Species at Risk Act
Management Plan Series
Adopted under Section 69 of SARA

Management Plan for Coastal Wood Fern (*Dryopteris arguta*) in Canada

Coastal Wood Fern

August 2011

Parks Canada Parcs Canada

Canada

Recommended citation:

Parks Canada Agency. 2011. Management plan for the Coastal Wood Fern (*Dryopteris arguta*) in Canada. *Species at Risk Act* Management Plan Series. Parks Canada Agency. Ottawa. iii + 35 pp.

For copies of the management plan, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk Public Registry (http://www.sararegistry.gc.ca).

Cover illustration: Terry McIntosh

Également disponible en français sous le titre
« Plan de gestion de la dryoptéride côtière (*Dryopteris arguta*) au Canada »

ISBN no. 978-1-100-19107-2
Catalogue no. En3-5/21-2011E-PDF

RECOMMENDATION AND APPROVAL STATEMENT

The Parks Canada Agency led the development of this federal management plan, working together with the other competent minister(s) for this species under the Species at Risk Act. The Chief Executive Officer, upon recommendation of the relevant Park Superintendent(s) and Field Unit Superintendent(s), hereby approves this document indicating that Species at Risk Act requirements related to management plan development (sections 65-72) have been fulfilled in accordance with the Act.

Recommended by:

Dale Redford
A/Field Unit Superintendent, Coastal BC Field Unit, Parks Canada Agency

Approved by:

Alan Latourelle
Chief Executive Officer, Parks Canada Agency

MANAGEMENT PLAN FOR THE COASTAL WOOD FERN (*Dryopteris arguta*) IN CANADA

August 2011

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of British Columbia has provided the 'Management Plan for the coastal wood fern (*Dryopteris arguta*) in British Columbia' to the Government of Canada. The federal Minister responsible for the Parks Canada Agency and the federal Minister of the Environment as the competent ministers under the Species at Risk Act (*SARA)* adopt or incorporates, in whole or in part, this management plan pursuant to section 69 of the Act, with any exceptions or modifications as detailed within the body of this document.

The finalized management plan, once included in the Species at Risk Public Registry, will be the SARA management plan for this species. Implementation of this plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The SARA management plan for the Coastal Wood Fern consists of two parts:

1. The Management Plan for the coastal wood fern (*Dryopteris arguta*) in British Columbia being adopted/incorporated, developed by the Garry Oak Ecosystems Recovery Team for the province of British Columbia (Appendix 2).
2. The federal text which completes the existing management plan in terms of meeting the requirements of *SARA* section 65. This text included additions, exceptions or modifications to the document being adopted or incorporated, in whole or in part.

EXECUTIVE SUMMARY

The Committee on the Status of Endangered Wildlife in Canada designated Coastal Wood Fern (*Dryopteris arguta*) as Special Concern in 2001. It is listed as Special Concern on the federal *Species at Risk Act*.

The coastal wood fern is an evergreen fern that occurs from southern British Columbia south to California. In Canada, the species occurs on southeastern Vancouver Island and several adjacent northern Gulf Islands. It grows under open forest canopies of Douglas-fir (*Pseudotsuga menziesii*), Garry oak *(Quercus garryana*), and/or arbutus (*Arbutus menziesii*), and on rocky coastal bluffs and outcrops. Most populations occur on steep slopes, with moderate to very dry, rapidly drained soils. The total population size is estimated at more than 7500 plants covering an area of occupancy of 1.9 ha. There are records of 13 populations.

The coastal wood fern faces threats that result in habitat loss or degradation including residential development, recreational activities, and invasive alien plants. Climate change is considered a potential threat: severe weather in the form of winter windstorms may cause erosion or sun and wind exposure. Sudden oak death (*Phytophthora ramorum*), a fungus, is also considered to be a potential threat.

The long-term management goal for coastal wood fern is to maintain all known populations at no less than their current size and to maintain the species' current distribution and area of occupancy in British Columbia. The management objectives for the coastal wood fern are as follows:

- To establish stewardship of all known populations.
- To assess the extent of the main threats (housing development/habitat conversion, recreational activities, and invasive alien plants) to the populations.
- To clarify the distribution of the coastal wood fern in British Columbia.
- To increase public awareness of the existence and conservation value of the coastal wood fern in areas with suitable habitat.
- To address knowledge gaps that prevent effective management of coastal wood fern (e.g., determine population trends, extent of occurrence, habitat attributes, type of reproduction, dispersal capabilities, genetic composition, significance of threats and natural disturbance) to ensure that populations remain at self-sustaining levels.

These objectives may be met through a combination of initiatives such as habitat protection, appropriate stewardship activities to minimize threats, research to address key knowledge gaps, inventory and monitoring of known populations, inventory to determine if there are undocumented populations, and outreach and communication efforts.

TABLE OF CONTENTS

EXECUTIVE SUMMARY II
ADDITIONS, MODIFICATIONS, AND EXCLUSIONS TO THE ADOPTED OR INCORPORATED DOCUMENT 1
APPENDIX 1: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES 2
APPENDIX 2: MANAGEMENT PLAN FOR THE COASTAL WOOD FERN (*DRYOPTERIS ARGUTA*) IN BRITISH COLUMBIA 3

ADDITIONS, MODIFICATIONS, AND EXCLUSIONS TO THE ADOPTED OR INCORPORATED DOCUMENT

Protection under SARA

This section provides clarity on the use of "protection" in the Management Plan for the coastal wood fern (*Dryopteris arguta*) in British Columbia, (Appendix 2) in relation to the concept of protection under SARA, the Act under which this document is being adopted as the SARA management plan for this species (section 69).

"Protection" is defined in the Management Plan for the coastal wood fern (*Dryopteris arguta*) in British Columbia in a manner which may not equate to the concept of protection under SARA. Under SARA the adequacy of a given protection measure can only be determined on a case-by-case and/or site-by-site basis. For information on protection under SARA, please see the relevant sections of the Act and the draft SARA Policies, available on the Species at Risk Public Registry.

APPENDIX 1: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into section eight of the adopted management plan..

APPENDIX 2: MANAGEMENT PLAN FOR THE COASTAL WOOD FERN (*DRYOPTERIS ARGUTA*) IN BRITISH COLUMBIA

As provided by the Government of British Columbia

Garry Oak Ecosystems Recovery Team. 2010. Management Plan for the coastal wood fern (*Dryopteris arguta*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 23 pp.

Management Plan for the coastal wood fern (*Dryopteris arguta*) in British Columbia

Prepared by the Garry Oak Ecosystems Recovery Team's
Plants at Risk Recovery Implementation Group

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

October 2010

About the British Columbia Management Plan Series

This series presents the management plans that are prepared as advice to the province of British Columbia. The Province prepares management plans for species' that may be at risk of becoming endangered or threatened due to sensitivity to human activities or natural events.

What is a management plan?

A management plan identifies a set of coordinated conservation activities and land use measures needed to ensure, at a minimum, that target species' do not become threatened or endangered. A management plan outlines what is and what is not known about a species or ecosystem, identifies threats to the species or ecosystem, and what should be done to mitigate those threats. Management plans set goals and objectives, and recommend approaches appropriate for species or ecosystem conservation.

What's next?

Direction set in the management plan provides valuable information on threats to the species and their conservation needs that may be used by individuals, communities, land users, conservationists, academics, and governments interested in implementing species conservation.

For more Information

To learn more about species at risk recovery planning in British Columbia, please visit the Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

Management Plan for the coastal wood fern (*Dryopteris arguta*) in British Columbia

Prepared by the Garry Oak Ecosystems Recovery Team's Plants at Risk Recovery Implementation Group

October 2010

Recommended citation

Garry Oak Ecosystems Recovery Team. 2010. Management Plan for the coastal wood fern (*Dryopteris arguta*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 23 pp.

Cover illustration/photograph

C. Maslovat and P. Williston

Additional copies

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

Publication information

ISBN: 978-0-7726-6350-4

Disclaimer

This management plan has been prepared by the Garry Oak Ecosystems Recovery Team's Plants at Risk Recovery Implementation Group, as advice to the responsible jurisdictions and organizations that may be involved in managing the species.

This document identifies the management actions that are deemed necessary, based on the best available scientific and traditional information, to prevent coastal wood fern populations in British Columbia from becoming endangered or threatened. Management actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and recovery approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions and all members of the recovery team have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all individuals on the recovery team.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this management plan. The Ministry of Environment encourages all British Columbians to participate in the conservation of coastal wood fern.

RECOVERY TEAM MEMBERS

Garry Oak Ecosystems Recovery Team's Plants at Risk Recovery Implementation Group
Brenda Costanzo (co-chair), B.C. Ministry of Environment, Victoria, BC
Tracy Cornforth, Department of National Defence (DND), Victoria, BC
Todd Kohler, Consultant, Surrey, BC
Carrina Maslovat, Consultant, Saltspring Island, BC
James Miskelly, Consultant, Victoria, BC
Matt Fairbarns (co-chair), Aruncus Consulting, Victoria, BC
Todd Kohler, Consultant, Surrey, BC
Terry McIntosh, Biospherics Environmental Inc., Vancouver, BC
Mike Miller, Consultant, Vernon, BC
Brian Reader, Parks Canada, Pacific-Yukon Region, Victoria, BC
Arthur Robinson, DND, Victoria, BC
Simone Runyan, Consultant, Vernon, BC
Andrea Schiller, DND, Victoria, BC
Shyanne Smith, Program Manager, GOERT, Victoria, BC

Former recovery team members
Tracy Fleming, Consultant, Duncan, BC
Heidi Guest, Consultant, Victoria, BC
Ted Lea (retired), Vegetation Consultant, Victoria, BC
Erica J. Wheeler, Consultant, Victoria, BC

RESPONSIBLE JURISDICTIONS

The British Columbia Ministry of Environment is responsible for preparing a management plan for coastal wood fern in British Columbia. Parks Canada Agency and Environment Canada's Canadian Wildlife Service also participated in the preparation of this management plan.

ACKNOWLEDGEMENTS

We thank Carrina Maslovat for her expertise in developing the first draft of this management plan. Many thanks to Jenifer Penny, Marta Donovan, and Katrina Stipec of the British Columbia Conservation Data Centre for technical support, and for providing element occurrence data and base maps. Thanks to Adolf Ceska, Matt Fairbarns, Hans Roemer, and Patrick Williston who provided field-based information about specific populations. Many thanks to Richard and Elaine Martin, Tony Law, Jenny Balke, and to Mae Pagdin, Ann Zielinski, Pam Gordon of the Heron Rocks Friendship Centre for their assistance with fieldwork. Thanks to Tracy Cornforth, Matt Fairbarns, Tracy Fleming, and Terry McIntosh of the Garry Oak Ecosystems Recovery Team's Plants at Risk Recovery Implementation Group for providing review comments on an earlier draft of this document. Ted Lea and Brenda Costanzo were invaluable for providing background information, facilitating this project, providing support for associated fieldwork, and providing review comments.

EXECUTIVE SUMMARY

The coastal wood fern (*Dryopteris arguta*) is an evergreen fern that occurs from southern British Columbia south to California. In Canada, the species occurs on southeastern Vancouver Island and several adjacent northern Gulf Islands. The total population size is estimated at more than 7500 plants covering an area of occupancy of 1.9 ha. There are records of 13 populations (including one unconfirmed at Mount Finlayson in Goldstream Provincial Park), nine of which occur, at least partially, on private land. The species was designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada in 2001 and added to the federal *Species at Risk Act* Schedule 1 in 2004. In British Columbia, the coastal wood fern is ranked S2S3 (imperiled to special concern, vulnerable to extirpation or extinction) by the Conservation Data Centre and is on the provincial Blue list. The Conservation Framework has assigned coastal wood fern a conservation priority 2, the second highest priority rank under Goal 3: Maintain the diversity of native species and ecosystems.

The coastal wood fern grows under open forest canopies of Douglas-fir (*Pseudotsuga menziesii*), Garry oak *(Quercus garryana*), and/or arbutus (*Arbutus menziesii*), and on rocky coastal bluffs and outcrops. Most populations occur on steep slopes, with moderate to very dry, rapidly drained soils.

The coastal wood fern faces threats that result in habitat loss or degradation including residential development, recreational activities, and invasive alien plants. A potential threat includes climate change and severe weather in the form of winter windstorms and the potential resulting erosion or sun and wind exposure. As well, sudden oak death (*Phytophthora ramorum*), a fungus, is considered to be a potential threat.

The long-term management goal is to maintain all known populations at no less than their current size and to maintain the species' current distribution and area of occupancy in British Columbia.

The management objectives for the coastal wood fern are as follows:

1. To establish habitat protection for all known populations.
2. To assess the extent of the main threats (housing development/habitat conversion, recreational activities, and invasive alien plants) to the populations.
3. To clarify the distribution of the coastal wood fern in British Columbia.
4. To increase public awareness of the existence and conservation value of the coastal wood fern in areas with suitable habitat.
5. To address knowledge gaps that prevent effective management of coastal wood fern (e.g., determine population trends, extent of occurrence, habitat attributes, type of reproduction, dispersal capabilities, genetic composition, significance of threats and natural disturbance) to ensure that populations remain at self-sustaining levels.

These objectives may be met through a combination of initiatives such as habitat protection, appropriate stewardship activities to minimize threats, research to address key knowledge gaps, inventory and monitoring of known populations, inventory to determine if there are undocumented populations, and outreach and communication.

TABLE OF CONTENTS

RECOVERY TEAM MEMBERS IV
RESPONSIBLE JURISDICTIONS IV
ACKNOWLEDGEMENTS IV
EXECUTIVE SUMMARY V
1. COSEWIC SPECIES ASSESSMENTS INFORMATION 1
2. SPECIES STATUS INFORMATION 1
3. SPECIES INFORMATION 1
3.1 Species Description 1
3.2 Populations and Distribution 2
3.3 Needs of the coastal wood fern 6
4. THREATS 7
4.1 Threat Assessment 8
4.2 Description of the threats 10
5. MANAGEMENT GOAL AND OBJECTIVES 11
5.1 Management Goal 11
5.2 Rationale for the Management Goal 11
5.3 Management Objectives 12
6. APPROACHES TO MEET OBJECTIVES 12
6.1 Actions Already Completed or Underway 12
6.2 Knowledge Gaps 13
6.3 Recommended Management Actions 15
6.4 Narrative to Support Management Actions Table 18
7. PERFORMANCE MEASURES 19
8. EFFECTS ON OTHER SPECIES 20
9. RECOMMENDED APPROACH FOR IMPLEMENTATION 20
10. REFERENCES 21

LIST OF TABLES

Table 1.Status and description of coastal wood fern populations in B.C. 5
Table 2. Threat classification table for coastal wood fern. 9
Table 3. Recommended management actions for coastal wood fern in British Columbia. 15

LIST OF FIGURES

Figure 1.Illustration of the coastal wood fern. Used with permission from the University of Washington Press (Hitchcock *et al.* 1969. Illustrations by Jeanne R. Janish). 2
Figure 2.North American distribution of coastal wood fern (from COSEWIC 1998). 3
Figure 3. Distribution of coastal wood fern in B.C. and Canada. Numbers for populations on Denman and Hornby Islands correspond to population names listed in Table 1. 4

1. COSEWIC SPECIES ASSESSMENTS INFORMATION

Date of Assessment: November 2001 (no change)
Common Name: coastal wood fern
Scientific Name: *Dryopteris arguta*
COSEWIC Status: Special Concern
Reason for Designation: A Pacific North American species reaching its northern limit on the Gulf Islands of British Columbia where it occurs as a series of small populations within rugged coastal forest habitat.
Canadian Occurrence: British Columbia
Status History: Designated Special Concern in April 1998. Status reexamined and confirmed in November 2001. Last assessment based on existing status report.

2. SPECIES STATUS INFORMATION

coastal wood fern[1]	
Legal Designation	
Identified Wildlife: [2] No	B.C. Wildlife Act: [3] No SARA Schedule: 1 (2003)
Conservation Status[4]	
B.C. Rank: S2S3 (2000) B.C. List: Blue	Global Rank: G5 (1999) COSEWIC: Special Concern (2001)
Subnational Ranks[5]: AZ: S2; All other states (WA ; OR; CA; MO): SNR	
B.C. Conservation Framework (CF)[6]	
Goal 1: Contribute to global efforts for species and ecosystem conservation.	Priority: [7] 3
Goal 2: Prevent species and ecosystems from becoming at risk.	Priority: 6
Goal 3: Maintain the diversity of native species and ecosystems	Priority: 2
CF Action Groups:	Compile Status Report; Send to COSEWIC; Planning; Monitor Trend; Habitat Protection; Habitat Restoration; Private Land Stewardship

[1] Data Source: B.C. Conservation Data Centre (2010) unless otherwise noted
[2] Identified Wildlife under the *Forest and Range Practices Act*
[3] Listed as Endangered or Threatened under the *Wildlife Act.*
[4] S = Subnational; N = National; G = Global; B= Breeding; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure; NA = not applicable; NR = unranked; U = unrankable
[5] Data Source: NatureServe (2009)
[6] Data Source: Ministry of Environment (2010).
[7] Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3. SPECIES INFORMATION

3.1 Species Description

The coastal wood fern is an evergreen fern, 20–60 cm tall, which grows in vase-like clusters from a stout, short, creeping rhizome (Figure 1). The oblong lanceolate-shaped leaves are twice divided with deeply cut pinnae (primary division of a compound frond with leaflets on both sides of a central axis). The pinnules (secondary leaflet in a bipinnately compound frond) have small,

spiny teeth along the margin. The rhizomes, stipes, and undersides of the pinnae have lance-shaped, chestnut-coloured scales (Douglas *et al.* 2000).

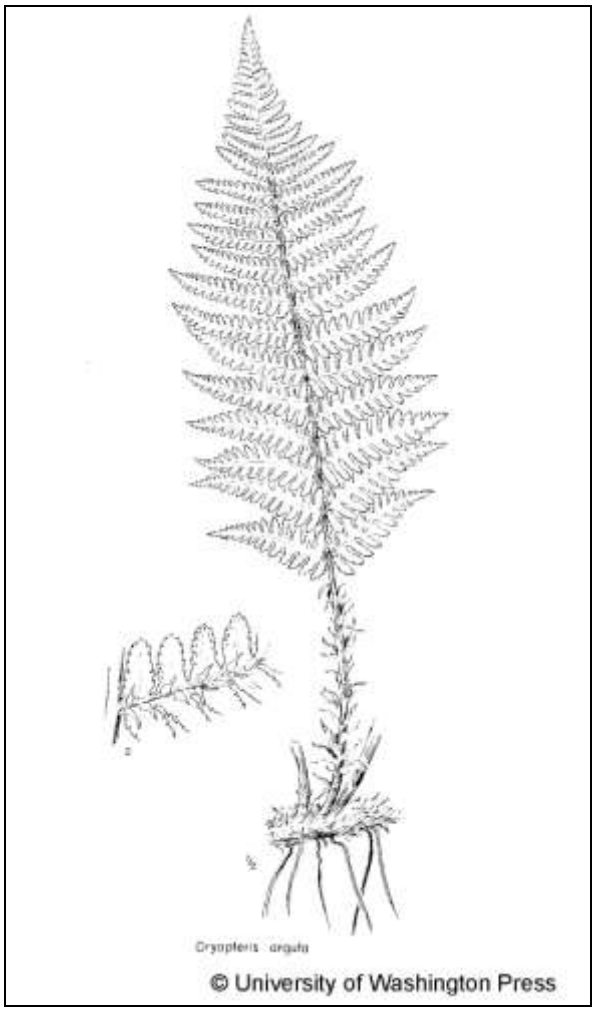

Figure 1.Illustration of the coastal wood fern. Used with permission from the University of Washington Press (Hitchcock *et al.* 1969. Illustrations by Jeanne R. Janish).

3.2 Populations and Distribution

The coastal wood fern is found along North America's west coast in British Columbia (B.C.), Washington, Oregon, and California; and inland in Montana and Arizona (NatureServe 2006). The Montana populations were not noted in the status report (COSEWIC 1998). The B.C. populations are approximately 250 km distance (disjunct) from the closest populations in Snohomish County, Washington State. Figure 2 outlines the North American distribution of this species.

Figure 2.North American distribution of coastal wood fern (from COSEWIC 1998).

In B.C. the distribution of the coastal wood fern is limited to eastern Vancouver Island and several adjacent northern Gulf Islands, including Denman and Hornby islands and several smaller islands in the Ballenas / Winchelsea Archipelago off the coast of Nanoose Bay (Figure 3) (COSEWIC 1998; B.C. CDC Element Occurrence Records 2006). The populations occur in a narrow rectangle measuring 6 km wide by 50 km long, totaling approximately 300 km^2, with

large expanses of water between populations. The area of occupancy for the coastal wood fern from Conservation Data Centre (CDC) records and recent surveys is approximately 1.9 ha.

B.C. supports less than 1% of the global abundance of this species. As of 2007, the total number of plants in B.C. is approximately 7500 (B.C. CDC Element Occurrence Data 2006; Maslovat, pers. obs. 2007).

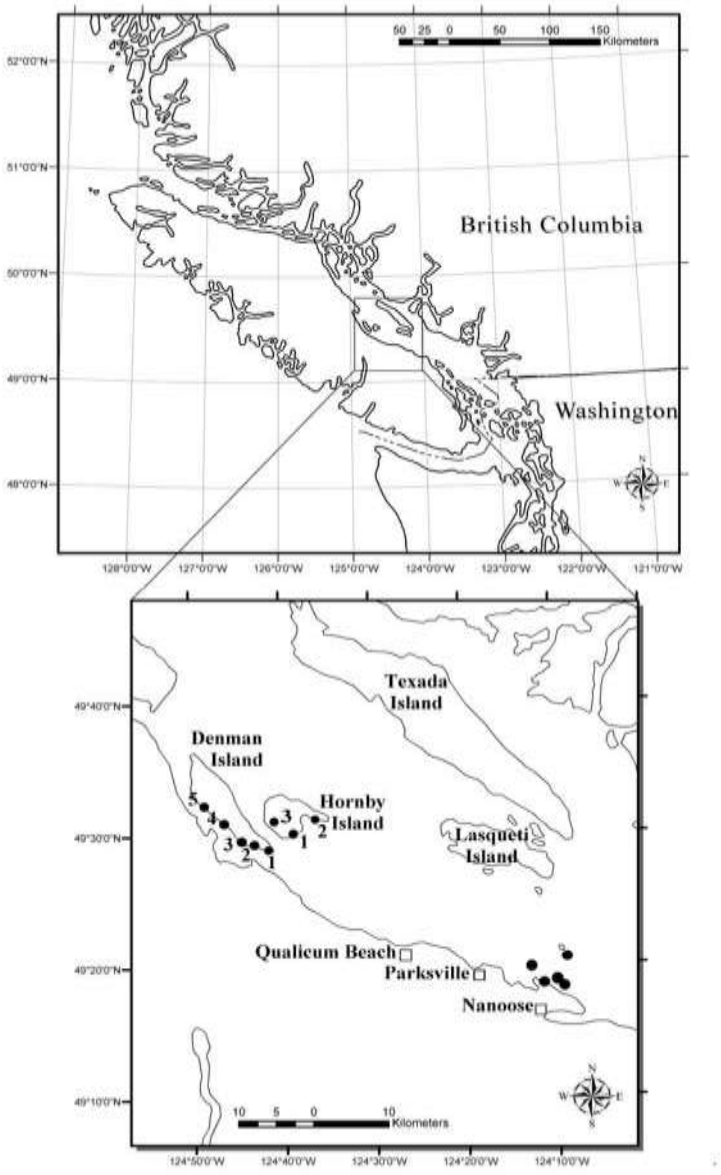

Figure 3. Distribution of coastal wood fern in B.C. and Canada. Numbers for populations on Denman and Hornby Islands correspond to population names listed in Table 1.

There are 13 recorded populations in B.C. (Table 1) rather than 18 populations as listed in the status report (COSEWIC 1998). One location at Mount Finlayson, in Goldstream Provincial Park is unconfirmed and is not addressed in this management plan. Therefore, there are 12 extant populations in British Columbia.

Although two additional populations were found after the status report was written (B.C. CDC Element Occurrence Data 2006), some of the populations listed in the status report are now treated as subpopulations, since they are less than 1 km apart (a criteria used by the CDC for distinguishing populations). In this report, subpopulations less than 1 km apart are combined into one subpopulation, except for Amelia and Gerald islands, which are treated as separate populations because they are geographically isolated by the ocean.

Table 1. Status and description of coastal wood fern populations in B.C.

(Note: With the exception of Henry (1915) the references in this table are denoting herbarium specimen collector and date, and not actual publications.)

Population	Status and description	Land tenure
Mount Finlayson, Vancouver Island	Henry (1915) referred to as *Aspidium rigidum.* Not verified with herbarium specimen or later observations and is therefore considered to be a potentially historical location.	Goldstream Provincial Park
Dorcas Point, Vancouver Island	Herbarium specimen (Taylor 1963). Jamison (1996) observed 7 plants over 10 m^2. Maslovat (2007) observed 2 subpopulations with 130 plants over 27 m^2.	Private
Amelia Island	Douglas *et al.* (1998) observed 250 plants in 4 subpopulations over approximately 1500 m^2.	Provincial Crown
Gerald Island	Jamison (1996) observed 300+ plants over 1.5 km^2. Douglas *et al.* (1998) observed 475 plants in 8 subpopulations over 1540 m^2.	Private
Mistaken Island **Ballenas Islands**, south island	Douglas *et al.* (1998) observed 20 plants over 2m^2. First observed by A. Ceska in 1995 and 1996 (no number of plants or area of occurrence). Jamison (1996) observed 70+ plants over 50 m^2. Douglas *et al.* (1998) observed 500 plants in 3 subpopulations (area of occurrence incomplete). Fairbarns and Miller (2005) observed several thousand reproductive fronds over 4,000–6,000 m^2.	Private Department of National Defence
Denman Island 1, Boyle Point	Herbarium specimen (Roemer 1982). Jamison (1996) observed 120 plants in 25 clusters in 250 m^2 split between two subpopulations. Williston (2006) observed 30 plants in southern subpopulations. Maslovat (2007) observed 220–270 plants over 260 m^2 in 3 subpopulations.	Boyle Point Provincial Park
Denman Island 2 Repulse Point	Jamison (1996) observed 300+ plants over 800 m^2. Maslovat (2007) observed 500 plants over 435 m^2 in 2 subpopulations.	Private
Denman Island 3 South/south east of Metcalf Bay	Herbarium specimen (Balke 1993). Jamison (1996) observed 40+ plants over 100 m^2. Maslovat (2007) observed 175 plants over 250 m^2.	Private

Population	Status and description	Land tenure
Denman Island 4 South of Millard Rd	Jamison (1996) observed 150+ plants over 400 m^2. Maslovat (2007) observed 75 plants over 270 m^2.	Private
Denman Island 5 Buckley Bay Ferry landing	First observed 1952. Herbarium specimen (Brayshaw 1968). Observed by Taylor (1968). Jamison (1996) observed 67 plants over 100 m^2. Maslovat (2007) observed 73–93 plants over 100 m^2 in two patches.	Private
Hornby Island 1 Norman Pt. from south east of Ford's Cove to Downes Pt. in 7 subpopulations.	Herbarium specimen (Brayshaw 1968). Observed by Taylor (1968). Jamison (1996) observed 4000+ plants in 5 subpopulations over 2.4 km^2. Douglas *et al.* (1998) observed 50–100 plants in 6 clumps at 2 subpopulations. Maslovat (2007) observed >3500 plants over 1.1 ha in 7 subpopulations.	Private land + Camping Co-operative and Conservation organization
Hornby Island 2 East of Tribune Bay to north west of Helliwell Park	Herbarium specimen (Pojar 1976; Ceska and Ceska 1976). Jamison (1996) observed 160+ plants in 2 populations (42 clumps) over 920 m^2. Douglas *et al.* (1998) observed 3000–6000 plants in 48 clumps at the southern subpopulation over 50–200 m^2 Maslovat (2007) found over 1000 plants over 800 m^2 (incomplete survey).	Helliwell Provincial Park + private (portion protected in conservation covenant)
Hornby Island 3 Mount Geoffrey	Janszen observed in 1982. No numbers of plants or area of occurrence.	Mount Geoffrey Escarpment Provincial Park

Summary of land tenure of known populations

- 6 private
- 1 private + provincial park
- 1 private + DND
- 1 private + camping co-op and conservancy association
- 2 provincial parks + Goldstream Park (Mt. Finlayson) unconfirmed historical population
- 1 provincial Crown land

3.3 Needs of the coastal wood fern

Habitat and biological needs

In Canada, the coastal wood fern is limited to the Coastal Douglas-fir Biogeoclimatic Zone, moist maritime subzone (CDFmm) (B.C. CDC 2006). The coastal wood fern grows in coastal wooded slopes under open forest canopies of Douglas-fir (*Pseudotsuga menziesii*), Garry oak *(Quercus garryana*) or arbutus (*Arbutus menziesii*), and on rocky coastal bluffs and outcrops with stunted Garry oak (*Quercus garryana*) and oceanspray (*Holodiscus discolor*) (COSEWIC 1998; B.C. CDC Element Occurrence Records 2006). Plants growing on rocky outcrops and coastal cliffs show more signs of stress than plants found in coastal wooded habitats, such as smaller leaf blades and chlorosis (COSEWIC 1998). Plants growing in exposed habitats have also been observed to be less successful at overwintering (Martin, pers. comm. 2007).

Site aspect ranges generally from southwest to southeast, and one subpopulation occurs in a site with an east aspect. Elevation ranges from 0 to 120 m. Most populations occur on steep slopes, which range from 0 to 80%. Soils are mostly very dry to moderately dry, rapidly drained, and with moderate levels of nitrogen (COSEWIC 1998; B.C. CDC Element Occurrence Records 2006).

Information concerning the biology and ecology of the coastal wood fern is limited. Plants take 1–5 years to reach maturity and each fertile blade can produce as many as 13.5–15 million wind-dispersed spores. Some of the spores are retained on the blades over the winter and released the following spring. Spore viability averages three years or more for other *Dryopteris* species. In other fern species, spore germination, early gametophyte development, and gamete fusion occur when soils are moist in early spring (COSEWIC 1998). In California, coastal wood fern young sporophytes are found only in shaded areas with bare mineral soil (Veilleux, pers. comm. 2007). No prothalli (leaf-like structure bearing sexual organs) were noted during recent winter surveys in B.C., although survey time may not have been ideal (Maslovat, pers. obs. 2007).

The coastal wood fern can also reproduce vegetatively by rhizome elongation. Vegetative reproduction appears to be more common in dry, rapidly drained sites that are not ideal for spore germination and gamete fertilization (COSEWIC 1998).

The coastal wood fern is difficult to propagate *ex situ* from spores (Fraser, pers. comm. 2007; Furman, pers. comm. 2007; Wilson pers. comm. 2007). Horticultural propagation is via division of rhizome offshoots in the spring or autumn (Leigh 1999; Furman, pers. comm. 2007; Wilson, pers. comm. 2007).

Limiting Factors

Demographic collapse. The degree of sexual reproduction of the coastal wood fern in Canada is not known and may be a limiting factor. Although survey times were not ideal for finding prothalli, no evidence of sexual reproduction was found during winter surveys of Denman and Hornby Island populations (Maslovat, pers. obs. 2007). The ability of coastal wood fern populations to rebound from disturbances or extirpation may be hampered by a lack of sexual reproduction. There is a low probability this will influence recovery or management potential for the species.

4. THREATS

Threats are defined as the proximate (human) activities or processes that have caused, are causing or may cause the destruction, degradation and/or impairment of biodiversity and natural processes. Threats can be past (historical), ongoing, and/or likely to occur in the future. Threats do not include intrinsic biological features of the species or population such as inbreeding depression, small population size and genetic isolation which are considered limiting factors.

4.1 Threat Assessment

The threat classification below is based on the IUCN-CMP (World Conservation Union-Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the British Columbia Conservation Data Centre and the Conservation Framework. For a detailed description of the threat classification system see the IUCN-CMP website (IUCN and CMP 2006) and Master *et al.* (2009). Threats for the coastal wood fern were assessed for the entire province (Table 2).

Table 2. Threat classification table for coastal wood fern.

Threat number	Threat description	Stress	Scope[1]	Severity[2]	Timing[3]	Impact[4]	Sites
1	Residential & commercial development		Small	Serious	High	Low	
1.1	Housing & urban areas	Reduced population size and viability, local extirpation	Small	Serious	High	Low	Dorcas Point; 1 subpopulation at Hornby #1
6	Human intrusions & disturbance		Small	Moderate	High	Low	
6.1	Recreational activities	Reduced numbers of plants, direct mortality	Small	Moderate	High	Low	1 subpopulation at Denman #1; 2 subpopulations at Hornby #1; potentially others
8	Invasive & other problematic species & genes		Restricted	Moderate-Slight	High	Medium-Low	
8.1	Invasive non-native/alien species	a) Resource competition leading to reduced growth and shading of seedlings; b) Reduced numbers of plants, direct mortality	Restricted	Moderate-Slight	High	Medium-Low	a) 1 subpopulation at Hornby #1; clumps at Hornby #2; potentially others b) Sudden Oak Death not yet observed at coastal wood fern locations in Canada
11	Climate change & severe weather		unknown	unknown	Low	N/A	
11.4	Storms & Flooding	Reduced viability, direct mortality of plants	unknown	unknown	Low	N/A	Most threatened by erosion and storm damage: several subpopulations at Hornby #1; 1 subpopulation at Denman #1; Gerald Island and Ballenas Is.

[1] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within ten years. Usually measured as a proportion of the species' population in the area of interest.
(Pervasive = 71-100%; Large = 31-70%; Restricted = 11-30%; Small = 1-10%)

[2] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within ten year or three-generation time frame. Usually measured as the degree of reduction of the species' population.
(Extreme = 71-100%; Serious = 31-70%; Moderate = 11-30%; Slight = 1-10%)

[3] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [less than 10 years or three generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4 Impact – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each stress is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: very high (75% declines), high (40%), medium (15%) and low (3%).

4.2 Description of the threats

IUCN #1. Residential & commercial development (1.1 Housing & urban areas)

Land development activities such as housing development, threaten the coastal wood fern through habitat conversion and an increase in the potential for erosion in adjacent habitats. The population at Dorcas Point exists on land that has recently been subdivided into two lots. The environmental assessment on the Dorcas Point property recommends creating fenced covenant areas totaling 1090 m^2 to protect the coastal wood fern population (Toth and Robert 2006). Construction of a residence may impact one subpopulation on Hornby Island (Hornby Island #1). Although many of the populations on Denman and Hornby islands are on privately owned property, the coastal wood fern occurs on steep slopes that are generally not targeted for development.

Gerald and Mistaken islands are unlikely to be developed since they are remote and lack fresh water (Bartemucci, pers. comm. 2005). Threats associated with habitat conversion are minimal in Provincial Parks on Denman and Hornby islands, on provincially owned Amelia Island, and on the federally owned Ballenas Islands, which are not currently used for operational activities by the Department of National Defence (COSEWIC 1998; Cornforth, pers. comm. 2007).

IUCN #6. Human intrusions & disturbance (6.1 Recreational activities)

Recreational activities currently threaten the coastal wood fern by trampling from pedestrian traffic and construction of hiking trails on or next to populations (COSEWIC 1998). Hiking trails on the steep slopes may also increase the potential for erosion.

One subpopulation in Boyle Point Provincial Park on Denman Island (Denman Island #1) is on a steep bluff approximately 10 m below a trail. Although the steep slope prevents access by most park visitors, in the past visitors have thrown beer cans and cigarette butts over the bluff, increasing the risk of accidental fire (Williston, pers. comm. 2006). However, it is not known if fire would be beneficial or not to the management of the species.

On Hornby Island, the subpopulations at Heron Rocks Camping Co-operative and Heron Rocks Friendship Centre (Hornby Island #1) are in areas that are used extensively by campers and their pets in the summer (Mogensen, pers. comm. 2007). Campers may harm plants by pitching their tents or constructing wooden shelters on or next to the coastal wood fern. The campgrounds are maintained by weed-whacking, which may damage plants.

IUCN #8. Invasive & other problematic species & genes (8.1 Invasive non-native species)

Exotic alien plants, such as Himalayan blackberry (*Rubus armeniacus*), daphne (*Daphne laureola*), and periwinkle (*Vinca major*), and exotic grasses (e.g., *Dactylis glomerata*) are present next to some populations of the coastal wood fern. Invasive plants may outcompete native species for moisture and light, and exotic grasses may form a thick thatch that prevents

germination. Some of the plants in one subpopulation on Hornby Island (Hornby Island #1) have been smothered by invasive shrubs and other subpopulations on Hornby Island are threatened by invasive shrub encroachment.

Other Potential threats

IUCN #8. Invasive & other problematic species & genes (8.1 Invasive non-native species)

The coastal wood fern is a host for sudden oak death (*Phytophthora ramorum*) in the United States. The fungus has caused damage to the coastal wood fern plants, ranging from damage to the leaves to frond dieback to killing the plants (Garbelotto and Rizzo 2005; CDFA 2006). Although sudden oak death has been found in B.C., it has not been observed in the locations where the coastal wood fern is found (CFIA 2005).

IUCN #11. Climate change & severe weather (11.4 Storms & Flooding)

Storms threaten the coastal wood fern by eroding soil and dislodging or burying the plants. Extensive windstorms during the winter of 2006/2007 blew over many trees on Denman and Hornby islands increasing the potential for erosion and increased exposure to sun and wind. The populations on exposed rocky outcrops and very steep slopes, including several subpopulations on Hornby Island (Hornby #1), one subpopulation in Boyle Point Provincial Park (Denman Island #1), Gerald Island, and south Ballenas Island, are most threatened by erosion and storm damage (COSEWIC 1998; Maslovat, pers. obs. 2007). The effects of changes to the fire regime (i.e., fire suppression) in the species' habitat are also unknown.

5. MANAGEMENT GOAL AND OBJECTIVES

5.1 Management Goal

The long-term management goal is to maintain all known populations at no less than their current size and to maintain the species' current distribution and area of occupancy in British Columbia.

5.2 Rationale for the Management Goal

There are currently 12 extant populations of the coastal wood fern in British Columbia. The distribution of the species is currently restricted, but there are no known extirpated populations that would indicate that the species was historically more abundant. The long-term goal to maintain all current populations is set to prevent further decline, range loss, or deterioration in status (National Recovery Working Group 2005).

5.3 Management Objectives

The management objectives for the coastal wood fern are as follows:

1. To establish habitat[1] protection for all known populations.
2. To assess the extent of and to mitigate the main threats (housing development/habitat conversion, recreational activities, and invasive alien plants) to the populations.
3. To clarify the distribution of the coastal wood fern in British Columbia.
4. To increase public awareness of the existence and conservation value of the coastal wood fern in areas with suitable habitat.
5. To address knowledge gaps that prevent effective management of coastal wood fern (e.g., determine population trends, extent of occurrence, habitat attributes, type of reproduction, dispersal capabilities, genetic composition, significance of threats and natural disturbance) to ensure that populations remain at self-sustaining levels.

6. APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

Actions have been categorized by the action groups of the Conservation Framework. Status of the action group for this species is given in brackets.

Compile Status Report (complete)

- COSEWIC report completed (COSEWIC 1998), and reassessment completed (COSEWIC 2001). Update due 2011.

Send to COSEWIC (complete)

Coastal wood fern designated Special Concern (COSEWIC 2001).

Planning (complete)

- BC Management Plan completed (this document, 2010).

Monitor Trends (in progress)

- A recent inventory of the population on Ballenas Islands was conducted as part of a survey for rare plants on some Department of National Defence properties (Fairbarns 2006).
- The Dorcas Point population and most populations on Denman and Hornby Islands were re-inventoried in 2007 (Maslovat 2007).
- The Garry Oak Ecosystems Recovery Team (GOERT) has funded a comprehensive survey for the coastal wood fern on Denman Island (Maslovat, 2007).

[1] Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, sale by willing vendors on private lands, land use designations, and protected areas.

Habitat Protection and Private Land Stewardship (in progress)

- The Denman Conservancy Association has a landowner contact stewardship program that has conducted landowner contacts, site visits, preparation of stewardship plans, and wildlife monitoring and education programs for this and other species (Denman Conservancy Association 2006). A stewardship agreement is in place with the landowner of a Denman Island property on which one of the populations occurs.
- On Denman Island, the Reginald Road subpopulation of Denman #1, and two subpopulations of Denman #2 are within Development Permit Area (DPA) #2, Steep Slopes (Islands Trust 2004). This DPA restricts the cutting of trees and also requires a permit for constructing roads or buildings.
- Members of the Heron Rocks Camping Co-operative (subpopulation of Hornby #1) have been removing invasive species next to the coastal wood fern (Mogensen, pers. comm. 2007).
- A fact sheet for this species is posted on the GOERT website (GOERT 2003).
- The coastal wood fern is noted in the Boyle Point Provincial Park Master Plan, which designates areas where the coastal wood fern occurs as a Special Features Zone. Special Features Zones protect "significant natural or cultural features or processes because of their special character, fragility and heritage value." Facilities and services within the park are to be kept to a minimum with recreation limited to walking, viewing, and nature appreciation (B.C. Parks 1990).
- The coastal wood fern is not specifically mentioned in the Helliwell Provincial Park Purpose Statement and Zoning Plan, although the plan does reference the total number of Blue- and Red-listed species found in the park. The plan states the primary role of Helliwell Park is to protect rare and endangered ecosystems with a secondary role of promoting low-impact recreation. The areas where the coastal wood fern occurs are designated as a Special Features Zone (B.C. Parks 2003).
- The Helliwell Provincial Park Ecosystem Based Plan identifies management prescriptions for the grassland and cliff areas where the coastal wood fern occurs within the park, including minimizing soil disturbance, restricting access, and posting seasonal closures during spring flowering (Balke *et al.* 2001).

6.2 Knowledge Gaps

Very little is known about the reproductive capabilities of the coastal wood fern in Canada. Further studies are required to understand the conditions necessary for successful sexual reproduction, such as spore germination, successful reproduction of gametophytes, sporophyte seedling survival, and whether specific microsite conditions are required for sexual reproduction. Further understanding of dispersal capability and breeding system would be beneficial.

The genetic composition of B.C. populations and the differences between subpopulations, as well as how B.C. populations differ from those in the United States has not been studied. Such studies would determine the primary mode of reproduction (via spores or vegetatively by rhizome divisions). Determining the genetic composition can suggest which stage of the life-cycle is best protected for the survival of the species (e.g., protecting the habitat attributes that support spore or vegetative reproduction).

The population-level impact of natural disturbances such as erosion and exposure from sun, wind, and storms, as well as the impact of an altered fire regime, is not understood. The impacts of invasive alien plants, pests and diseases – in particular the impact of sudden oak death – are not known.

Essential habitat attributes for the coastal wood fern have not been determined; knowledge gaps include soil moisture regime, soil composition including particle size, organic matter, soil depth, vegetation composition (including presence and abundance of invasive plant species), slope, aspect, and elevation.

It is not known why this species has a limited distribution, whether there are specific habitat requirements as outlined above, and whether natural disturbance regimes contribute to the distribution of the species.

Further surveys should be conducted within the extent of occurrence to determine whether there are unreported populations that may be discovered on inaccessible rocky cliffs and steep dry forested slopes on the northern Gulf Islands and adjacent Vancouver Island.

Populations have not been monitored to determine population trends, and this should be in acted in an inventory, monitoring and assessment program at least every 10 years.

6.3 Recommended Management Actions

Table 3. Recommended management actions for coastal wood fern in British Columbia.

Priority	Obj #	Threat or concern addressed	Broad strategy to address threat or concern	Management Action
Urgent	1	Habitat loss (IUCN #1.1)	Habitat protection	Establish protection for private (x9) populations through stewardship approaches and/or voluntary land acquisition on private land. Monitor populations (Hornby Island 1 and 2) that have an existing conservation covenant and a common protected area (strata). Ensure the occupied habitats of populations in provincial parks are monitored to ensure the special management zones and area descriptions are recognized and implemented. Determine and develop best management practices for coastal wood fern habitat to guide stewardship activities. Engage the cooperation of all involved landowners and managers in habitat stewardship where protection is not currently in place. Initiate stewardship with the owners of the camping co-operative and conservation organization on Hornby Island 1 (Norman Point) to decrease mowing at the site.
Necessary	2	Recreation (IUCN #6.1); Erosion (IUCN #11.4); Exotic species (IUCN #8.1)	Threat mitigation	Determine effects of recreation, erosion from winter storms, invasive alien plants. Monitor encroachment and remove exotic shrubs and low trees as necessary to prevent shading of species.

Priority	Obj #	Threat or concern addressed	Broad strategy to address threat or concern	Management Action
Necessary	3, 5	Knowledge Gaps; All threats	Inventory, monitoring and assessment	Re-inventory populations not recently inventoried. Conduct inventories in suitable habitat not previously surveyed to determine if additional populations exist. Monitor each population every 10 years at a minimum, to determine population trends and impact of threats.
		Exotic species (IUCN #8.1)	Inventory and monitoring	Monitor encroachment of exotic shrubs.
Beneficial	3, 4, 5	Recreation (IUCN #6.1); Erosion (IUCN #11.4); Exotic species, (IUCN #8.1)	Outreach and communication	Develop education and outreach material for the coastal wood fern. Develop on-site interpretive material for populations in provincial parks threatened by recreational activities. In conjunction with GOERT, increase public awareness of the coastal wood fern by delivering public education and outreach. Increase public awareness of sudden oak death to minimize the spread of potentially contaminated species. Develop education and outreach material for the coastal wood fern. Distribute outreach material and best management practices to private landowners/land managers of 9 populations (1 is shared with a provincial park), 4 provincial landowners/land managers, and one federal landowner/land manager. Distribute outreach material to Islands Trust representatives on Denman and Hornby Islands. Distribute outreach material to hiking/naturalist groups on Denman and Hornby islands.

Priority	Obj #	Threat or concern addressed	Broad strategy to address threat or concern	Management Action
Beneficial	5	Knowledge gaps	Research	Identify essential habitat attributes for the coastal wood fern. Determine the genetic composition of subpopulations in B.C. and how they compare to the populations in U.S. Determine the primary mode of reproduction for the species. Determine the level of impact of natural disturbance. Determine effects of invasive alien plants and sudden oak death. Determine if habitat attributes and natural disturbance contribute to limited distribution.

6.4 Narrative to Support Management Actions Table

Habitat protection

Most of the coastal wood fern populations (9 of 13) occur at least partially on private lands. Habitat protection on private land will include a variety of initiatives, such as working with private landowners to develop appropriate stewardship activities, establishing conservation agreements/easements, and limiting development through development permit areas (DPAs). All populations of the coastal wood fern, except Dorcas Point, are in the area covered by the Islands Trust. Islands Trust is a federation of independent local governments that plan land use and regulate land development within the Gulf Islands to preserve areas for the local residents and for the province. In provincial park locations, the occupied habitats of populations should be monitored to ensure the Special Management Zones and area descriptions are recognized and implemented. Only one of the populations on private land (Denman #3) is currently protected by a stewardship agreement in place with the Denman Island Conservancy.

Threat mitigation

Landowners should be contacted through local land trusts in conjunction with the Garry Oak Ecosystems Recovery Team (GOERT) landowner contact program and should be advised of appropriate habitat management and stewardship activities for the coastal wood fern.

Inventory, monitoring, and assessment

The populations on Amelia, Gerald and Mistaken islands should be reinventoried because it has been nine years since they were systematically examined. A thorough inventory is also required because some populations (e.g., Hornby #1, Hornby #3, and Denman #1) may be more extensive than initially reported (Martin, pers. comm. 2007). Each population should be monitored every 10 years to assess the status of the population and determine population trends.

Inventories should also target potential habitat of the coastal wood fern (e.g., southwest, southeast, or south-facing dry slopes or rock outcrops) on the Gulf Islands and appropriate coastlines of Vancouver Island to search for undocumented populations.

Management activities should include monitoring the effects of recreational activities, invasive alien plants, and erosion associated with winter storms. For the federal lands, ingrowth of exotic shrubs and low trees are encroaching into parts of the habitat of the species, and should be monitored and removed if necessary (Fairbarns 2006).

Outreach and communication

There needs to be continued communication to increase public awareness of the coastal wood fern and other species at risk.

Public education should also focus on building community and stakeholder awareness of the link between sudden oak death and coastal wood fern in order to limit the potential spread of the disease from offsite nursery plants.

Research

Research is required to address key knowledge gaps. Research to determine essential habitat characteristics for the coastal wood fern could be done in association with inventory and monitoring. Research should also identify appropriate invasive plant management, and the impacts, if any of sudden oak death.

7. PERFORMANCE MEASURES

Habitat protection

- Completion of best management practices for coastal wood fern habitat to guide stewardship activities on private and public lands by 2013.
- Land management plans developed for all populations on provincial (four sites) and federal land (one site) by 2013.
- Nine land owners engaged in positive stewardship actions on private lands by 2014.
- Three provincial sites and one federal site have protection measures in place by 2014.

Threat mitigation

- Impacts of three main threats have been investigated on private and provincial lands by 2015.

Inventory, monitoring, and assessment

- Re-inventory of populations not recently examined is completed by 2015.
- Inventory of 20 unsurveyed locations with suitable habitat completed by 2015.
- Monitoring of exotic shrub encroachment on DND lands has been initiated by 2015.
- Initiation of and completion of population monitoring at all sites every 10 years.

Outreach and communication

- Educational and outreach material developed for the coastal wood fern by 2012.
- Outreach material and best management practices distributed to private landowners of nine populations (two shared with provincial parks), four provincial landowners / land managers and one federal landowner by 2013.
- Outreach material distributed to Islands Trust representatives on Denman and Hornby islands by 2013.

- Outreach material distributed to hiking/naturalist groups on Denman and Hornby islands by 2013.

Research

- Research on knowledge gaps (e.g., essential habitat attributes, genetic composition, type of reproduction, level of impact of natural disturbance, effects of invasive alien plants, limits to distribution) initiated by 2016.

8. EFFECTS ON OTHER SPECIES

The coastal wood fern occurs in the vicinity of species at risk in Garry oak woodlands, as well as in maritime meadows and vernal pools/ephemeral wet areas associated with Garry oak and associated ecosystems. Therefore, the habitat protection and stewardship of Garry oak will contribute to the protection of other species in these habitats.

9. RECOMMENDED APPROACH FOR IMPLEMENTATION

This management plan is one component of the recovery strategy for Garry oak and associated ecosystems, in particular, strategic approach D: "protection and recovery of species at risk" (GOERT 2002). Species at risk in these adjacent habitats are addressed in several multi-species recovery strategies (Parks Canada Agency 2006a, 2006b, 2006c).

Since coastal wood fern occurs on private lands, stewardship efforts will be the key to their conservation and recovery. It is recognized that to successfully protect many species at risk there will have to be voluntary initiatives by landowners to help maintain areas of natural ecosystems that support these species of risk. Examples of this stewardship approach for landowners include: following guidelines or best management practices to support species at risk; voluntarily protecting important areas of habitat on private property; establishing conservation covenants on property titles; ecogifting of private property, in whole or in part; and sales of part or all of their property to protect certain ecosystems or species at risk; or selling their property for conservation. For example, both government and nongovernmental organizations have had good success in partnering with private land owners to conserve private lands in B.C. This could be aided by stewardship programs and local land trusts in British Columbia, such as the Islands Trust, the Land Trust Alliance, Conservancy Hornby Island, and the Denman Island Conservancy.

10. REFERENCES

Balke, J., J. Booth, K. Dunster, and B. Penn. 2001. Helliwell Provincial Park ecosystem based plan. Subm. to B.C. Parks, Strathcona District, BC.

B.C. Conservation Data Centre. 2010. BC Species and Ecosystems Explorer. B.C. Min. Environ., Victoria, BC. <http://a100.gov.bc.ca/pub/eswp/> [Accessed June 2, 2010]

British Columbia Conservation Data Centre (B.C. CDC) Element Occurrence Records. 2006. B.C. Minist. Environ., Victoria, BC.

British Columbia Ministry of Environment. 2010. Conservation framework. Victoria, BC. http://www.env.gov.bc.ca/conservationframework/index.html (Accessed Feb. 8, 2010).

British Columbia Parks. 1990. Boyle Point Provincial Park master plan. http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/boyle/boyle_mp.pdf [Accessed Jan. 2007].

British Columbia Parks. 2003. Helliwell Provincial Park: purpose statement and zoning plan. http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/helliwel/helli_ps.pdf [Accessed Jan. 2007].

California Department of Food and Agriculture (CDFA). 2006. Plant quarantine manual. http://www.cdfa.ca.gov/phpps/pe/sod_survey/pdfs/CCR3700_OMDC.pdf [Accessed Jan. 2007].

Canadian Food Inspection Agency (CFIA). 2005. Plant protection survey report. http://www.collectionscanada.gc.ca/webarchives/20071123060325/http://www.inspection.gc.ca/english/sci/surv/sit2005e.shtml [Accessed March 2007].

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 1998. Status report on coastal wood fern (*Dryopteris arguta*) in Canada. Ottawa, ON.

Commitee on the Satus of Endangered Wildlife in Canada (COSEWIC). 2001. Vascular Plant Subcommittee. Assessment of coastal wood fern (*Dryopteris arguta*) in Canada. Ottawa, ON. http://www.cosewic.gc.ca/eng/sct4/result_e.cfm?SSGBox=0&StartRow=741&Page=75

Denman Conservancy Association. 2006. Denman Stewardship Project. http://www.denmanconservancy.org/stewardship.html [Accessed Dec. 2006].

Douglas, G.W., D. Meidinger, and J. Pojar, eds.. 2000. Illustrated flora of British Columbia. Volume 5: Dicotyledons (Salicaceae through Zygophyllaceae) and Pteridophytes. B.C. Minist. Environ., Lands and Parks, Victoria, BC.

Fairbarns, M. 2006. Survey for species at risk on Department of National Defence Lands on Vancouver Island. Work Point (Golf Hill), Mary Hill, Albert Head, CFMETR, South Ballenas

Island. March 23, 2006. Canadian Forest Service and Department of National Defense. Unpubl. rep.

Garbelotto, M., and D. M. Rizzo. 2005. A California-based chronological review (1995–2004) of research on *Phytophthora ramorum*, the causal agent of sudden oak death. Phytopathol. Mediterr. 44 00-00. http://www.cnr.berkeley.edu/garbelotto/downloads/garbelotto2005a.pdf [Accessed Jan. 2007].

Garry Oak Ecosystems Recovery Team (GOERT). 2002. Recovery strategy for Garry oak and associated ecosystems and their associated species at risk in Canada: 2001–2006. Draft 20 Feb. 2002. Victoria, BC.

GOERT (Garry Oak Ecosystems Recovery Team). 2003. Species at Risk in Garry Oak and Associated Ecosystems in British Columbia. Garry Oak Ecosystems Recovery Team. Victoria, BC. http://www.goert.ca/pubs_at_risk.php . [Accessed March 2010].

Henry, J.K. 1915. Flora of southern British Columbia and Vancouver Island with many references to Alaska and northern Species. W.J. Gage and Co., Toronto, ON.

Hitchcock, L.C., A. Cronquist, and M. Ownbey. 1969. Vascular plants of the Pacific Northwest: Part 1 Vascular Cryptogams, Gymnosperms, and Monocotyledons. Univ. Washington Press, Seattle, WA.

(IUCN and CMP) International Union for Conservation of Nature and Conservation Measures Partnership. 2006. IUCN – CMP unified classification of direct threats, ver. 1.0 – June 2006. IUCN and CMP, Gland, Switzerland. 17 pp. <http://www.iucn.org/about/work/programmes/species/red_list/resources/technical_documents/new_classification_schemes/> [Accessed June 2, 2010]

Islands Trust. 2004. Development permit areas on Denman Island. http://www.islandstrust.bc.ca/lup/pdf/dpapplicationde.pdf [Accessed Feb. 7, 2007). Map at: http://www.islandstrust.bc.ca/ltc/de/pdf/deshcocpe1.pdf [Accessed March 2007].

Leigh, M. 1999. Grow your own native landscape. Washington State Univ. Press, Olympia, WA.

Maslovat, C. 2007. Summary of *Dryopeteris arguta* field observations in Nanoose Bay, Denman and Hornby islands, February 2007. Unpubl. rep. to Minist. Environ., Victoria, BC.

Master, L., D. Faber-Langendoen, R. Bittman, G. A. Hammerson, B. Heidel, J. Nichols, L. Ramsay, and A. Tomaino. 2009. NatureServe Conservation Status Assessments: Factors for Assessing Extinction Risk. NatureServe, Arlington, VA. http://www.natureserve.org/publications/ConsStatusAssess_StatusFactors.pdf [Accessed June 2, 2010]

Ministry of Environment. 2010. Conservation framework. B.C. Min. Environ., Victoria, BC. <http://www.env.gov.bc.ca/conservationframework/index.html> [Accessed June 2, 2010]

National Recovery Working Group. 2005. Recovery Handbook (ROMAN). 2005–2006 Edition. October 2005. Recovery of Nationally Endangered Wildlife, Ottawa, ON.

NatureServe. 2009. NatureServe explorer: an online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, VA. <http://www.natureserve.org/explorer> [Accessed Dec, 2006]

Parks Canada Agency. 2006a. Recovery strategy for multi-species at risk in Garry oak woodlands in Canada. *In* Species at Risk Act Recovery Strategy Series, Environment Canada, Ottawa, ON.

Parks Canada Agency. 2006b. Recovery strategy for multi-species at risk in maritime meadows associated with Garry oak ecosystems in Canada. *In* Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa, ON.

Parks Canada Agency. 2006c. Recovery strategy for multi-species at risk in vernal pools and other ephemeral wet areas in Garry oak and associated ecosystems in Canada. *In* Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa, ON.

Toth, S., and C.B. Robert. 2006. Biological inventory and development impact assessment of Lot A, D.L. 100, Nanoose District, Plan VIP76564, Nanoose Bay, BC. Schedule No. '3' of Development Permit No. 60628. EcoDynamic Solutions Inc.

Personal Communications

Paula Bartemucci, Gentian Botanical Research, Smithers, BC.

Tracy Cornforth, Natural Resources Coordinator, Department of National Defence, CFB Esquimalt, Victoria, BC.

Marta Donovan, Conservation Data Centre, Victoria, BC.

Matt Fairbarns, Aruncus Consulting, Victoria BC.

Dave Fraser, Ministry of Environment, Victoria, BC.

Paul Furman, Horticulturalist, Bay Natives Nursery, San Francisco, CA.

Richard Martin, Botanist, Denman Island, BC.

Norm Mogensen, Heron Rocks Camping Co-operative, Hornby Island.

Pete Veilleux, East Bay Wild. 1972A 36th Avenue, Oakland, CA.

Patrick Williston, Gentian Botanical Research. Smithers, BC.

Bert Wilson, Horticulturalist, Las Pilitas Nursery.