Reserve :

“To be a place of refuge, recreation and renewal within a region characterized by increasing population growth and urbanisation”

(GINPR, Interim Management Guideline, 2006)

The purpose

The purpose of this project is to restore the Coastal Sand Ecosystem and several Species at Risk located on Sidney Island Spit, a priority place for the GINPR. (see map Annex 3).

The methodology

To support the conceptualisation of the project, the elaboration of the strategic plan and the workplan, a open standard software called CMP (CMP, 2013) was used. This tool created initialy by a consortiom of conservation NGOs has been adopted recently by Park Canada as pilot program for their Conservation and Restoration (CoRe) program.

This restoration project proposal was developed following the framework for planning and implementation of Ecological Restoration for Protected Areas (IUCN, 2008). It is, in large part based on the Society for Ecological Restoration International’s “Guideline for Developing and Managing Ecological Restoration Projects” (Clewell et al.2005)

The object

The project will focus its attention to one of the most threatened ecosystems of the island, the coastal sand ecosystem located at the tip of Sidney Island spit often named as the “teardrop” for its shape. This area, of not more than 6000 square meters, is a priority for the park management of the Park for several reasons:

- It is the location of the most sensitive and rare ecosystems on the island.
- It is the location of many Species At Risk (SAR) of the Island.
- It is the place where conservation efforts will be the most cost effective
- It is a limited and confined area where it is more easy to concentrate effort

2. Identify Natural and Cultural Heritage Values

The identification of natural and cultural heritage values should be considered as the first step in the ecological restoration planning process. Natural heritage values of the protected area that are to be maintained or restored are captured in planning documents.

The Gulf Islands National Park Reserve Draft Management Plan (November, 2013) is an important document as strategic guide to managing the protected area, including ecological restoration activities. It describes the protected area and its regional setting, and identifies conservation, visitor experience, and education goals as well as issues and challenges associated with the attainment of those goals. This document was consulted to identify an initial set of values for consideration in the proposed restoration project.

A protected natural area such as Sidney Island has also a cultural significance. This area is important to people for various reasons. Although Cultural heritage values are not described in the limited scope of this restoration project proposal, they should be identified and respected in the restoration plan.

The focus of this project proposals being more oriented towards biodiversity values of the Sidney Spit area, others documents have been consulted to be able to consider more in depth the value of particular habitats or species.

The following information sources were used to compile and identify element of conservation significance in the project area:

- ‘Sidney Island Area Planning Ecological Overview’ (Todd Golumbia, 2008),
- ‘Gulf Islands National Park Reserve Species at Risk Analysis: Summary of priority species and related activities (Parks Canada Agency July 2011)
- ‘Status Report on Coastal Sand Ecosystems in British Columbia.(Nick Page, 2011)

Finally, several meetings with the resources managers of the Park have been essential to refine the identification of the natural values of the restoration project area.

Translated into Open Standards for the Practice of Conservation (OSPC) vocabulary (CMP, 2013), these natural values will be considered as our Conservation Target.

2.1. Selection of the Conservation Target:

Following OSPC, Conservation targets are specific species or ecological systems/habitats that are chosen to represent and encompass the full suite of biodiversity in the project area (CMP, 2013). They are the basis for setting goals, carrying out conservation action, and measuring conservation effectiveness.

Seven conservation targets have been selected in the restoration project. The choice has been based on their conservation status and/or values (see table Figure.1).

Conservation Target	**Conservation Status**	**Why selected**	**Reference**
Coastal Sand Ecosystem	Overall, 85.6% of coastal sand ecosystem in BC are protected as park	Support Species and Ecological Communities at Risk. Stopover habitat for shore birds moving on Pacific Flyway.	(Page N., 2011) http://www.registrelep-sararegistry.gc.ca
Contorted-Pod Evening-Primrose (Camissonia contorta)	G5, S1, Endangered (SARA)	Ranked as one of the most important plant to be protected by the park	(Page N., 2011) http://www.registrelep-sararegistry.gc.ca
Yellow sand-verbena (Abronia latifolia)	Substantial and imminent threat (S2)	Considered under substantial threat in BC	(BC Conservation Data Center, 2015)
Silky Beach Pea (Lathyrrus littoralis)	G5, S2, Red	Considered very rare and a candidate species for SARA listing	(Page N., 2011) http://www.registrelep-sararegistry.gc.ca
Edward's beach moth (Anarta edwardsii)	No national or Provincial rank	Designated as Endangered under Sara Schedule 1	(Page N., 2011) http://www.registrelep-sararegistry.gc.ca
Common nighthawk (Chordeiles minor)	G5, S4B, Yellow Threatened	Threatened in Canada by Cosewic due to declining populations	(Page N., 2011) http://www.registrelep-sararegistry.gc.ca
Migratory shore birds (They migrate to the arctic for the nesting season, and use the spit in April/May on their way north, and again from July through September on their way south (See link list of birds: http//ebird.org/ebird/canada))	N.A	This island is an important resting spot for migrating shorebirds Many shorebird species winter here thanks to the lack of dog disturbance	See link: http//ebird.org/ebird/canada (Todd Golumbia, 2008)

Figure 1: Table indicating the conservation status of the conservation targets and why these targets have been selected

2.2. Description of the status of each conservation target

Using the protocol proposed by CMP, the viability of each conservation target has been assessed by evaluating the state of one or few of their Key Ecological Attributes.

Key Ecological Attribute (KEA) is an aspect of a target's biology or ecology that, if missing or altered, would lead to the loss of that target over time (CMP, 2013)

Three attribute categories often collectively determine the health of a conservation target but not all classes apply to all conservation targets:

- Size: a measure of the area of the conservation target's occurrence (for an ecosystem target) or abundance of the target's occurrence (for a species or population target).

- Condition: a measure of the biological composition, structure and biotic interactions that characterize the space in which the target occurs.

- Landscape context: an assessment of the target's environment including:

a) ecological processes and regimes that maintain the target occurrence such as flooding, fire regimes and other kinds of natural disturbance; and

b) connectivity that allows species targets to access habitats and resources or allows them to respond to environmental change through dispersal or migration

We did not used all three KEA types for a single target; in many cases it was sufficient to have only one KEA such as population size.

Conservation Target	KEA	Indicator	Source	Last measure	Status		Scale			
					KEA level	Global level	Poor	Fair	Good	Very good
Coastal Sand Ecosystem	Low profile herbaceous vegetation	% cover of shrubs and trees	Field survey & aerial image	70%	Poor	Poor	>30%	30-20%	20-10%	<10%
Contorted-Pod Evening-Primrose (Camissonia contorta)	Population size	Number of Individuals	Field survey	1296	Fair	Poor	<1200	1200-1500	1500-3000	>3000
	Open sand cover	% cover of open sand	Aerial image	10%	Poor		<15%	15-20%	20-30%	>30%
Yellow sand-verbena (Abronia latifolia)	Population size	Number of Individuals	Field survey	Not Available		Poor				
	Open sand cover	% cover of open sand	Aerial image	10%	Poor		<15%	15-20%	20-30%	>30%
Silky Beach Pea (Lathyrrus littoralis)	Population size	Number of Individuals	Field survey	40-50	Poor	Poor	50	100	200	300
	Open sand cover	% cover of open sand	Aerial image	10%	Poor		<15%	15-20%	20-30%	>30%
Edward's beach moth (Anarta edwardsii)	Population size	Occurrence number of observation per year	Field survey	Not yet Available			0	1-5	5-10	>10
Common nighthawk (Chordeiles minor)	Population size	Number of Nest each 4 year	Field survey	4.5	Fair	Fair	<4	4-5	5-6	6-7
	Open sand cover	% cover of open sand	Aerial image	10	Poor		<15%	15-20%	20-30%	>30%
Migratory shore bird	Species Richness	Nbr of species observed	Christmas count	51 (in 2016) 127 (in 2015)	Poor	Poor	50	100	150	163

Figure 2: Conservation Target Viability Table (Sidney Island's teardrop Restoration Project)

3. Define the problem

3.1. Historical data

The teardrop of Sidney Spit is classified as a coastal sand ecosystem. Coastal sand ecosystems occur at the intersection of marine and terrestrial realms where ecological patterns are structured by geomorphic and oceanographic disturbance processes such as sand movement, wind erosion, tides, storm surges and ocean spray (Page N., 2011). These ecosystems contain typically sparsely-vegetated and herbaceous ecological communities.

Research on aerial photos taken on Sidney Island can bring valuable information about the evolution of the vegetation cover over the years. The first color photo showing distinctly the vegetation covers of Sidney Spit dates back to 1976 (see Figure 3). The image indicates what was probably a Coastal Sand Ecosystem not yet affected by invasive species.

The imagery taken more recently in 2015 shows how in 39 years the vegetation cover has changed dramatically changed.

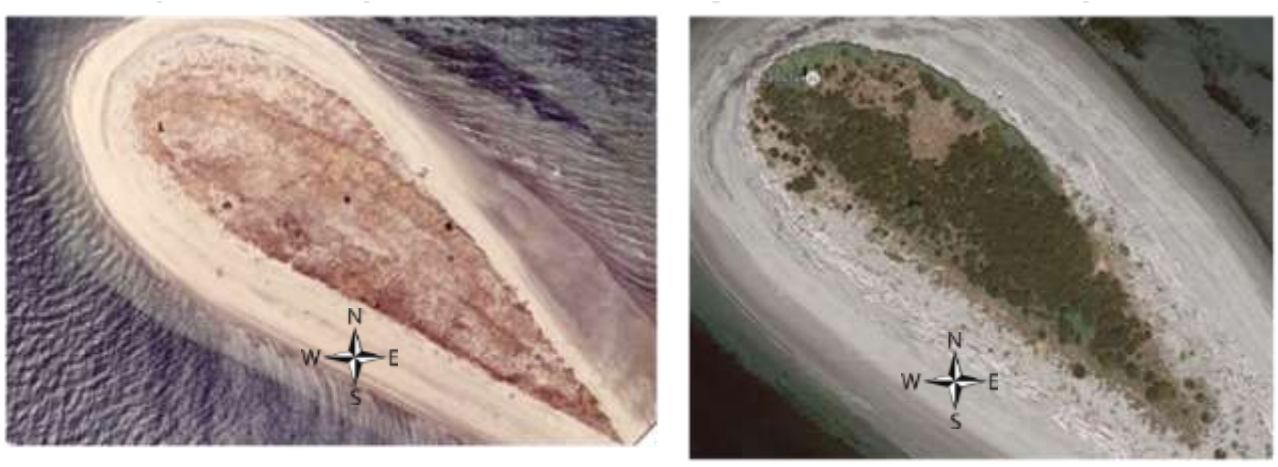


Figure 3: Comparison of the aerial view of the "teardrop" of the Sidney Island Spit in 1976 (left) and 2015 (right). Size of the teardrop: 6000 square meter with maximum length of 160m and maximum width of 43m (source: Google map 2015; Aerial photo BCC133 0073(1976) BC Ministry of Lands, Forest and Natural resource)

3.2. Ecological degradation of the “teardrop”

Which factors have constrained natural process?

Four fundamental processes govern ecosystems: water cycling, nutrient cycling, energy flow and succession. In order to maintain this Coastal Sand Ecosystem (CSE) it is important to ensure that processes that govern this specific ecosystem are still in place.

Invasive plants are considered the most important threat to species and ecological communities at risk in coastal sand ecosystems in BC (Page N., 2011). They can cause functional changes to ecological processes such as enhancing soil fertility and reducing sand movement, as well as competing with native plants for limited resources (light, moisture and nutrients), and reducing plants and animals’ habitat that require sparsely-vegetated ecosystems.

During our visit to the Spit, we have been able to identify several factors that interfere with natural processes associated to CSE:

Factors affecting the vegetation cover associated to CSE:

- Invasive species that compete with native plants for light, water and space.

- Bryophyte and lichen that create a crust that contributes to the stabilization of the sand and affects the development of native plants.

- Visitors and/or their dogs that trample outside trails and caused damage to native plants.

- Hyper abundant herbivores that browse native plants.

Factors affecting disturbance process and successional stage associated to CSE:

- Invasive species stabilize and enrich the soil with organic matter paving the way for a more mature successional stage.

- Woody debris brought by the sea contribute to stabilize the sand and create conditions more favourable to invasive species.

Climate Variability and Change:

Coastal sand ecosystems are susceptible to two aspects of climate variability and

change: increased storm activity or intensity and sea-level rise (Page, N., 2011)

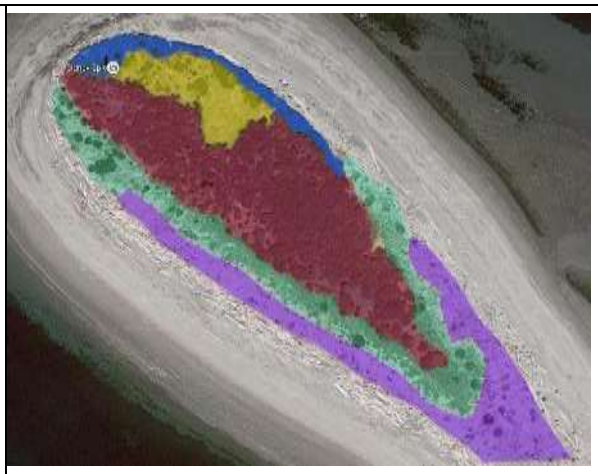
Although it is difficult to estimate its impact, global climate change represents also an important factor, which will affect CSE:

- Native plants that grow on coastal sand ecosystems need specific climate conditions to survive. We don’t know how climate change will affect these conditions.

- Sea level is rising but we don’t know how the phenomenon will be compensated by the accumulation of sand and debris on the Spit.

3.3. Assessing conditions

Thanks to a short field trip in October 2015 and information collected from the monitoring staff, a brief description of the actual vegetation cover has been elaborated. We can distinct five different plant communities:



Red Polygon: Dense shrub community dominated by Scotch broom (with some European beachgrass in understory)

Green Polygon: Mixed open shrub and grass dominated community, dominated by European beach grass, scattered Scotch broom, some native dune grass and some native/exotic forbs (including CPEP).

Purple Polygon: Salt/wind-influenced open community dominated by open sand, scattered native dune grass, occasional European beach grass and some forbs (e.g. yellow sand verbena).

Yellow Polygon: Open community with mixed low profile vegetation (grasses, forbs, bryophyte/lichen crust) amongst open sand patches. Common vegetation in this zone includes scattered European beach grass, scattered native dune grass, scattered mixed native and exotic forbs (including contorted-pod evening-primrose), and the occasional Scotch broom shrub.

Blue Polygon: Grass zone dominated by native dune grass. Dune blue grass (Poa macrantha): clump forming perennial grass that spreads from rhizome; sometime on the upper margin of beaches

(Source: Pippi Lawn personal communication)

Figure 4: Image (Google Map, 2015) displaying the restoration site where different coloured polygons represent different plant communities

3.4. Analysis of the conservation situation

3.4.1. Relation between threats and conservation targets

Once identified, the threats have been connected to their relevant targets using the CMP conceptual model diagram *(Figure 5)*.

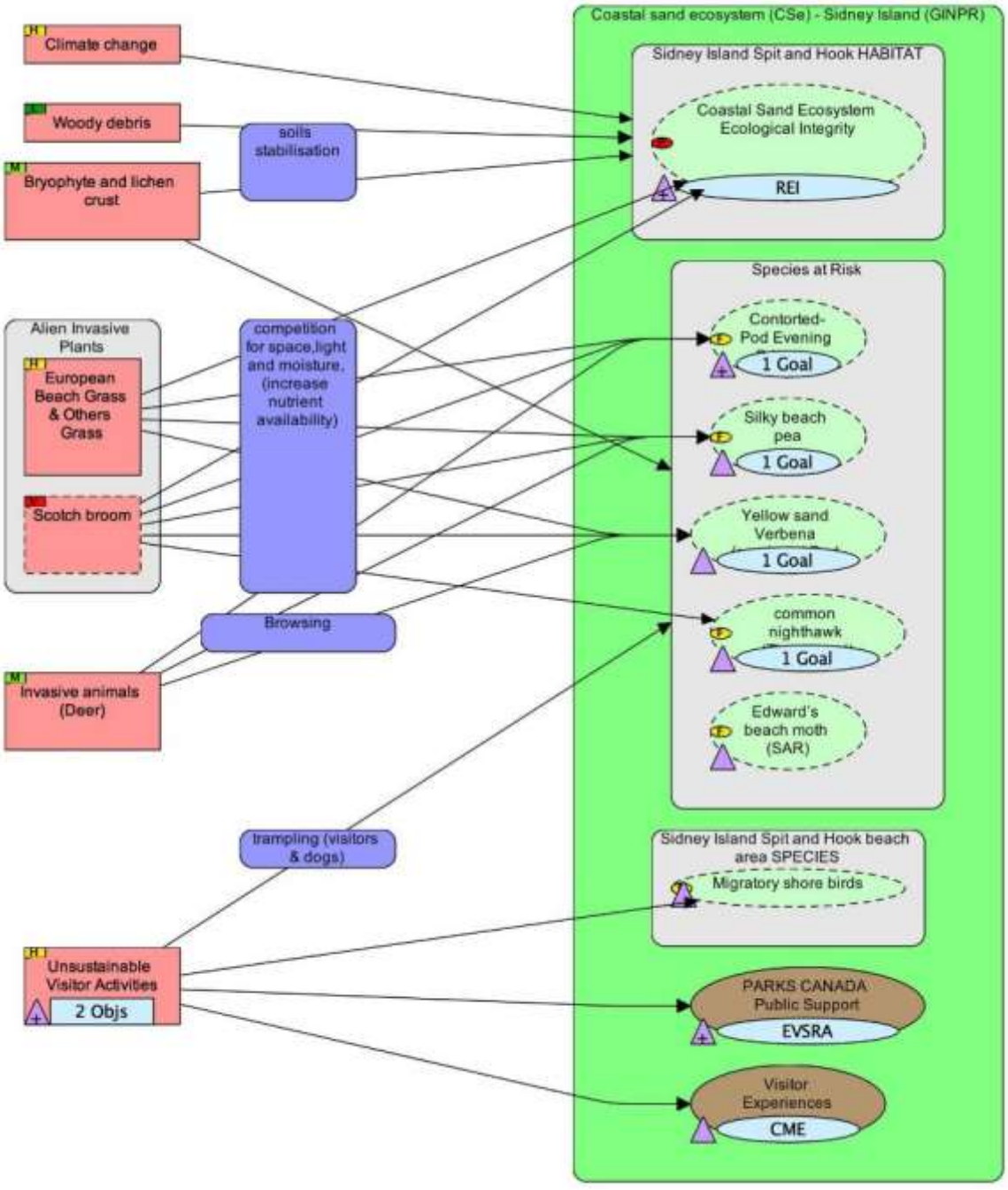


Figure 5: Conceptual Models Diagram displaying target and direct threat (Sidney Island's teardrop Restoration Project)

3.4.2. Threat ratings

In order to identify the most significant threats for the different conservation targets, a threat rating system developed by Conservation Measures Partnership (CMP, 2013) has been adopted. The approach is using three elements to evaluate the threats, each of them being rated low, medium, high and very high:

- Scope: A threat rating criterion that is most commonly defined spatially as the proportion of the target affected by the threat.
- Severity: Within the scope, the level of damage to the target caused by the threat that can reasonably be expected given the circumstances and trends.
- Irreversibility: The degree to which the effects of a threat can be reversed

Once the rating is completed for all three criteria, the CMP software uses a rule-based system for combining the scope severity and irreversibility criteria *(Figure 6)*.

The analysis indicates that Scotch broom is the most severe treat followed by European beach grass, climate change and unsustainable visitors' activities.

The restoration project will focus its attention on the three threats it can reasonably influence: Scotch Broom, European Beach Grass and unsustainable visitors' activities.

Figure 6: Threat ratings table (Sidney Island's teardrop Restoration Project)

3.4.3. Relation between the context and drivers that affect conservation targets

In order to create a common understanding of the project's context, the relationships between the biological environment and the human context that affect the conservation targets have also been described. *(Figure 7)*

Understanding better the context helps to identify the best strategy that will achieve the conservation goals and objectives. It involves identifying the key factors that drive the direct threats and ultimately influence the conservation targets.

These include indirect threats (also known as root causes and drivers), opportunities, and enabling conditions. These factors can range in scale from local to global and each factor can be linked to one or more stakeholders.

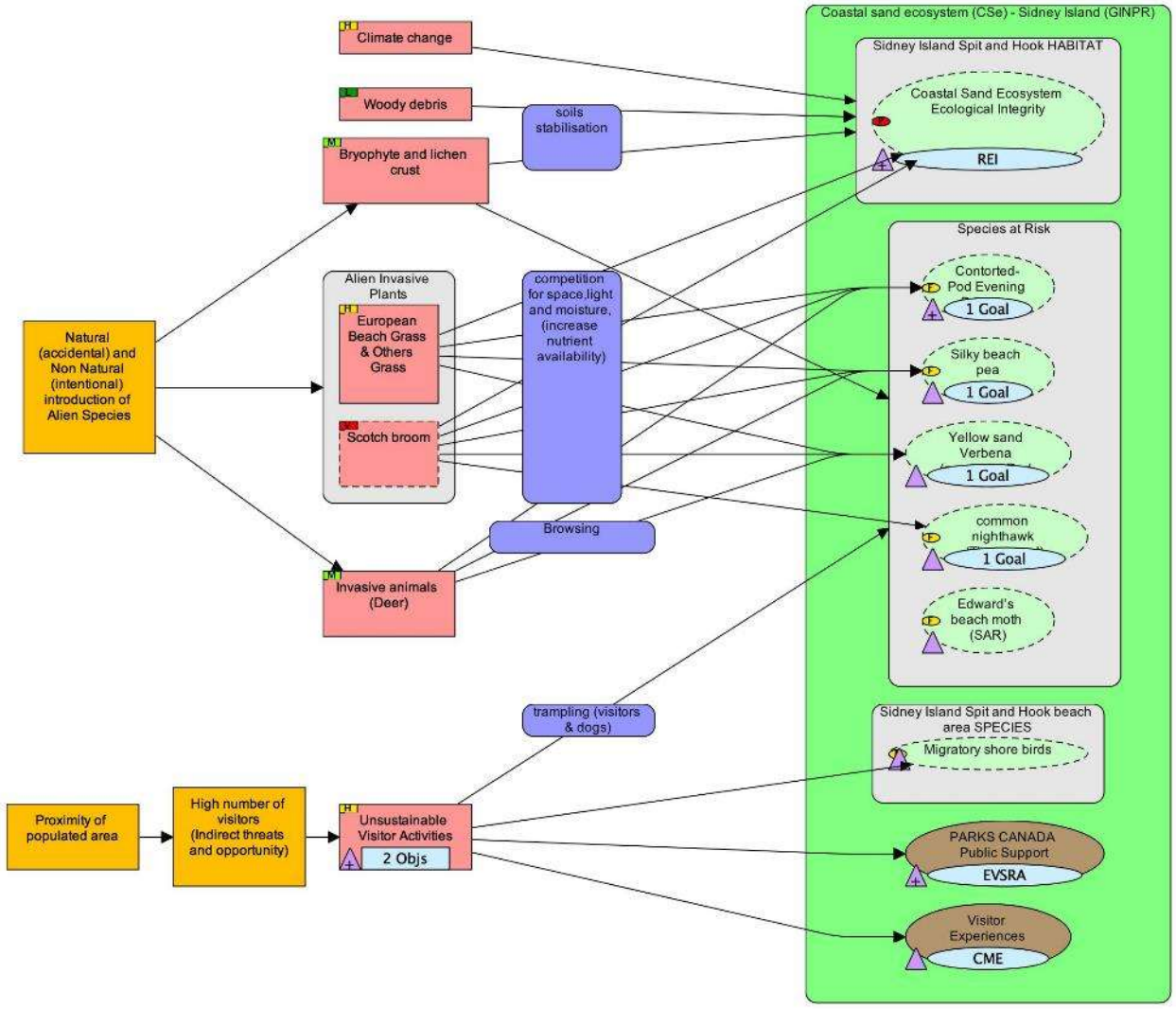


Figure 7: Conceptual Models Diagram displaying targets, direct and indirect threats (Sidney Island's teardrop Restoration Project)

4. Develop Restoration Goals

The following goals are based on shared vision where Parks Canada has worked closely with all stakeholders, including partners, local communities (First Nations) and general public:

“Restore and improve the ecological integrity of the coastal sand ecosystem on Sidney Island in collaboration with stakeholders and the public by eradicating alien invasive plant species, recovering native species, and in particular species at risk, and by creating meaningful experience and engagement of the visitors in restoration activities.”

Setting effective restoration goals will guide project planning and implementation (Hobbs, 2007).

The site has been mainly degraded by invasive species. Achieving the restoration goal therefore involves primarily removing the key threats to enable a more functional and resilient ecosystem.

As such, this restoration plan does not aim to modify the entire island. Activities are focused on restoring a specific degraded area of the coastal sand ecosystem known as the “teardrop” of the Sidney spit.

The objectives and monitoring protocols described in the next sections are directly linked to the restoration goal.

5. Develop Restoration Objectives

The teardrop at the end of Sidney Spit on Sidney Island is a relatively small and isolated area where coordinated and focused efforts can lead to concrete results.

In ‘SMART’ (Specific – Measurable – Attainable – Realistic - Timely) terms our objectives are within two years (2017-2018):

Objective1: All species at risk population targeted are at least stable and maintained in the project area by the end of 2018.

Objective 2: The invasive plants (Scotch broom and European beach grass) will cover less than 15% of the targeted restoration area (see Figure 4: Polygon Red, Yellow, Green and Purple) by the end of 2018

Objective 3: Increase public awareness providing meaningful experience and engagement with improved infrastructure, interpretation and/or participation to restoration activities.

6. Develop Restoration Plan

To develop a restoration plan, strategies need to be elaborated in order to describe the course of actions necessary to meet our objectives and ultimately to reach our goals. *(Figure 8)*

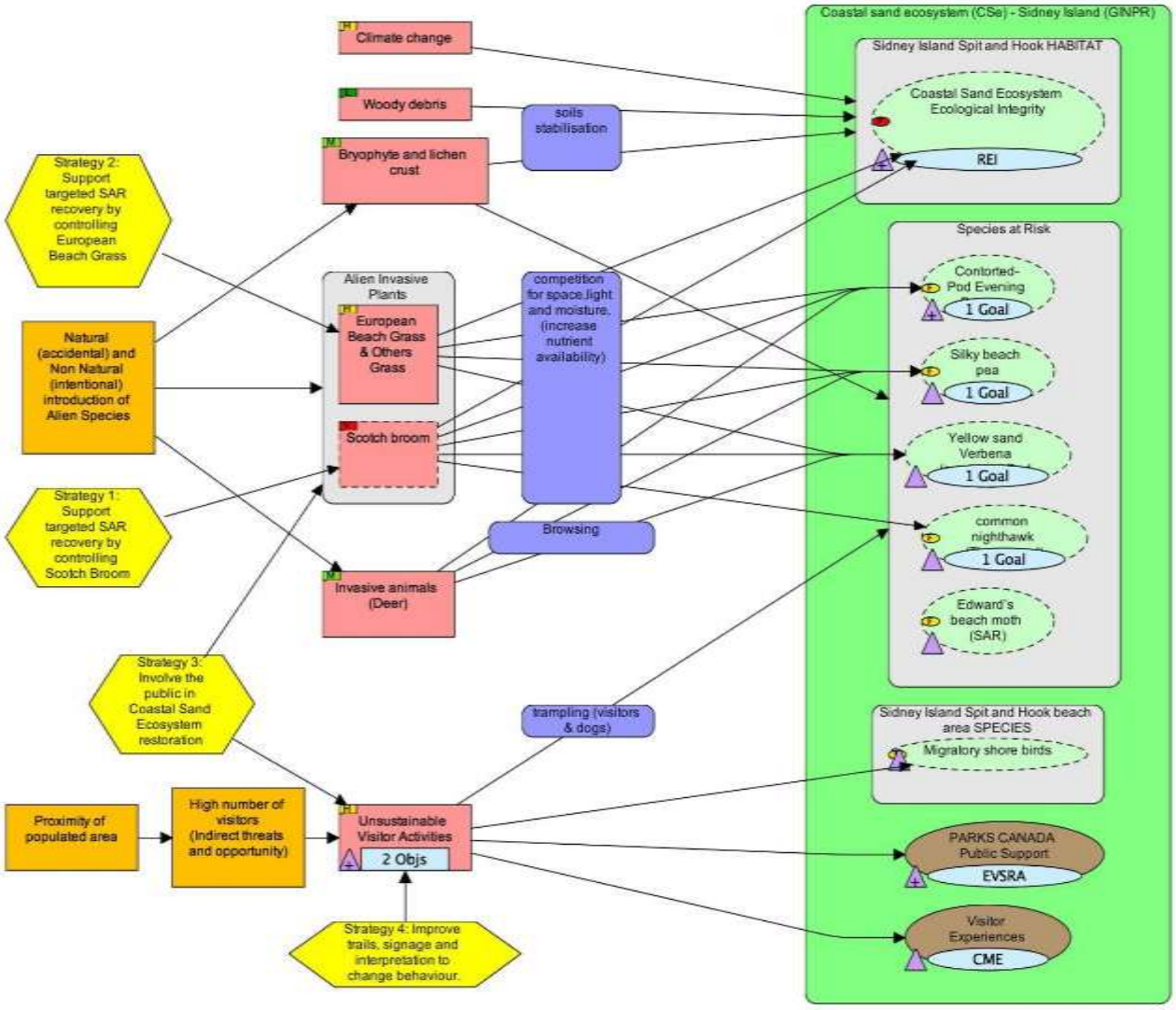


Figure 8: Conceptual Models Diagram displaying targets, direct, indirect threats and strategies (Sidney Island's teardrop Restoration Project)

For each strategy, results chains will be developed in order to identify all the steps necessary to reach our final goal. These results chains become the basis for setting intermediate results with their associated objectives and indicators that will help to track the project progress.

6.1. Strategies and results chains

6.1.1. Strategy 1: Support targeted SAR recovery by eradicating Scotch broom

Figure 9 presents the results chain of strategy 1 leading to conversation targets.

The red polygon (see Figure 4) is where dense shrub community is dominated by Scotch broom with some European beach grass in understory. In this polygon, restoration must start with the elimination of Scotch broom. Considering the state of this polygon and its size, a labor intensive operation with the support of volunteers is required.

Depending on their size, Scotch broom can be eliminated pulling small stems or cutting big ones at the ground level. These measures to eliminate Scotch broom need to be repeated each year before it flowers (late winter, early spring) to prevent seed maturation. Due to important ‘seed banking’ and re-sprouting potential (stumps and roots), mechanical treatments may need to be repeated over a 3 to 5 year period (BC Ministry of Forest, 2016).

To avoid that understory European beach grass expand after the first elimination of Scotch broom, European beach grass will be eradicated too. The new open sand area will be monitored to see if native dune grass will recolonize the space. If native plants or SAR do not naturally increase their population size once the invasive plants are eliminated, transplantation will be investigated to expand the distribution of native plants and SAR.

The Yellow and Green polygons are critical areas because it is where species at risk have been located. Only trained workers will operate in these areas to reduce the risk to damage SAR. When Scotch broom stem are small and are not in the immediate vicinity of a rare plant it can be pulled. When Scotch broom stem are bigger or nearby rare plants, it is recommended to cut at or just below the ground level with lopper (Nature Conservancy, 2012)

YEAR 1 TO 2		YEAR 3 TO 5			YEAR 10	
Strategy	Result 1	Result 2	Result 3	Result 4	Threat Reduction	Impact Conservation Target (Goal)
Strategy 1: Support targeted SAR recovery by eradicating Scotch broom	First Scotch broom elimination	Improved habitat for all target SAR	Second Scotch broom elimination	Following Scotch broom elimination	Scotch broom controlled	- Coastal Sand Ecosystem ecological integrity -Target SARs (CPEP, SBP, YSV, CNH)
Objectives & Goals	Objective R1.: Scotch broom will cover less than 15% of the targeted restoration area by 2018	Objective R2.1.: Open sand habitat cover 50% of the project area Objective R2.2.: Presence of target SAR don't decrease in the project area	Objective R3.1.: Re-sprouting reduced by 90% Objective R3.2.: No decrease number of target SAR		Objective TR1 : Scotch b. will cover less than 5% of the targeted restoration area Objective TR2 : All SAR are at least maintained in the project area	Goal : -CSE ecological integrity is restored or improved – All target SAR are recovering
Indicators	Indicator R1.1.: Scotch Broom % cover	Indicator R2.1.: % of open sand habitat cover Indicator R2.2.: Count of target SARs	Indicator R3.1.: Scotch broom re-sprouting % cover		Indicator TR.1.: Scotch broom re-sprouting % cover Indicator TR.2.: Count of target SAR	

Figure 9: Strategy 1 results chain leading to conservation target: Support targeted SAR recovery by eradicating Scotch broom (Sidney Island's teardrop Restoration Project)

6.1.2. Strategy 2: Support targeted SAR recovery by eradicating E. Beach Grass

Figure 10 presents the results chain of strategy 2 leading to conversation targets.

As described above, once Scotch broom will be eliminated from the red polygon, it will be important to avoid expand of European beach grass by eliminating this plant too. The new open sand will be monitored four months later to evaluate if active revegetation with native plants will be necessary.

As mentioned before, the yellow and green polygons are critical areas because it is where species at risk have been located. Only trained workers will operate in these areas to reduce the risk to damage to SAR. Manual removal uses a shovel to sever rhizome at a depth of about eight inches and then pull the cut (isolated) rhizome. Re-sprouting occurred throughout the season and more vigorously during the first clearing operation. Crews returned to pull and/or dig re-sprouts an average of eight times over the first season, and seven times the second season. By the end of the second season plants are usually largely eradicated (California Exotic Pest plant council, 1997).

YEAR 1 TO 2		YEAR 3 TO 5			YEAR 10	
Strategy	Result 1	Result 2	Result 3	Result 4	Threat Reduction	Impact Conservation Target (Goal)
Strategy 2: Support target SAR recovery by eradicating European Beach Grass	First E.Beach Grass elimination	Improved habitat for all target SAR	Second E.Beach Grass elimination	Following Beach Grass elimination	E.Beach Grass controled	- Coastal Sand Ecosystem ecological integrity -Target SARs (CPEP, SBP, YSV, CNH)
Objectives & Goals	Objective R1.1.: E.Beach Grass will cover less than 15% of the targeted restoration area by 2018	Objective R2.1.: Open sand habitat cover 50% of the project area Objective R2.2.: Presence of target SAR don't decrease in the project area	Objective R3.1.: Re-sprouting reduced by 90 % Objective R3.2.: No decreased number of target SAR		Objective TR1 : E.beach grass. will have less than 5% cover within a targeted restoration area Objective TR2 : All SAR are at least maintained in the project area	Goal : -CSE ecological integrity is restored or improved – Target SARs are recovering
Indicators	Indicator R1.1.: E.Beach Grass % cover	Indicator R2.1.: open sand habitat % cover Indicator R2.2.: Count of target SAR	Indicator R3.1.: E.Beach Grass re-sprouting % cover		Indicator TR.1.: E.Beach Grass re-sprouting % cover Indicator TR.2.: Count of target SARs	

Figure 10: Strategy 2 results chain leading to conservation target: Support targeted SAR recovery by eradicating E. beach grass (Sidney Island's teardrop Restoration Project)

6.1.3. Strategy 3: Involve the public in Coastal Sand Ecosystem restoration

Figure 11 presents the results chain of strategy 3 leading to conversation targets.

Figure 12 presents the results chain of strategy 3 leading to Parks Canada targets.

Sidney Island restoration activities will provide opportunities for public education and enhanced visitor experience. Various initiatives will help the public to learn about Parks Canada's commitment to improve ecological integrity, and gain knowledge about ecological restoration methods that can be applied elsewhere. When the restoration plan is approved, it will be made available to interested communities and restoration groups.

YEAR 1					YEAR 2	
Strategy	Result 1	Result 2	Result 3	Result 4	Threat Reduction	Impact Conservation Target (Goal)
Strategy 3: Involve the public in Coastal Sand restoration	Recruitment campaign for volunteers organized	Volunteers Identified	Restoration activities with volunteers organised	Scotch Broom and E.Beach Grass eliminated from target areas	Improved habitat for target SAR	- Coastal Sand Ecosystem ecological integrity -Target SARs (CPEP, SBP, YSV, CNH)
Objectives & Goals	Objective R1.1.: Effective and engaging campaign concept is ready 3 months before the restoration activities	Objective R2.1.: At least 100 volunteers have been identified 2 months before the restoration activities.	Objective R3.1.: Scotch broom will cover less than 15% of the targeted restoration area by 2018 Objective R3.2.: E.Beach Grass will cover less than 15% of the targeted restoration area by 2018		Objective T.R.1.: Open sand habitat has increased by 50% in the project area. Objective T.R2.: Presence of target SAR don't decrease in the teardrop	Goal : -CSE ecological integrity is restored or improved – Target SARs are recovering
Indicators	Indicator R1.1.: Campaign strategy document	Indicator R2.1.: List of voluteers	Indicator R3.1.: Scotch Broom % cover Indicator R3.2.: E. Beach Grass % cover		Indicator T.R.1.: open sand habitat % cover Indicator T.R.2.: Count of target SARs	

Figure 11: Strategy 3 Results chain leading to conservation target: Support targeted species at risk recovery by eradicating E. beach grass (Sidney Island's teardrop Restoration Project)

YEAR ONE					YEAR TWO	
Strategy	Result 1	Result 2	Result 3	Result 4	Sustainable Visitor Activities	Impact Parks Canada Target
Strategy 3: Involve the public in Coastal Sand Ecosystem restoration	Recruitment campaign for volunteers organized	Volunteers Identified	Restoration activities with volunteers organised	Volunteers have positive experiences	Volunteers for new activities	- Visitor experiences -Parks Canada support
Objectives & Goals	Objective R1.1.: Effective and engaging campaign concept is ready 3 months before the restoration activities	Objective R2.1.: At least 100 volunteers have been identified 2 months before the restoration activities.	Objective R3.1.: Scotch broom will cover less than 15% of the targeted restoration area by 2018 Objective R3.2.: E.Beach Grass will cover less than 15% of the targeted restoration area by 2018	Objective R4.: More than 75% of the volunteers are satisfied by their experience	Objective SVA.1.: Positive attitude towards conservation Objective SVA.2.: Active supporters	Goal : -Create meaningful experience – Engagement of the visitors and stakeholders in restoration activities
Indicators	Indicator R1.1.: Campaign strategy document	Indicator R2.1.: List of volunteers	Indicator R3.1.: Scotch Broom % cover Indicator R3.2.: E. Beach Grass % cover	Indicator R4.: Volunteers survey	Indicator SVA.1.: open sand habitat % cover Indicator SVA.2.: Count of target SARs	

Figure 12: Strategy 3 Results chain leading to Parks Canada target: Involve the public in Coastal Sand Ecosystem restoration (Sidney Island's teardrop Restoration Project)

6.1.4. Strategy 4: Improve trails, signage and interpretation to change behaviour

Figure 13 presents the results chain of strategy 4 leading to conversation targets.

Figure 14 presents the results chain of strategy 4 leading to Parks Canada targets.

Improvement of park facilities such as trail location, maintenance and signage can contribute to reduce trampling of fragile and endangered species. Interpretation can strength a better appreciation of the unique value of the place and consequently enhance the visitor experience and his motivation to protect and respect the place.

Interpretation activities can be delivered by park staff, through several means:

- Interpretative walks can be organised during the summer when the area is intensively used.
- Interpretation signboards can be installed in pertinent locations, explaining why some areas are closed to the public or why it it is important to keep the dogs on leash.
- Similar messages can be conveyed via Parks Canada website

YEAR 1					YEAR 2	
Strategy	Result 1	Result 2	Result 3	Result 4	Sustainable Visitor Activities	Impact Conservation Target (Goal)
Strategy 4: Improve trails, signage and interpretation to change behaviour	Improvement projects are identified	Improvement projects are designed	Improvement project are installed	Improvement project are operating	Unsustainable Visitor Activities Reduced	- Coastal Sand Ecosystem ecological integrity -Target SARs (CPEP, SBP, YSV, CNH)
Objectives & Goals	Objective R1.: Projects proposals address correctly the issues	Objective R2.: Project design respect Parks Canada norms and local context	Objective R3.: Projects are completed respecting the budget and time frame	Objective R4. Improvements respond effectively to the problems identified	Objective SVA.: Trampling by visitors and dogs has been reduced	Goal : Enhance protected habitat of species at risk through the use of signage, trail redesign, improved facilities, and increased interpretation
Indicators	Indicator R1.: List of project proposals.	Indicator R2..: Project documents	Indicator R3.: Excecution report	Indicator R4.: Project evaluation report	Indicator SVA.: Report of unsustainable activities	

Figure 13: Strategy 4 Results chain leading to conservation targets: Improve trails, signage and interpretation to change behaviour (Sidney Island's teardrop Restoration Project)

YEAR 1					YEAR 2	
Strategy	Result 1	Result 2	Result 3	Result 4	Sustainable Visitor Activities	Impact Parks Canada Target
Strategy 4: Improve trails, signage and interpretation to change behaviour	Improvement projects are identified	Improvement projects are designed	Improvement project are installed	Improvement project are operating	Unsustainable visitor' activities reduced	
Objectives & Goals	Objective R1.: Project proposals address correctly the issues	Objective R2.: Project design respect Parks Canada norms and local context	Objective R3.: Projects are completed respecting the budget and time frame	Objective R4. Improvements respond effectively to the problems identified	Objective SVA.: Respect signage and positive attitude towards conservation	Goal : Enhance Parks Canada public support Enhance visitor experience through the use of signage, trail redesign, improved facilities, and increased interpretation
Indicators	Indicator R1.: List of project proposals.	Indicator R2..: Project documents	Indicator R3.: Excecution report	Indicator R4.: Project evaluation report	Indicator SVA..: Protected habitat survey and Public survey	

Figure 14: Strategy 4 Results chain leading to Parks Canada target: Improve trails, signage and interpretation to change behaviour (Sidney Island's teardrop Restoration Project)

6.2. Develop an Activity Plan and a Monitoring Plan

Activity Plan:

SYDNEY TEARDROP COASTAL SAND ECOSYSTEM ACTIVITY PLAN		2017												2018			
ACTIVITY	**TASK**	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	J F M	A M J	J A S	O N D
EXOTIC PLANT TREATMENT																	
Scotch Broom eradication in Polygones R, G, P, Y	Scotch Broom extirpation				O									O			
European Beach Grass eradication in Polygones R, G, P, Y	European Beach Grass extirpation					O											
	Repeat as needed						O										
PROPAGATION & PLANTING																	
Natives Dunes grass planting in Polygones R, G, P, Y to partly replace invasives (if natural colonization don't occur)	Collect & ship whips for cutting propagation										O			O			
VOLUNTEERS RESTORATION PROGRAM																	
Recruitment campaign	Design		O									O					
	Implementation			O													
Volunteers' Activities	Design			O										O			
	Implementation				O	O											
IMPROVEMENT PROJECTS PROGRAM																	
Trails and signage	Design		O														
	Implementation			O	O												
Interpretation program	Design		O	O													
	Implementation				O	O											

Monitoring Plan:

SYDNEY TEARDROP COASTAL SAND ECOSYSTEM MONITORING PLAN		2017												2018			
ACTIVITY	**TASK**	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	J F M	A M J	J A S	O N D
OBJECTIVE 1: CONSERVATION TARGET SARs RECOVERED																	
Count of target SARs	CPEP,YSV,SBP (Nbr of Individuals)					O									O		
	Common Nighthawk (Nbr of Nests)							O								O	
	Migratory Bird (Nbr of Species)												O				O
OBJECTIVE 2: INVASIVE PLANTS CONTROLLED																	
Invasive plants Photos and % cover evaluation	Before and after first Scotch Broom extirpation				O										O		
	Before and after first European Beach Grass extirpation					O									O		
	4 months after EBG extirpation (new open sand area)									O							
Re-vegetation Native Dune Grass	Estimated mortality														O		
OBJECTIVE 3: PUBLIC AWARENESS INCREASED PROVIDING MEANINGFUL EXPERIENCES																	
Involve the public in restoration activities	Recrutment campaign elaborated	O	O											O			
	List of volunteers			O										O			
	Volunteers' feedback survey					O									O		
Improve trails,signage and interpretation	Implementation Monitoring			O	O												
	Public Survey regarding the improved services								O	O						O	

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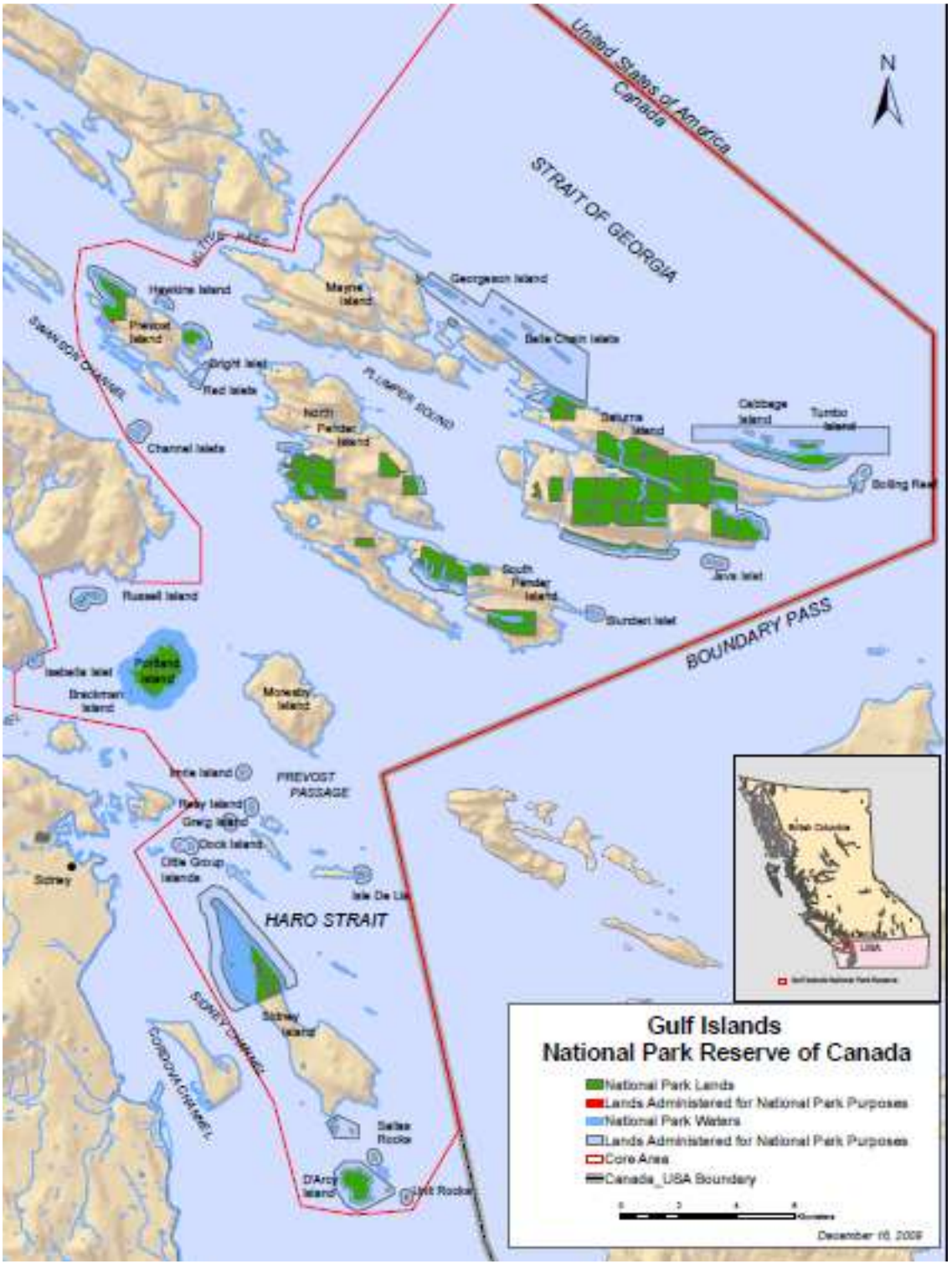
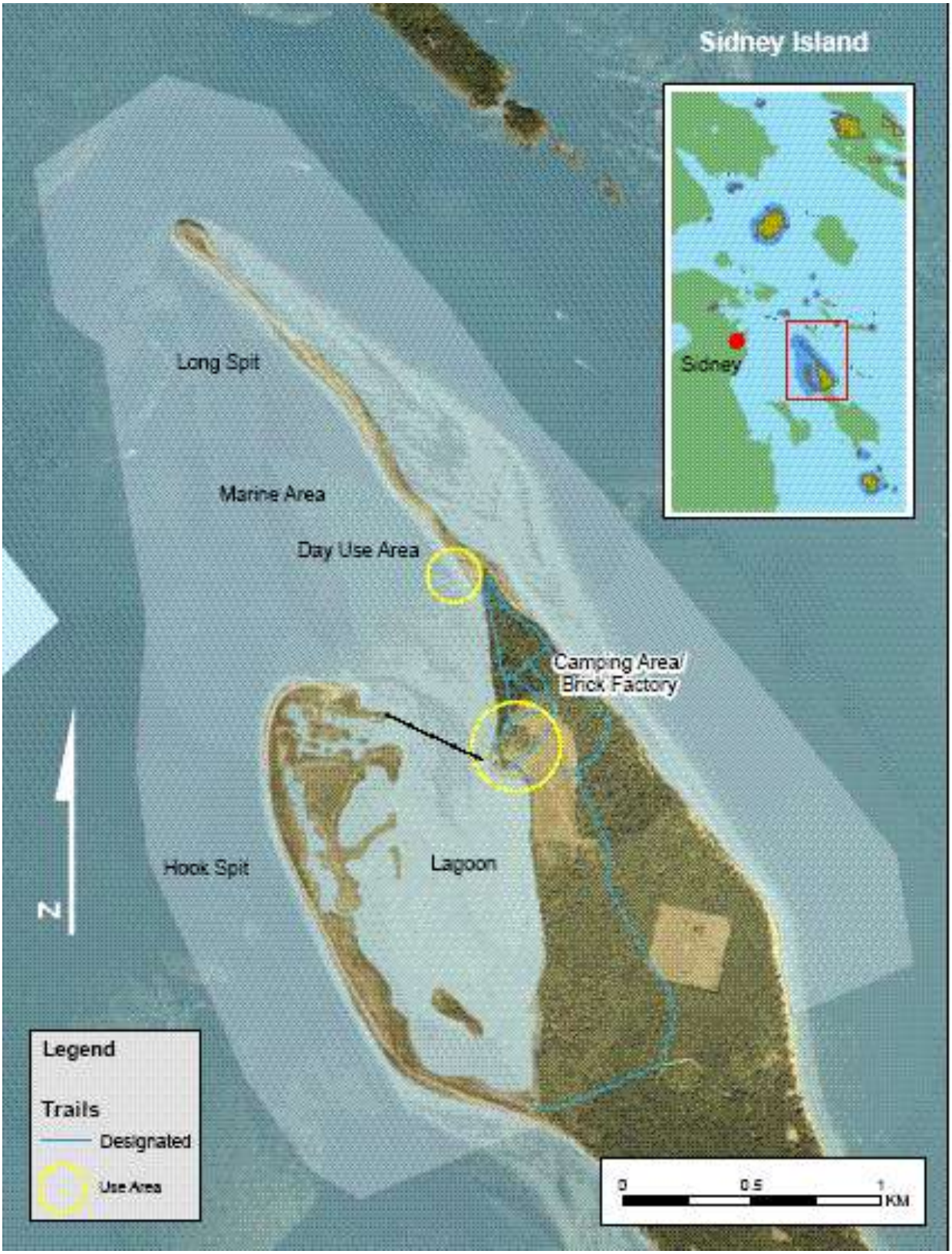
Annex 1: Gulf Islands National Park Reserve - map



Annex 2: Sydney Island – map



Annex 3: Sydney Island Spit: Restoration Project area - map