

Impacts of Exotic and Indigenous Invasive Plant Species on Forest Ecosystems

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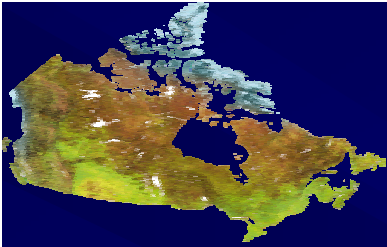
Meeting the Challenge: Invasive Plants in PNW Ecosystems
University of Washington – Seattle, Washington, USA
September 19-20, 2006



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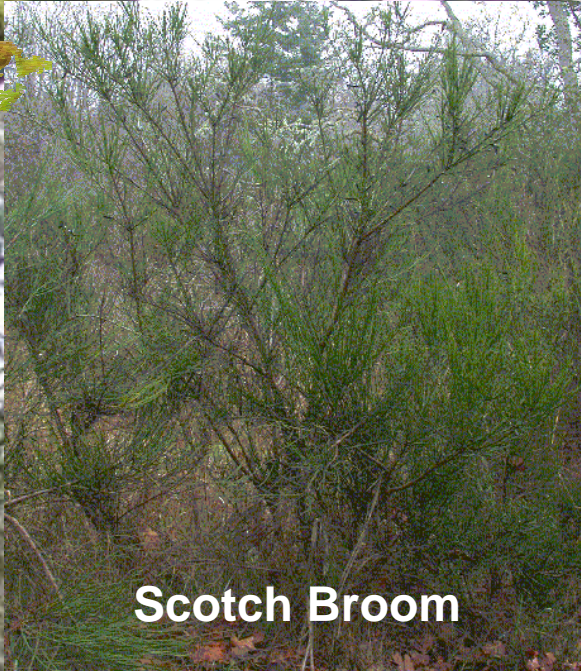
Exotic & Invasive Weeds of Forestry in Coastal British Columbia, Canada



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Scotch Broom



Daphne



English Ivy



Gorse

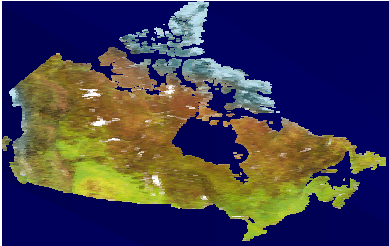
CEAD Rocky Point



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Scotch Broom (*Cytisus scoparius*)

- Exotic, leguminous shrub (pea family *Leguminosae*)
- Native of Europe
- Distributed along Pacific/Atlantic coasts
- Aggressive colonizer of disturbed sites



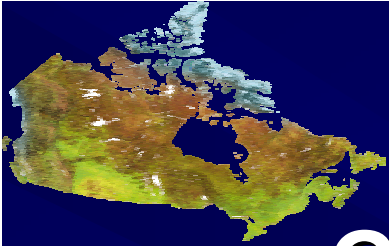
Albert Head



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Gorse (*Ulex europaeus*)

- Exotic, leguminous shrub (pea family *Leguminosae*)
- Conspicuous spines
- Native to central/western Europe and North Africa
- Only found in BC
- Classified as noxious weed
- Highly successful in disturbed habitats



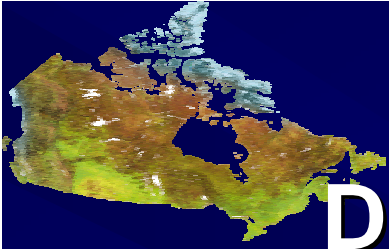
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Impacts of Broom and Gorse

- Detrimental
 - GOME
 - SAR Deltoid Balsamroot, White-top Aster, Bear's-foot Sanicle, Golden Paintbrush
 - Extremely flammable
- Beneficial
 - Slope stabilization
 - Early pollen source
 - Nitrogen fixation
- Legislation
 - Gorse is listed as a noxious weed throughout the province under the BC Weeds Act
 - Broom is not listed





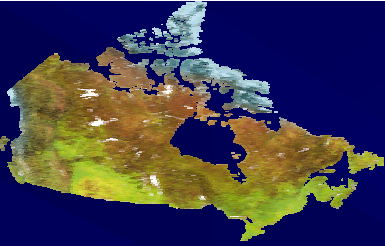
Daphne (*Daphne laureola*)

- Exotic, evergreen shrub (family *Thymelaeaceae*)
- Native to Europe and North Africa
- Long lived, slow-growing
- Introduced to Southwest BC and Washington State
- Very common around the Victoria area



Fort Rodd Hill





Impacts of Daphne



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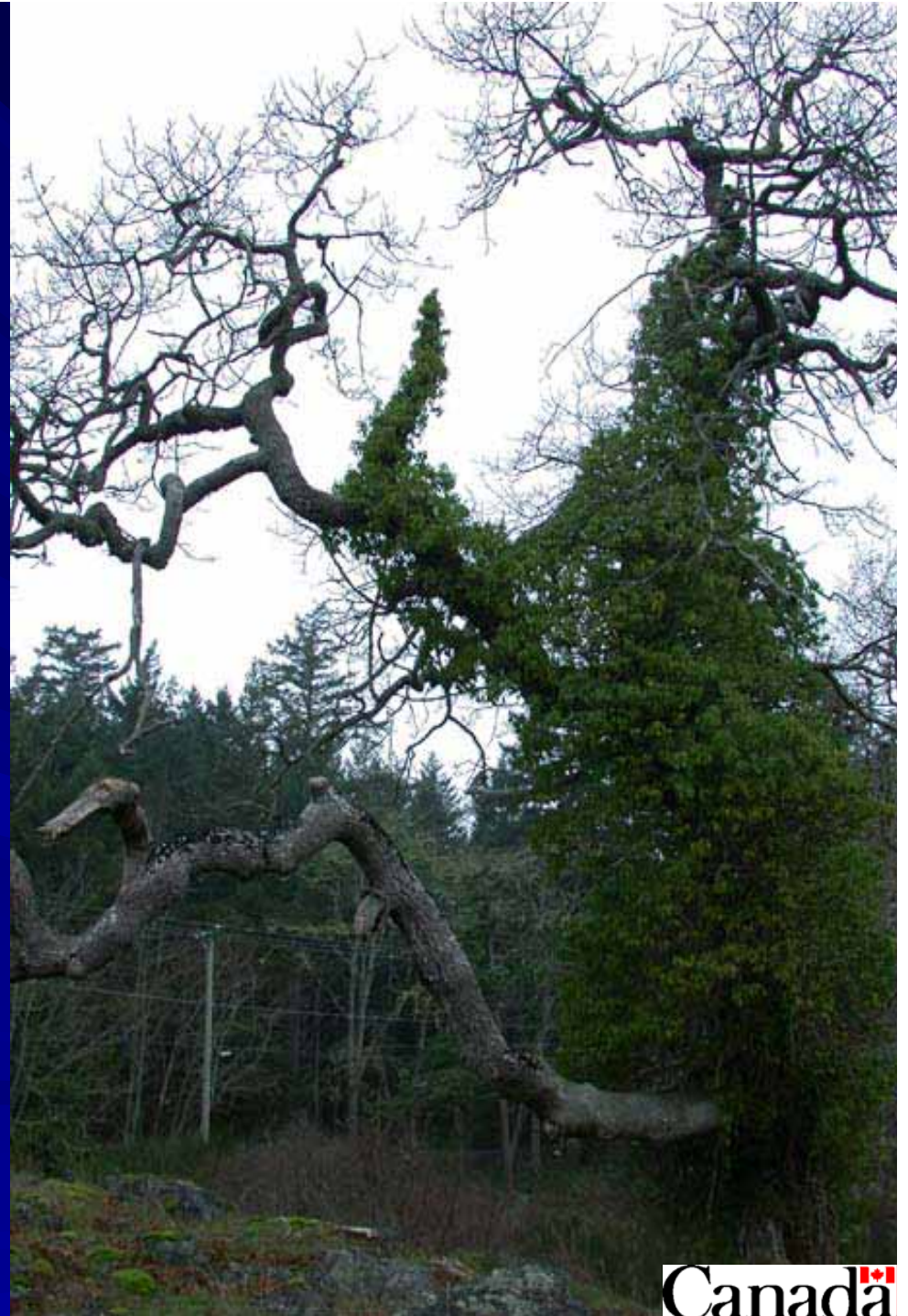
- Detrimental
 - Garry Oak and Arbutus
 - Dense stands shade out forest floor
 - Toxic bark, berries, leaves and sap
- Beneficial
 - Attractive ornamental
 - Berries as a source of food
- Legislation
 - Not classed as noxious in BC

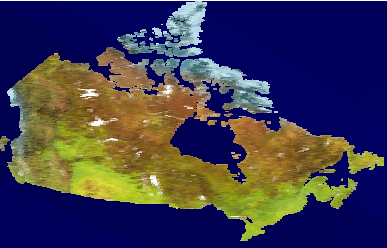




English Ivy (*Hedera spp.*)

- Evergreen climbing vine (ginseng family *Araliaceae*)
- Native of Europe
- Introduced to N. America in 18th century
- Widely cultivated as an ornamental
- Often associated with some form of land disturbance





Impacts of English Ivy



- Detrimental
 - GOME
 - SAR especially when in creeping form
 - Threat to biodiversity
 - Increase storm damage
- Beneficial
 - Late pollen source
 - Food source for birds
- Legislation
 - No legislation under the BC Weeds Act





Field Experiments



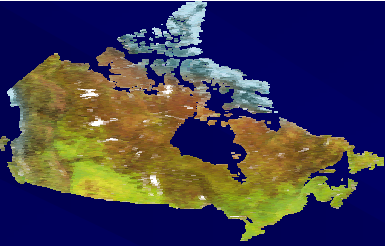
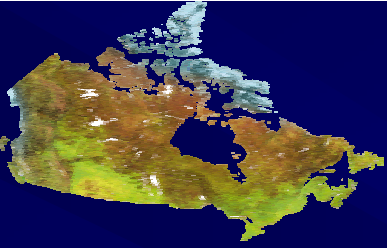


Table 1: Influence of various treatments on re-sprouting of four exotic weeds in British Columbia after 2 years.

Treatment	Scotch broom	Gorse	Daphne spurge	English ivy
	(% resprouting)			
Cutting alone	80.0	85.0	95.0	98.0
Cutting and herbicide	0.0	0.0	0.0	0.0
Cutting and herbicide-Cp	49.0	51.0	90.0	95.0
Cutting and mulches	0.0	0.0	0.0	0.0

Source: Prasad 2005, Outlook on Pest Management





Aquacide: Super heated water to kill invasive plants



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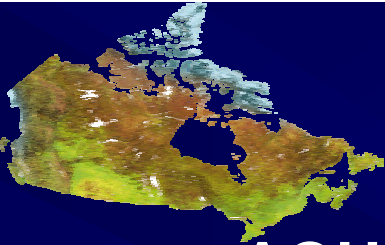
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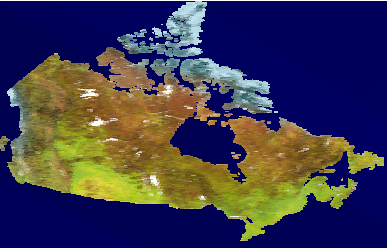
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AQUACIDE:

Effect of super heated water on gorse seedlings





Impact of treatment on seed bank and sensitive sites



1 month after treatment



4 months after treatment



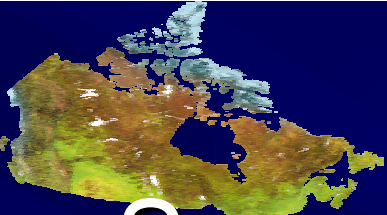


Table 2: Comparison of control options.

Options	Methods	Comments
1. Mechanical	Cutting Pulling	Labour intensive Promotes re-sprouting and new emergence of seedlings
2. Mulching	Black plastic	Labour intensive Not practical on large scale
3. Chemical herbicides	Triclopyr	Very efficacious, cost-effective Environmental concerns
4. Biological		
(a) Bioherbicide-Cp	Native fungal pathogen Treatment of cut stumps	Slow to act Variable results
(b) Bioherbicide- <i>Phomopsis</i>	Patch treatment on Daphne stems	Very efficacious but needs further testing

Source: Prasad 2005, Outlook on Pest Management

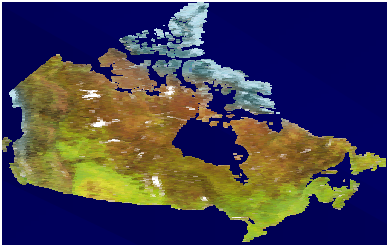




Summary

- Herbicide (Release® or Garlon®) is most effective
- Mulching is effective although not always practical
- Further research is necessary to:
 - Develop effective bioherbicides
 - Determine the impact of Aquacide on sensitive ecosystems
- Integrated approach provides best sustainable results





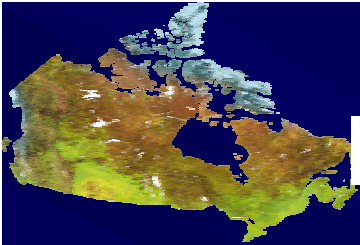
Indigenous Forest Weeds



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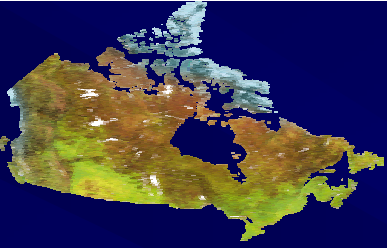
Indigenous Forest Vegetation Management

Conifer Plantations



Utility Rights-of-way





Tools for Management of Indigenous Forest Weeds

Mechanical removal



Manual cutting



Prescribed burning

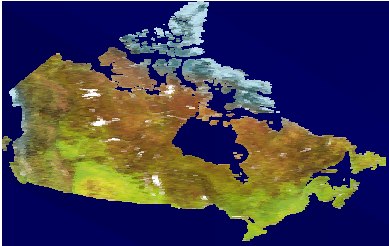


Chemical herbicides



Biological control (e.g. *C. purpureum*)





Indigenous Target Weeds

Weedy Hardwood Species

- *Acer macrophyllum* (big leaf maple)
- *Alnus rubra* (red alder)
- *Populus tremuloides* (trembling aspen)

Weedy Shrub species

- *Rubus* spp.
- *Gaultheria shallon* (salal)





Comparative efficacy of *C. purpureum* on Forest Weeds

Fruiting bodies



Formulated product

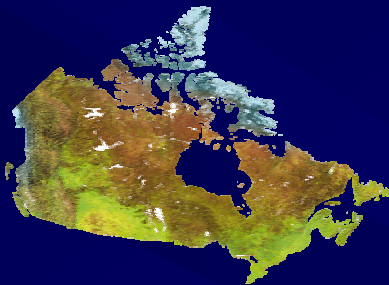


Application on red alder



Application on bigleaf maple





Red Alder Site – Duncan, Vancouver Island, BC

- Randomized Complete Block Design
- 5 Blocks x 6 Treatments = 30 plots
- Treatments (20 alder trees/treatment)

Treatment #	Treatment Description
1	Manual cut control
2	Formulation control
3	Cp PFC 2140
4	Cp PFC 2139
5	Vision® (Carbopaste®)
6	Vision® (spray)



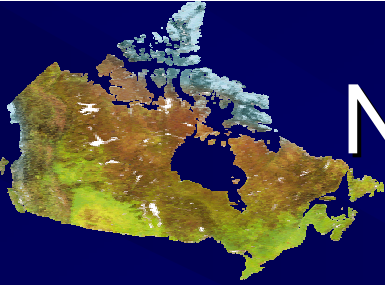


Percent stump mortality of red alder, after treatment with *C. purpureum* and herbicides

Treatment	Stump mortality (%)
Manual-cut control	65.0 b
Formulation control	70.0 b
Cp PFC 2140	96.0 a
Cp PFC 2139	100.0 a
Vision® (Carbopaste®)	99.0 a
Vision® (spray)	100.0 a

Treatments with the same letter are not significantly different by
Duncan's multiple range test ($p \leq 0.05$)



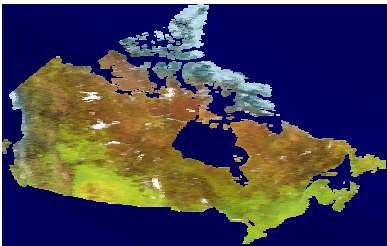


Number of alder sprouts/stump treated with *C. purpureum* and herbicides

Treatment	Mean #living sprouts/stump
Manual-cut control	1.18 a
Formulation control	1.37 a
Cp PFC 2140	0.02 b
Cp PFC 2139	0.00 b
Vision® (Carbopaste®)	0.01 b
Vision® (spray)	0.00 b

Treatments with the same letter are not significantly different by Duncan's multiple range test ($p \leq 0.05$)





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A Vegetation Management Product

FOR SALE / FOR USE IN BOREAL AND MIXED FOREST
REGIONS, EAST OF THE ROCKY MOUNTAINS ONLY

For inhibition of regrowth on cut stumps of
deciduous tree species, in right's-of-way and
conifer release management situations

COMMERCIAL

GUARANTEE: *Chondrostereum purpureum*
(strain HQ1)...min. of 10⁷ cfu/mL

READ THE LABEL BEFORE USING
KEEP OUT OF REACH OF CHILDREN
POTENTIAL SENSITIZER
CAUTION EYE IRRITANT

REGISTRATION NO. 27020
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À VENDRE / À UTILISER DANS LES RÉGIONS
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À L'EST DES ROCHEUSES

Inhibe la formation de rejets de souches
de certains feuillus dans les emprises et
les opérations de dégagement des conifères

COMMERCIAL

GARANTIE: *Chondrostereum purpureum*
(isolat HQ1)...min. of 10⁷ cfu/mL

LIRE L'ÉTIQUETTE AVANT L'EMPLOI
GARDER HORS DE LA PORTÉE DES ENFANTS
AGENT DE SENSIBILISATION POTENTIEL
IRRITANT POUR LES YEUX

NUMÉRO D'HOMOLOGATION : 27020
LOI SUR LES PRODUITS ANTIPARASITAIRES

Contenu net : 3 L

Utiliser dans les 3 mois de la fabrication



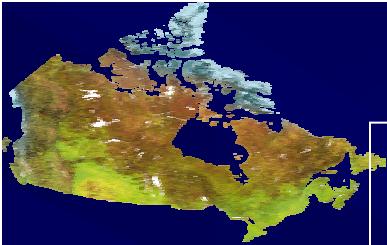
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Product Development

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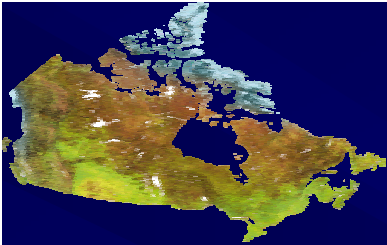
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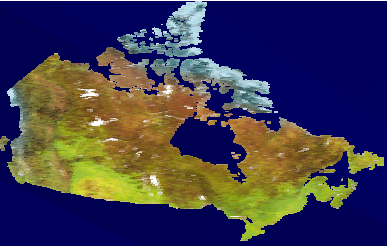
Biological Control of Weedy Shrub Species



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Biocontrol of *Rubus* spp.

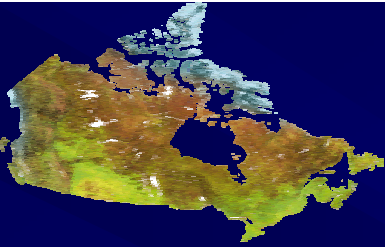


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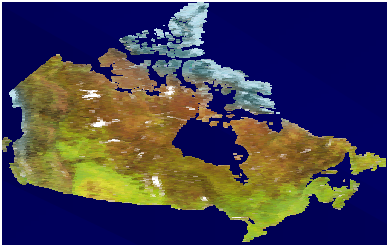
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Biocontrol of salmonberry with *Phoma argillacea*



- > 70% leaf necroses after 7 days
- Leaves dry, curled, brown, defoliates
- Damage extend to branches and stems
- Mycelia more infective than spores (100% vs 76%)





Biocontrol of salal (*Gaultheria shallon*)



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Biocontrol of salal (*Gaultheria shallon*) with *Phoma exigua*

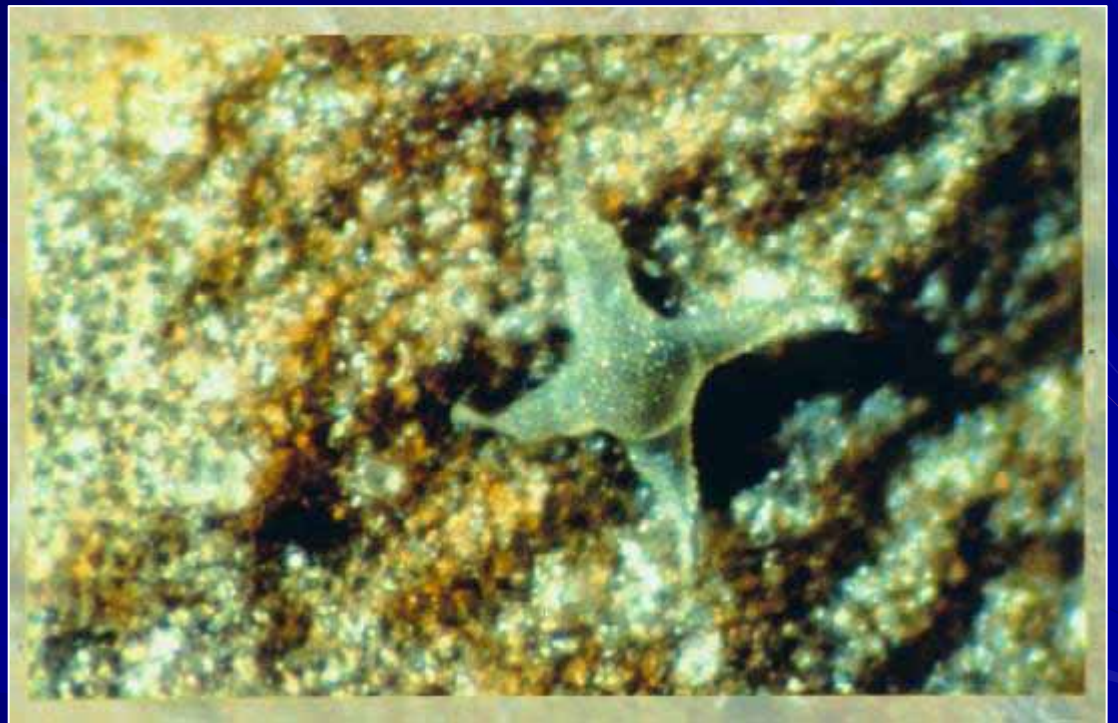


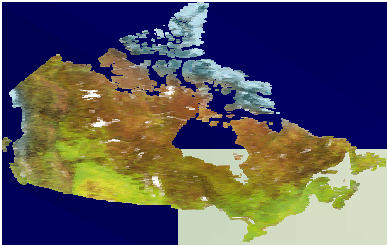
8 weeks after inoculation, newly growing shoots can be completely controlled



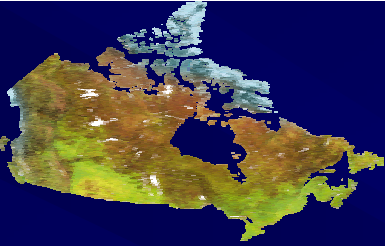


Biocontrol of salal (*Gaultheria shallon*) with *Valdensinia heterodoxa*





Shamoun and Vogelgsang, 2005. U.S. Patent 6,913,920 B2



Summary

- *Chondrostereum purpureum* treatment on red alder is as effective as chemical herbicides
- *C. purpureum* can be integrated with manual cutting operations and reduce reliance on chemical herbicides
- Commercialization of the first forest vegetation management product based on biocontrol agent *C. purpureum* as (Chontrol TM & Myco-Paste TM) for use in North America
- *Phoma argillacea* is a potential biocontrol agent for *Rubus spectabilis*
- *Phoma exigua* and *Valdensinia heterodoxa* are promising biocontrol agents for management of *Gaultheria shallon*



Thank you

