Friend or Foe in the Forest?

Andy MacKinnon
Metchosin, BC

Olympic's Worst Invasive Plants

Canada Thistle
(*Cirsium arvense*)

Himalayan Blackberry
(*Rubus armeniacus*)

Scotch Broom (*Cytisus scoparius*)

Olympic's Worst Invasive Plants

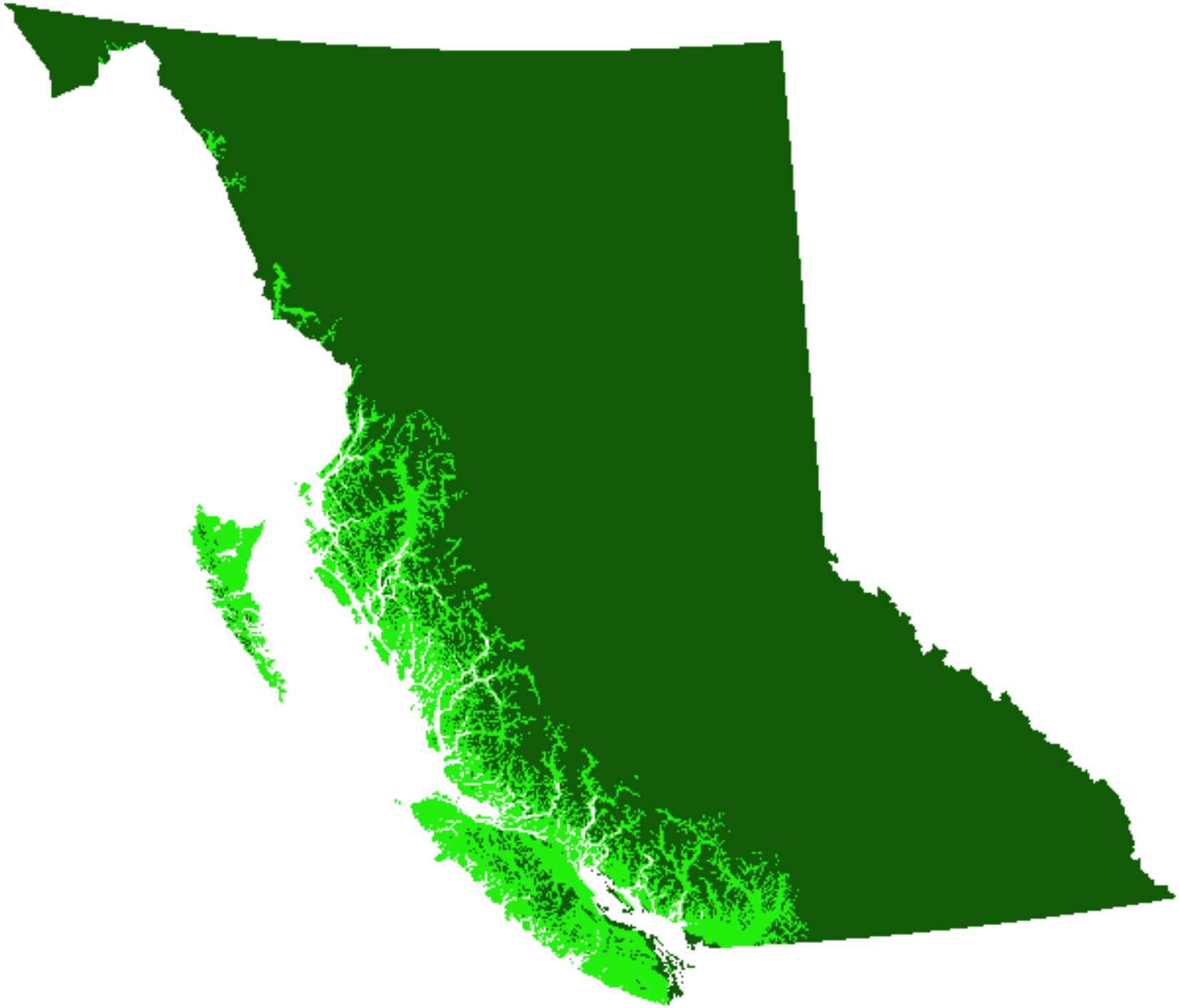
English Ivy
(*Hedera helix*)

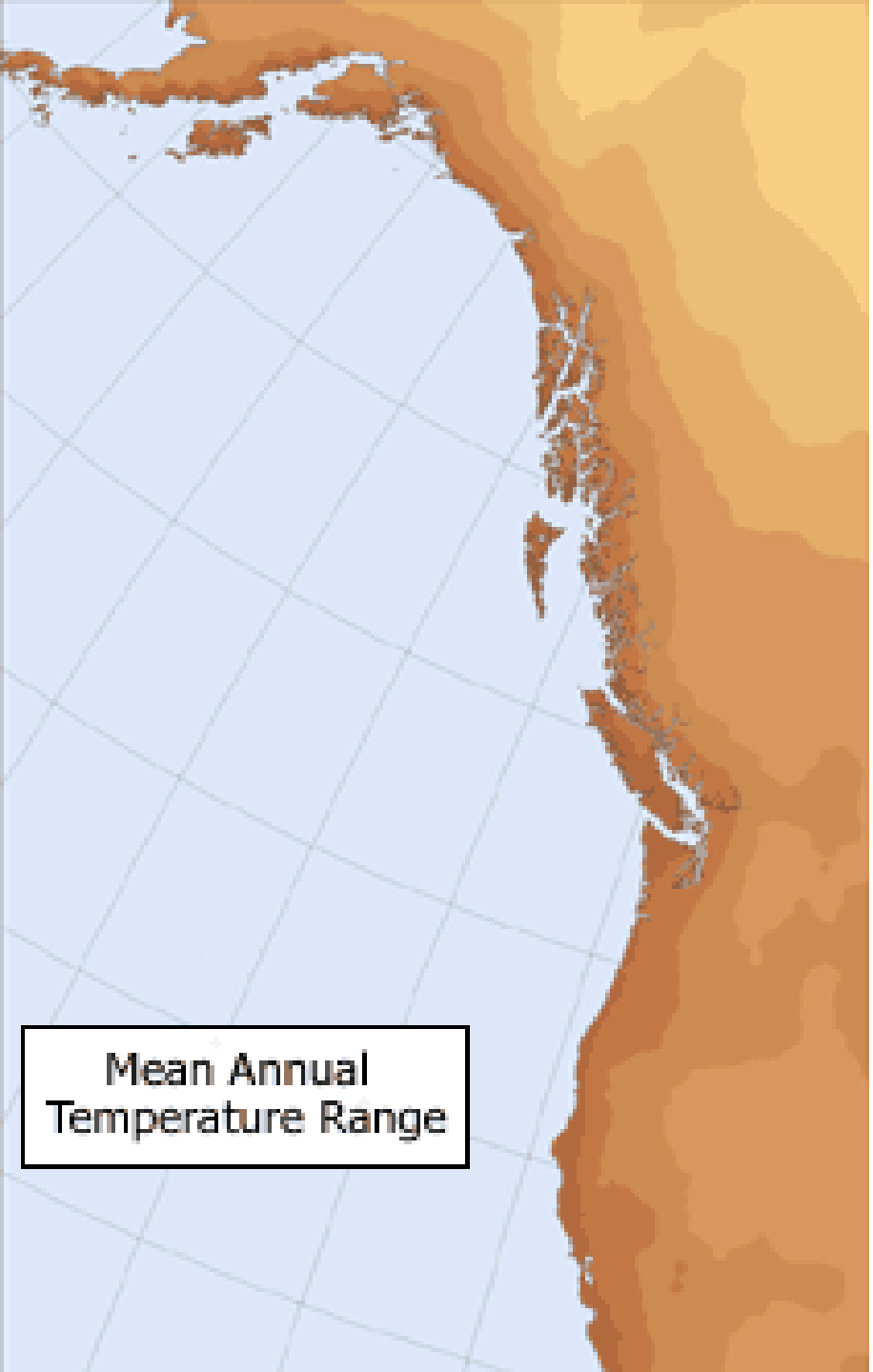
Herb Robert
(*Geranium robertianum*)

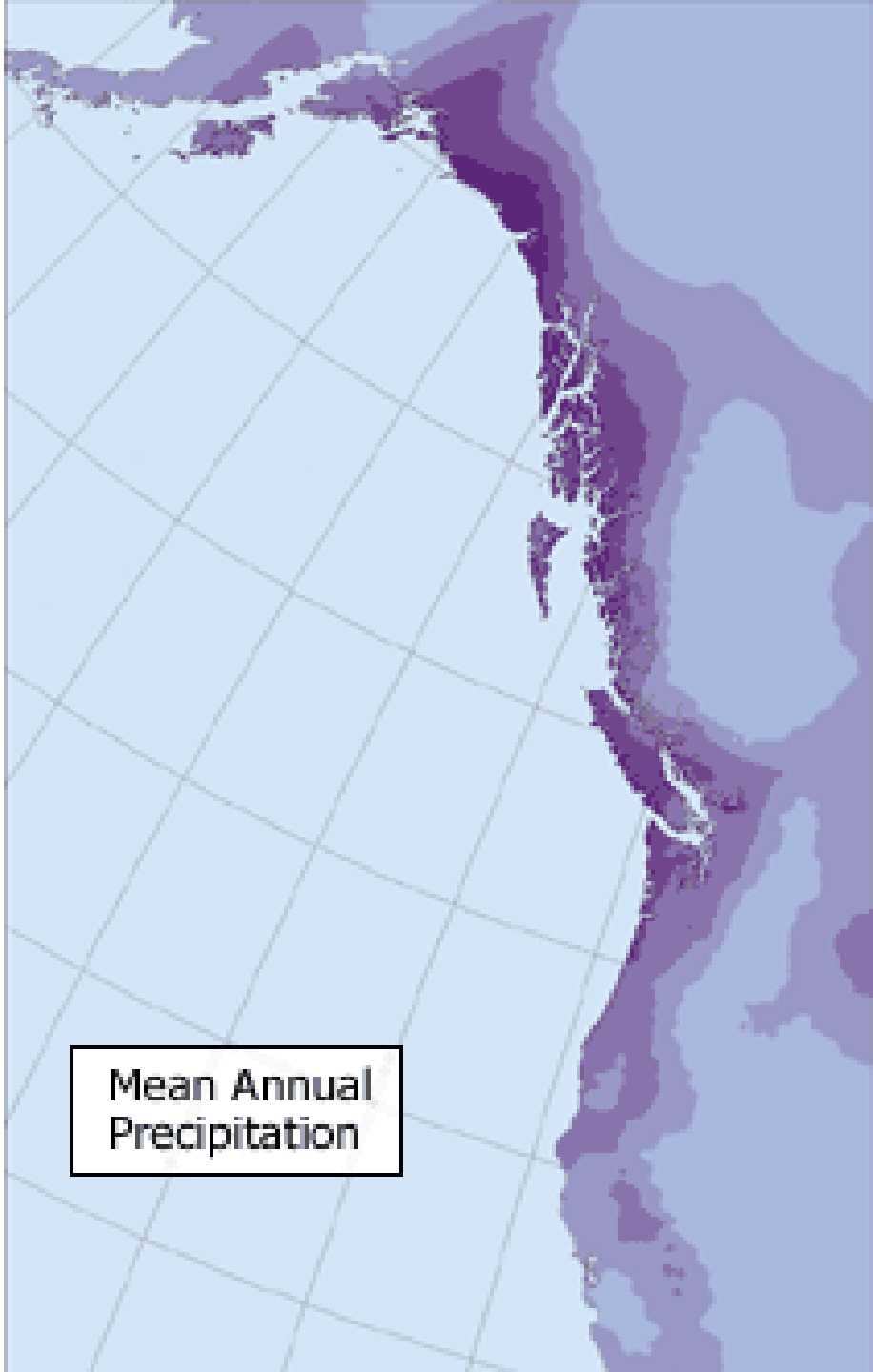
English Holly (*Ilex aquifolium*)

Japanese Knotweed (*Fallopia japonica*)


Vancouver
Nanaimo
Thetis Island
Gulf Islands
Chemainus
Duncan
Vancouver Island
Anacortes
San Juan Islands
Victoria
N
Port Angeles
Olympic Peninsula
Seattle
100 Km
Tacoma




Mean Annual
Temperature Range


Mean Annual
Precipitation

Very Low Frequency

Low Frequency High Severity

Mod. Frequency High Severity

Mixed Severity

High Frequency Low Severity

10 100 1000

Fire Interval (yrs)

2:00-3:30- Friend or Foe in the Forest Andy MacKinnon (British Columbia Forest Service, research ecologist, famed author, professor emeritus,). Invasive plants are not only found in agricultural areas, roadside or “waste areas”, but more and more they are found in our forests. What belongs, what doesn’t, how do invaders change the forest for the worst? Andy MacKinnon has spent over three decades working in B.C Forests and garnered a lot of information. Learn about forest ecosystem processes, what makes the forest resilient, and what makes it vulnerable to weed invasions. How do different management practices and patterns affect different species? What techniques provide the best result to prevent or circumvent weed competition? What natural processes can be used or mimicked to resist weed invasions and protect important natural resources?

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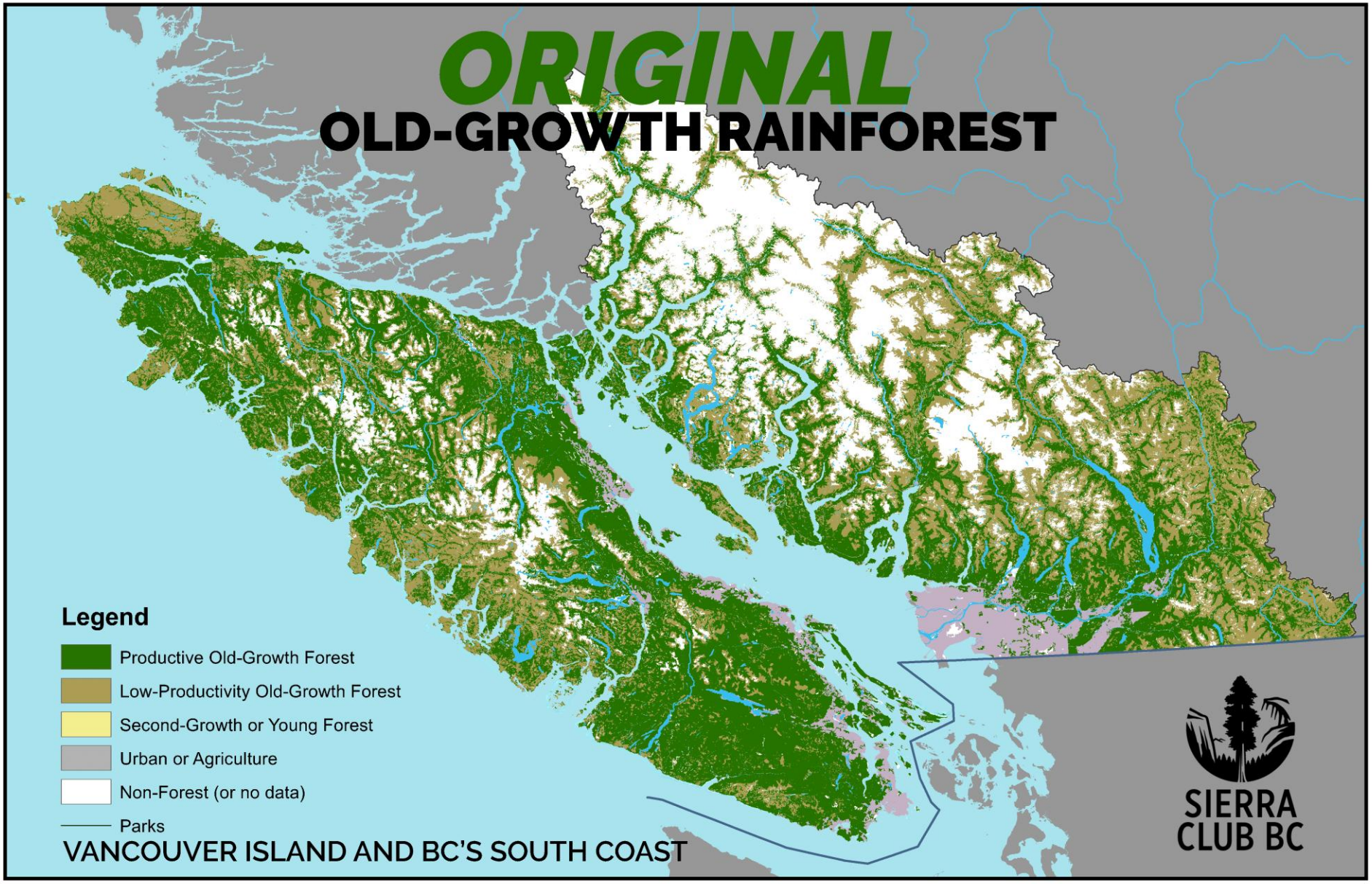
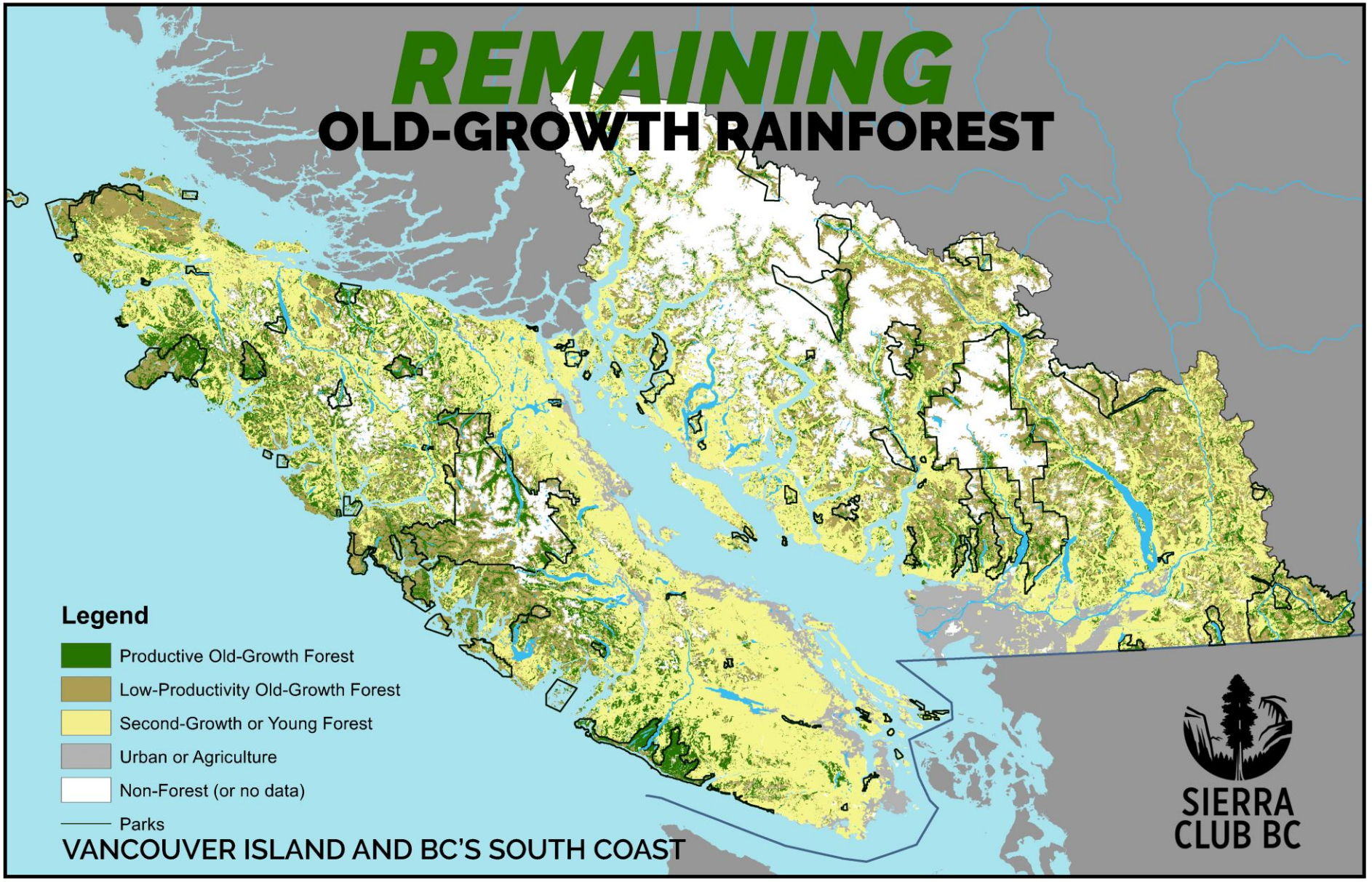
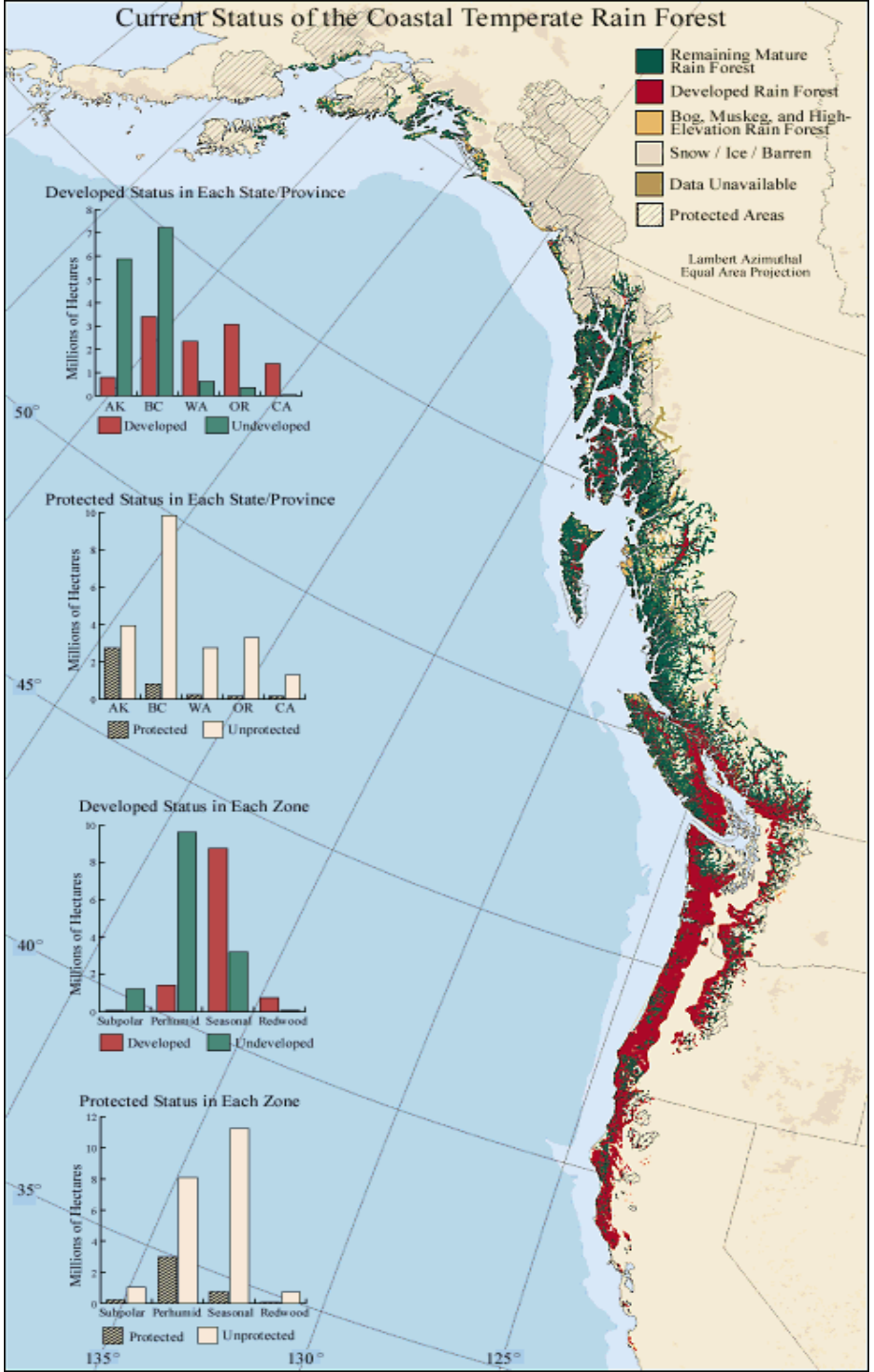

ORIGINAL
OLD-GROWTH RAINFOREST
Legend
Productive Old-Growth Forest
Low-Productivity Old-Growth Forest
Second-Growth or Young Forest
Urban or Agriculture
Non-Forest (or no data)
Parks
VANCOUVER ISLAND AND BC'S SOUTH COAST
SIERRA CLUB BC


REMAINING
OLD-GROWTH RAINFOREST
Legend
Productive Old-Growth Forest
Low-Productivity Old-Growth Forest
Second-Growth or Young Forest
Urban or Agriculture
Non-Forest (or no data)
Parks
VANCOUVER ISLAND AND BC'S SOUTH COAST
SIERRA CLUB BC

- about half of the world's coastal temperate rainforest is on western North America, and about half of that is in British Columbia
- as of 1995, 44% of North America's coastal temperate rainforest had been developed
- 16% of the coastal temperate rainforest had been protected – more in the north than in the south

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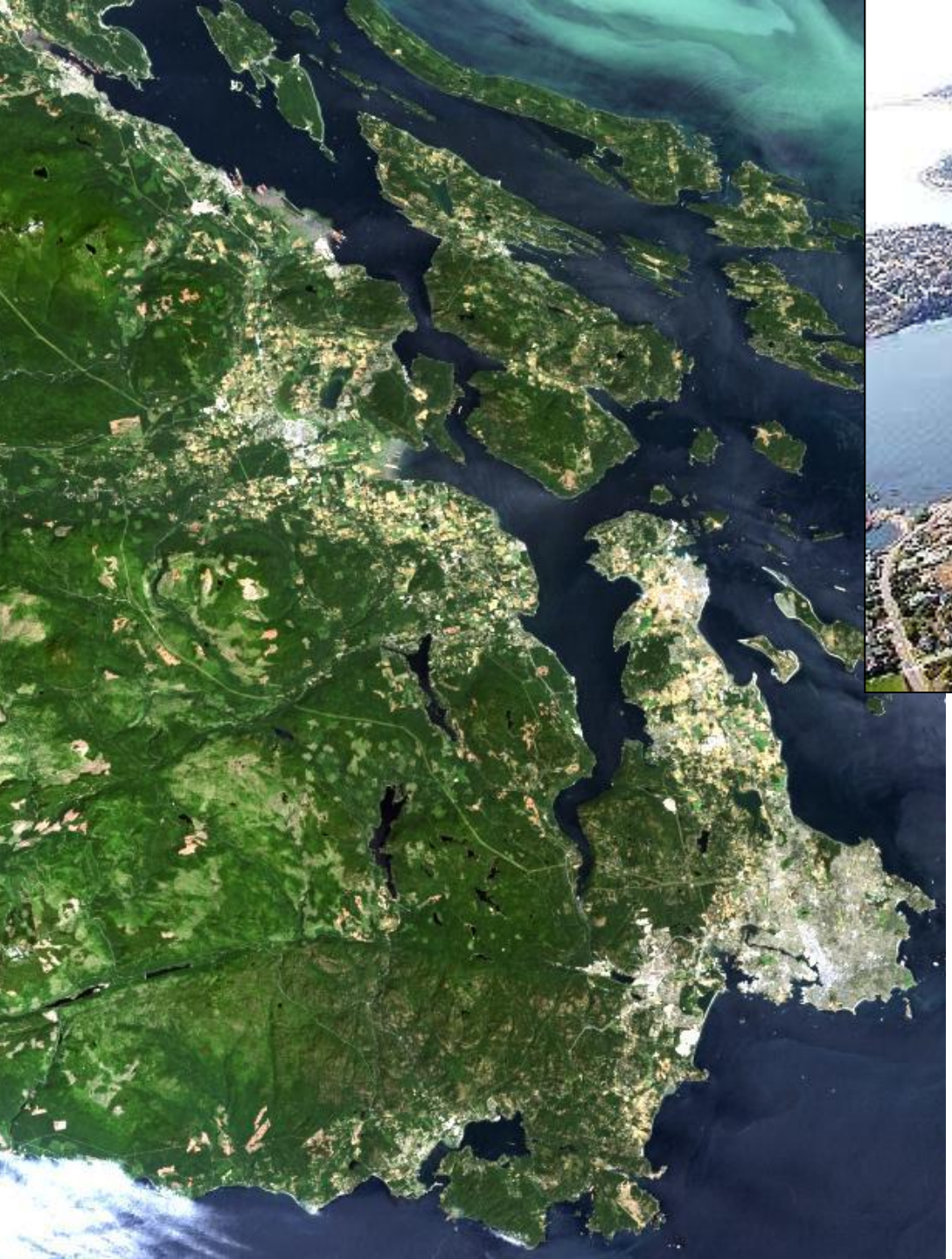

Consider Scotch Broom.

The Broom O' The Cowdenknowes
Traditional

CHORUS
Oh the broom, the bonnie, bonnie broom
The broom o' Cowdenknowes
Fain would I be in my ain country
Tendin' my father’s ewes

How blithe each morn was I tae see, My lass come o'er the hill
She tripped the burn and ran to me, I met her with good will **CHORUS**

She would oblige me every hour, Could I but faithful be?
She stole my heart, could I refuse, Whate'er she asked of me? **CHORUS**

Hard fate that I should banished be, Sae early in the morn
Because I lo'ed the fairest lass, That ever yet was born **CHORUS**

Fareweel, ye Cowdenknowes, fareweel, Fareweel all pleasures there
To roam again wi' my lass by my side, Is all I want or care **CHORUS**

Horn, K., I.M. Parker, W. Malek, S. Rodríguez-Echeverría, and M.A. Parker. 2014. Disparate origins of *Bradyrhizobium* symbionts for invasive populations of *Cytisus scoparius* (Leguminosae) in North America. FEMS Microbial Ecology 89(1): 89 – 98.

… [*Bradyrhizobium*] bacteria ancestrally associated with other North American legumes have evolved to utilize *C. scoparius*, by acquiring SI-region genes from European *C. scoparius* symbionts.

Rostgaard, N.L., U. Brandes, E. Dahl Kjaer, and S. Fjellheim. 2016. Introduced Scotch broom (*Cytisus scoparius*) invades the genome of native populations in vulnerable heathland habitats." Molecular Ecology 25(12): 2790-2804.

Analyses of population structures confirmed the presence of two gene pools: one native and the other invasive. The nuclear genome of the native types was highly introgressed with the invasive genome, and we observed advanced-generation hybrids, suggesting that hybridization has been occurring for several generations. There is asymmetrical gene flow from the invasive to the native gene pool, which can be attributed to higher fecundity in the invasive individuals, measured by the number of flowers and seed pods. … We further show that the growth habits of heathland plants become more vigorous with increased introgression from the invaders.

Grove, S., I.M. Parker, and K.A. Haubensak. 2015. Persistence of a soil legacy following removal of a nitrogen-fixing invader. Biological Invasions 17(9): 2621–2631.

Here we evaluate the persistence of soil legacy effects following the death of *Cytisus scoparius*, an invasive nitrogen-fixer. … One month after *C. scoparius* removal, there was a soil legacy effect in the form of a large initial pulse of inorganic N, presumably as a result of rapid decomposition of N-rich *C. scoparius* biomass. In the 10-month removal plots, this initial pulse of N had declined dramatically and was 70% less than the invaded state. However, over the following year, there was little additional decline of N. … Rather than providing a lasting positive fertilization effect on native vegetation, our results suggest that increased N availability instead favors the invasion of fast-growing, nitrophyllic exotic grasses and forbs, and that these species limit colonization and growth of native vegetation including the locally dominant tree Douglas-fir.

Grove, S., I.M. Parker, and K.A. Haubensak. 2012. Direct and indirect effects of allelopathy in the soil legacy of an exotic plant invasion. Plant Ecology 213 (12): 1869–1882.

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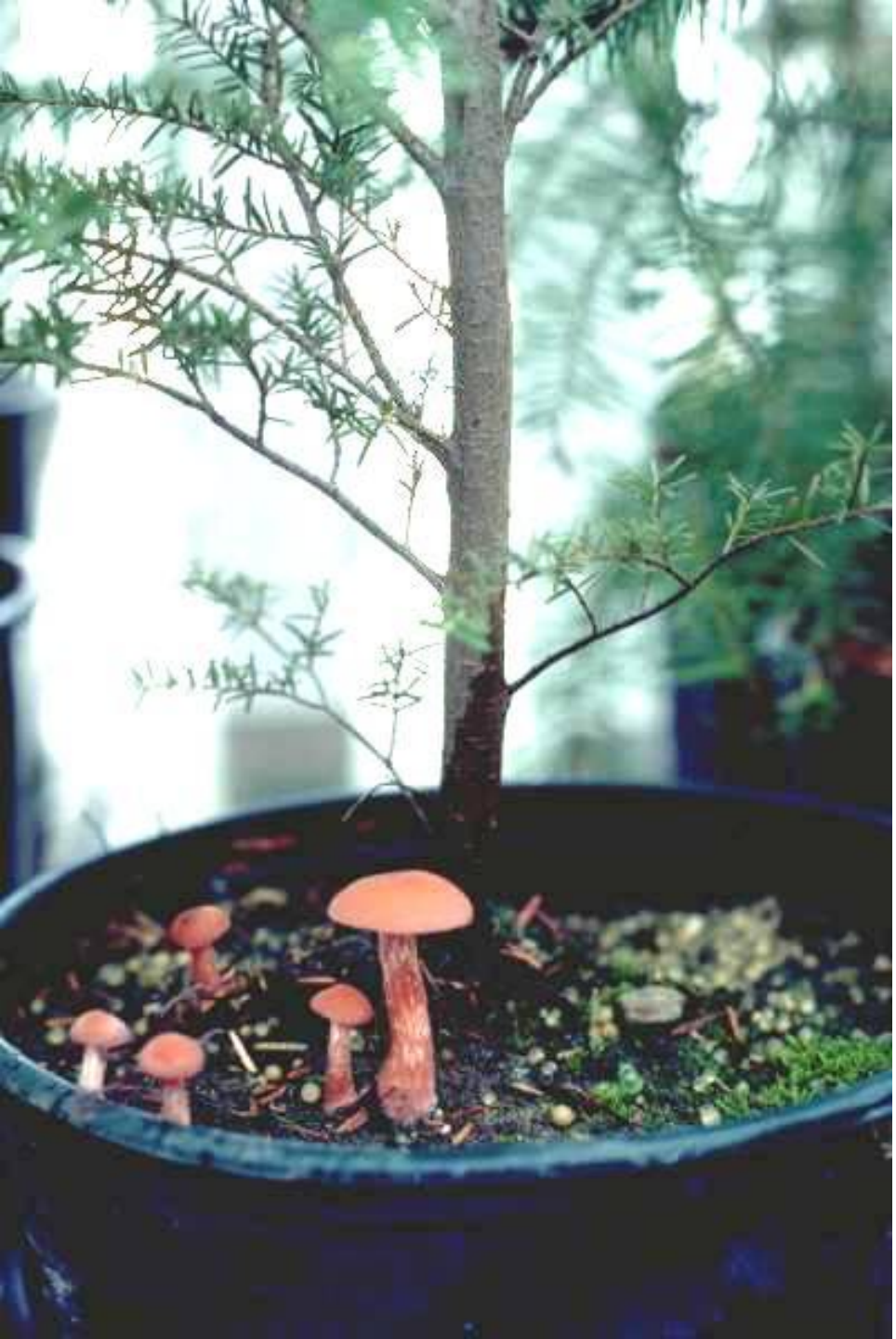
Invasive species may leave behind legacies that persist even after removal, inhibiting subsequent restoration efforts. We examined the soil legacy of *Cytisus scoparius*, a nitrogen-fixing, putatively allelopathic shrub invading the western US. We tested the hypothesis that allelopathy plays a critical role in the depressive effect of *Cytisus* on the key native Douglas-fir, both directly on tree growth and indirectly via effects on its ectomycorrhizal fungi (EMF). … These results together suggest an overall negative effect of Cytisus on the growth of a dominant native tree and its fungal symbionts. Our study suggests how the role of allelopathy in ecological restoration may play out on two time scales: through immediate, direct impacts on native plants as well as through long-term, persistent impacts mediated by the collapse or transformation of microbial communities

Grove, S., I.M. Parker, and K.A. Haubensak. 2011. Soil legacy effects of Scotch broom invasion on Douglas-fir mycorrhizae. Conference Paper, 96th ESA Annual Convention.

… Exotic invasive plants that have not coevolved with the mycorrhizal species in the introduced environment may decrease the abundance and richness of the native mycorrhizal fungi. After two consecutive years of wholesale failure of Douglas-fir (DF) reforestation efforts in Scotch broom invaded sites in western Washington, we conducted a series of greenhouse experiments to better understand the mechanisms responsible for the astounding seedling mortality within these invaded sites. … We found that DF seedlings grown in broom-invaded forest soils had lower rates of ectomycorrhizal colonization than seedlings grown in soils not invaded by Scotch broom and that the EMF communities were different. We also found that DF growth was strongly and positively correlated with the degree of EMF colonization.

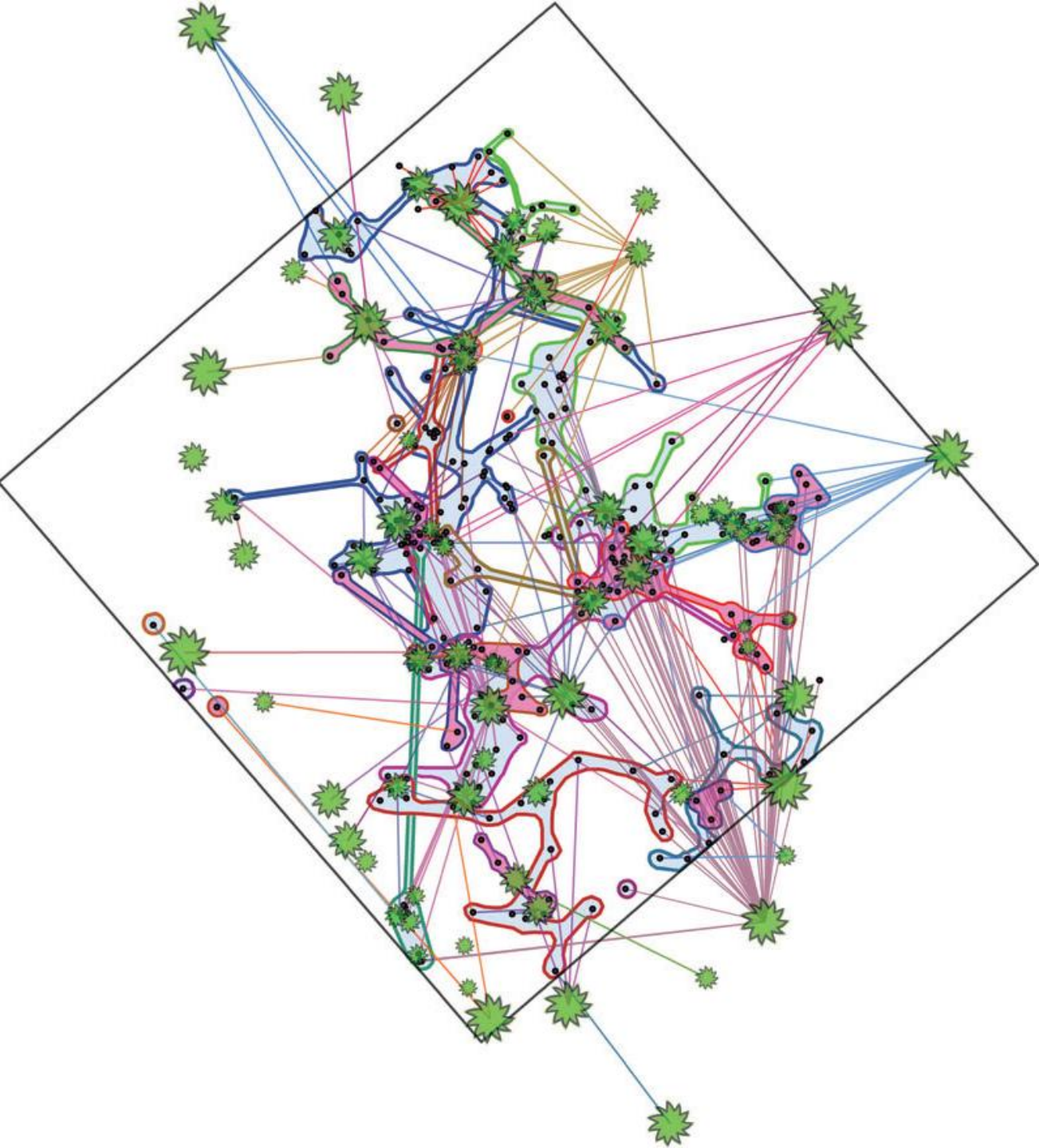


ectomycorrhizae

VA (endo-) mycorrhizae

ericoid mycorrhizae

salal



Rhizopogon vinicolor

broad-leaved helleborine (*Epipactis helleborine*)

- Usually mixotrophic, but …
- Fungal associates: *Pyronemataceae, Sebacina, Tomentella, Tuber*

Tuber oregonense

Candystick (*Allotropa virgata*)

- Mycoheterotrophic
- Fungal associate: pine mushroom (*Tricholoma magnivelare*)

Indian-pipe (*Monotropa uniflora*)

- Mycoheterotrophic
- Fungal associate: Russulaceae, often short-stemmed Russula (*Russula brevipes)*


Death Cap
(Amanita phalloides)

B.C.'s Great Bear Rainforest

A Global Treasure

Logged Areas / Second Growth

Remaining Ancient Forest

Protected from Logging
(2 million hectares in Conservancies and Biodiversity Areas on the Central and North Coast)

Ecosystem Based Management
(A new approach to more sustainable, lighter touch forestry.)

SIERRA CLUB BC

GREENPEACE

FORESTETHICS

- about half of the world's coastal temperate rainforest is on western North America, and about half of that is in British Columbia
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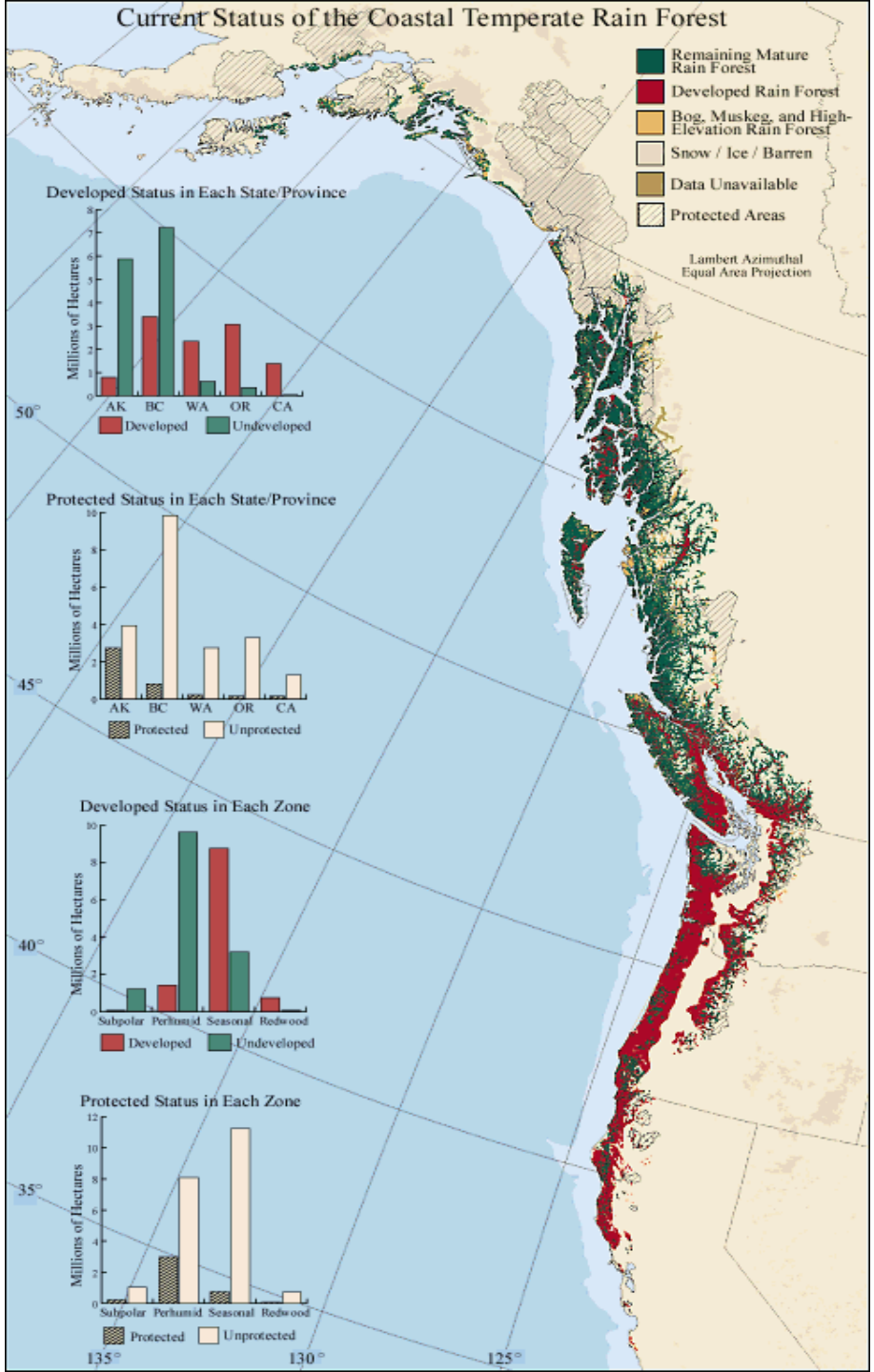
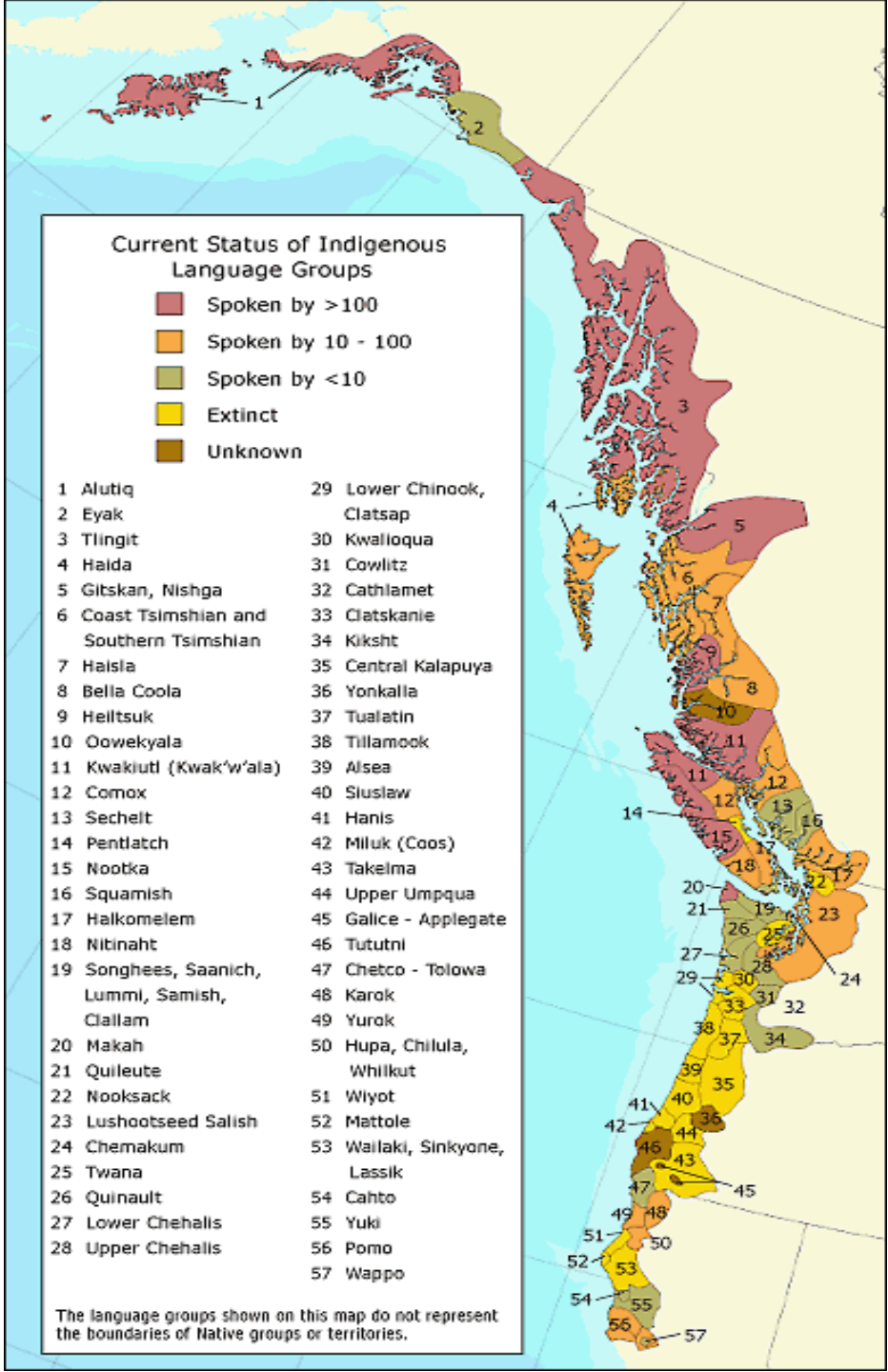


- at European contact, 68 distinct languages were spoken by peoples living between the Kodiak Archipelago of Alaska and San Francisco Bay

- today, 26 of these languages are extinct, 18 are spoken by <10, 12 are spoken by 10-100, 8 spoken by >100, and 4 status



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GREENPEACE

FORESTETHICS

Haida Gwaii, Great Bear Rainforest, and Clayoquot Sound Land Use Plans

- Government-to-government
- Informed by Science Panels
- 35-75% protected areas
- Ecosystem-Based Management outside of PAs


and make it right
BRITISH COLUMBIA
The Great Bear Rainforest is one of the
world's largest coastal temperate rainfore
British Columbia's gift to the Commonwe
was officially dedicated to
The Queen's Commonwealth Canop
on September 26, 2016 by
TRH The Duke and Duchess of Camb
Premier Christy Clark, Dallas Smi
President, Nanwakolas Council a
Chief Marilyn Slett, President,
Coastal First Nations.
The dedication was made possib
with the efforts of Great Bear
Initiative - Coastal First Nations
Nanwakolas Council, Stand,
Greenpeace, Sierra Club BC,
Catalyst Paper, Interfor,
BC Timber Sales, Howe Sound
Pulp & Paper and
Western Forest Products.
www.queenscommonwealthcanopy.or
ARC'TERYX

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Andy's "techniques provid[ing] the best result to prevent or circumvent weed competition"

Andy's "techniques provid[ing] the best result to prevent or circumvent weed competition"

1. Relax. Breathe deeply. Have fun.

Andy's "techniques provid[ing] the best result to prevent or circumvent weed competition"

2. Avoid screwing things up in the first place.

Andy's "techniques provid[ing] the best result to prevent or circumvent weed competition"

3. If it's too late for #2 … i.e., you've already screwed it up … begin the restoration process. (And no, you can't "restore" it.)


STANLEY PARK
25 years
ECOLOGY SOCIETY
Connecting people with nature since 1988

Andy's "techniques provid[ing] the best result to prevent or circumvent weed competition"

5. Clip, pull, spray. Set goals, document, monitor.

Andy's "techniques provid[ing] the best result to prevent or circumvent weed competition"

6. Celebrate your successes.

Andy's "techniques provid[ing] the best result to prevent or circumvent weed competition"

7. Collaborate.


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isc
Invasive Species Council of British Columbia
WASHINGTON STATE RECREATION AND CONSERVATION OFFICE
Washington Invasive Species Council

Andy's "techniques provid[ing] the best result to prevent or circumvent weed competition"

7. Relax. Breathe deeply. Repeat.