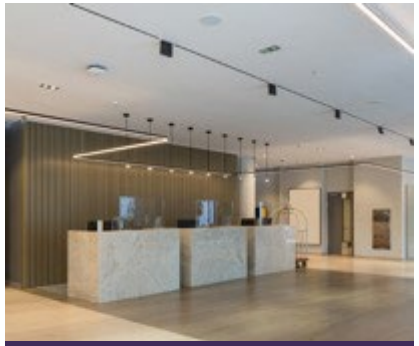
New Company from October 2022

envu™ Forestry

Same people and same products as Bayer Environmental Science

Envu Business Segments



Professional Pest Mgmt.

Industrial Vegetation Mgmt.

Range & Pasture

Forestry

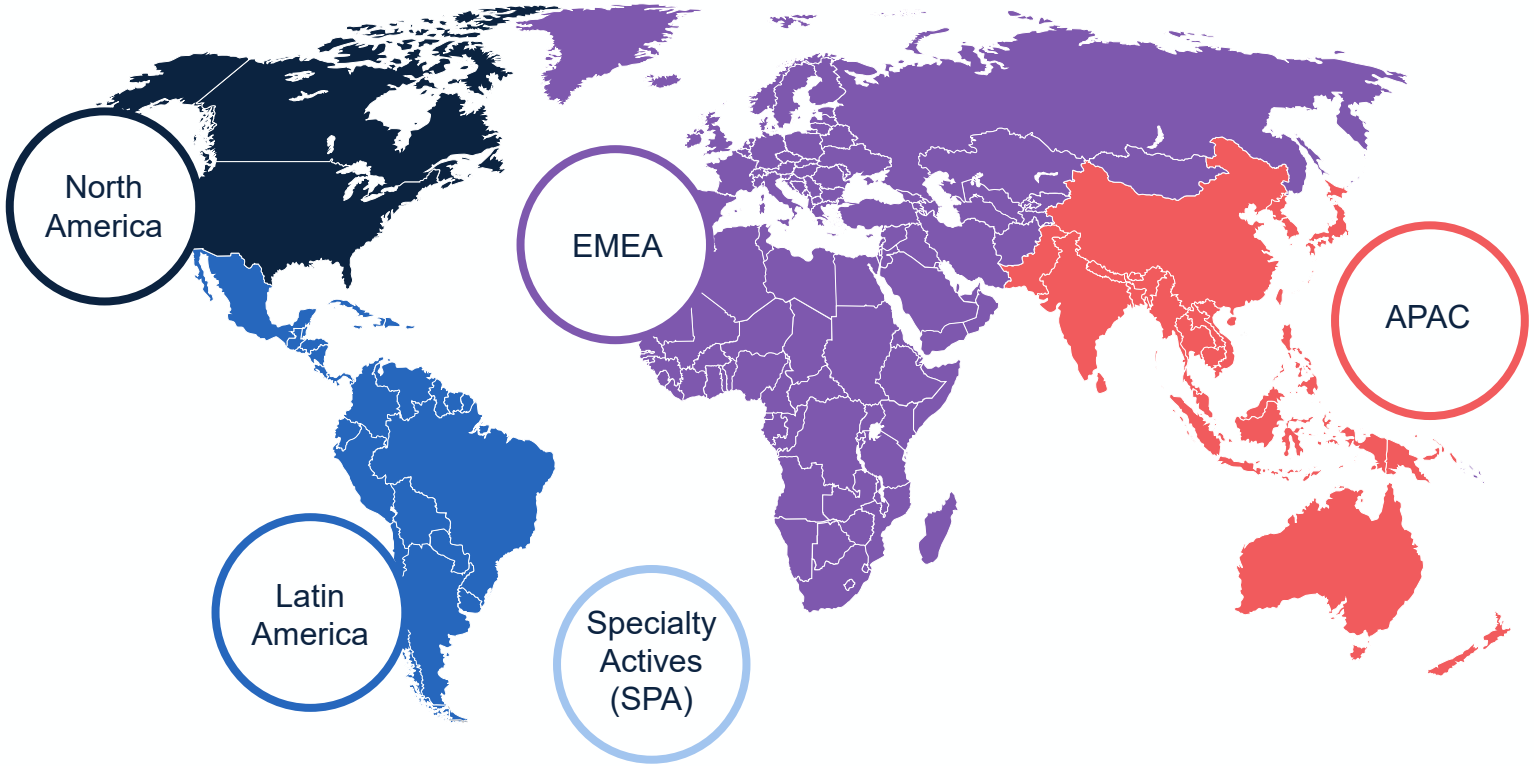
Mosquito Management

Lawn & Landscape

Ornamentals

Golf

Global Operations



Commercial Operations AMERICAS

Commercial Operations EMEA/APAC

Envu key figures

2022

INNOVATION
4 main R&D hubs
around the world

EMPLOYEES
+900 FTEs

GLOBAL PRESENCE
Operations and Sales
in more than 100 countries

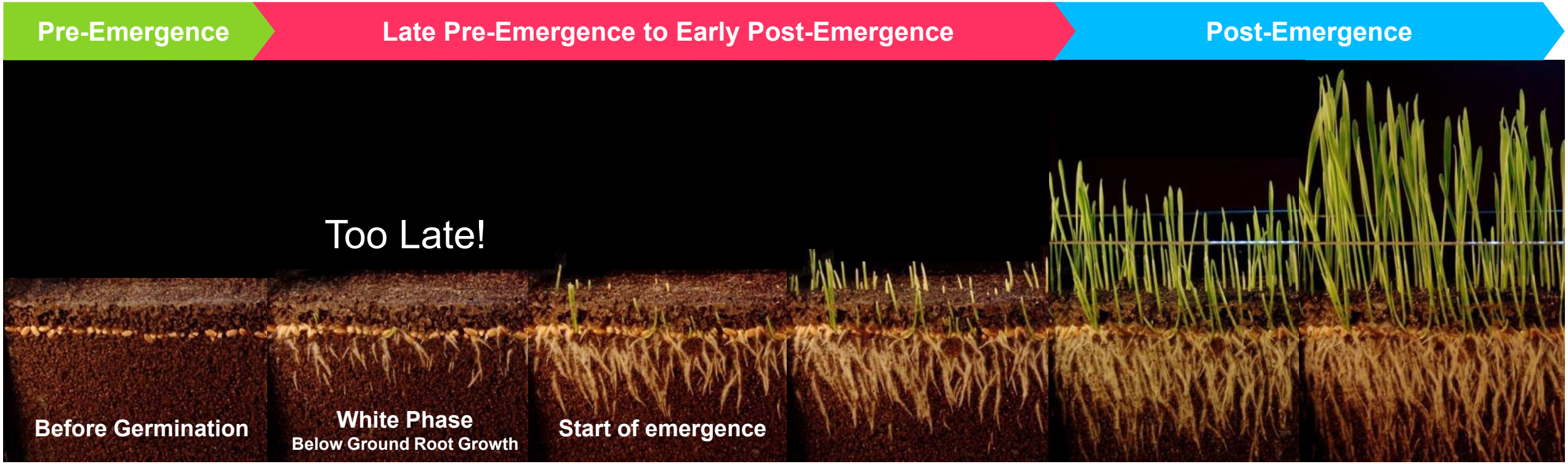
Efficient Establishment: Stopping Weeds Before They Emerge

PNW Forest Vegetation Management Conference
December 2022
Harry Quicke and Jerry Ellis

What is needed to stop weeds before they emerge?

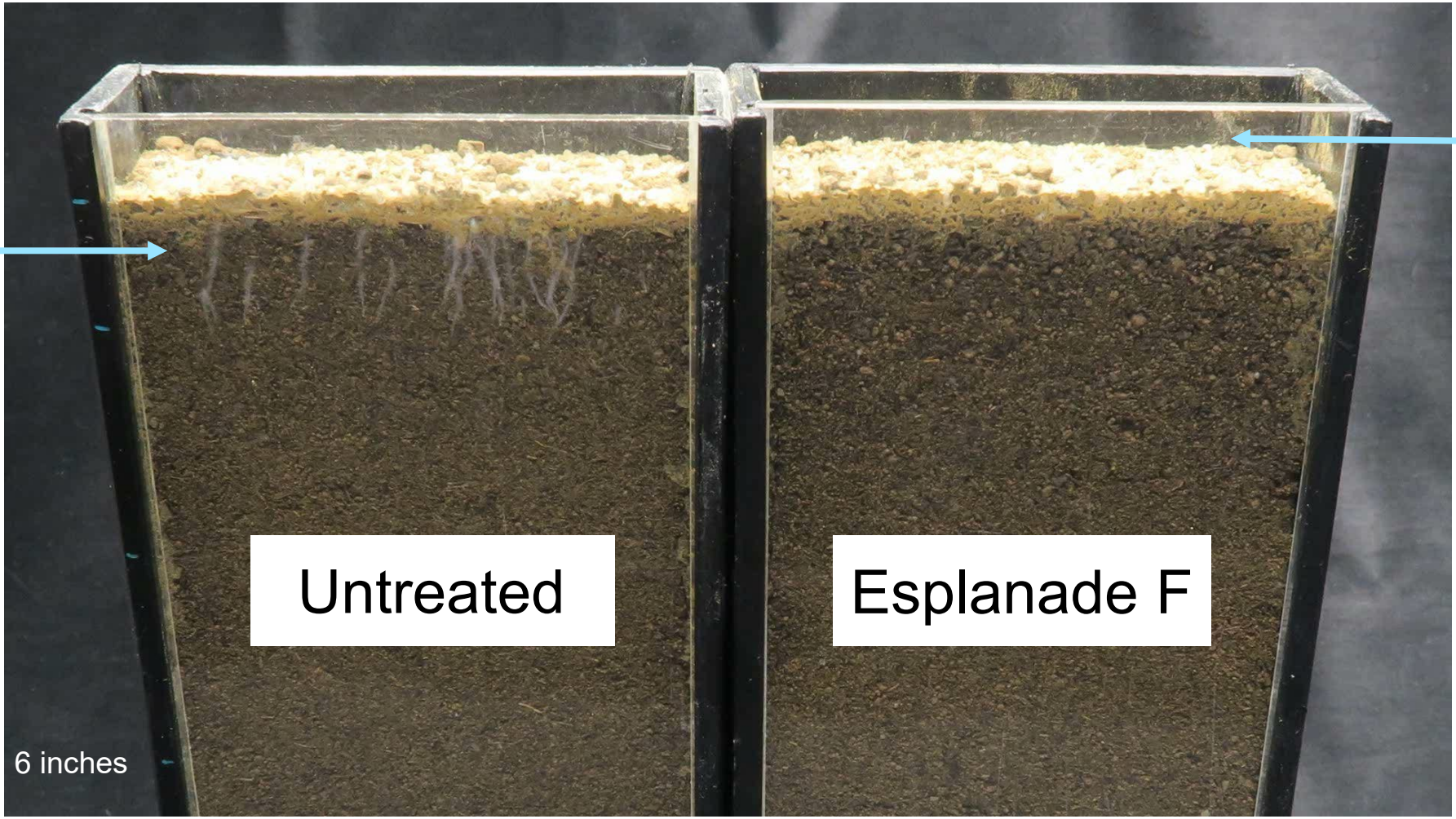
A pre-ergence herbicide to target the soil seed bank

Esplanade F is a pre-emergence herbicide

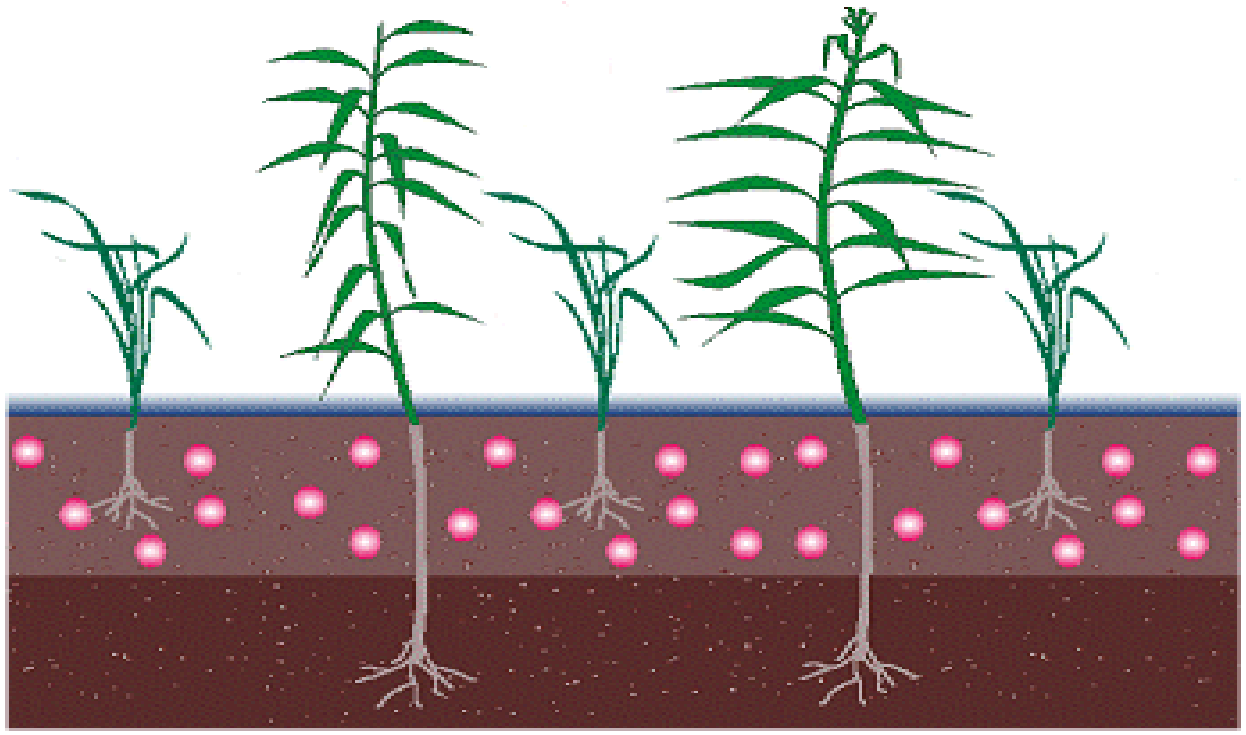


Needs to be activated by rainfall at this stage.
Tank mix partners are needed to control weeds at later stages.

Cheatgrass time lapse video spanning 10 days



Does not impact conifer root growth



Herbicide stays in top layer
– roots of germinating weeds contact the herbicide
– root growth stops

No herbicide below
– tree roots do not contact herbicide


Crop Tolerance Tests
Ponderosa pine
Pinus ponderosa
Douglas-fir
Pseudotsuga menziesii
Incense cedar
Calocedrus decurrens

Esplanade F

Advantages

Extended residual weed control

- Herbaceous weed control into the second year after treatment

Low use rate (7 oz/A)

Low volatility and low photodegradation

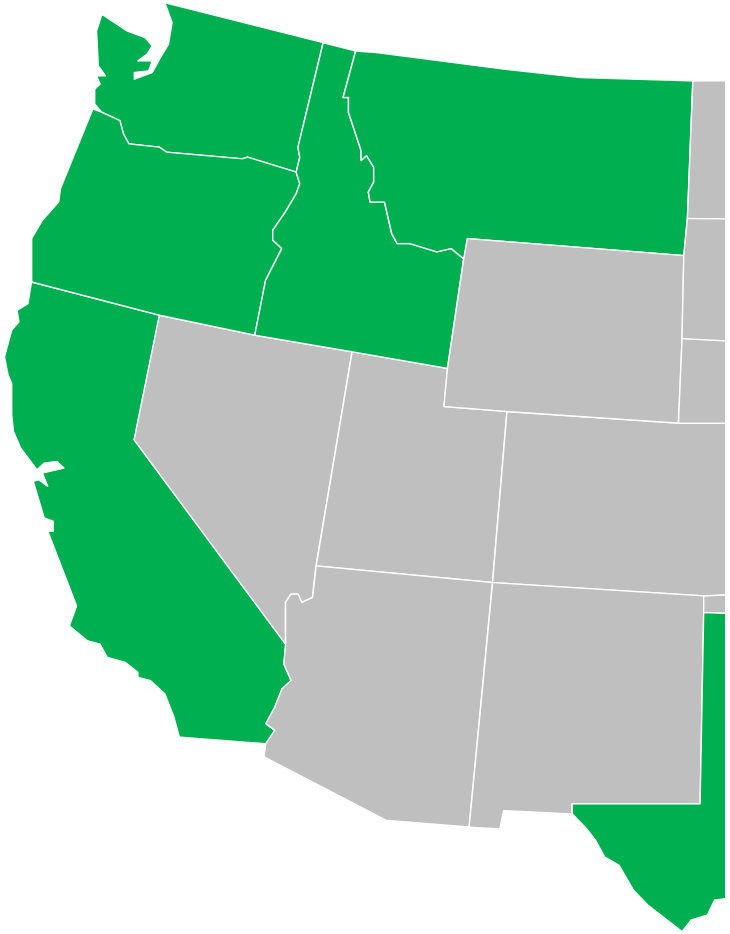
- Herbicide waits on soil surface until activated by precipitation

Low water solubility and tight binding to soil

- Herbicide stays near the soil surface where it continues to inhibit germination

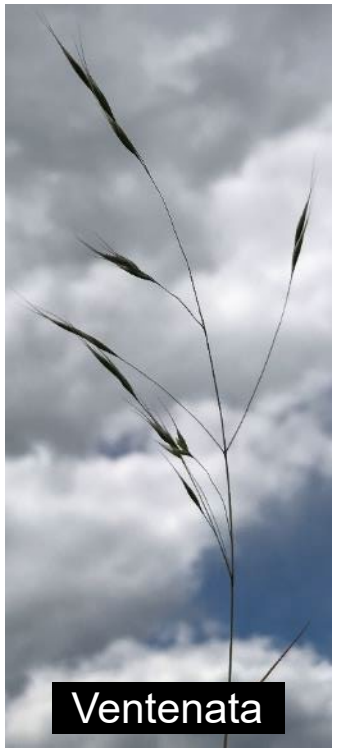
Pre-emergence control of annual grasses and many broadleaf weeds

Western State Registrations



Multi-year control of invasive annual grasses

- Cheatgrass / downy brome *(Bromus tectorum)*
- Cheat *(Bromus secalinus)*
- Medusahead *(Taeniatherum caput-medusae)*
- Ventenata *(Ventenata dubia)*
- Jointed goatgrass *(Egilops cylindrica)*



Impact of annual grass on fire behavior

Graduate student project at University of Idaho

Burn experiments were conducted with *Bromus tectorum* (invasive annual grass) and two native perennial bunchgrasses (Bluebunch wheatgrass and Columbia needlegrass) across a range of typical fire season fuel moistures (5-55%).

Burned 20 g of perennial grass with 2.5, 5, 10, and 15 g of cheatgrass.

Flammability was assessed by recording temperature, flame length, and mass consumption throughout each burn.

Annual grass sustained high ignitability and mass consumption even at the highest moisture levels

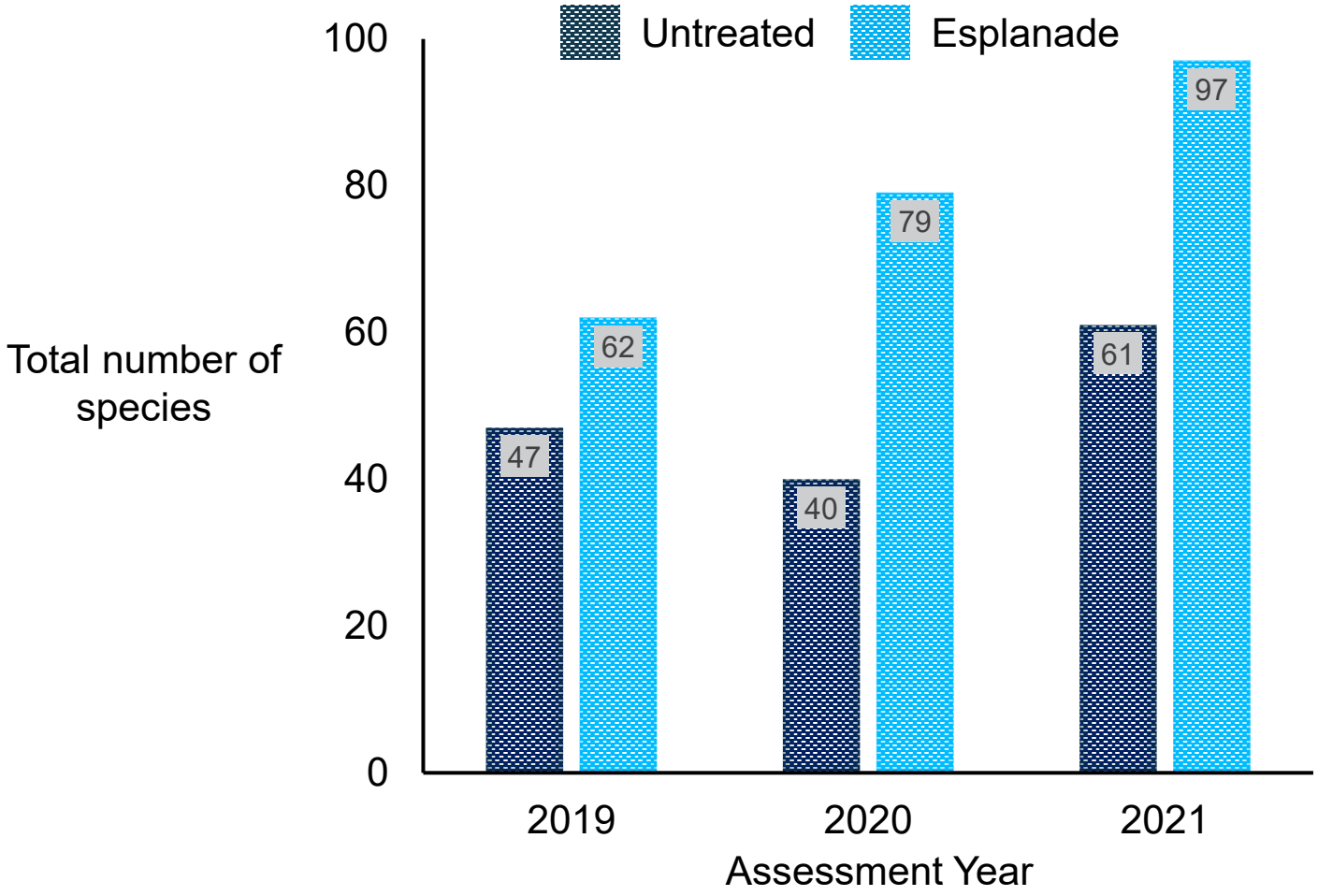
Suggests increased ignitability and spread even before senescence

Even small amounts of annual grass mixed with perennial grass increased flaming duration, maximum temperature, and mass consumption

Impact of Esplanade on Species Diversity

Environmental Stewardship

- Esplanade F controls weeds during the critical early years after planting
- A diversity of species can recolonize in later years



Evaluation of 12 rangeland sites in Colorado

Treatment Year	Number of sites
2016	3
2018	7
2019	2

Impact of Esplanade on Small Mammals

Collaborative project with Boulder County and Cedar Creek Associates


SW W NW N
0 240 270 300 330 0 30
305°NW (T) LAT: 40.181283 LON: -105.259309 ±4m ▲1767m
BOLO-Trevorton
7/20/22
Sherman +
Tomahawk
Sherman / Tomahawk
Boulder County
30 Jul 2022, 07:31:25

	Rabbit Mtn (6/22-6/24)		Trevaton (7/29-7/31)		Hall Ranch (8/25-8/27)	
	Treated	Untreated	Treated	Untreated	Treated	Untreated
Deer mouse	3	2	2	3	2	6
Hispid pocket mouse	1	-	1	1	-	-
Long-tailed vole	1	-	-	-	-	-
Mexican woodrat	1	-	5	5	-	-
Olive-backed pocket mouse	-	-	2	-	-	-
Species Diversity (# of species)	4	1	4	3	1	1
Total Captures	6	2	10	9	2	6

Untreated sites did not have annual grass invasion
Trial was to determine if Esplanade treatment had a negative impact

Impact of Esplanade on Soil Crusts

RESTORATION ECOLOGY
The Journal of the Society for Ecological Restoration

SER SOCIETY FOR ECOLOGICAL RESTORATION

RESEARCH ARTICLE

THEMATIC SERIES *Arid Lands*

No evidence of three herbicides and one surfactant impacting biological soil crusts

Mandy L. Slate[1,2,3], Rebecca A. Durham[1], Chuck Casper[1], Daniel Mummey[1], Philip Ramsey[1], Dean E. Pearson[4,5]

Land managers rely heavily on herbicides to mitigate exotic plant invasions but the nontarget effects of herbicides on treated plant, animal, and soil communities are often overlooked. Biological soil crusts (biocrusts) are important components of ecosystems yet the effects of different herbicides on biocrusts are rarely considered. We tested the impact of three widely used herbicides, indaziflam, imazapic, aminocyclopyrachlor, and chlorsulfuron, two of which were applied with or without a surfactant, on biocrusts dominated by mosses or lichens in intermountain grasslands. We found that neither the herbicides nor surfactant impacted biocrust moss or lichen cover within 2 years of their application.

Key words: aminocyclopyrachlor and chlorsulfuron, biocrusts, herbicide, imazapic, indaziflam, surfactant

Esplanade F

Group 29 herbicide

- Cellulose biosynthesis inhibitor

Not on FSC list of Highly Hazardous Pesticides

Labeled Personal Protective Equipment*

- Long sleeved shirt and long pants
- Shoes plus socks
- Waterproof gloves

* Follow state regulations if different from the label

Because Esplanade provides extended control of emerging weeds there are opportunities to transition to a one-pass fall site preparation program

One Pass Vegetation Control

Cascades, OR

One pass vegetation control prescription
Cascades Ecoregion, OR

Prescription based on replicated trials established on 5 sites

- 7 oz Esplanade F
- 1.5 lb Velpar DF
- 4 oz Oust Extra
- 3 qt Accord

Applied in September

Coast Range example demonstrating the value of long-term pre-emergence control

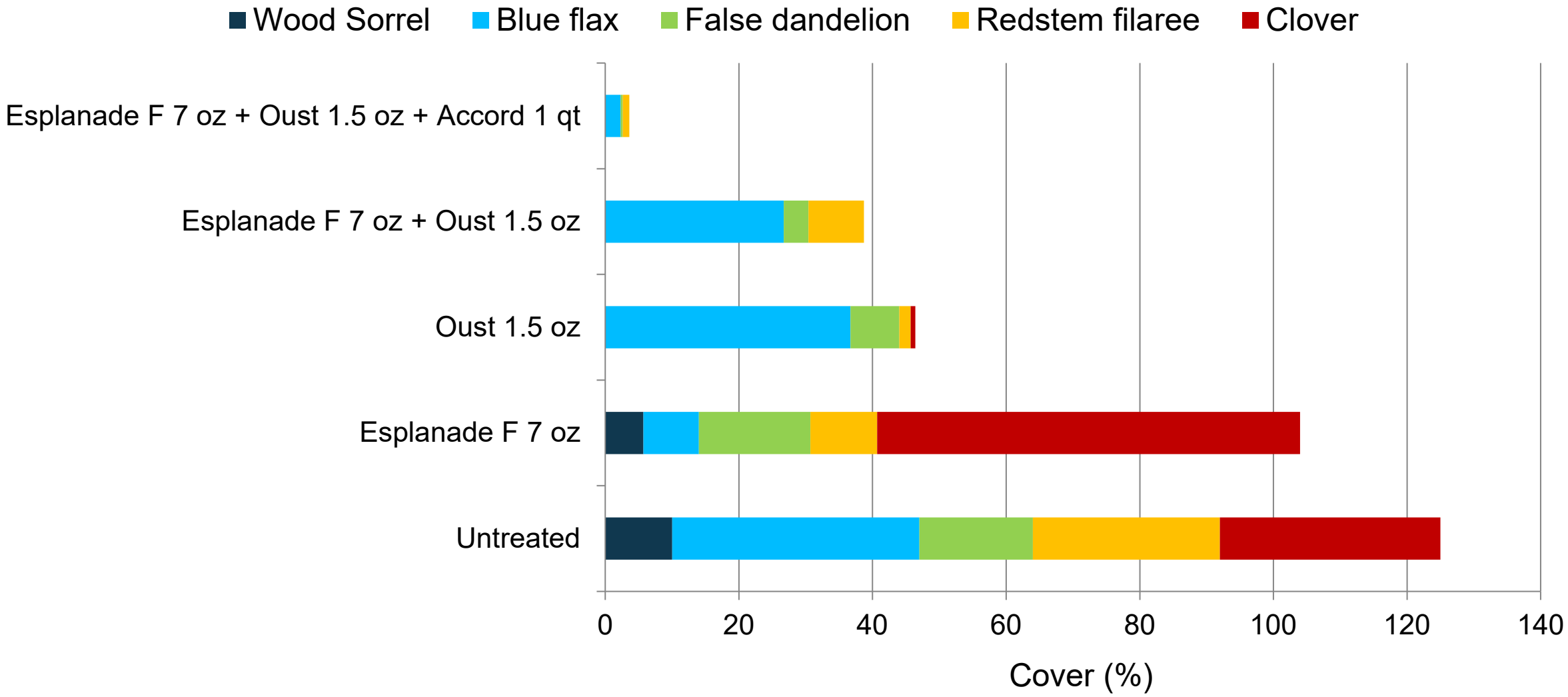
Herbaceous Release Coast Range

Coast redwood

Planted: 2019 February
Applied: 2019 February (day of planting)
Assessed: 2019 July

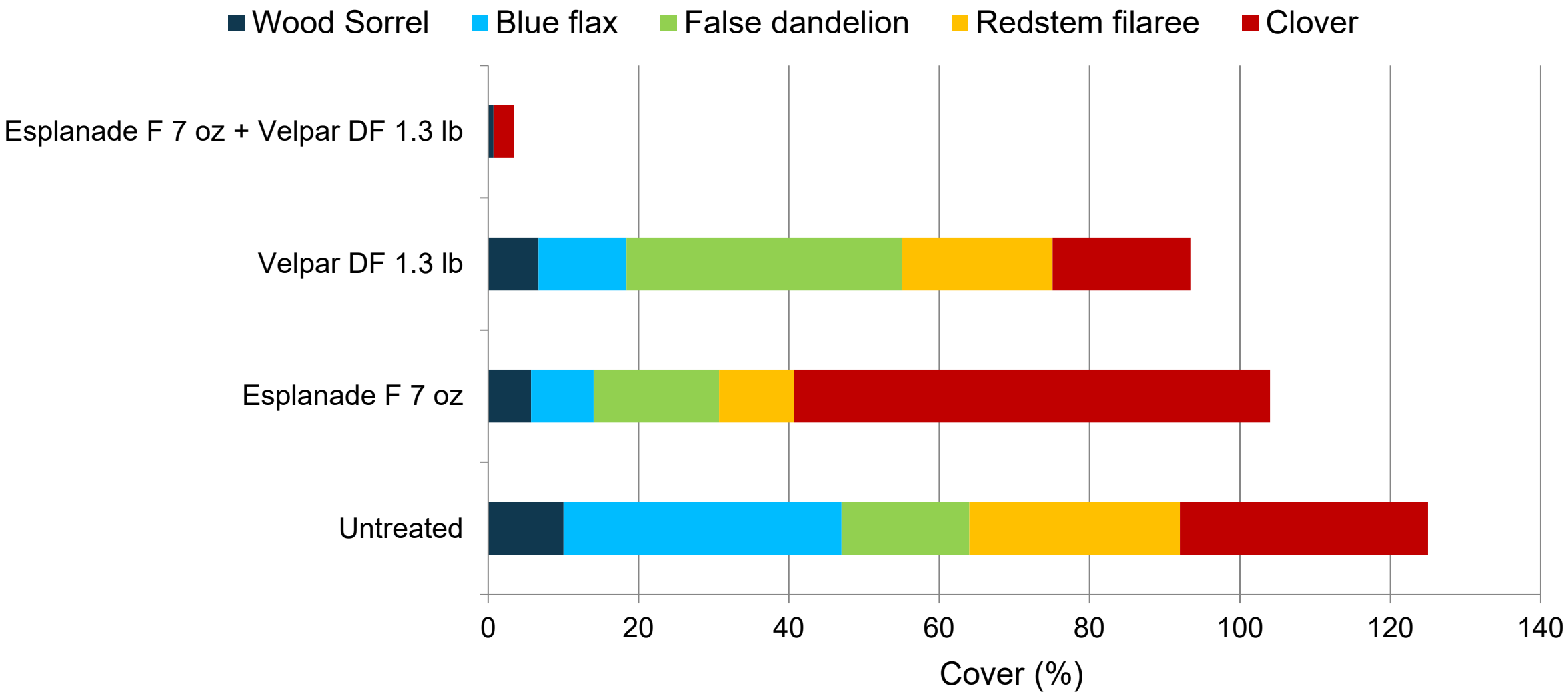
% Cover for Oust Combinations

- Straight Esplanade not effective at this post emergence timing
- Oust or Esplanade+Oust provided good weed suppression
- Best control from Esplanade+Oust+Accord



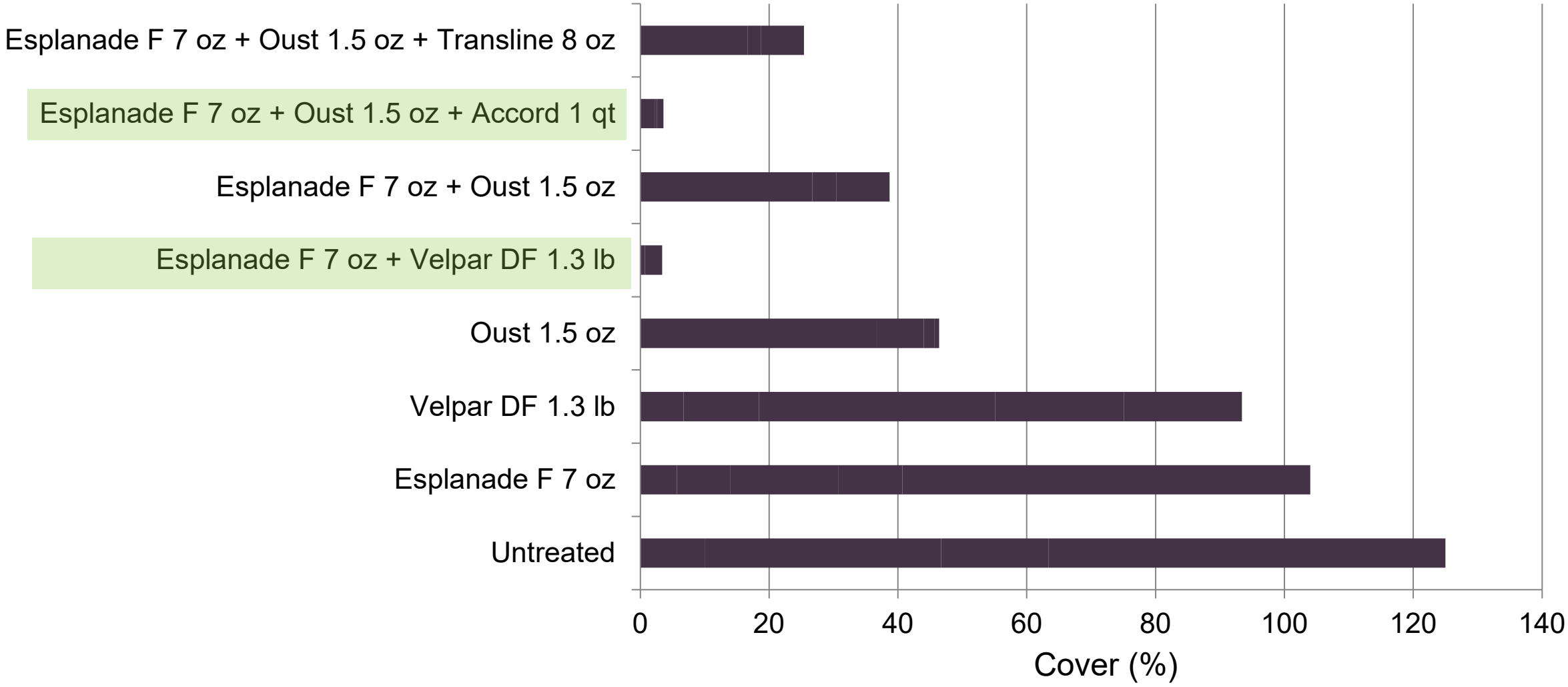
Planted: **2019 February**
Applied: **2019 February (day of planting)**
Assessed: **2019 July**

% Cover for Velpar Combinations
Straight Esplanade or low rate Velpar not effective at this late timing
Best control from Esplanade + Velpar

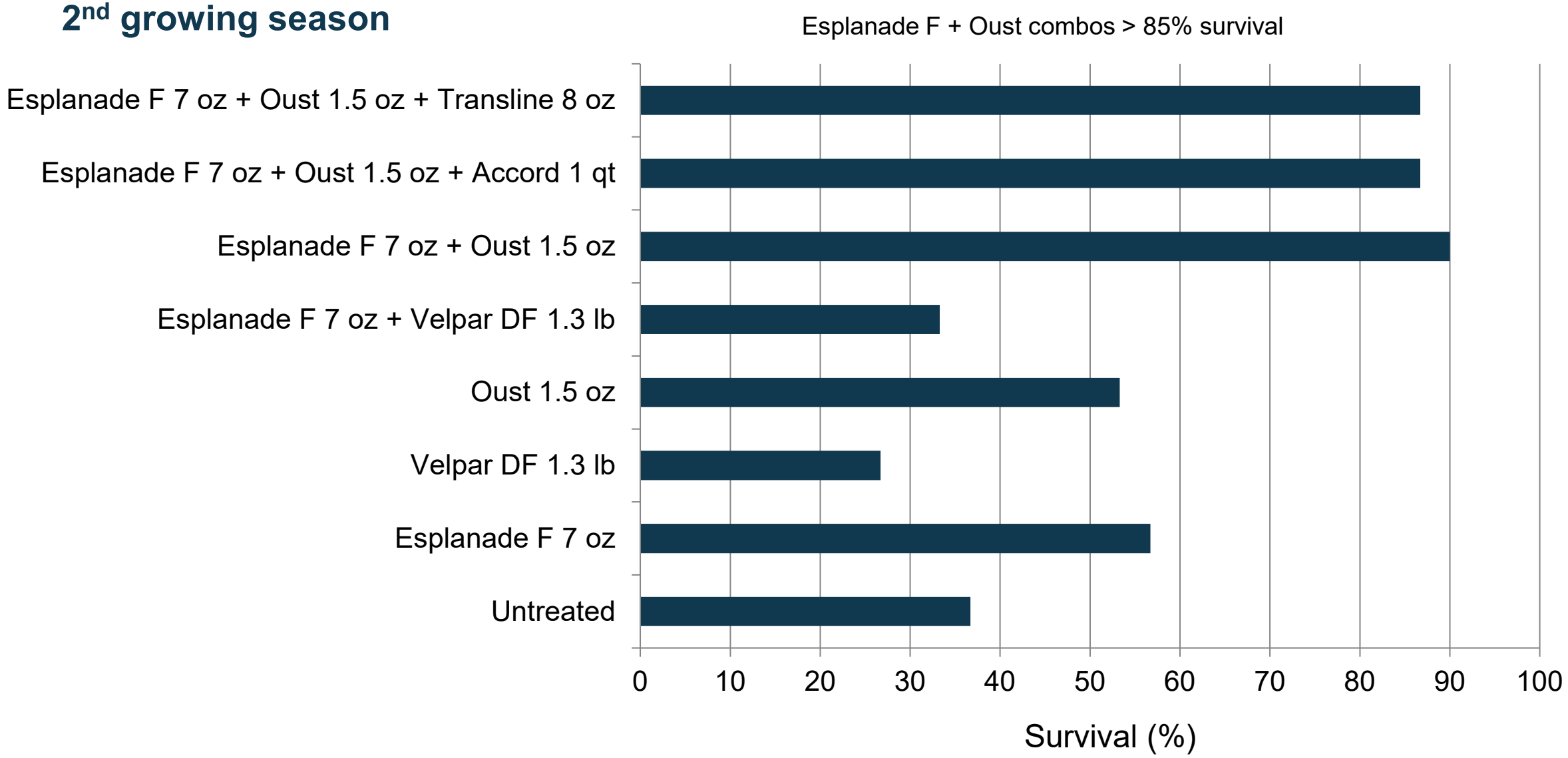


Planted: 2019 February
Applied: 2019 February (day of planting)
Assessed: 2019 July

% Cover for all treatments
Best control from:
- Esplanade + Velpar
- Esplanade + Oust + Accord

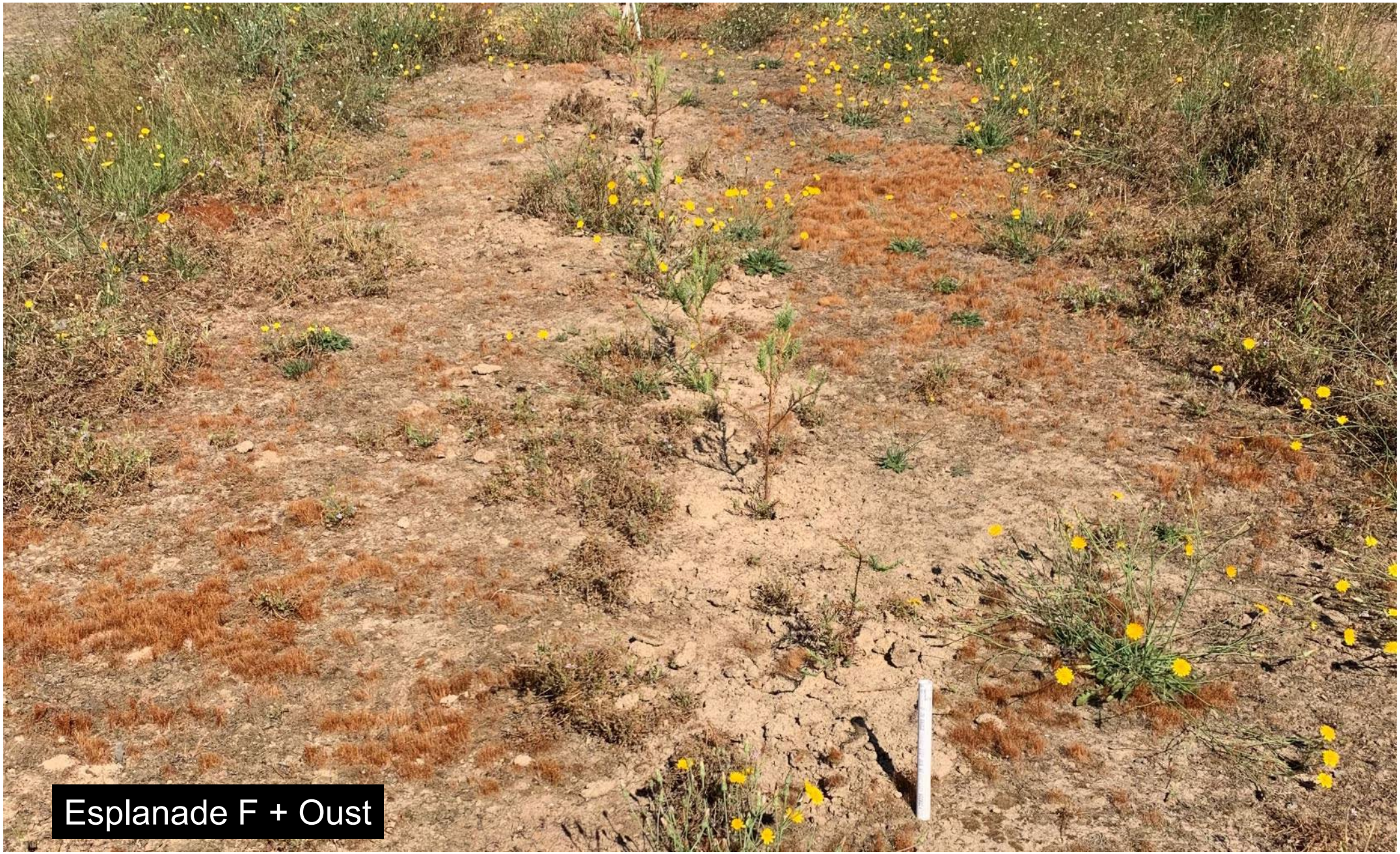


Redwood survival
2nd growing season



Trees bagged before Esplanade + Oust + Accord treatment

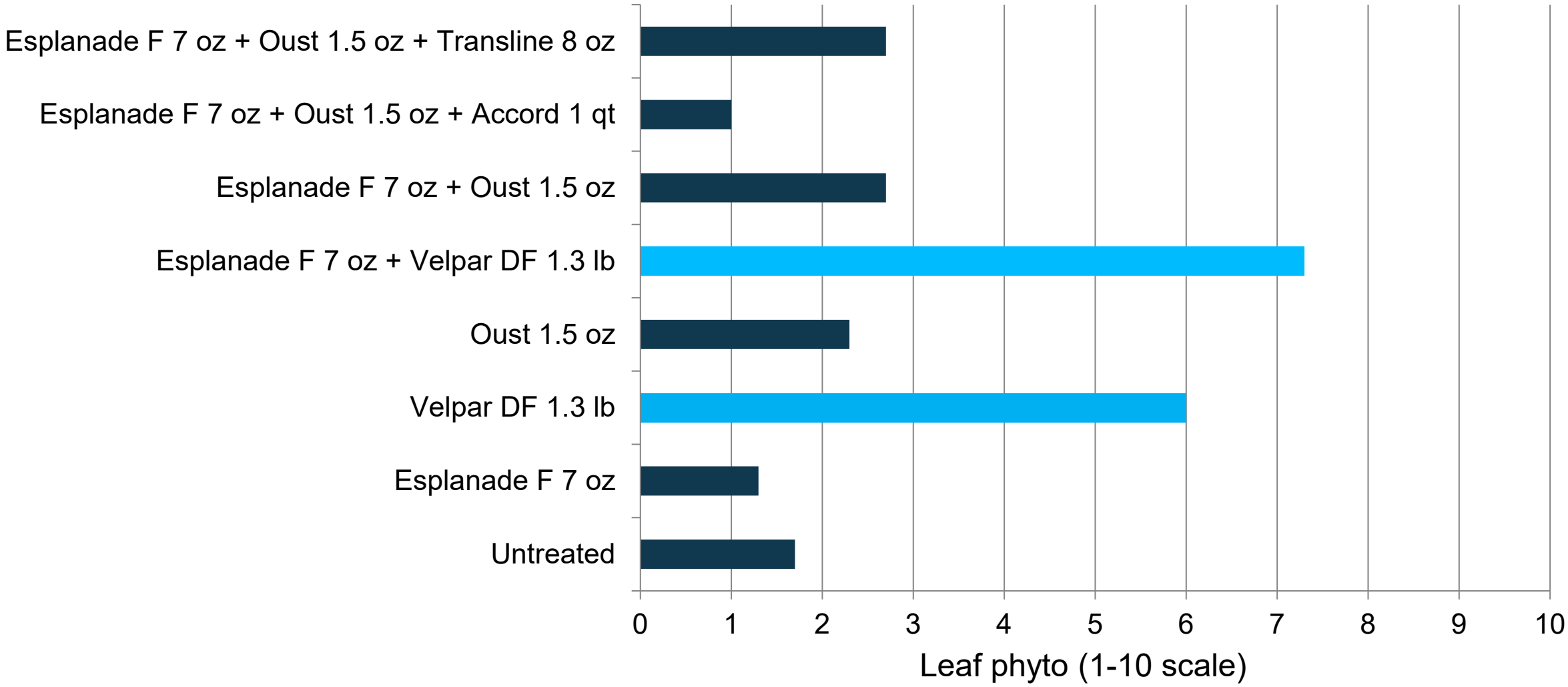

Untreated


Esplanade F + Oust


Esplanade F + Velpar


Esplanade F + Oust + Accord

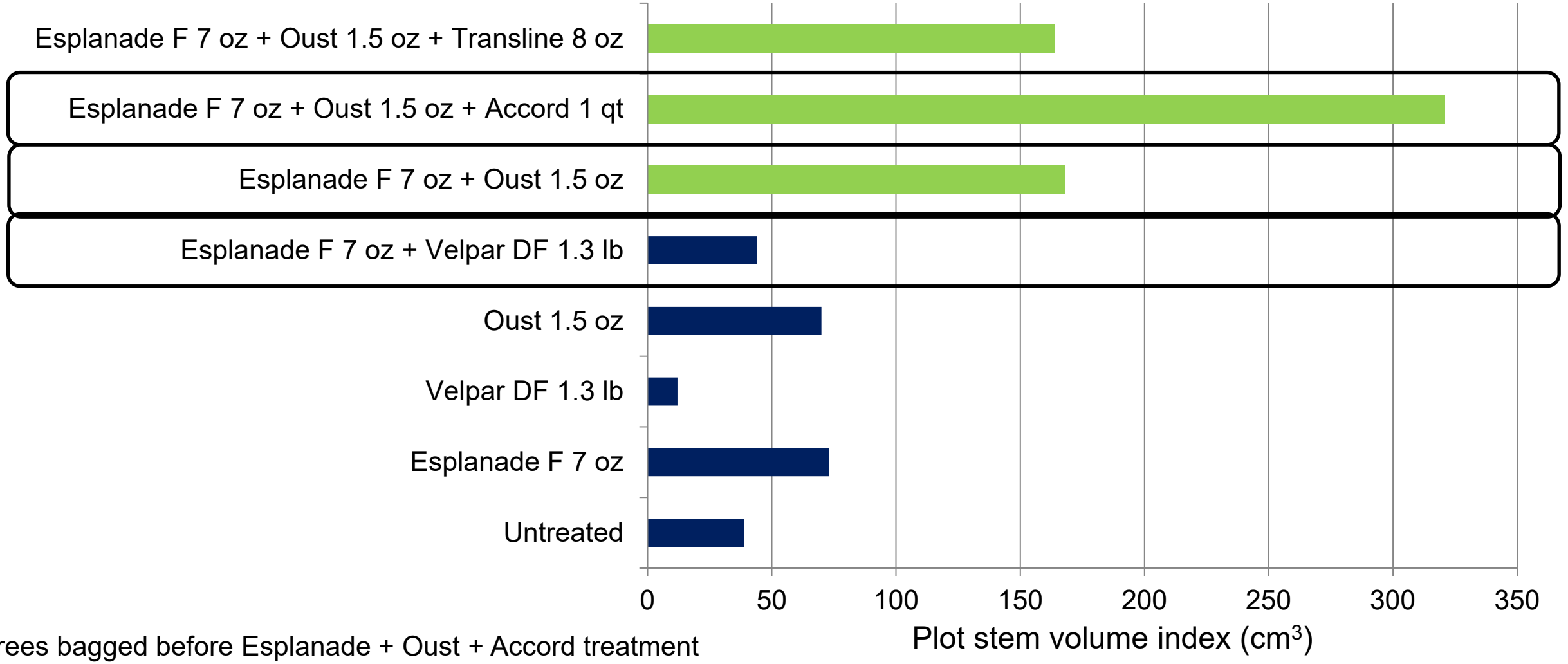
Redwood leaf phyto
1st growing season



Trees bagged before Esplanade + Oust + Accord treatment

Redwood plot stem volume index
2nd growing season

Esplanade+Oust+Accord the best treatment (8X growth increase)
-- Treatment must be directed or apply prior to planting
Esplanade+Oust can be applied over the top (4X growth increase)
Esplanade+Velpar = good weed control but not tolerated by redwood
-- Good combination for Velpar labeled species
-- Need trials with fall application in coast redwood

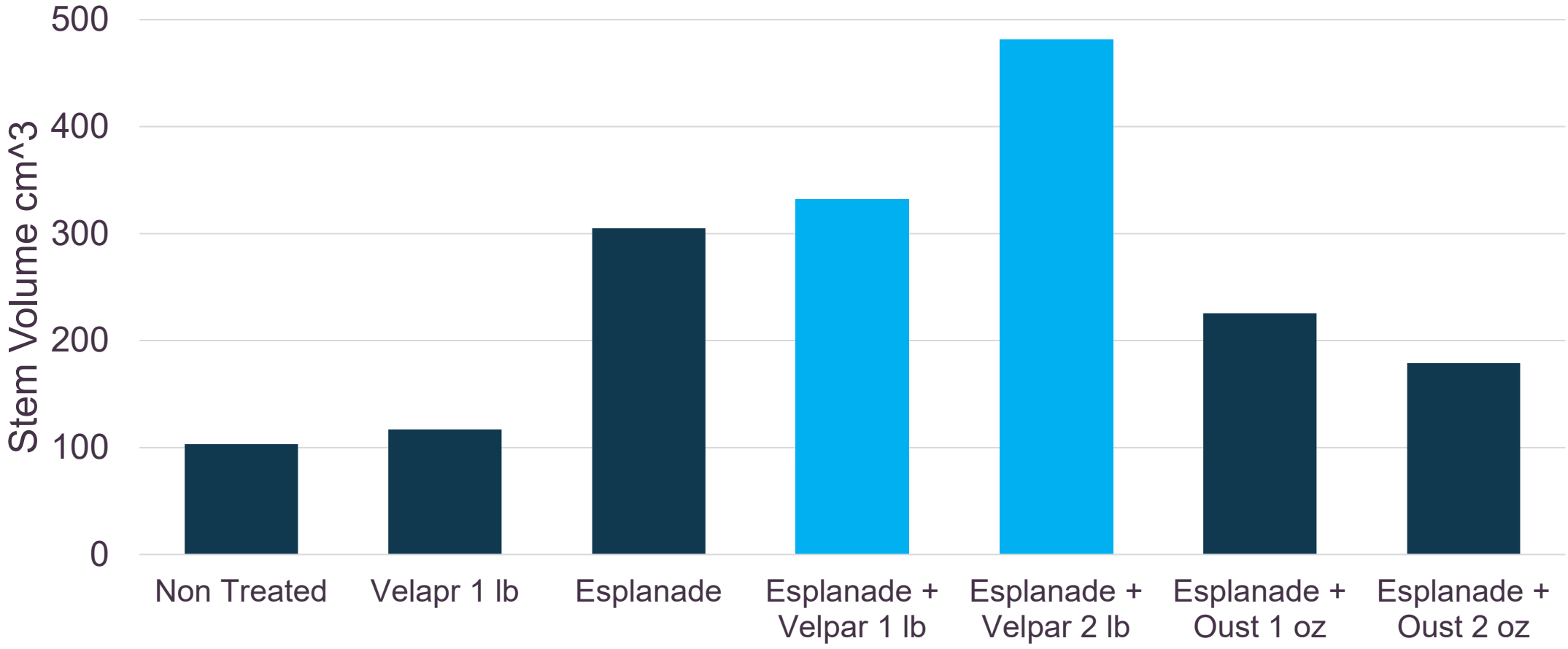


Trees bagged before Esplanade + Oust + Accord treatment

Site Preparation
Coast Range

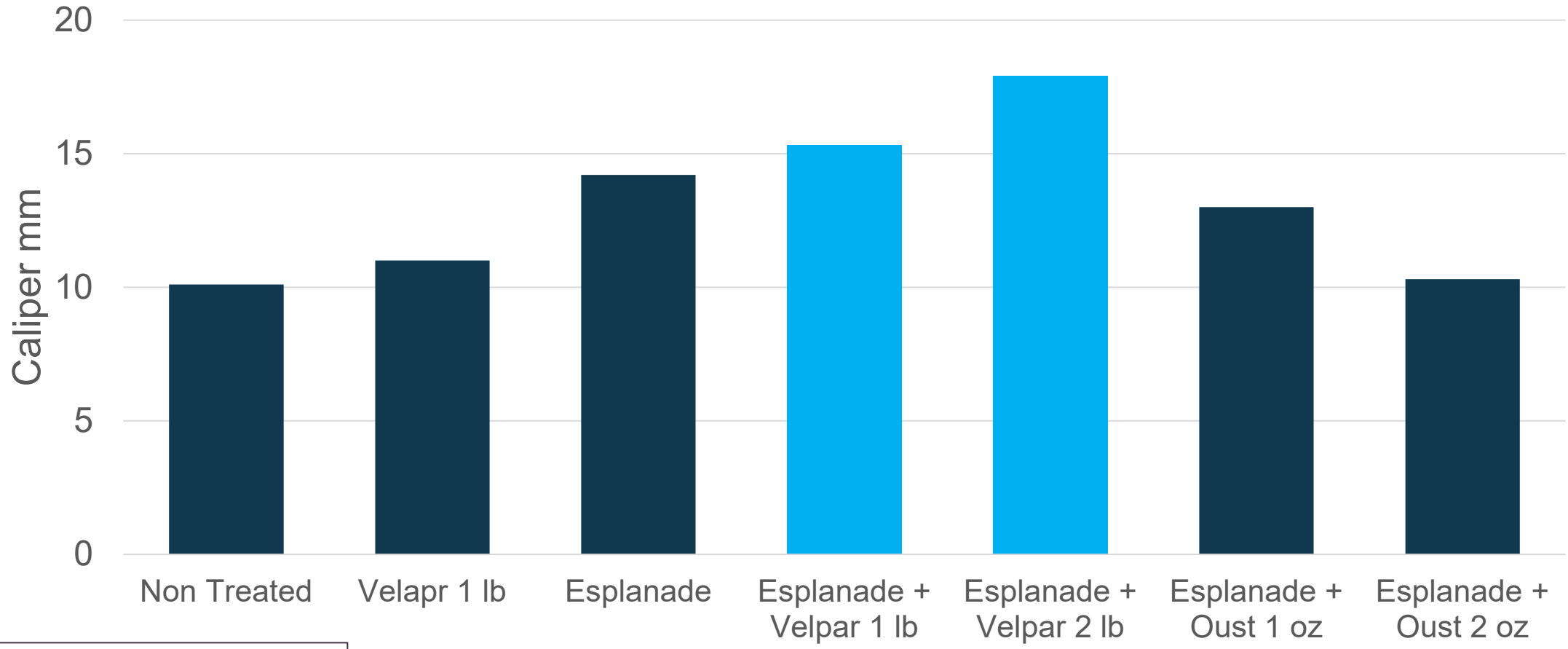
Coast redwood

Redwood Stem Volume 2 YAT for Coast Fall Site Prep Trial



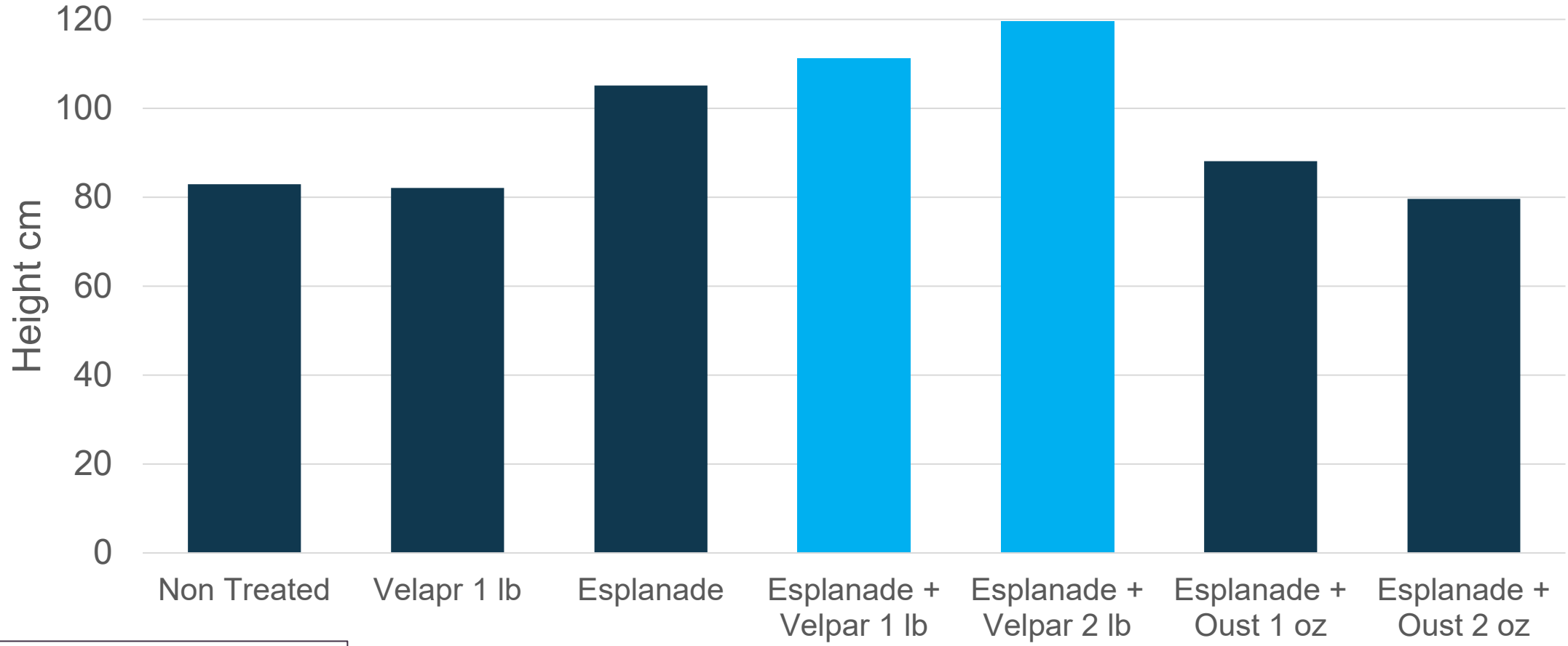
All treatments with 2 qt Accord
Esplanade rate is 7 oz

Redwood Caliper 2 YAT for Coast Fall Site Prep Trial



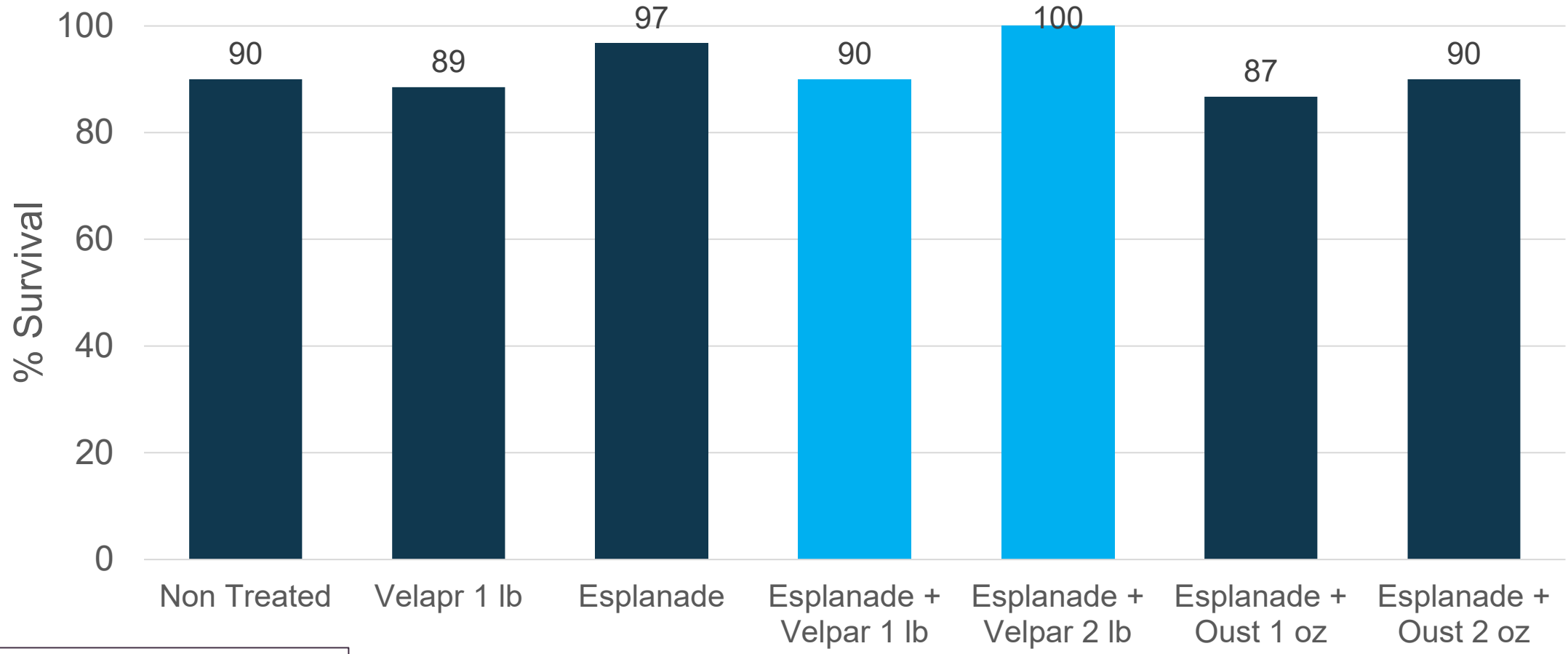
All treatments with 2 qt Accord
Esplanade rate is 7 oz

Redwood Height 2 YAT for Coast Fall Site Prep Trial



All treatments with 2 qt Accord
Esplanade rate is 7 oz

Redwood % Survival 2 YAT for Coast Fall Site Prep Trial



All treatments with 2 qt Accord
Esplanade rate is 7 oz

Best treatments for spring herbaceous release and fall site prep in the Coast Range

Spring herbaceous release

- Directed: 7 oz Esplanade + 1.5 Oust + 1 qt Accord (Year 2 individual stem volume 321)
- 7 oz Esplanade + 1.5 oz Oust (Year 2 individual stem volume 168)

Fall site prep

- 7 oz Esplanade + 2 lb Velpar (Year 2 individual stem volume 481)

New Option for Velpar DF fall site prep in the Coast Range

Because Esplanade provides long term pre-emergence control the focus for Velpar becomes

- Short term pre- and post-emergence control
- Lower rates and fall application for crop tolerance

Western Sierras example demonstrating the value of long-term pre-emergence control

Heavy cheat grass *(Bromus secalinus)* infested site after the RIM fire

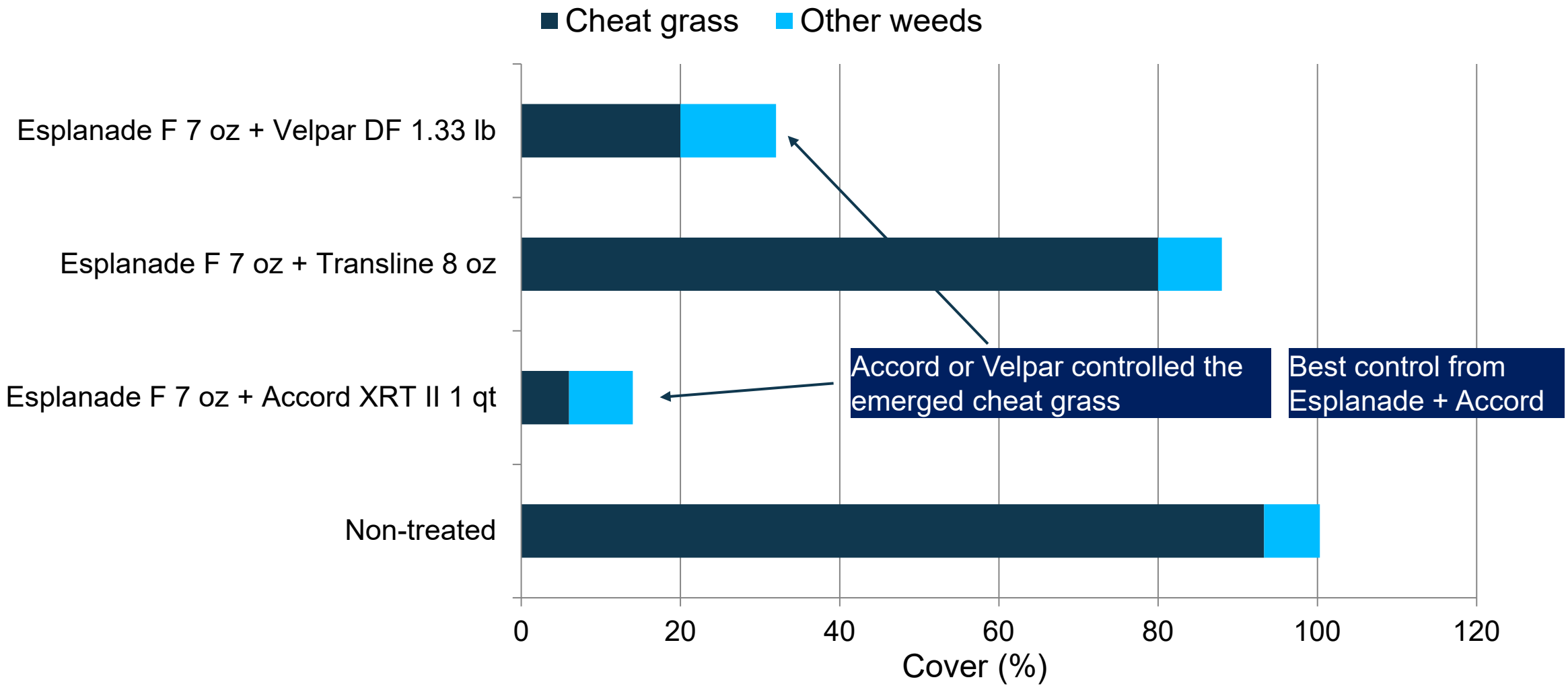

Heavy thatch layer = major threat of fast spreading wildfire
If cheat grass germination is stopped, thatch layer is reduced after one year
Esplanade can stop annual grass germination for multiple years
Sugar pine
Ponderosa pine

Herbaceous Release Western Sierras

Ponderosa pine

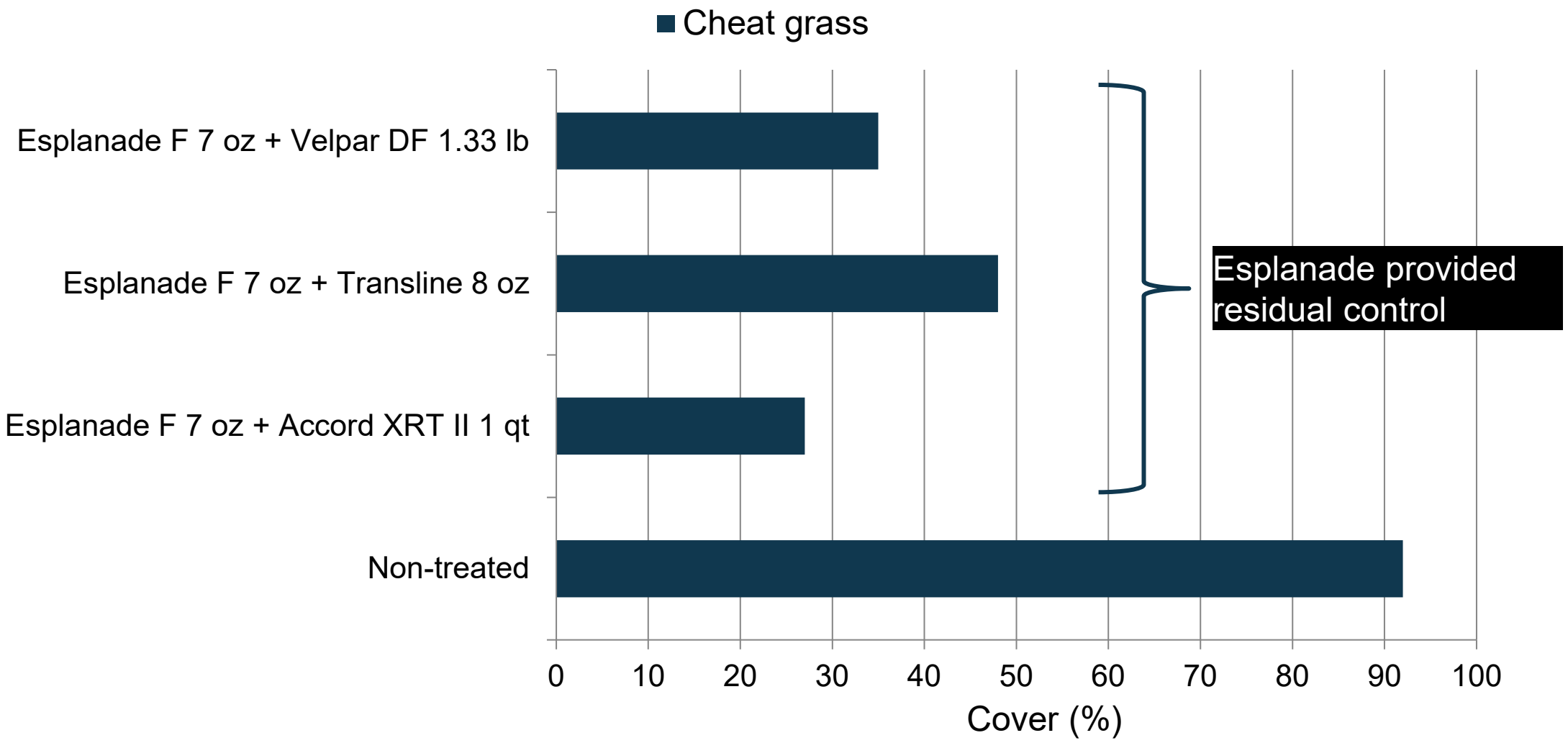
Planted: 2017 April
Applied: 2017 April (day of planting)

Vegetation – First year after treatment



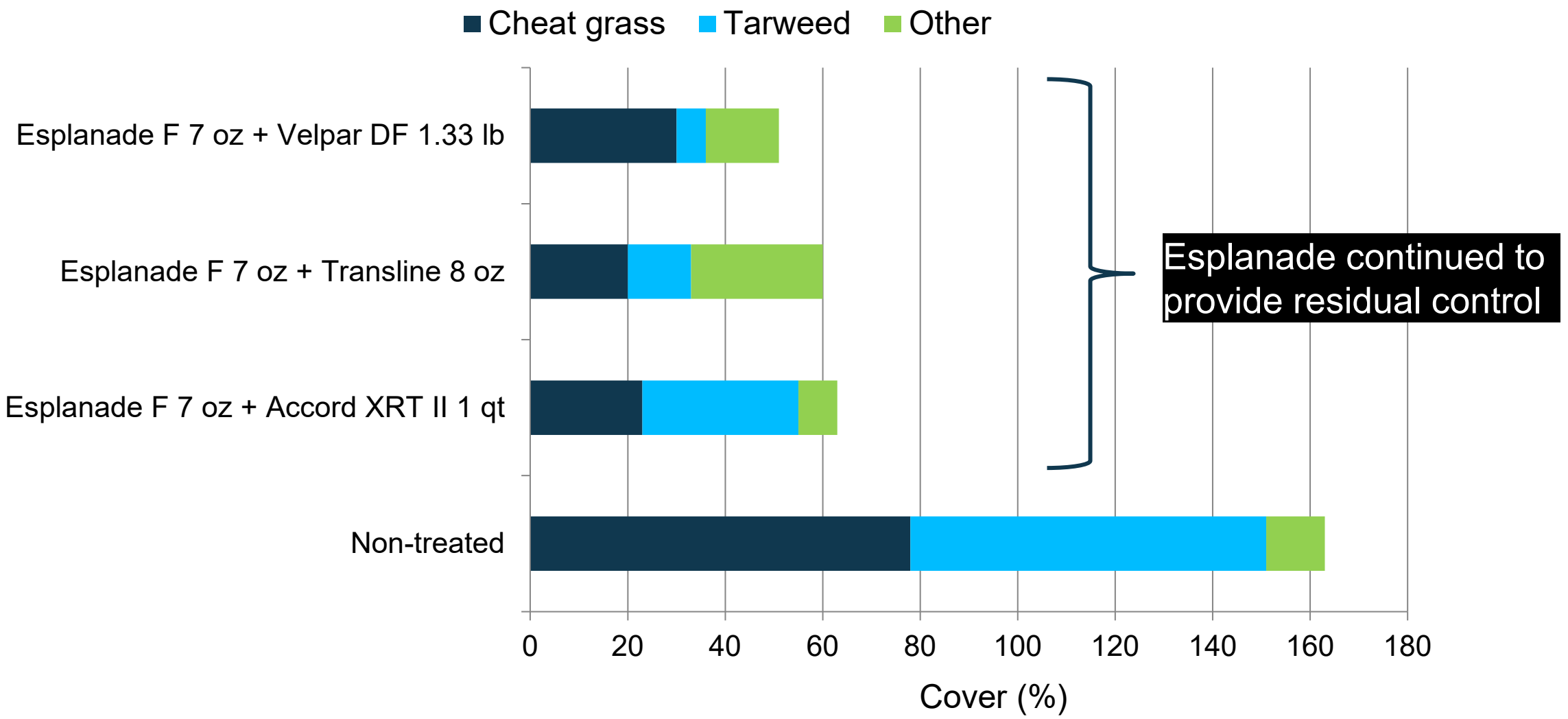
Planted: 2017 April
Applied: 2017 April (day of planting)

Vegetation – Second year after treatment



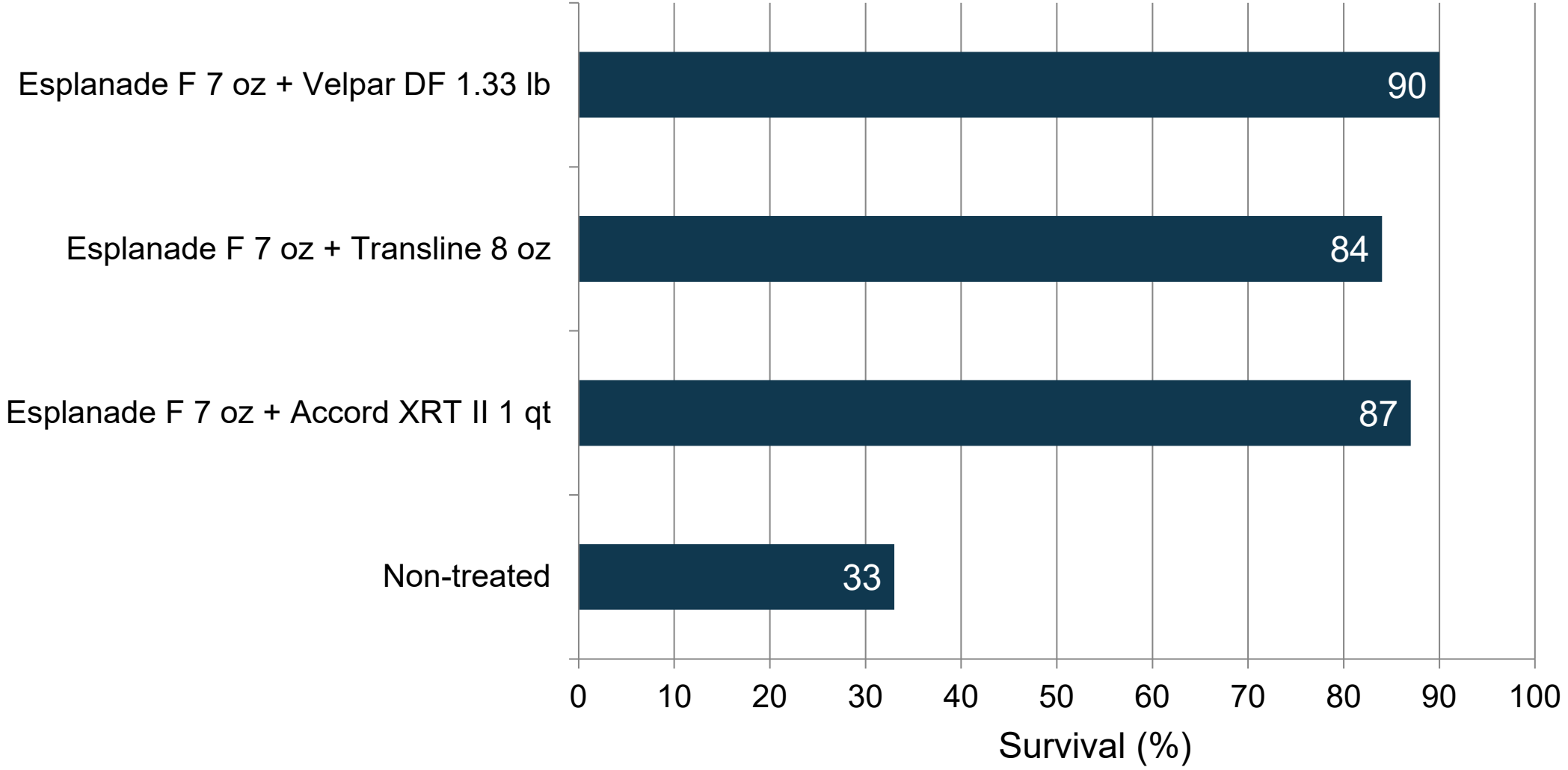
Planted: 2017 April
Applied: 2017 April (day of planting)

Vegetation – Third year after treatment



Planted: 2017 April
Applied: 2017 April (day of planting)

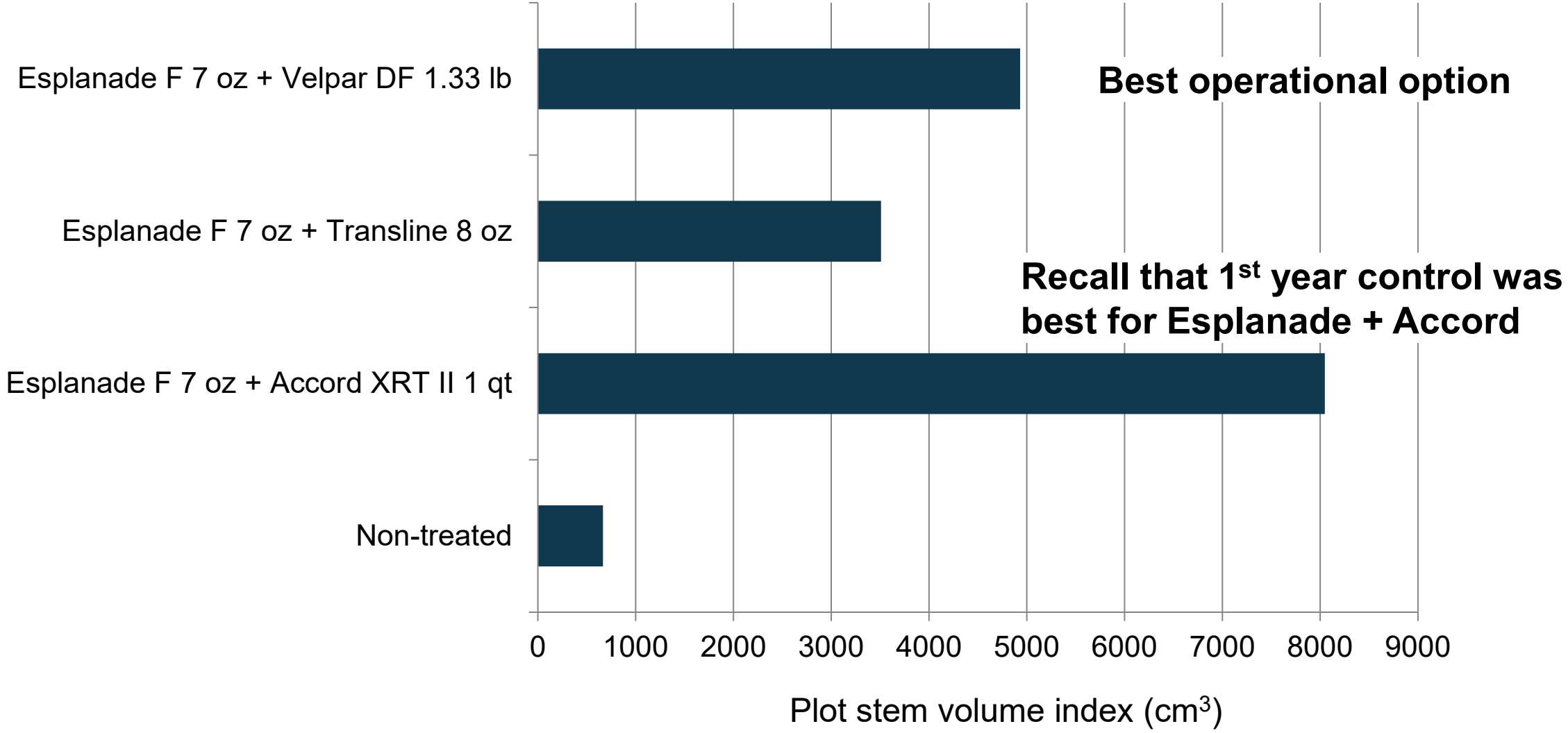
Ponderosa pine survival
3rd year after treatment



Trees bagged before Esplanade + Accord treatment

Planted: 2017 April
Applied: 2017 April (day of planting)

Ponderosa pine plot stem volume index
3rd year after treatment



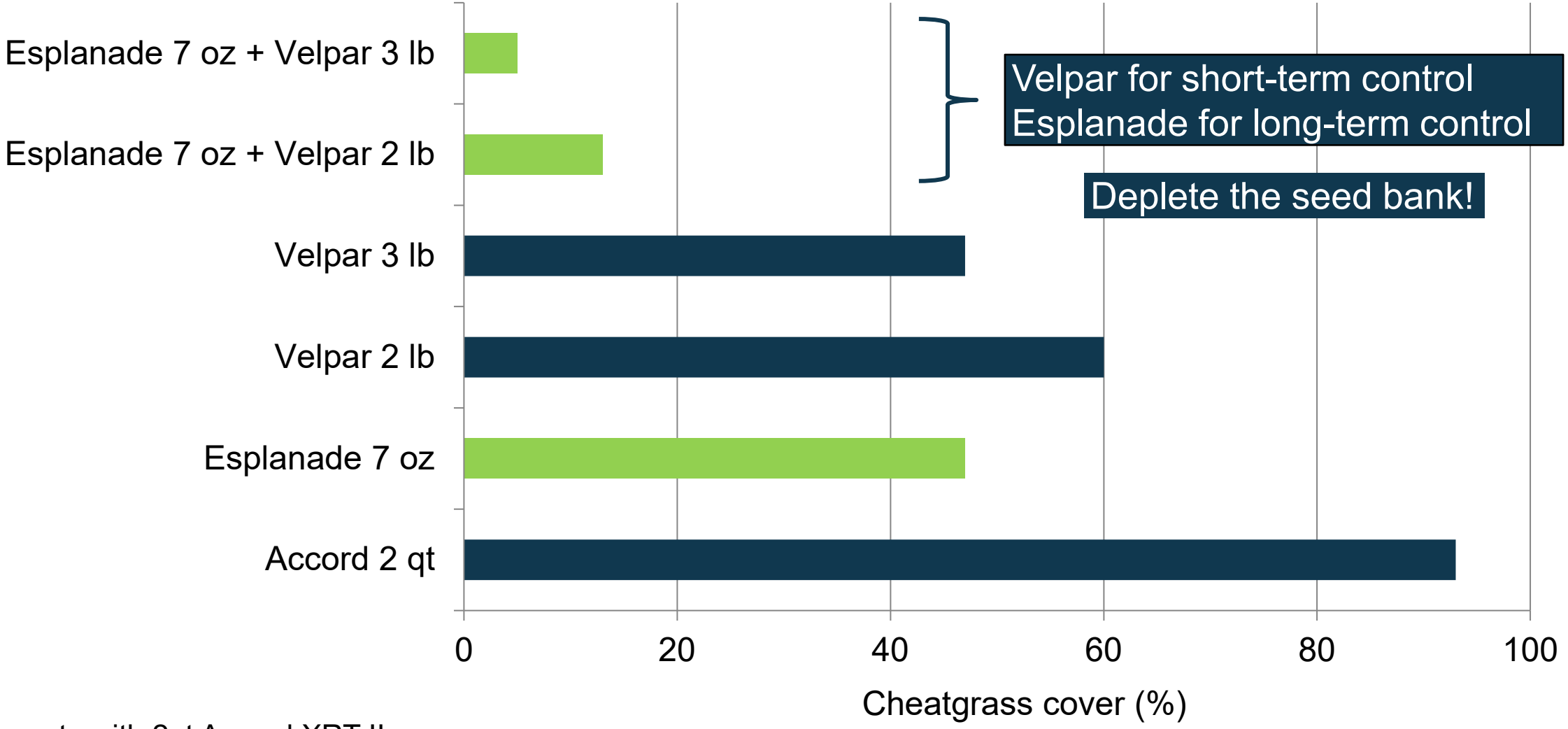
Trees bagged before Esplanade + Accord treatment

Site Preparation
Western Sierra

Ponderosa Pine

Applied: 2016 October
Planted: 2017 April
Assessed: 2017 July

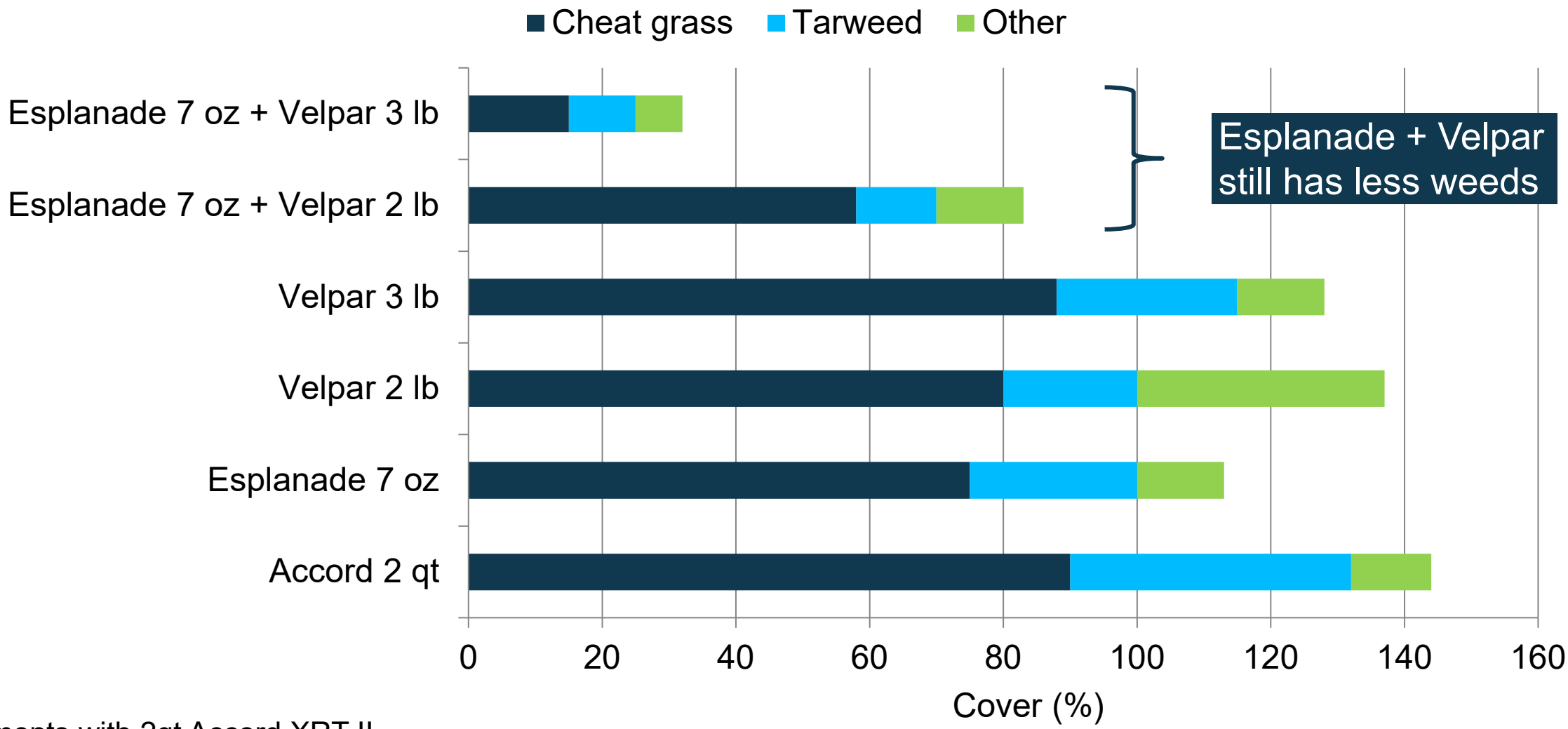
Vegetation - First year after treatment



All treatments with 2qt Accord XRT II

Applied: 2016 October
Planted: 2017 April
Assessed: 2019 September

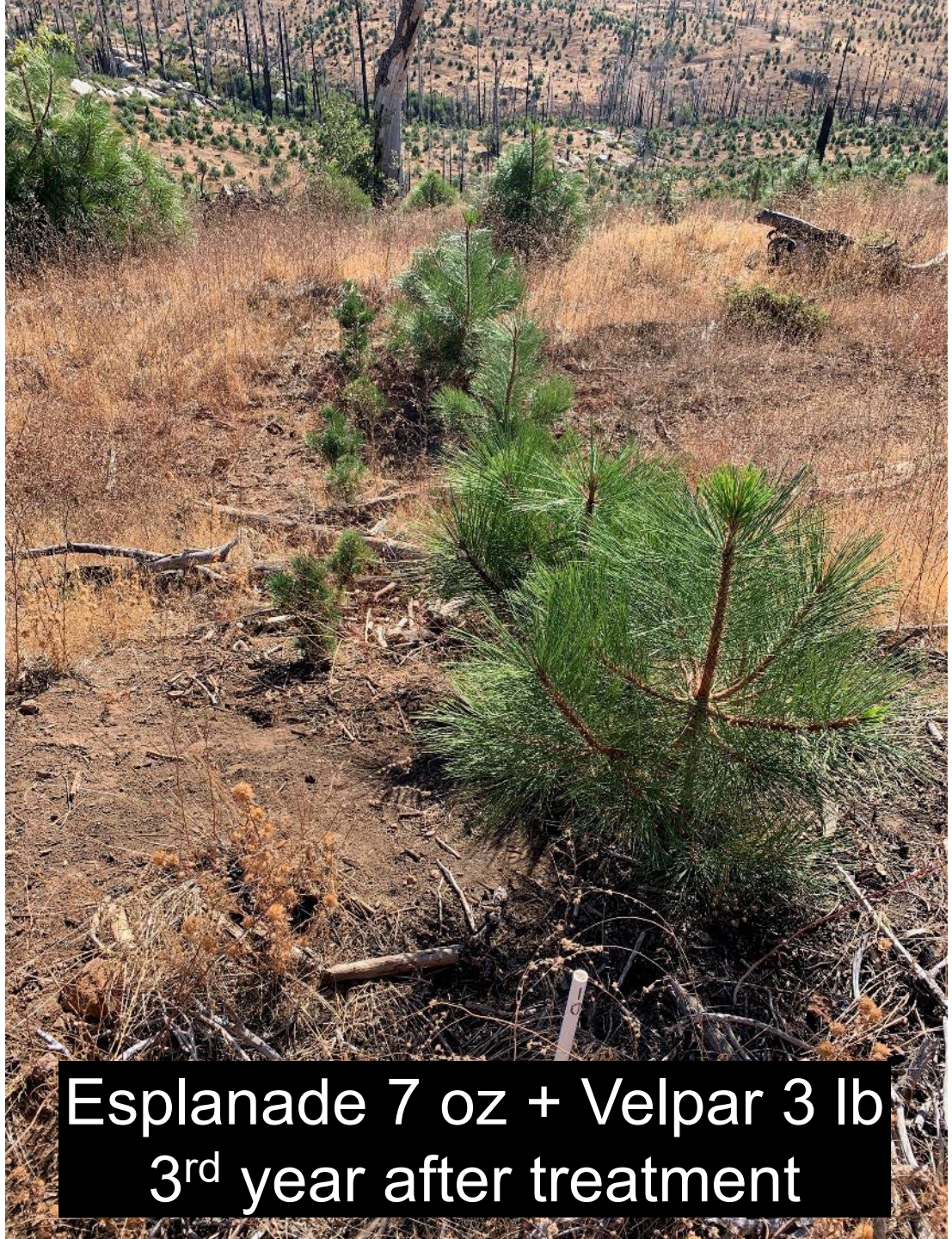
Vegetation - Third year after treatment



All treatments with 2qt Accord XRT II


Esplanade 7 oz + Velpar 3 lb
1st year after treatment


Esplanade 7 oz + Velpar 3 lb
2nd year after treatment

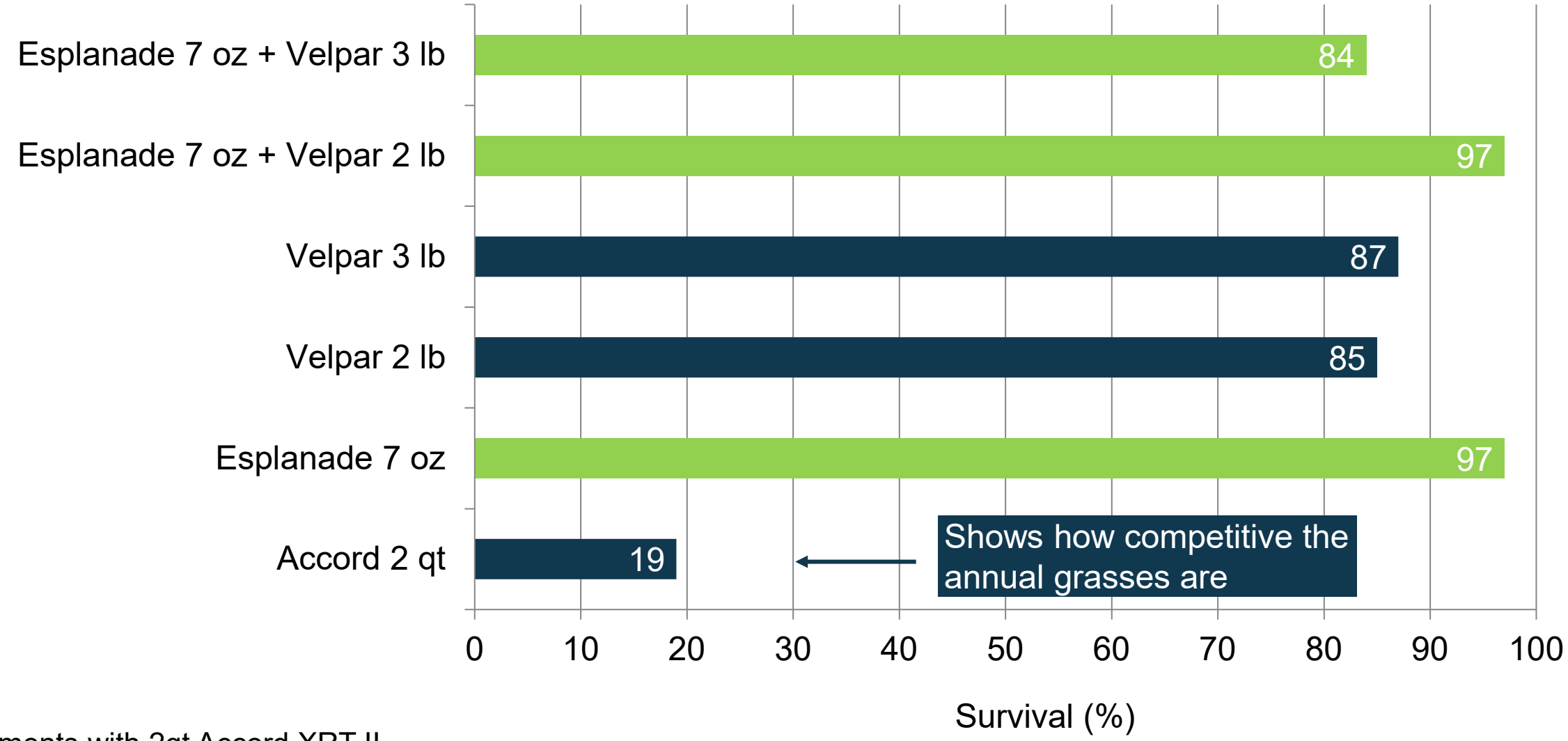


envu Forestry

Applied: 2016 October
Planted: 2017 April
Assessed: 2019 September

Ponderosa Pine - Survival
3rd growing season

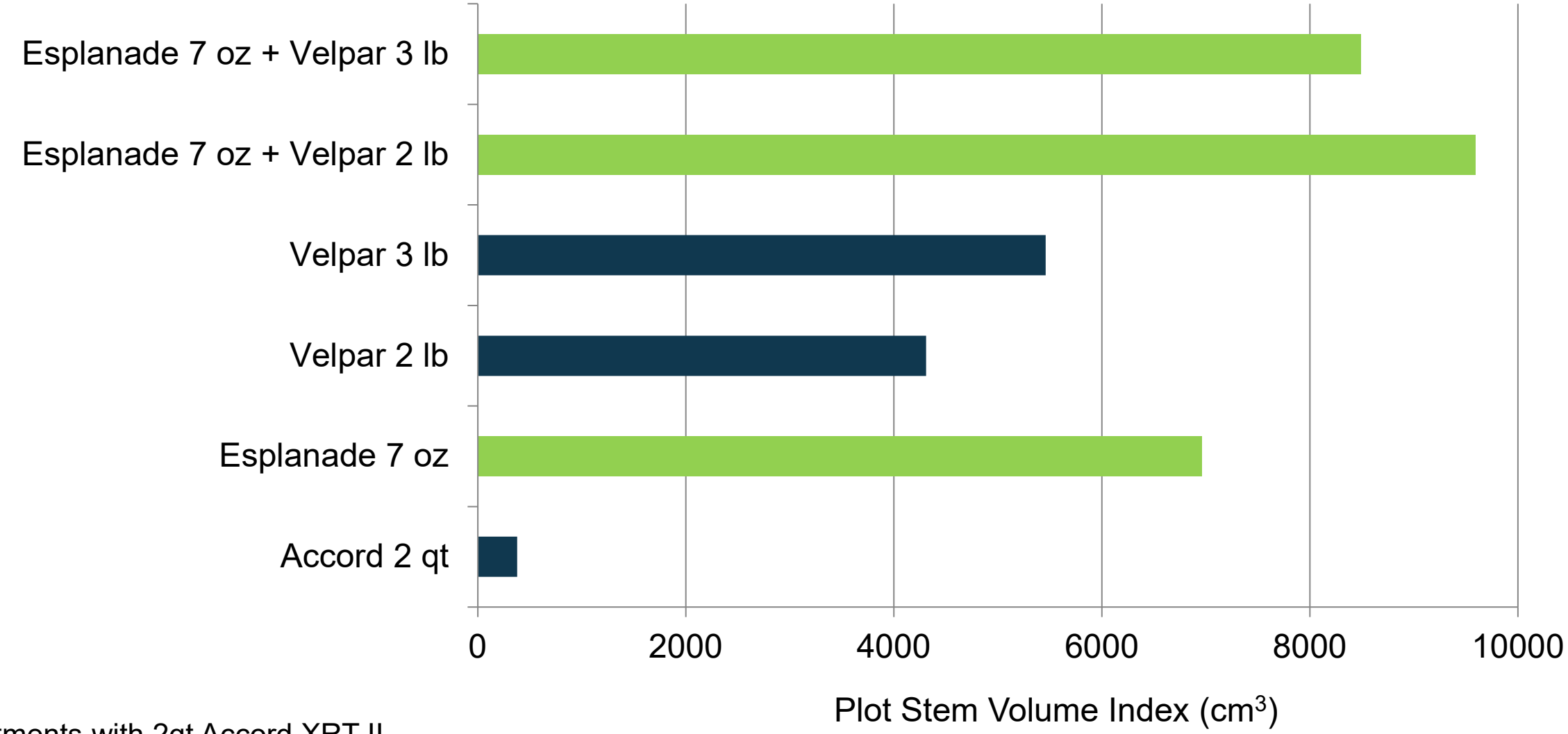
envu Forestry



All treatments with 2qt Accord XRT II

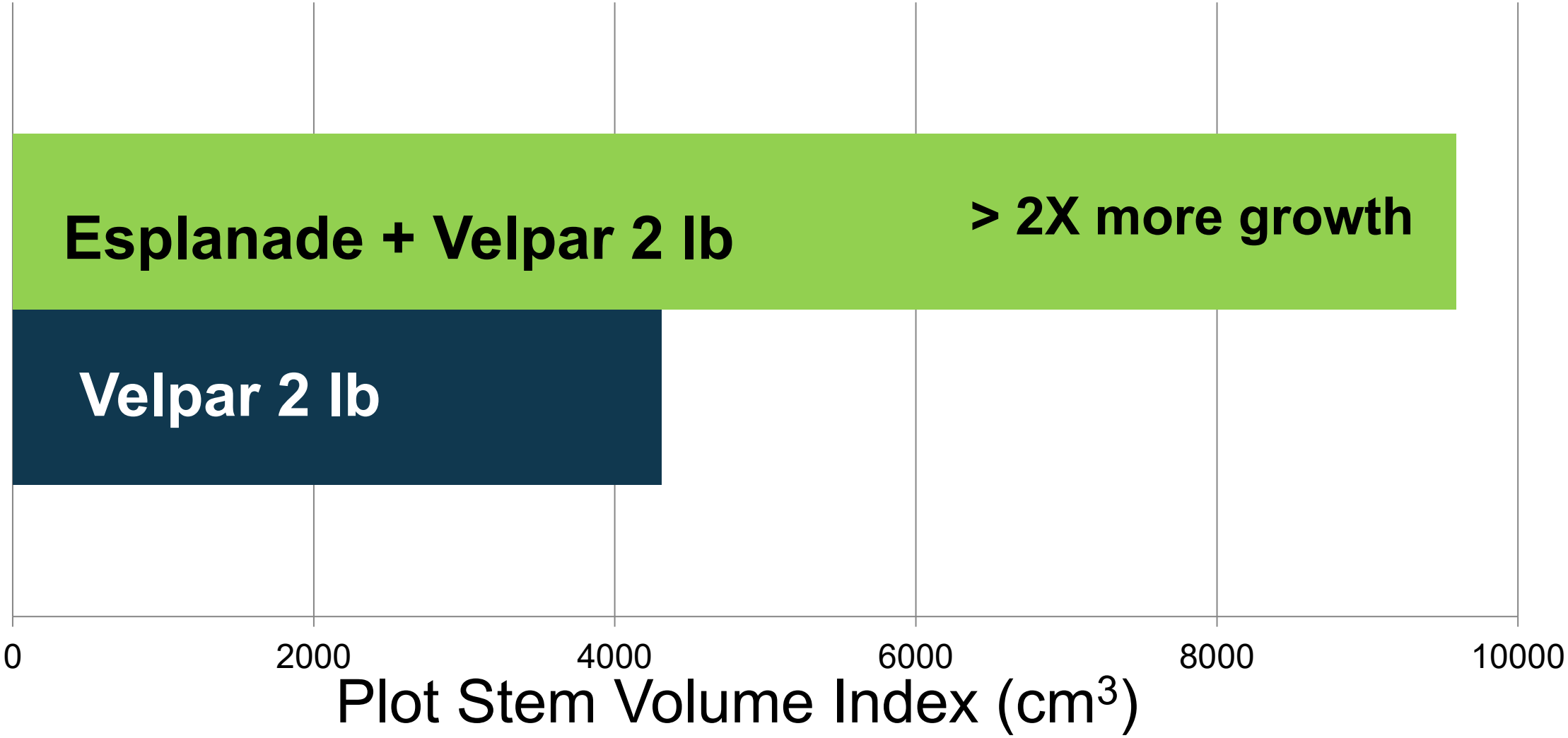
Applied: 2016 October
Planted: 2017 April
Assessed: 2019 September

Ponderosa Pine – Plot Stem Volume Index
3rd growing season



All treatments with 2qt Accord XRT II

Ponderosa Pine – Plot Stem Volume Index
3rd growing season
Isolating the impact of Esplanade



Best treatments for spring herbaceous release and fall site prep in the Western Sierra

Spring herbaceous release

- Directed: 7 oz Esplanade + 2 qt Accord (Year 3 plot stem volume 8049)
- 7 oz Esplanade + 2 lb Velpar (Year 3 plot stem volume 4933)

Fall site prep

- 7 oz Esplanade + 2 lb Velpar (Year 3 plot stem volume 9590)

New Option for Velpar DF fall site prep in the Western Sierras

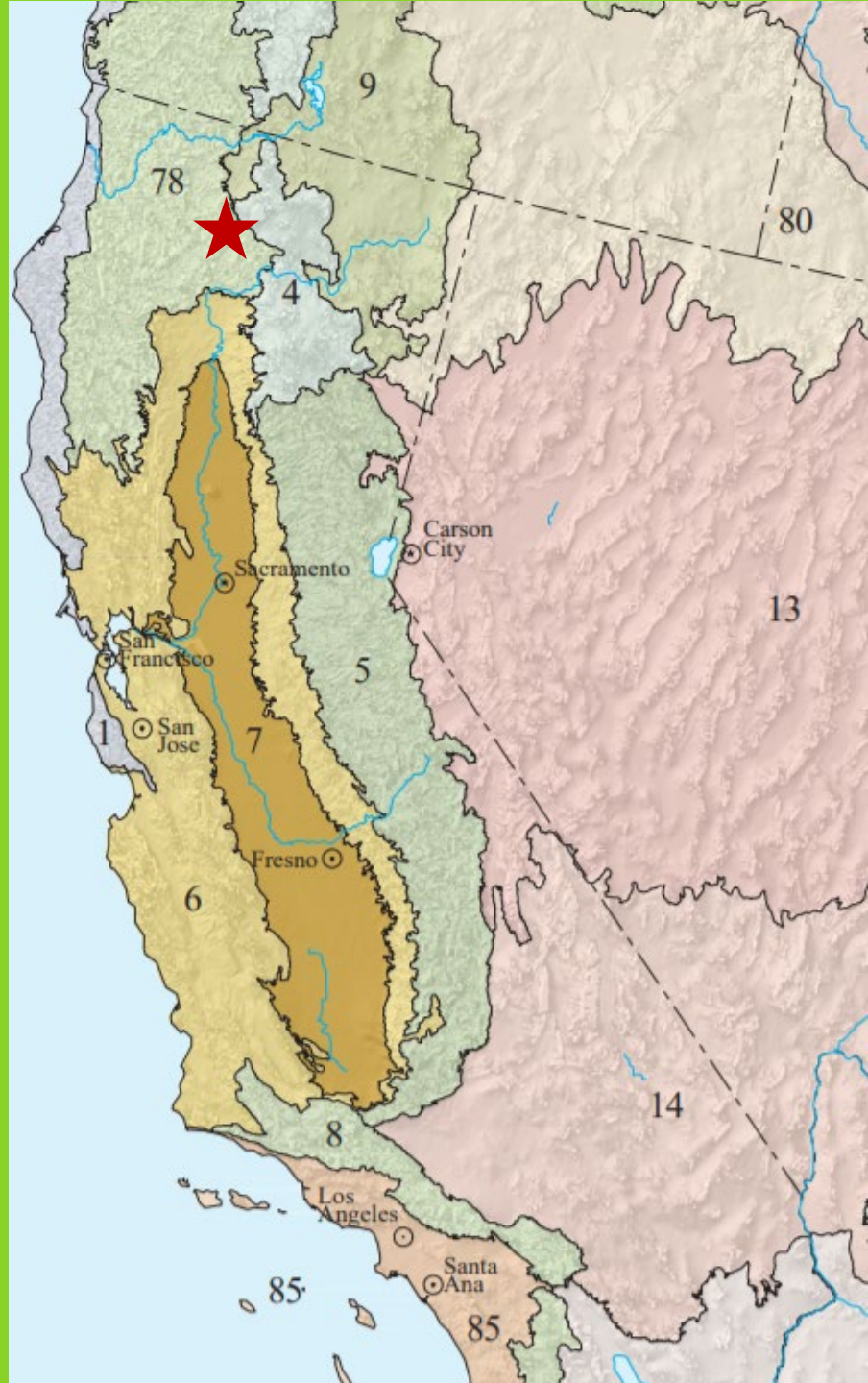
Because Esplanade provides long term pre-emergence control the focus for Velpar becomes

- Short term pre- and post-emergence control
- Lower rates and fall application for the most efficient vegetation control

California High North Coast Range example of fall site prep

Site Preparation
California High North Coast Range

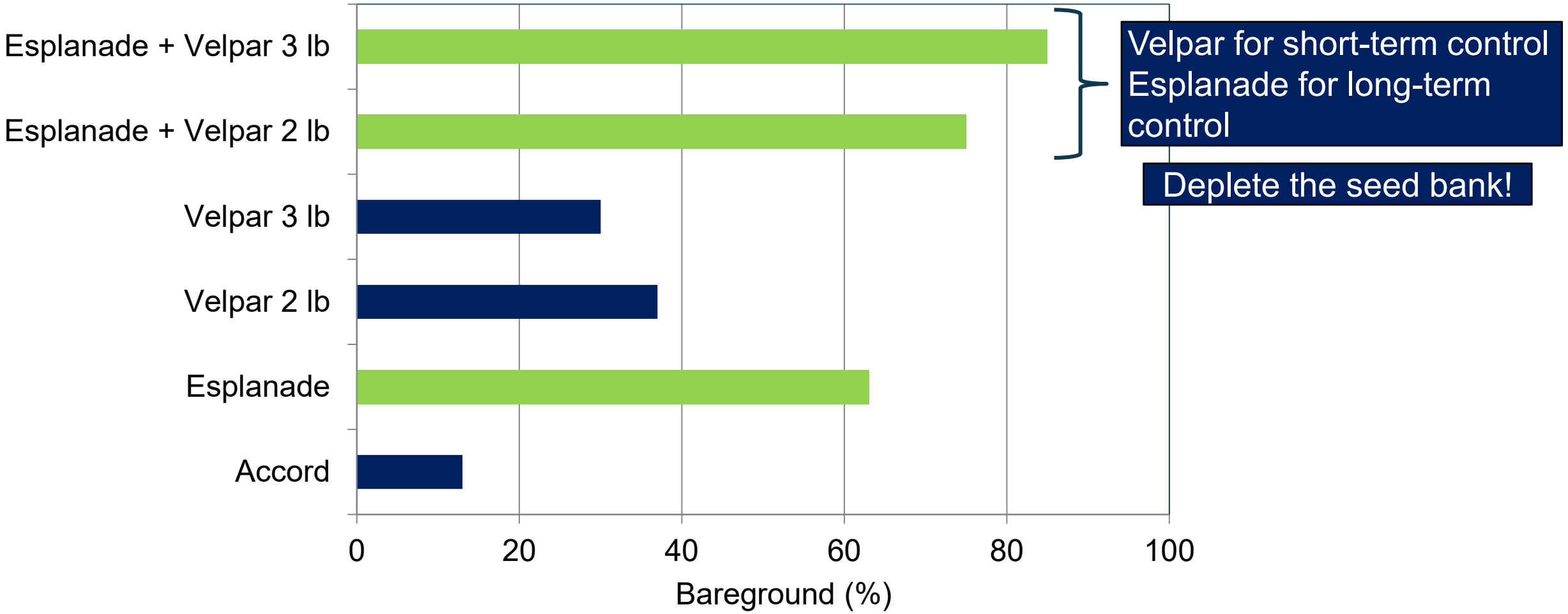
Incense Cedar



Cheat grass *(Bromus secalinus)* and rattail fescue *(Vulpia myuros)* infested site

Applied: 2016 October
Planted: 2017 April
Assessed: 2017 August

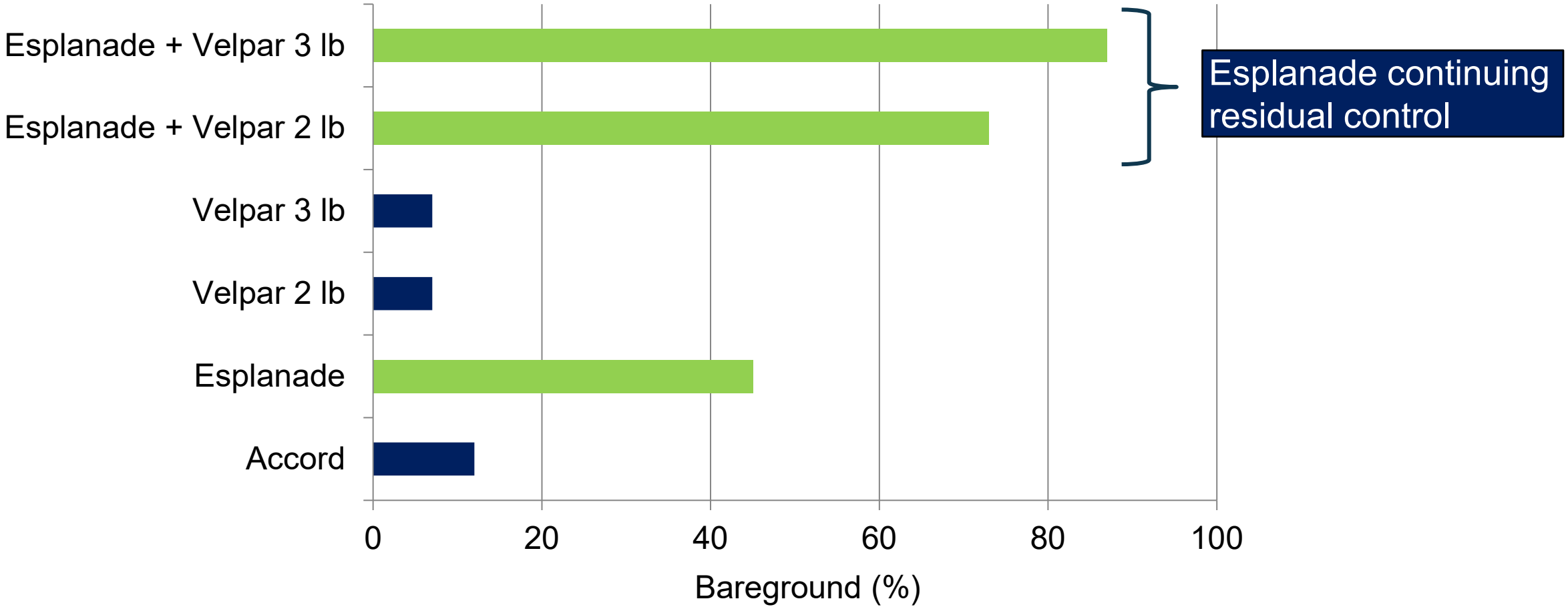
Bareground - First year after treatment



All treatments with 2qt Accord XRT II

Applied: 2016 October
Planted: 2017 April
Assessed: 2018 August

Bareground - Second year after treatment

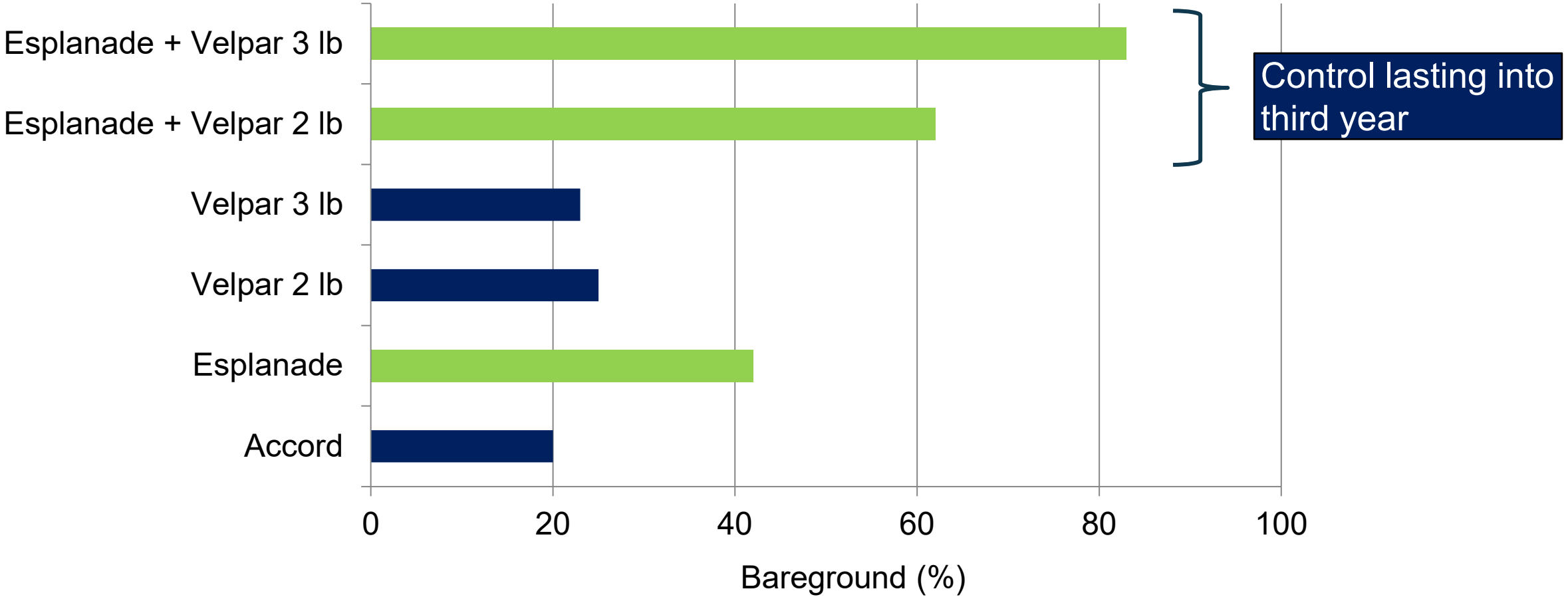


All treatments with 2qt Accord XRT II


Esplanade + Velpar + Accord

Applied: 2016 October
Planted: 2017 April
Assessed: 2019 August

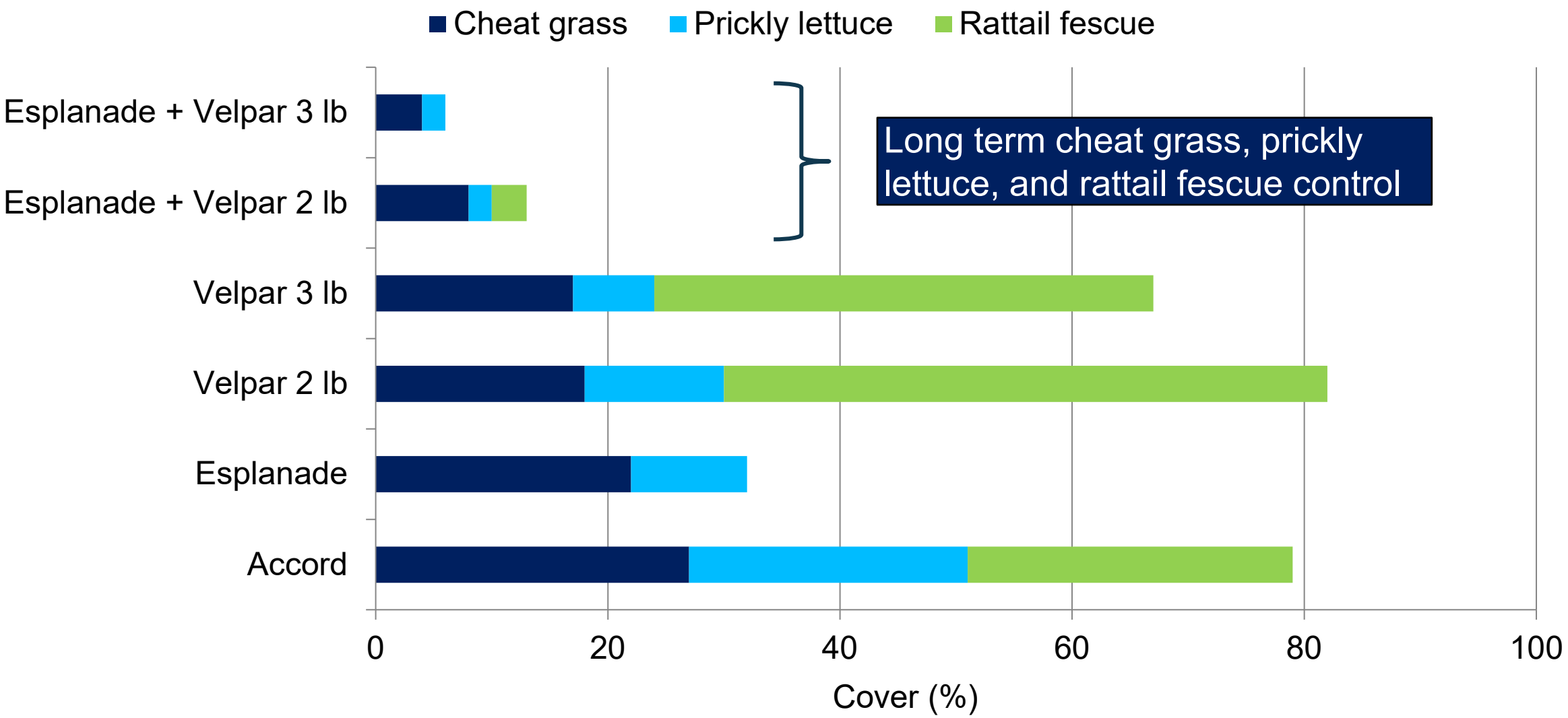
Bareground - Third year after treatment



All treatments with 2qt Accord XRT II

Applied: 2016 October
Planted: 2017 April
Assessed: 2019 August

Vegetation - Third year after treatment



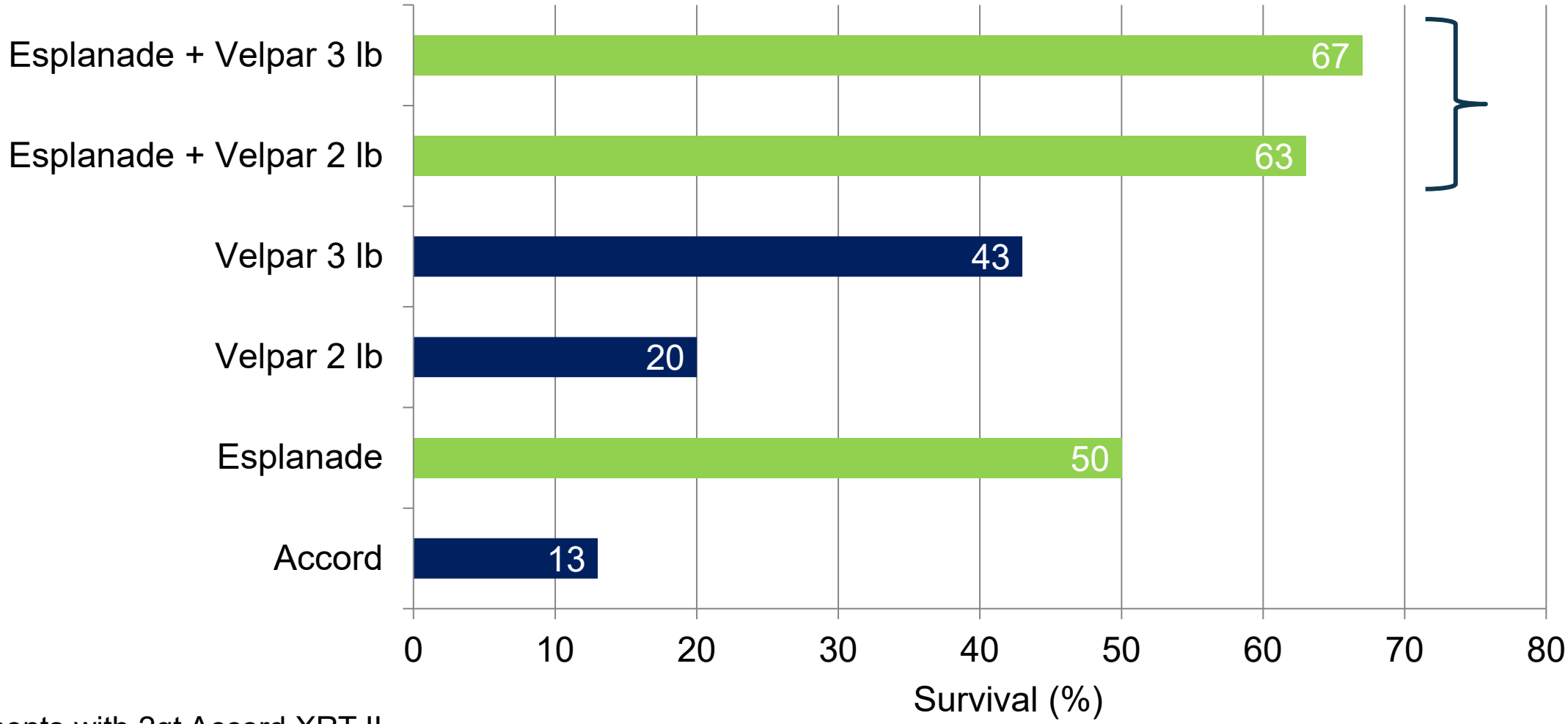
All treatments with 2qt Accord XRT II

Applied: 2016 October
Planted: 2017 April
Assessed: 2019 August

Incense cedar survival
3rd growing season

envu Forestry

Overall poor survival from poor planting stock
Survival > 60% for Esplanade + Velpar



All treatments with 2qt Accord XRT II

Northern Rockies example of fall site prep

Site Preparation Northern Rockies

Douglas-fir

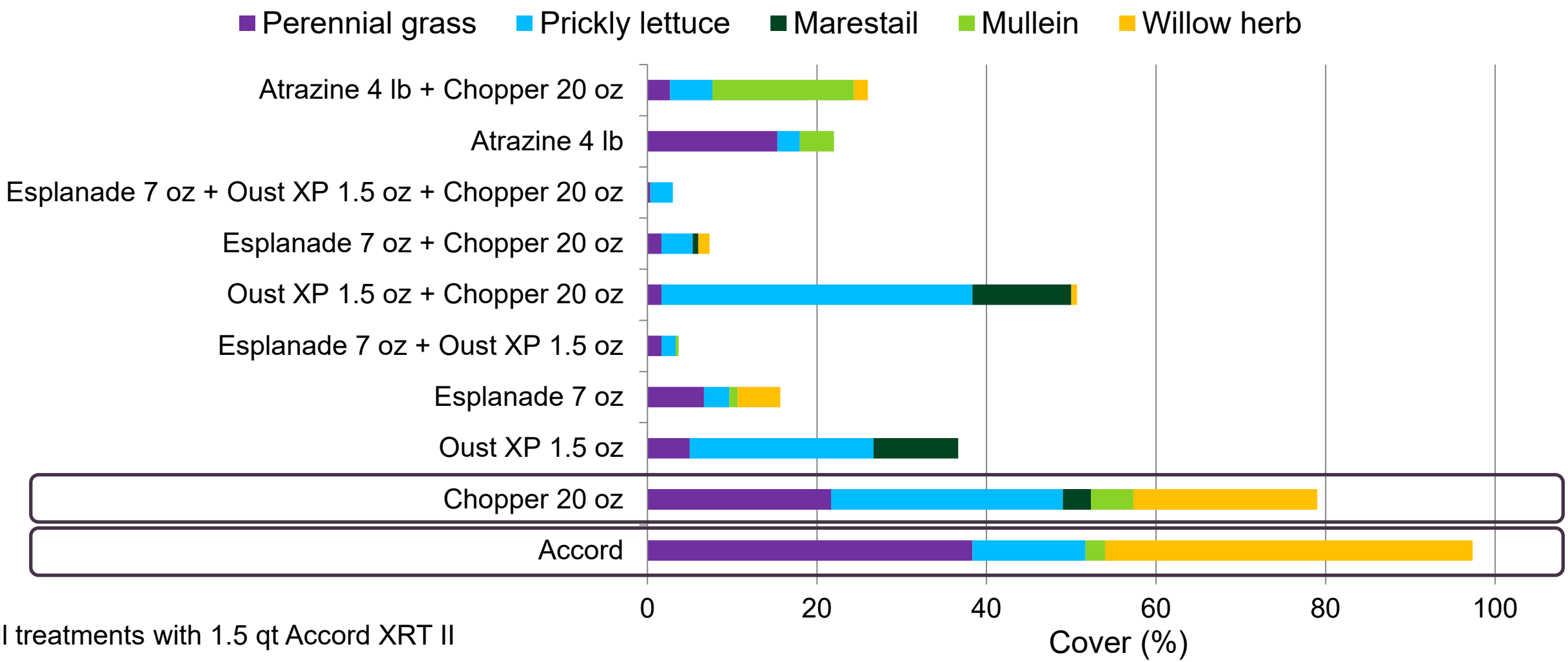
Western larch

Applied: 2017 October
Planted: 2018 May

Vegetation - First year after treatment

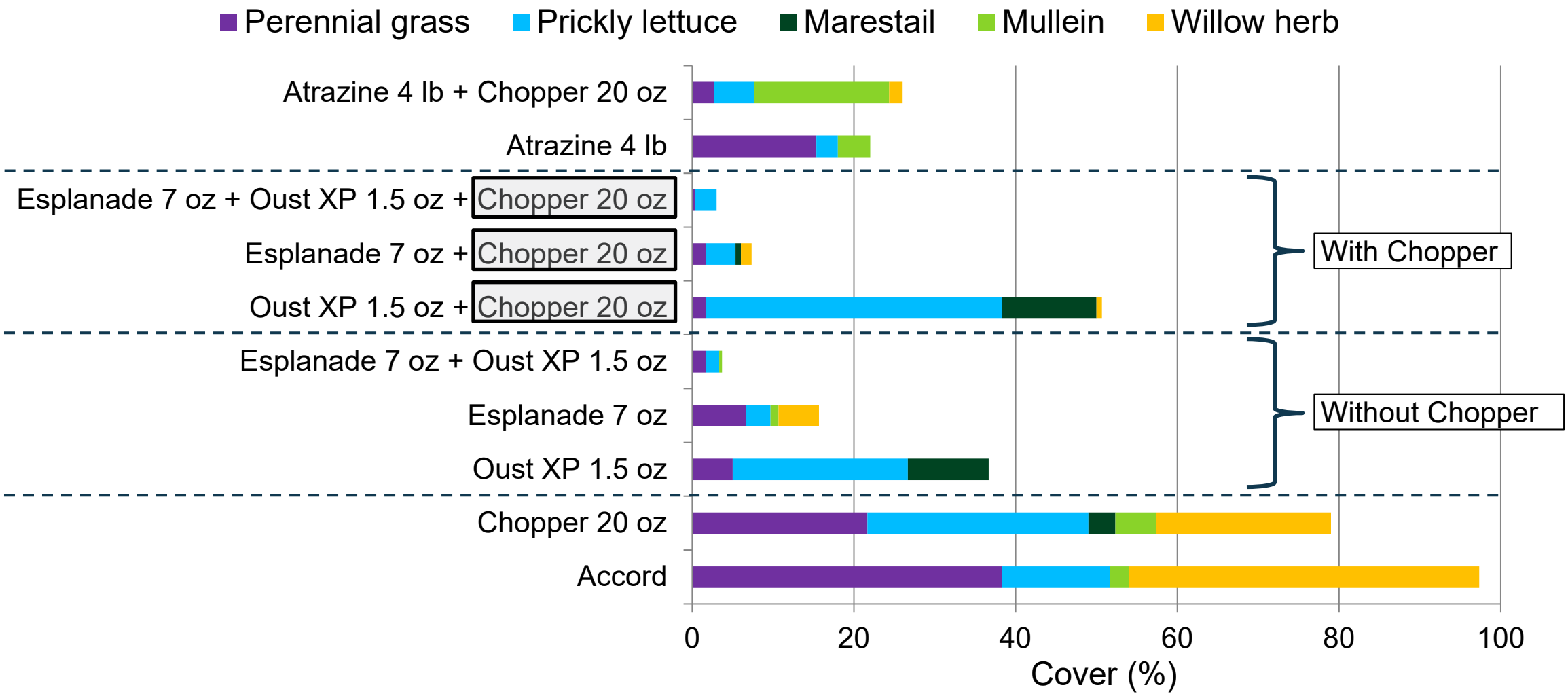
Good mix of species

Minimal residual control from straight Chopper

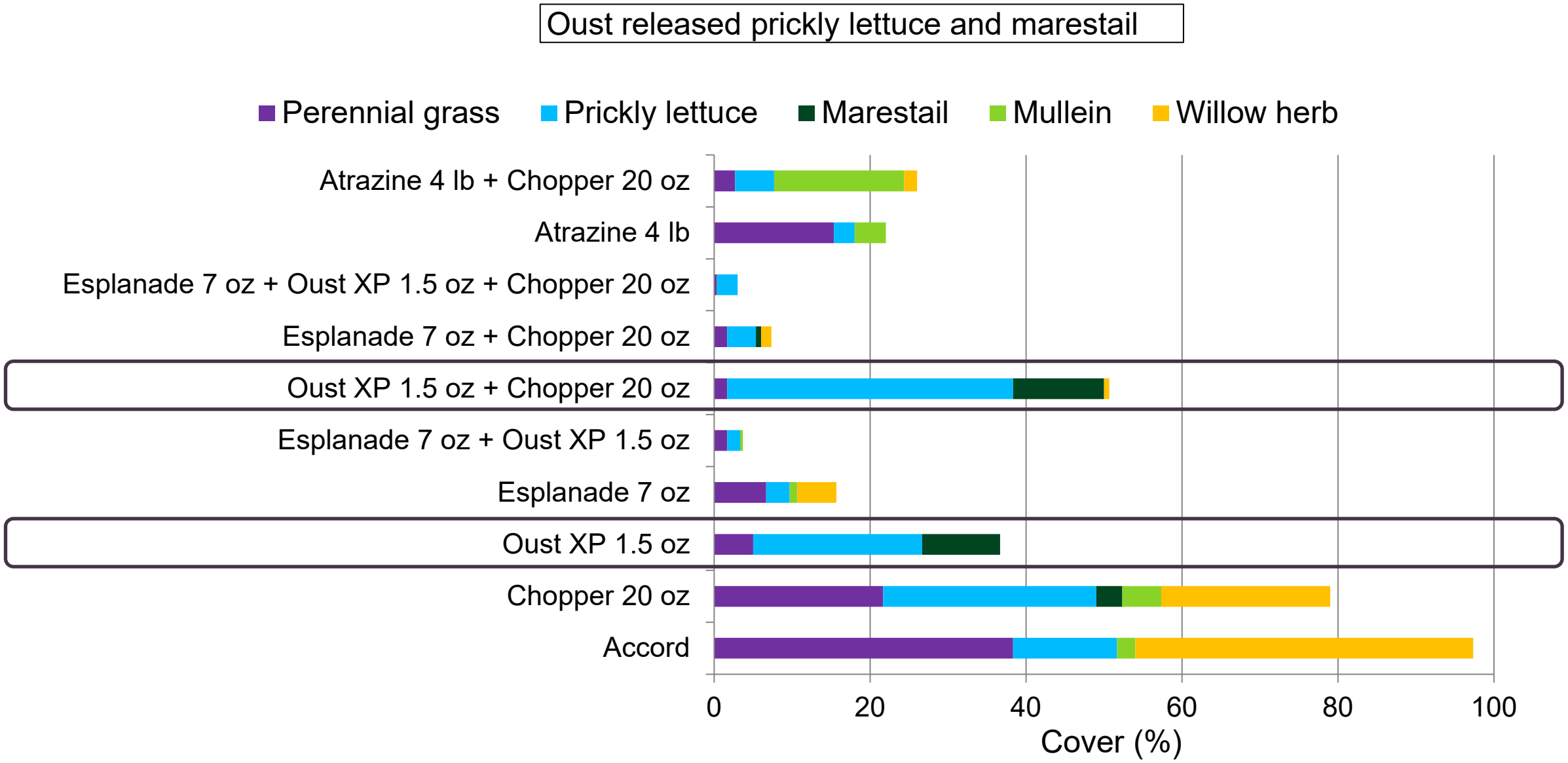


All treatments with 1.5 qt Accord XRT II

Minimal residual control benefit from adding Chopper to Oust or Esplanade

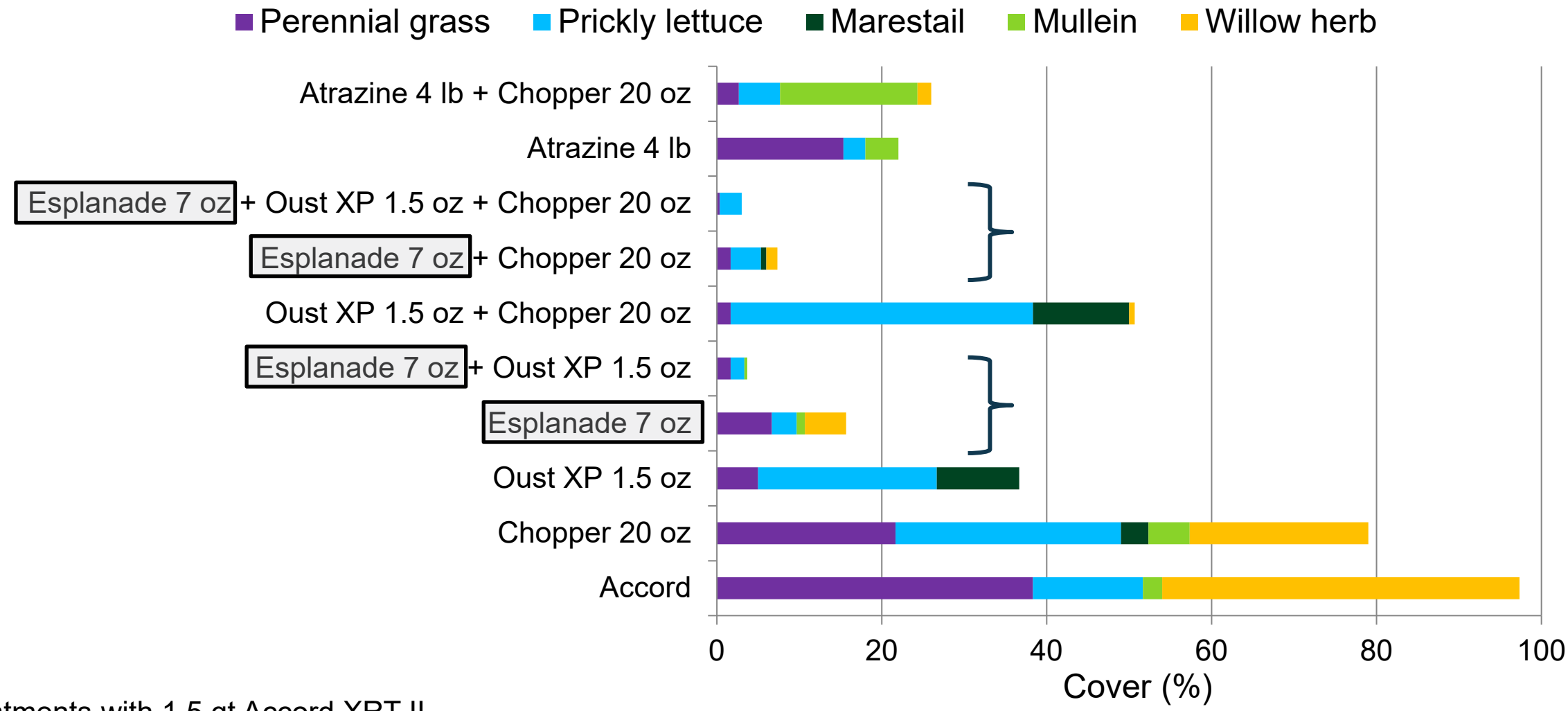


All treatments with 1.5 qt Accord XRT II

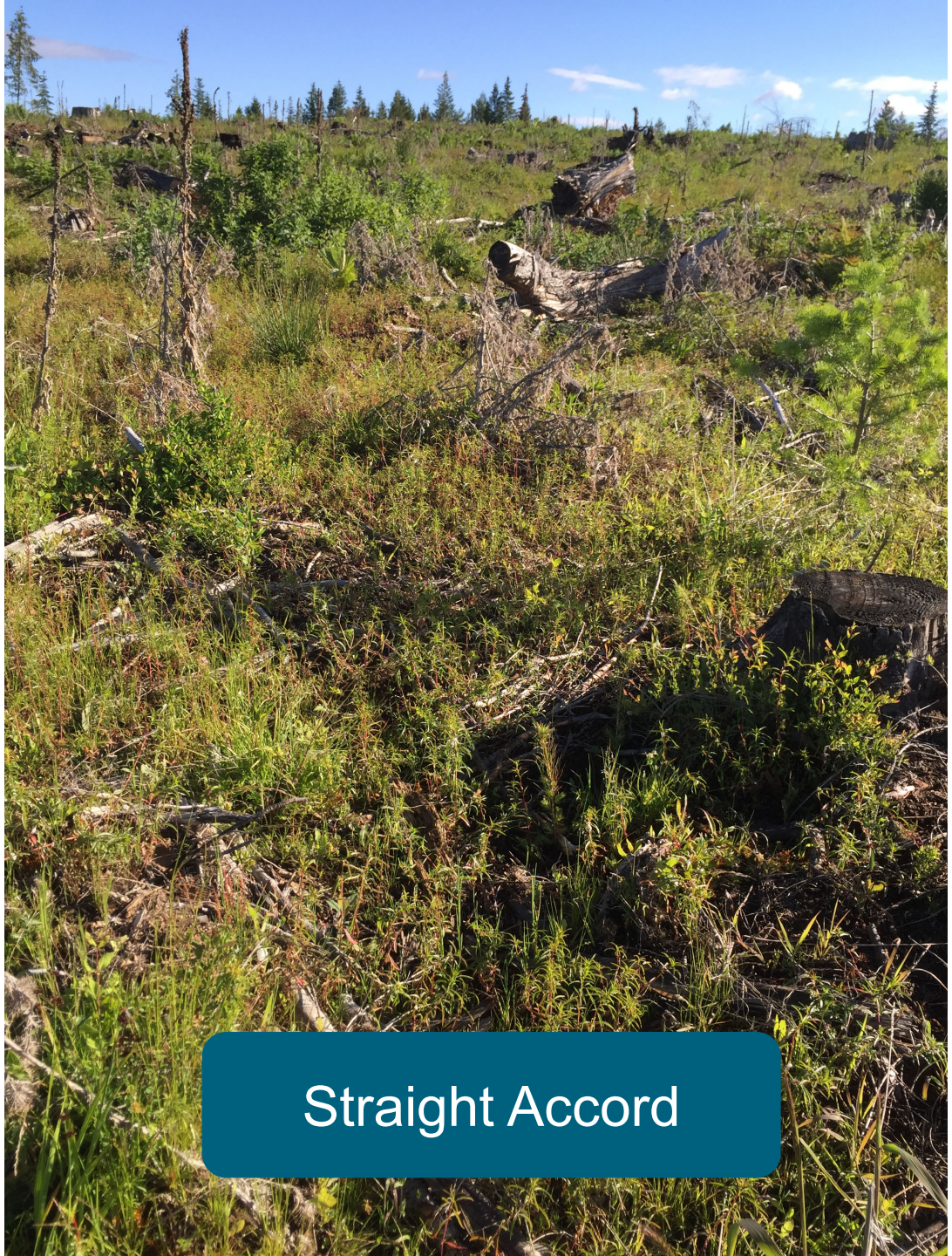


All treatments with 1.5 qt Accord XRT II

Best residual control from all treatments with Esplanade



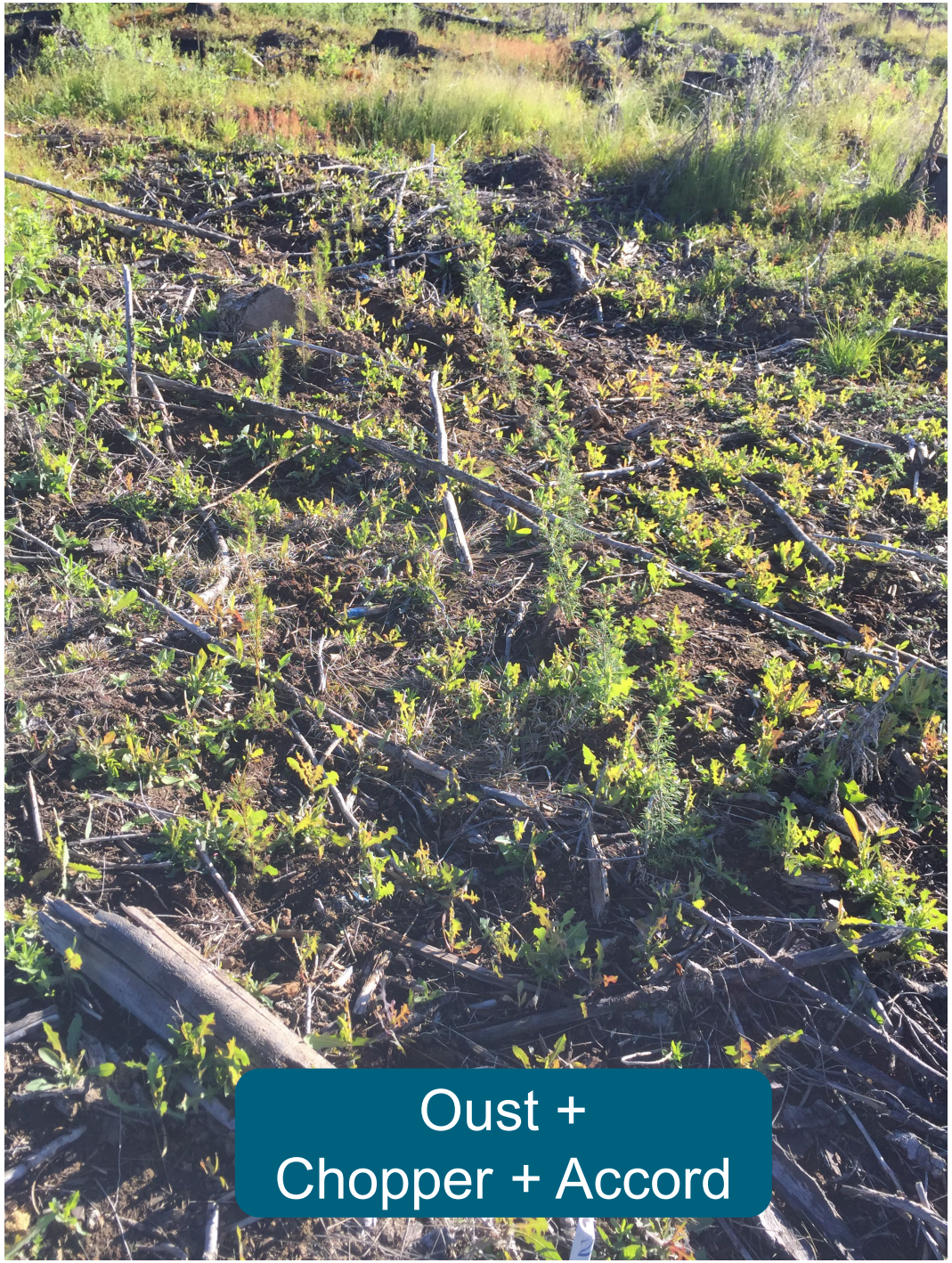
All treatments with 1.5 qt Accord XRT II



envu Forestry


Oust +
Accord


Esplanade +
Accord


Oust +
Chopper + Accord


Esplanade +
Chopper + Accord

Vegetation - Second year after treatment

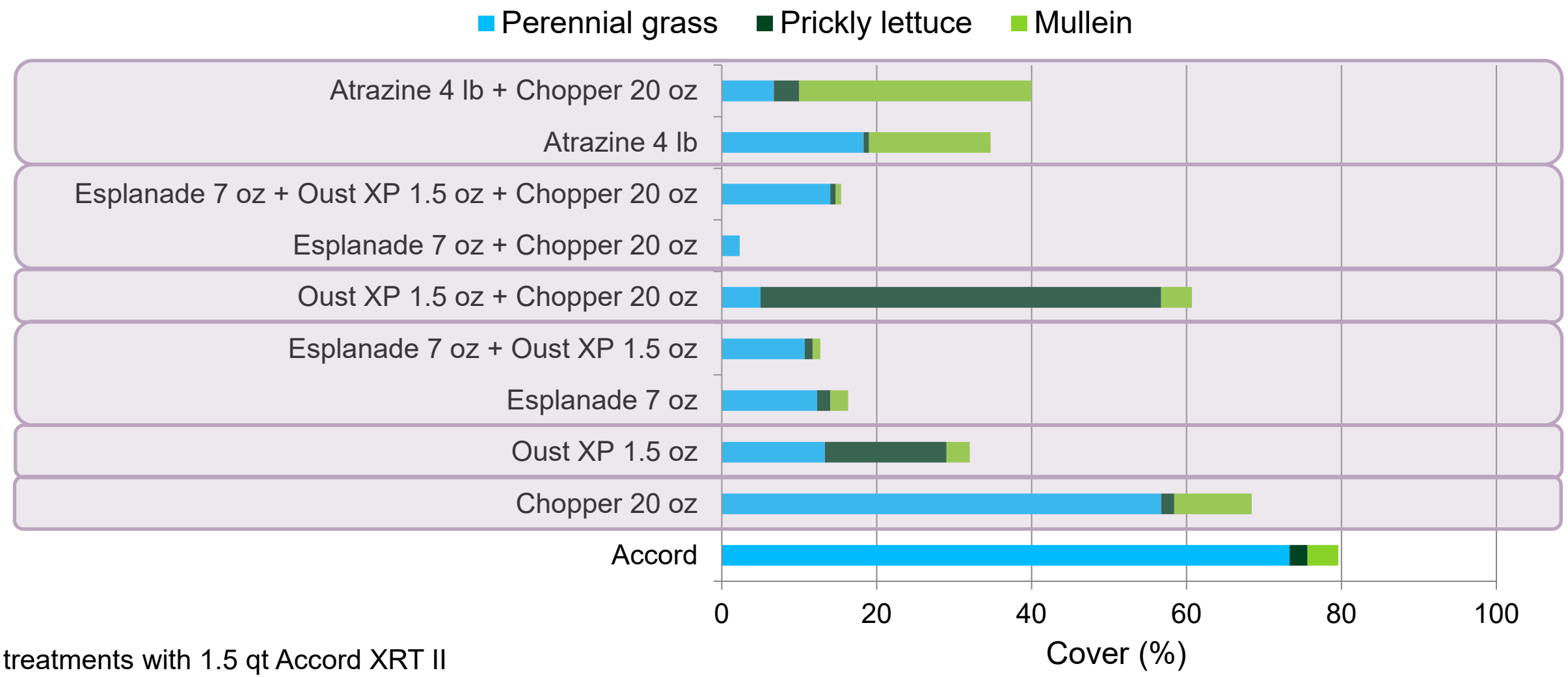
Straight Chopper did not provide residual control of perennial grass

Atrazine released common mullein

Oust released prickly lettuce

Best control from all treatments with Esplanade

Esplanade + Chopper = Best residual control

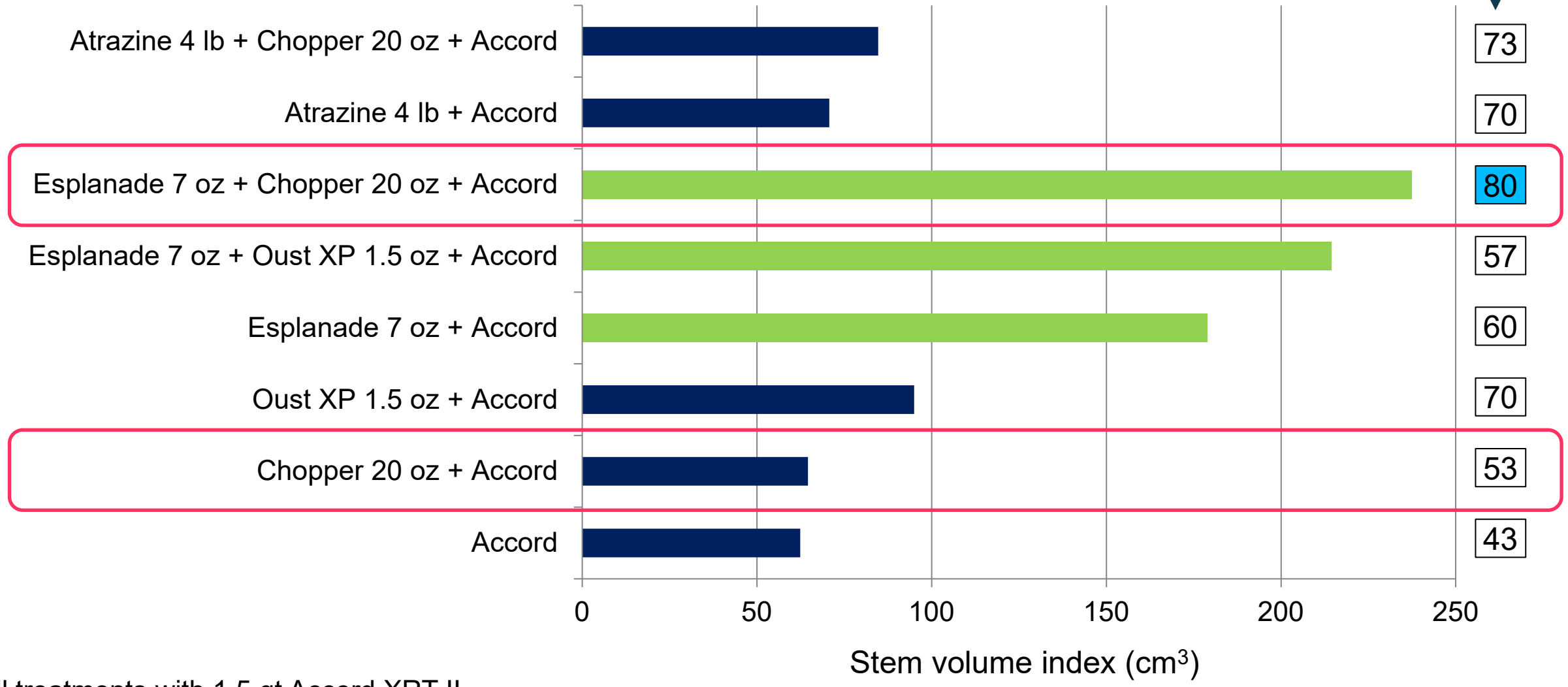


All treatments with 1.5 qt Accord XRT II

Douglas-fir stem volume 3rd growing season

Esplanade + Chopper + Accord = Best vegetation control and best tree growth

3.7 X more growth than Chopper + Accord

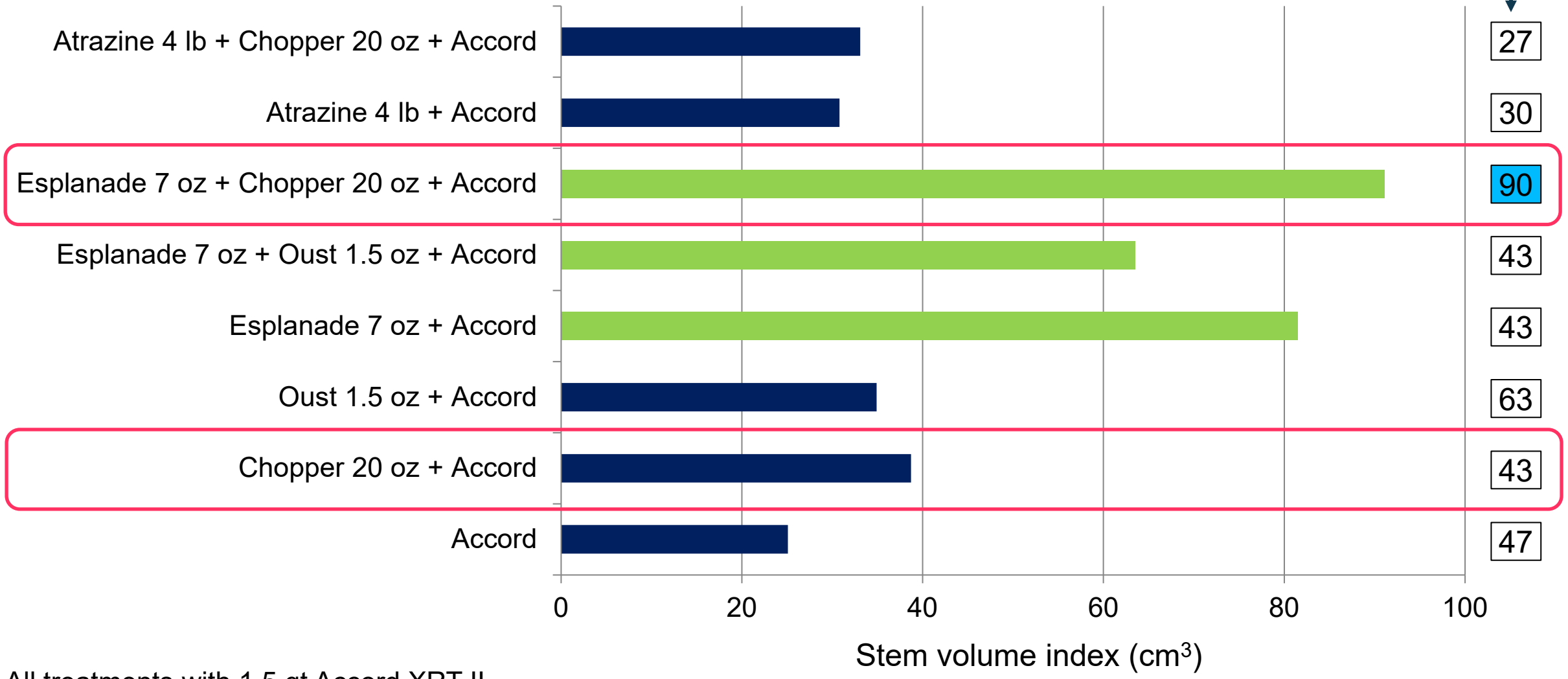


All treatments with 1.5 qt Accord XRT II

Western larch stem volume 3rd growing season

Esplanade + Chopper = Best vegetation control and best tree growth

2.4 X more growth than Chopper + Accord



All treatments with 1.5 qt Accord XRT II

Best treatments for fall site prep in the Northern Rockies

Douglas-fir

- 20 oz Chopper + 1.5 qt Accord (Year 3 stem volume 65)
- 7 oz Esplanade F + 20 oz Chopper + 1.5 qt Accord (Year 3 stem volume 237)

Western Larch

- 20 oz Chopper + 1.5 qt Accord (Year 3 stem volume 39)
- 7 oz Esplanade F + 20 oz Chopper + 1.5 qt Accord (Year 3 stem volume 91)

New Option for one pass vegetation control in the Northern Rockies

Esplanade F adds the long-term residual control missed by other site prep herbicides

Douglas-fir and grand fir in the Coast Range

Site prep compared to herbaceous release

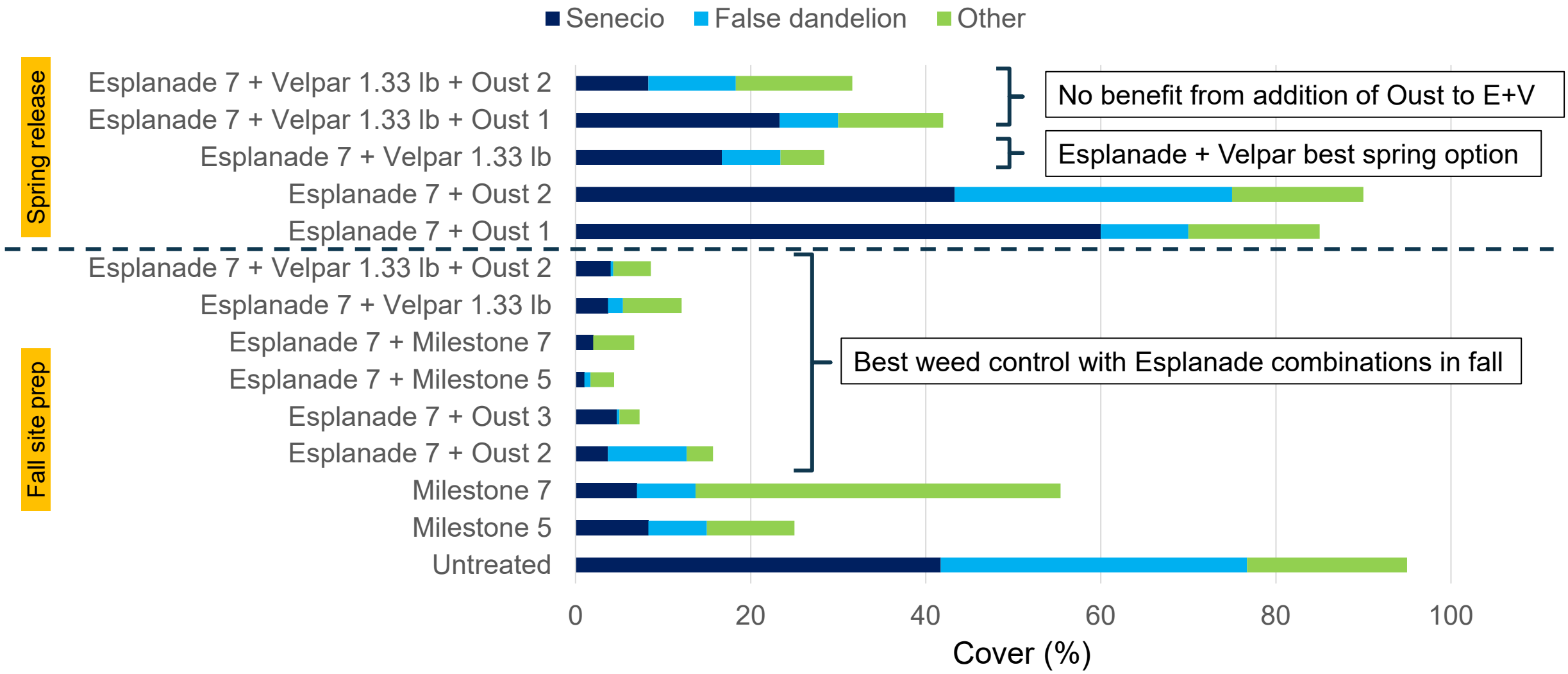
Site Preparation and Herbaceous Release Coast Range

Douglas-fir

Grand fir

Site prep: 2018 October
Planted: 2019 February
Release: 2019 March

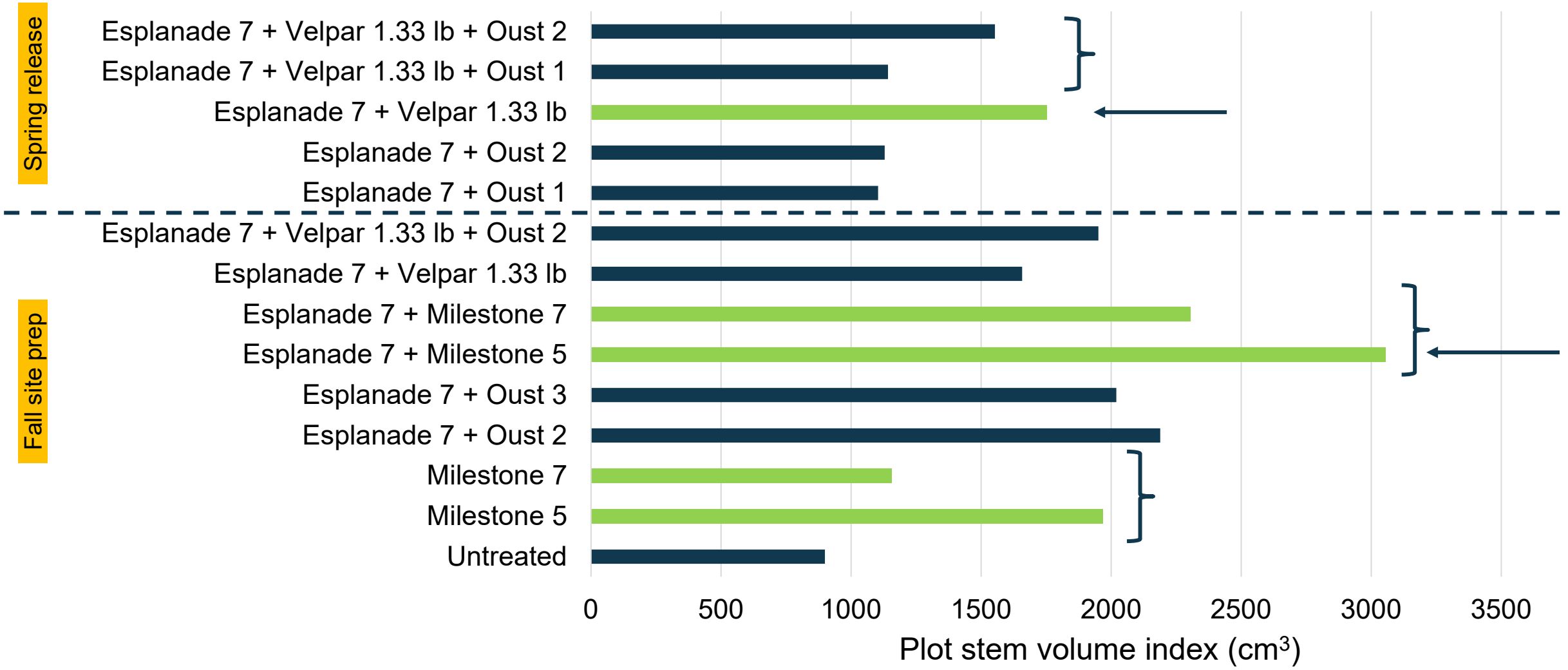
Vegetation – First year after treatment



All fall site prep treatments included glyphosate + 1 oz Escort

Douglas-fir plot stem volume index
2nd growing season

Esplanade + 5 oz Milestone the best fall treatment
Negative rate response to Milestone
Esplanade + Velpar the best spring treatment
No benefit from adding Oust to Esplanade+Velpar



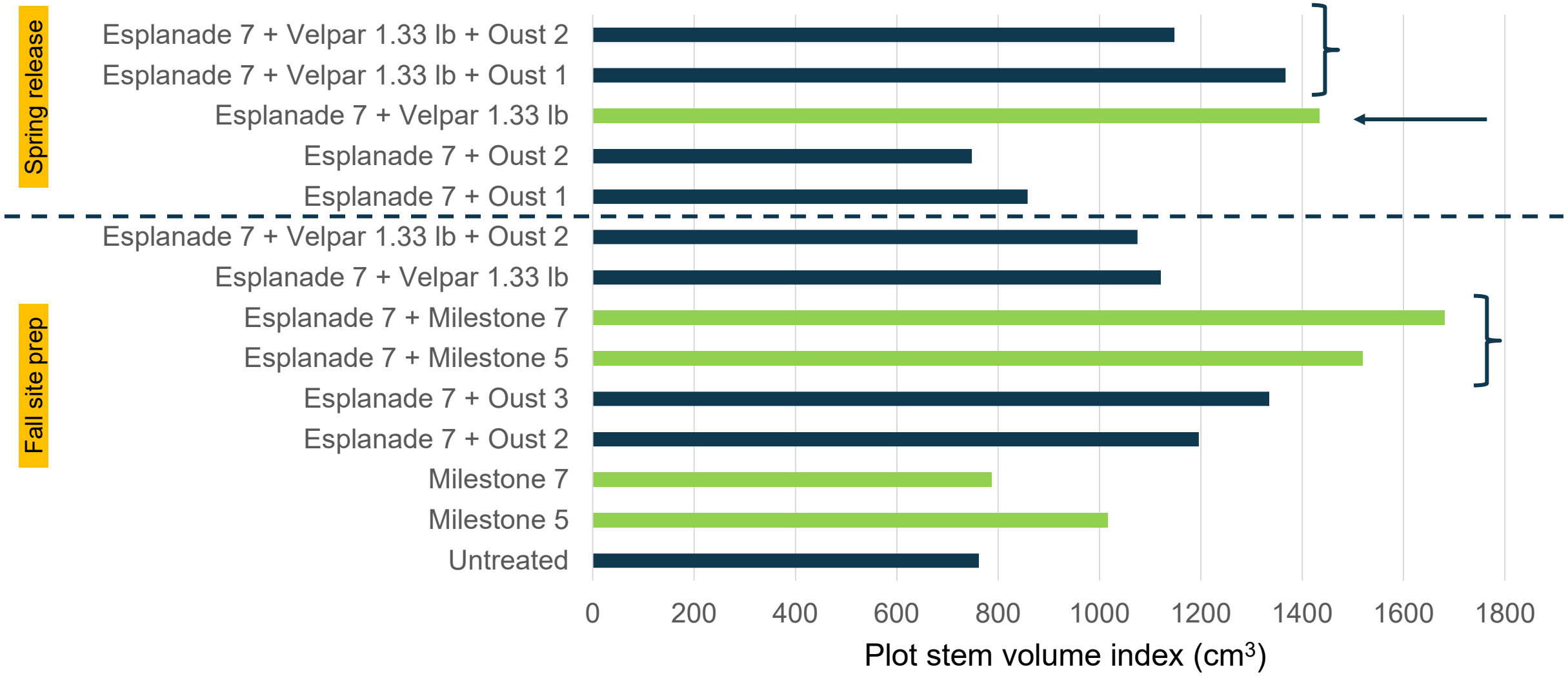
All fall site prep treatments included glyphosate + 1 oz Escort

Grand fir plot stem volume index
2nd growing season

Esplanade + Milestone the best fall treatment

Esplanade + Velpar the best spring treatment

No benefit from adding Oust to Esplanade+Velpar



All fall site prep treatments included glyphosate + 1 oz Escort + 0.5% MSO

Best treatments for fall site prep in the Coast Range (Douglas-fir, Grand fir)

Douglas-fir

- Spring release: 7 oz Esplanade + 1.33 lb Velpar + 1 oz Escort + glyphosate (Year 3 plot stem volume 1753)
- Fall site prep: 7 oz Esplanade F + 5 oz Milestone + 1 oz Escort + glyphosate (Year 3 plot stem volume 3055)

Grand fir

- Spring release: 7 oz Esplanade + 1.33 lb Velpar + 1 oz Escort + glyphosate (Year 3 plot stem volume 1435)
- Fall site prep: 7 oz Esplanade F + 7 oz Milestone + 1 oz Escort + glyphosate (Year 3 plot stem volume 1681)

New Option for one pass fall site prep in the Coast Range (Douglas-fir and Grand fir)

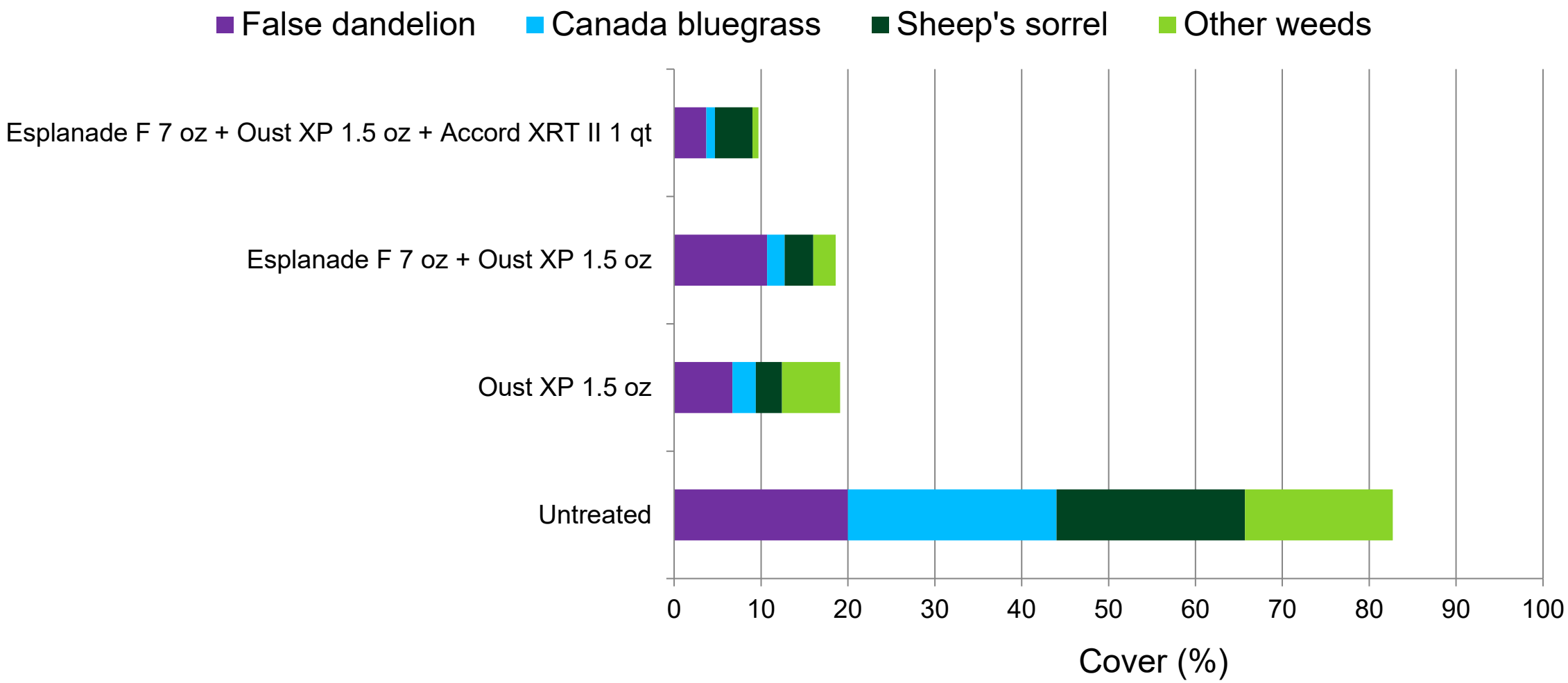
Esplanade F adds the long-term residual control missed by other site prep herbicides

Herbaceous Release Coast Range

Dougas-fir

Planted: 2016 March
Treated: 2016 March (9 days after planting)

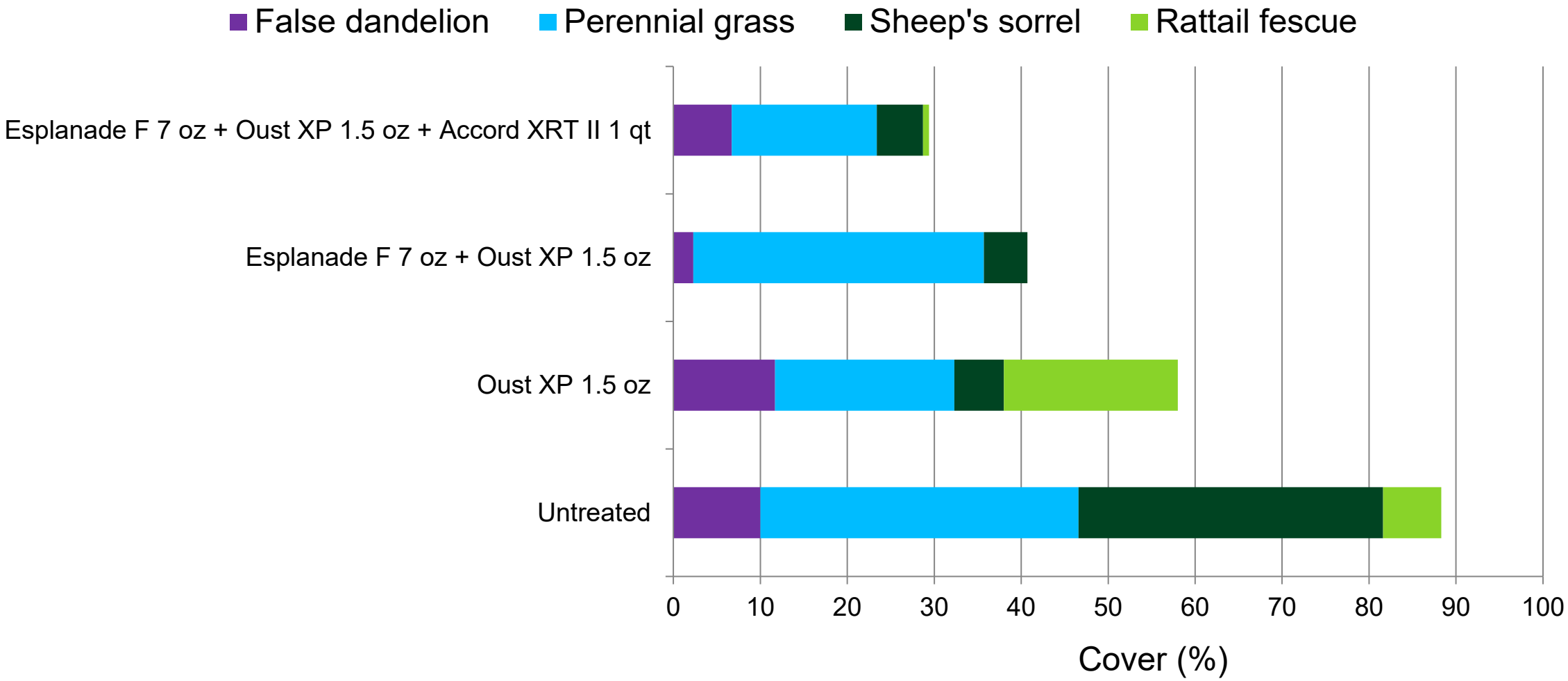
Vegetation – First year after treatment



Planted: 2016 March
Treated: 2016 March (9 days after planting)

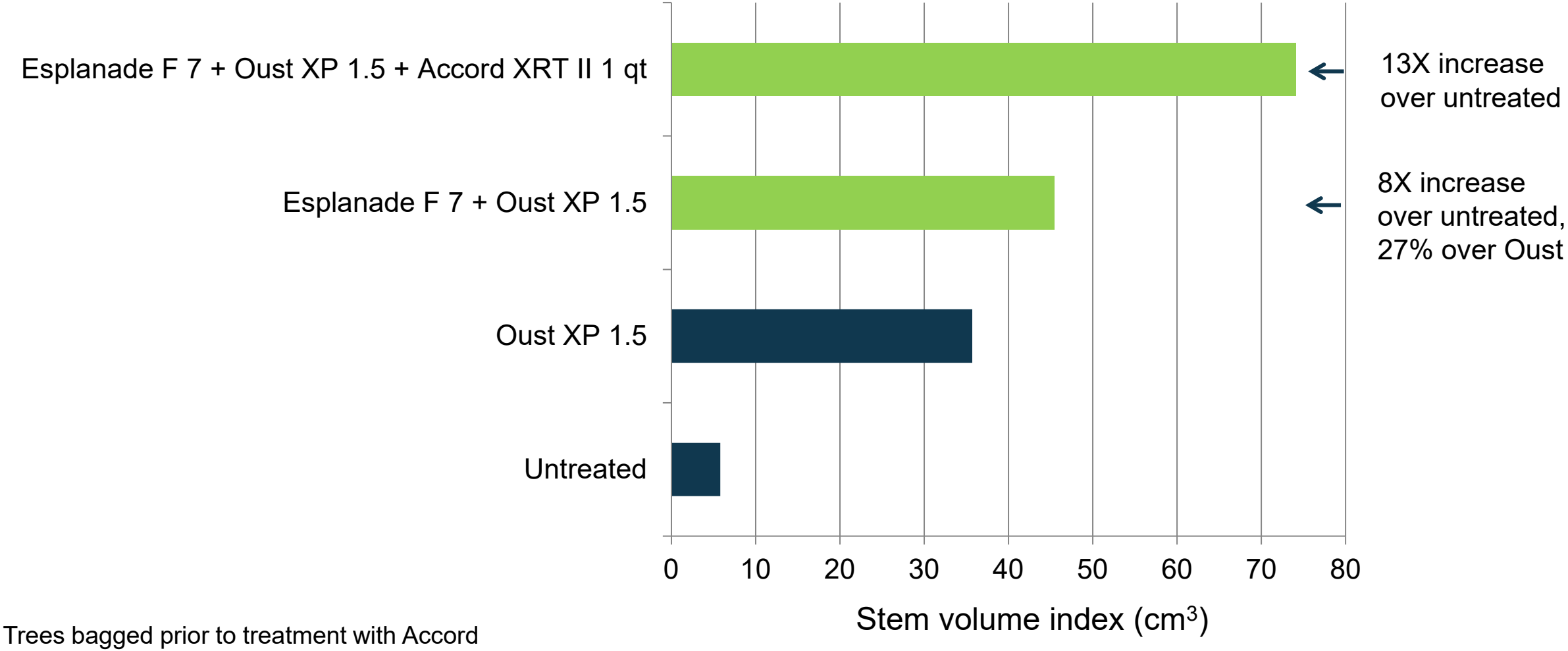
Vegetation – Second year after treatment

Perennial grass not controlled at treatment was released



Planted: 2016 March
Treated: 2016 March (9 days after planting)

Douglas-fir stem volume index
2nd growing season



Trees bagged prior to treatment with Accord

July 2016

4 Months after treatment

Untreated

Esplanade F + Oust XP

Esplanade F + Oust XP
+ Accord XRT II

Tolerance trials

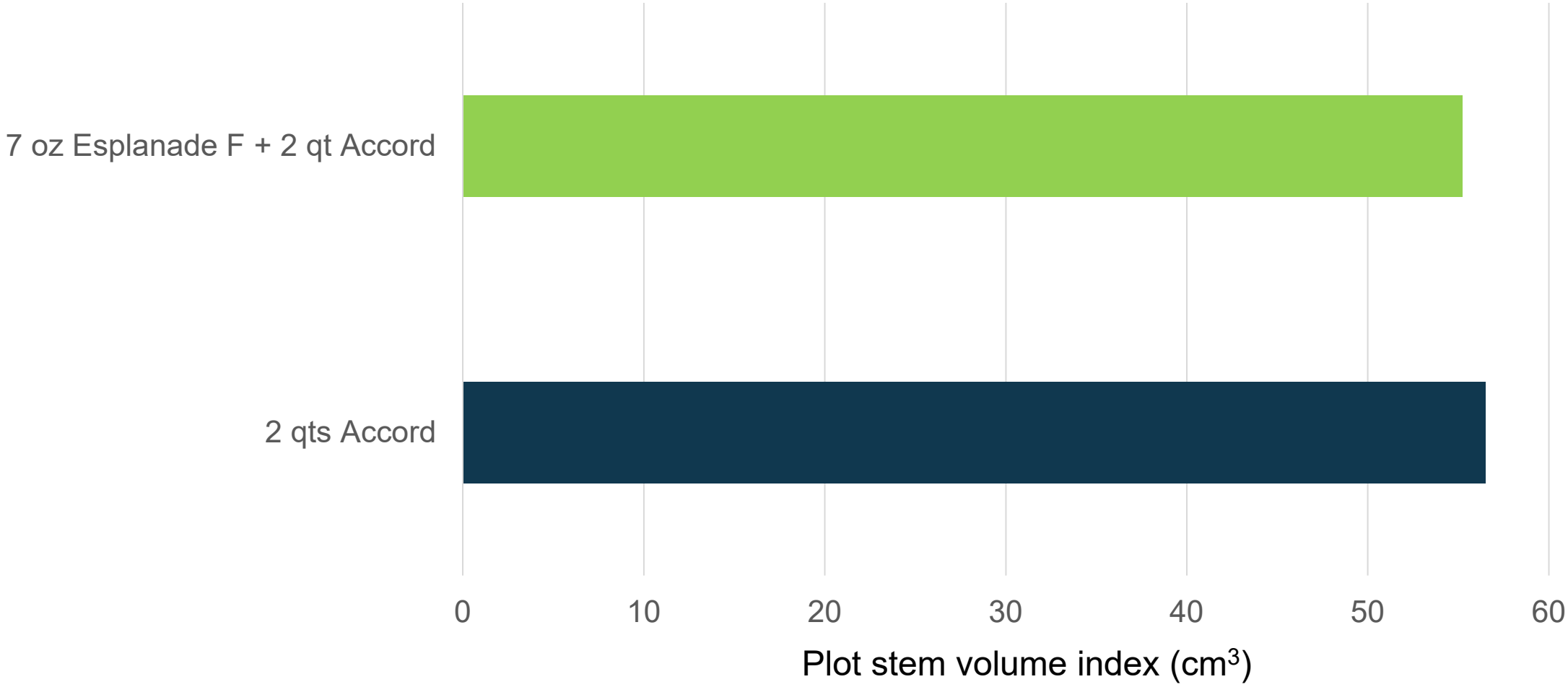
Site Preparation
Cascades

Red fir

White fir

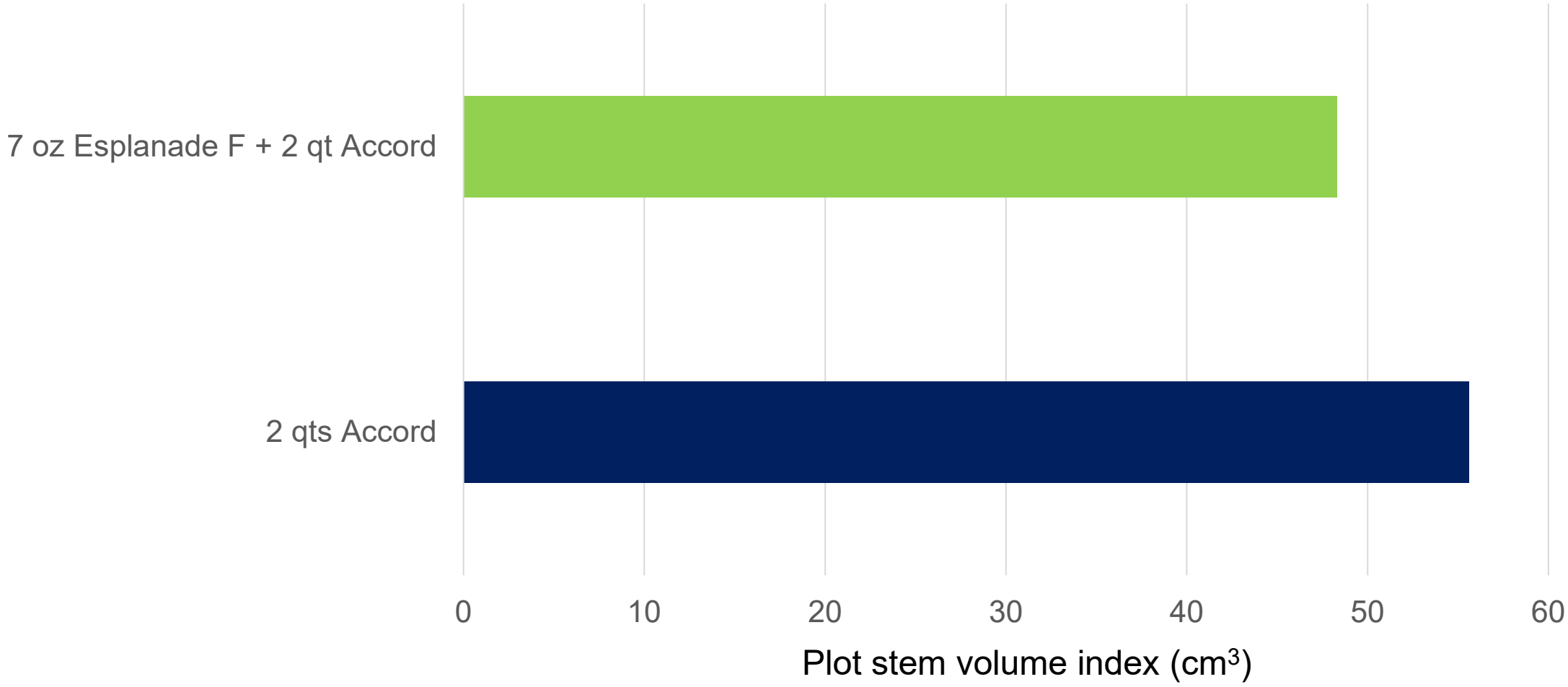
Applied: 2018 August
Planted: 2018 October

Red fir – Plot stem volume index (cm^3)
2nd growing season



Applied: 2018 August
Planted: 2018 October

White fir – Plot stem volume index (cm^3)
2nd growing season



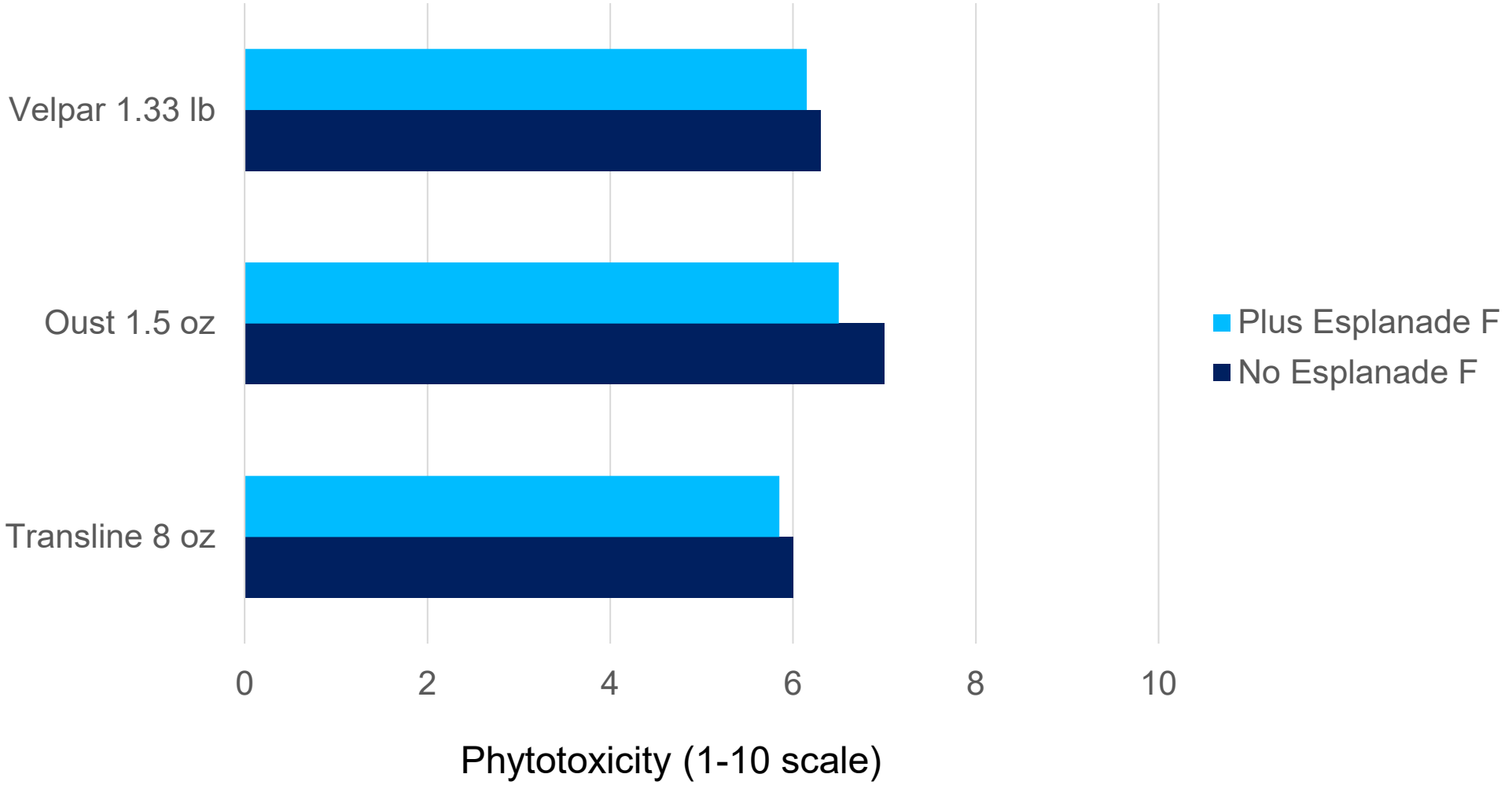
Herbaceous Release Cascades

Western red cedar

Western hemlock

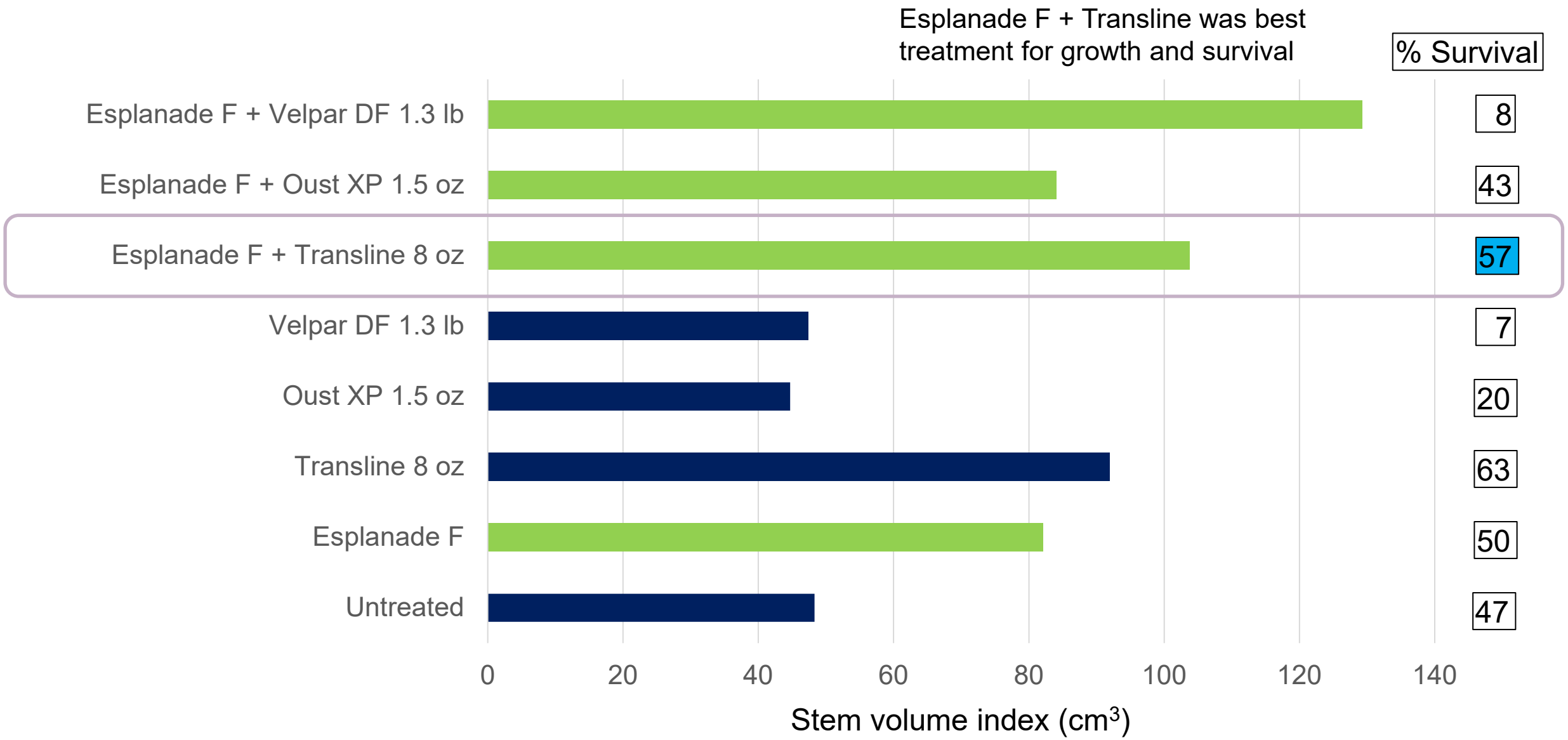
Applied: 2019 April
Planted: 2019 April
Assessed: 2019 July

Western red cedar phytotoxicity 1st growing season



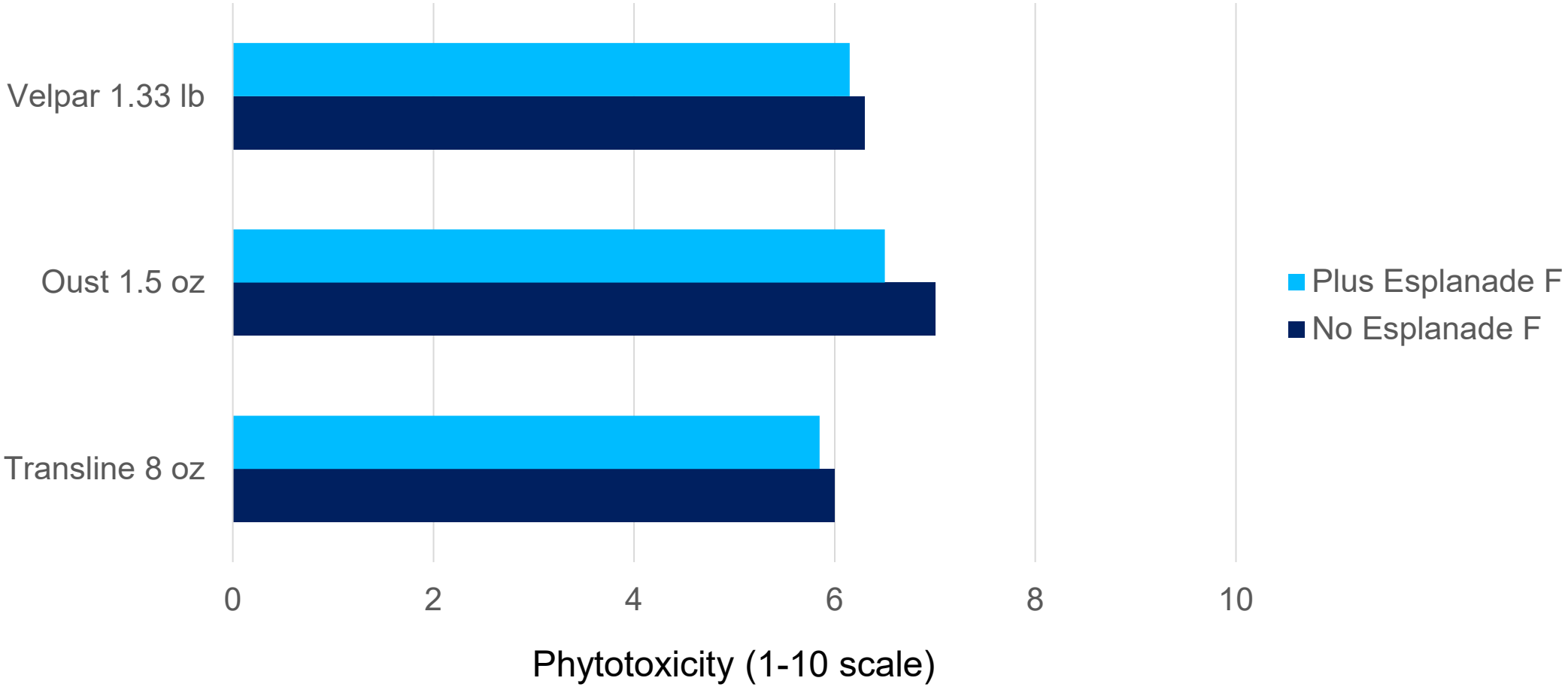
Applied: 2019 April
Planted: 2019 April

Western red cedar stem volume index
2nd growing season



Applied: 2019 April
Planted: 2019 April
Assessed: 2019 July

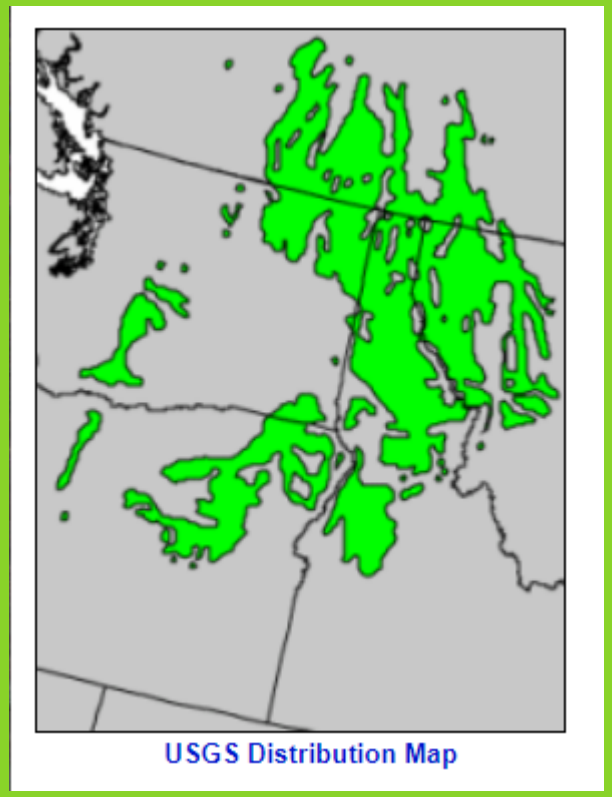
Western hemlock phytotoxicity
1st growing season



No growth data due to poor survival from planting

Herbaceous Release Northern Rockies

Western Larch

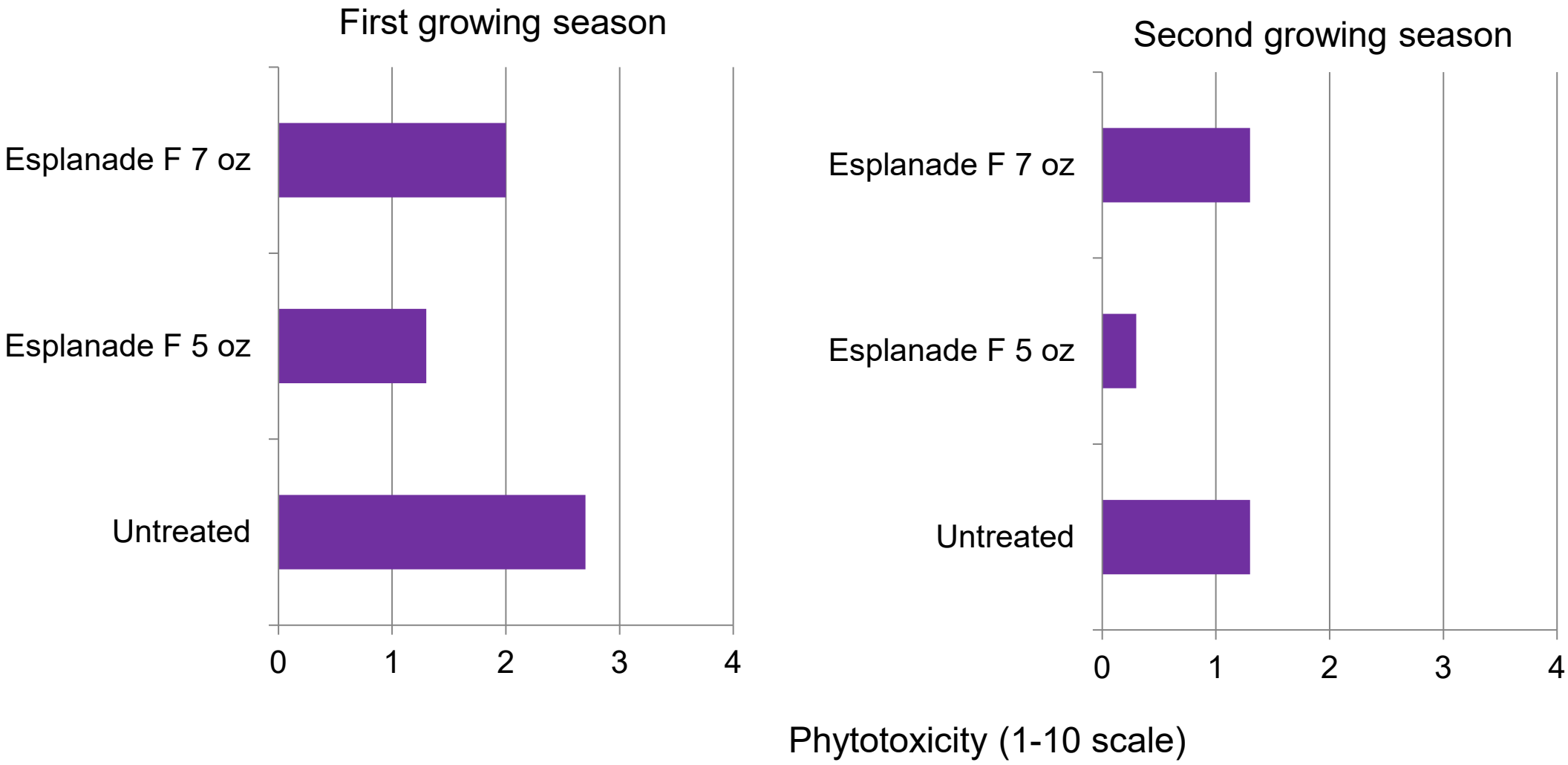


October 2018

Site prep herbicide application: Chopper 20 oz + Roundup Pro Concentrate 48 oz + Oust XP 1.5 oz + Escort 1 oz

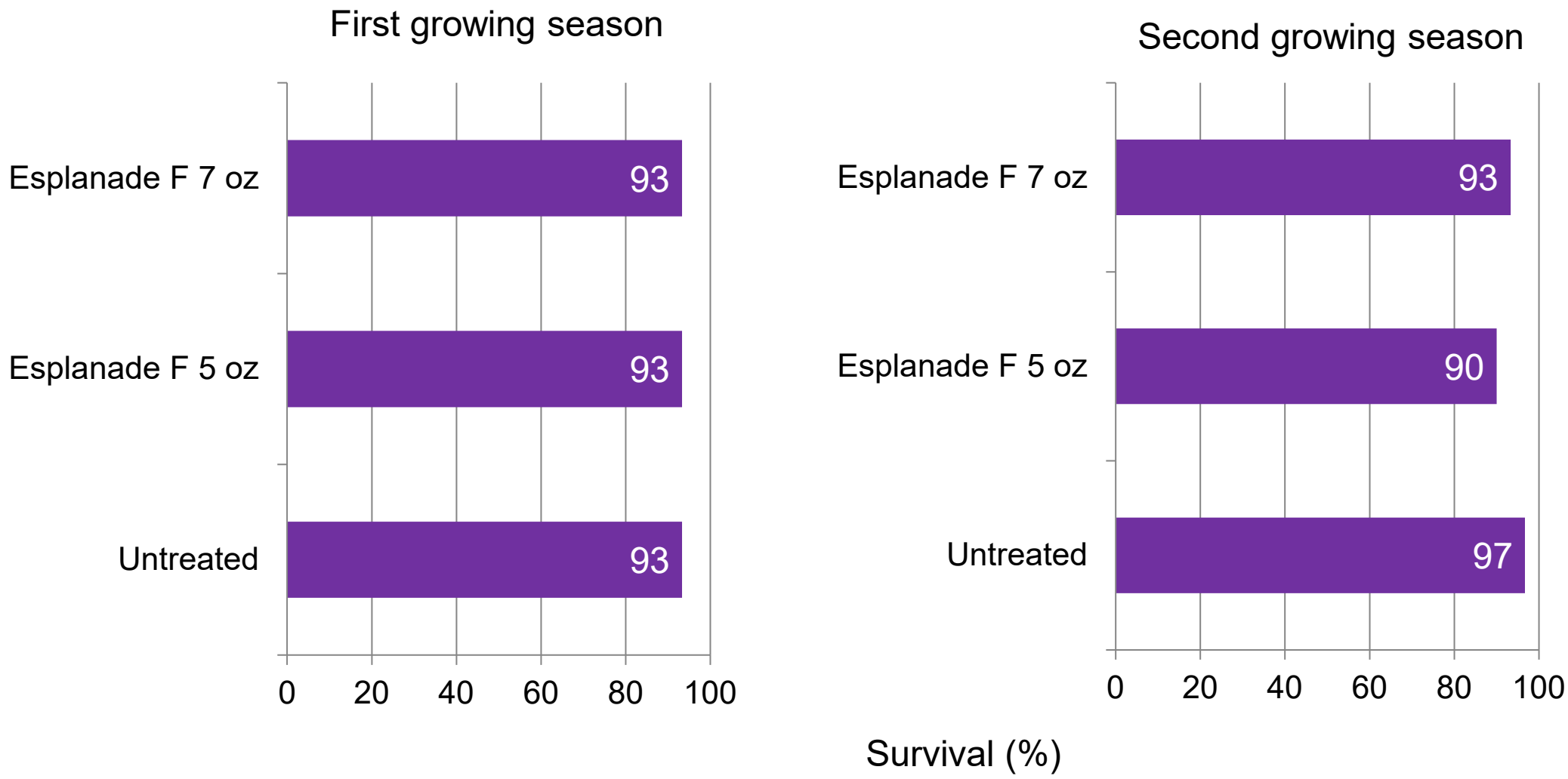
Planted: 2019 April
Applied: 2019 May

Western larch phytotoxicity



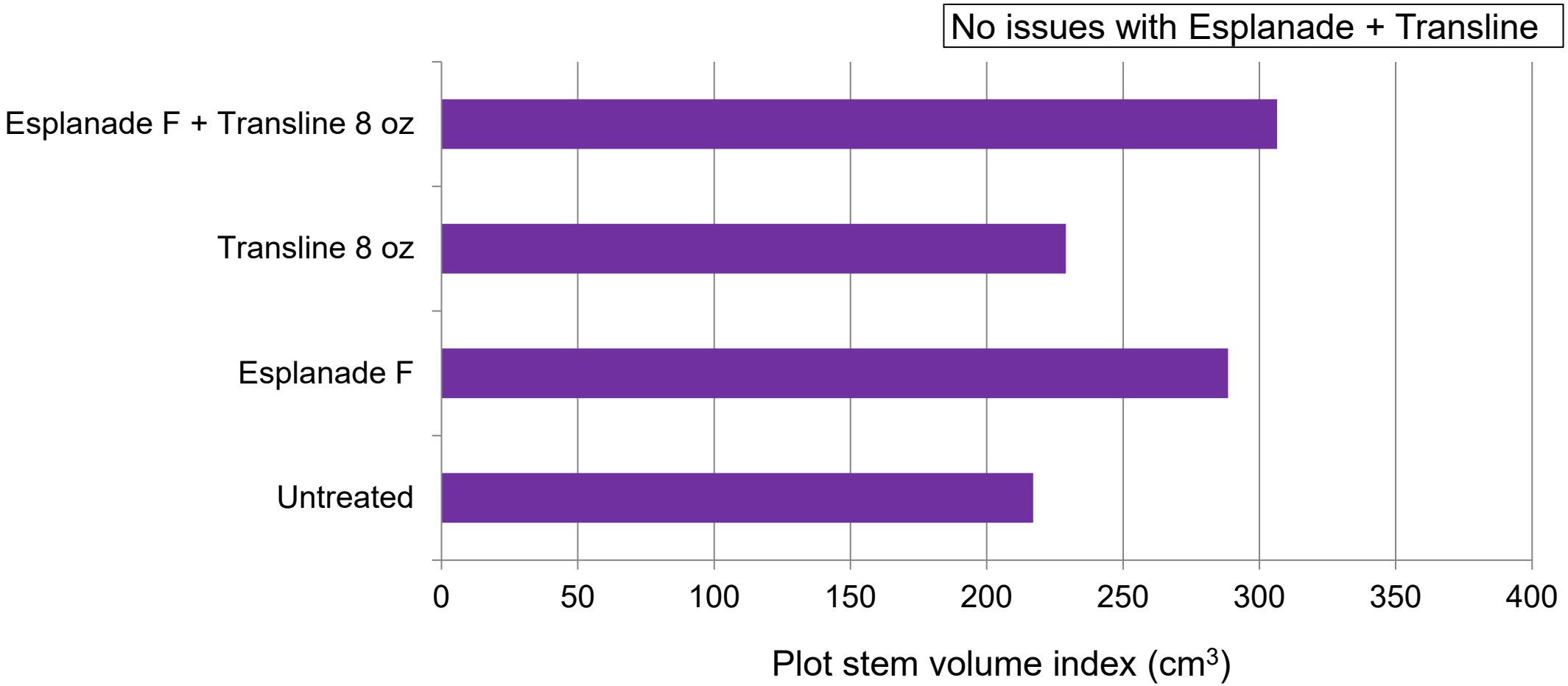
Planted: 2019 April
Applied: 2019 May

Western larch survival



Planted: 2019 April
Applied: 2019 May

Plot stem volume index – Esplanade + Transline 2nd growing season

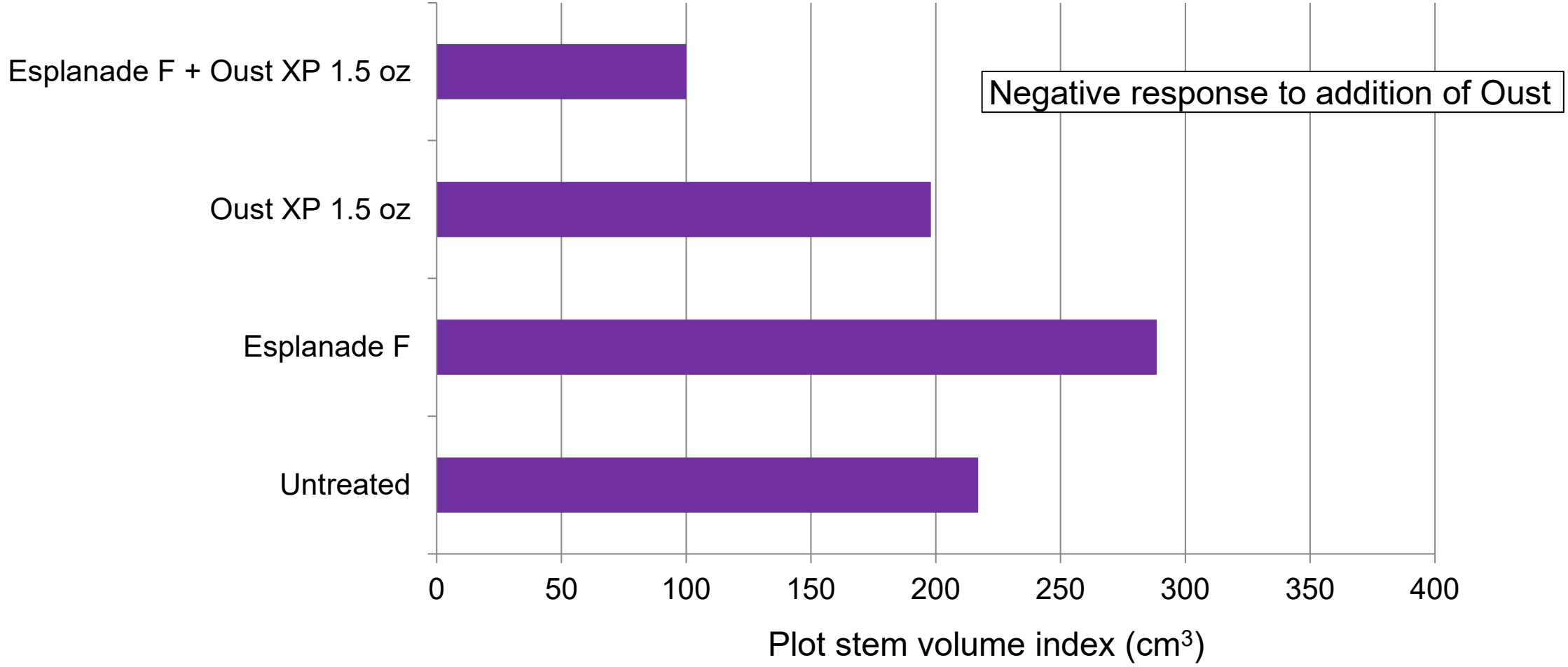


Esplanade values averaged over 5 and 7 oz


June 2020
Esplanade F 5 oz + Transline 8 oz

Planted: 2019 April
Applied: 2019 May

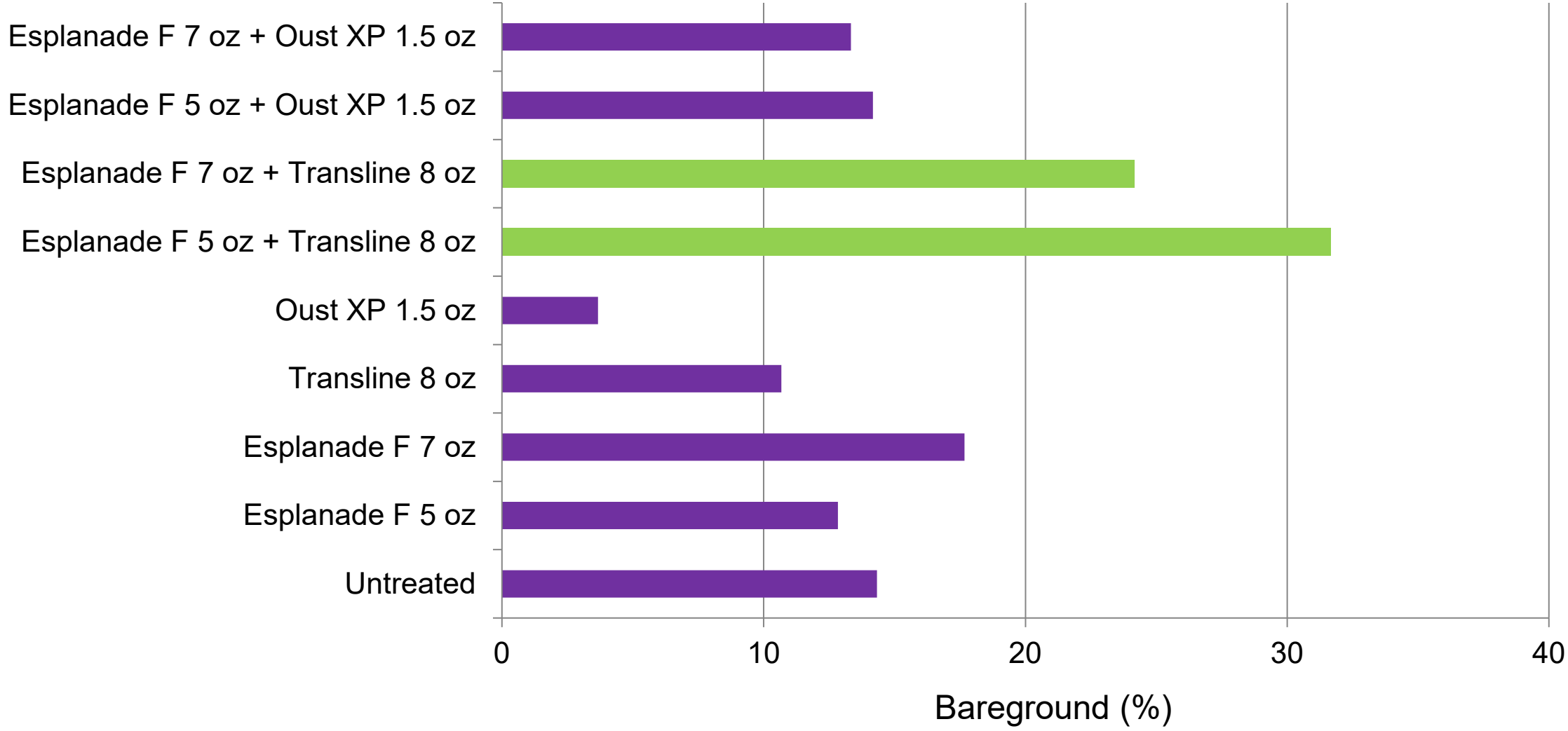
Plot stem volume index – Esplanade + Oust
2nd growing season



Esplanade values averaged over 5 and 7 oz

Planted: 2019 April
Applied: 2019 May

Bareground – Second year after treatment




June 2020


July 2021

Summary


77
1
Seattle
2
Olympia
15
41
10
Portland
Salem
3
4
1
11
16
17
Helena
Boise
9
78
80
12
4
Salt Lake City
Carson City
19
Sacramento
13
San Francisco
5
1
San Jose
7
20
Fresno
6
23
14

Esplanade F Summary

Tank mix Esplanade with other herbicides that provide

- Burndown of established vegetation
- Early post-emergence control
- Pre-emergence control

Esplanade targets the soil seed bank

Esplanade F
For Site Preparation

Choose tank mix partners based on the crop species to be planted, the target vegetation and the environment

- Velpar DF
- Chopper
- Oust Extra / Oust / Escort
- Milestone
- Cleantraxx
- Roundup

Esplanade F
For Site Preparation

Tolerant Conifers

- Ponderosa pine
- Coast redwood
- Douglas-fir
- Western larch

Additional species showing tolerance

- Sugar pine
- Incense cedar
- Red fir
- White fir
- Grand fir

Esplanade F
For Herbaceous Release

Choose tank mix partners based on the crop species, the target vegetation and the environment

- Velpar DF
- Oust XP
- Transline
- Roundup (pre-plant or directed)

Esplanade F
For Herbaceous Release

Tolerant Conifers

- Ponderosa pine
- Coast redwood
- Douglas-fir

Additional species showing tolerance

- Western red cedar
- Western hemlock
- Grand fir
- Sugar pine
- Western larch

Thank You