



# Stand Development Monitoring FREP Timber Production Protocol

# SDM

The goal of SDM is to monitor shifts in stand attributes from the baseline data set from FG surveys. This will allow us to make inferences about our Stocking Standard and FG Policy as well as Forest Health Issues

- **SDM data can be valuable for many other uses:**
  - Monitoring the impacts of forest management decisions such as site prep, planting density, spacing and fertilization
  - Feedback to Standards Contained in Operational Contracts ie Spacing, Planting contracts
  - Comparing our stands to TIPSy to supply input to TSR for Managed Stand Analysis Units

# 31 SDM blocks completed in the Arrow TSA

|      |           |
|------|-----------|
| 2010 | 1 block   |
| 2012 | 5 blocks  |
| 2013 | 11 blocks |
| 2014 | 14 blocks |

|          |           |
|----------|-----------|
| ESSF wc1 | 2 block   |
| ESSF wc4 | 5 blocks  |
| ICH dw1  | 4 blocks  |
| ICH mw2  | 17 blocks |
| ICH wk1  | 2 block   |
| ICH mw1  | 1 block   |

## Easy survey to complete – Access is our main challenge

- Blocks are taken from a random list produced by Victoria
- Establish 10 - 3.99 plots in strata
- Count all trees dead and alive by layer by species (no Layer 4)
- Measure the dbh of all Layer 1 and 2 trees
- Take the height of four Layer 1 and 2 trees per plot
- Assess Forest Health on all live and dead trees by layer
  - (Use SDM damage criterion not FG)
- Select SI tree from 5.64 m plot – largest dbh tree
- Count FG stems/ha in 3.99 plot – no assessment of FG status is taken except for FG height

# Access is the main productivity problem

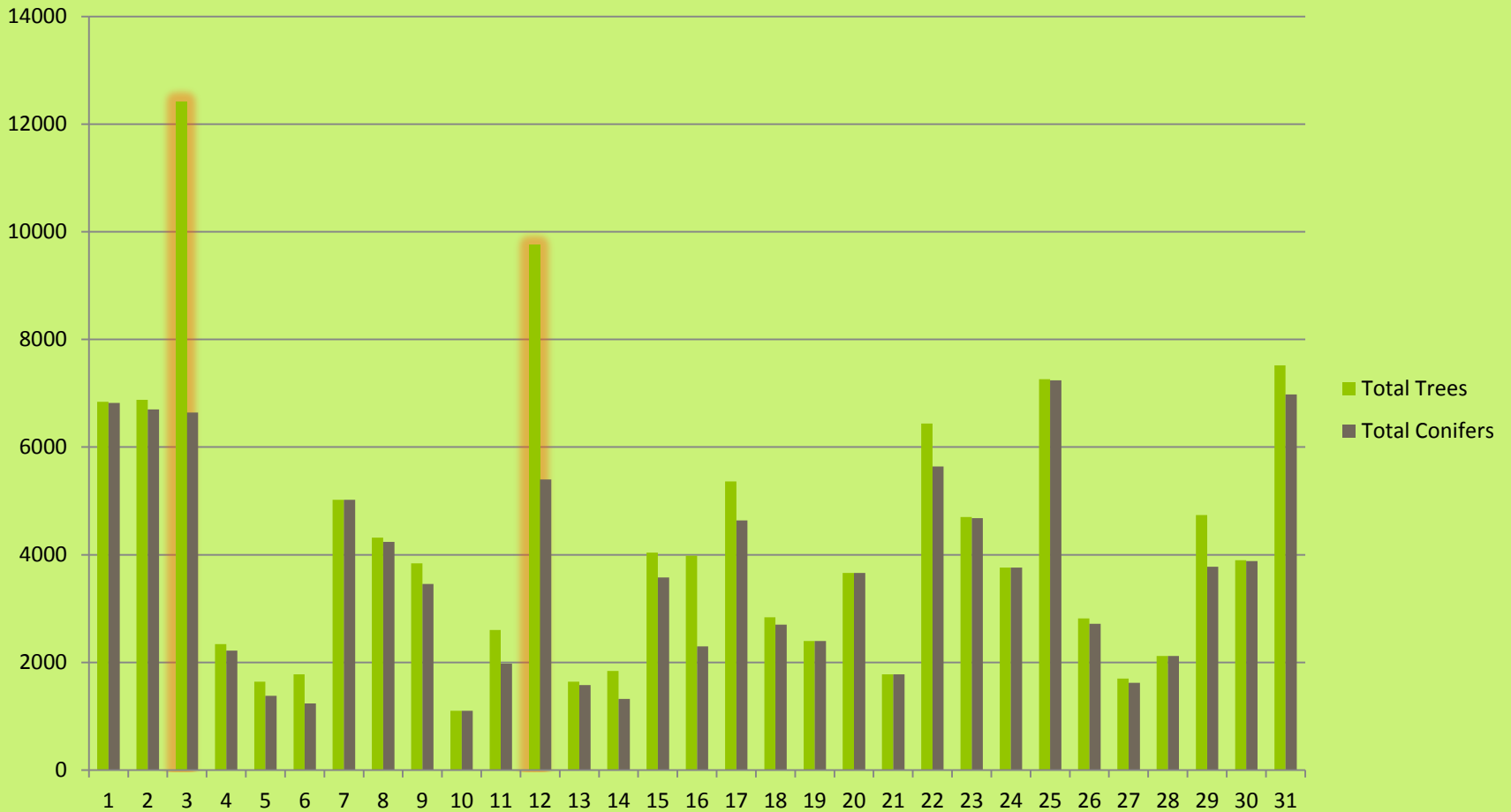


# There is no Free Growing Assessment apart from height



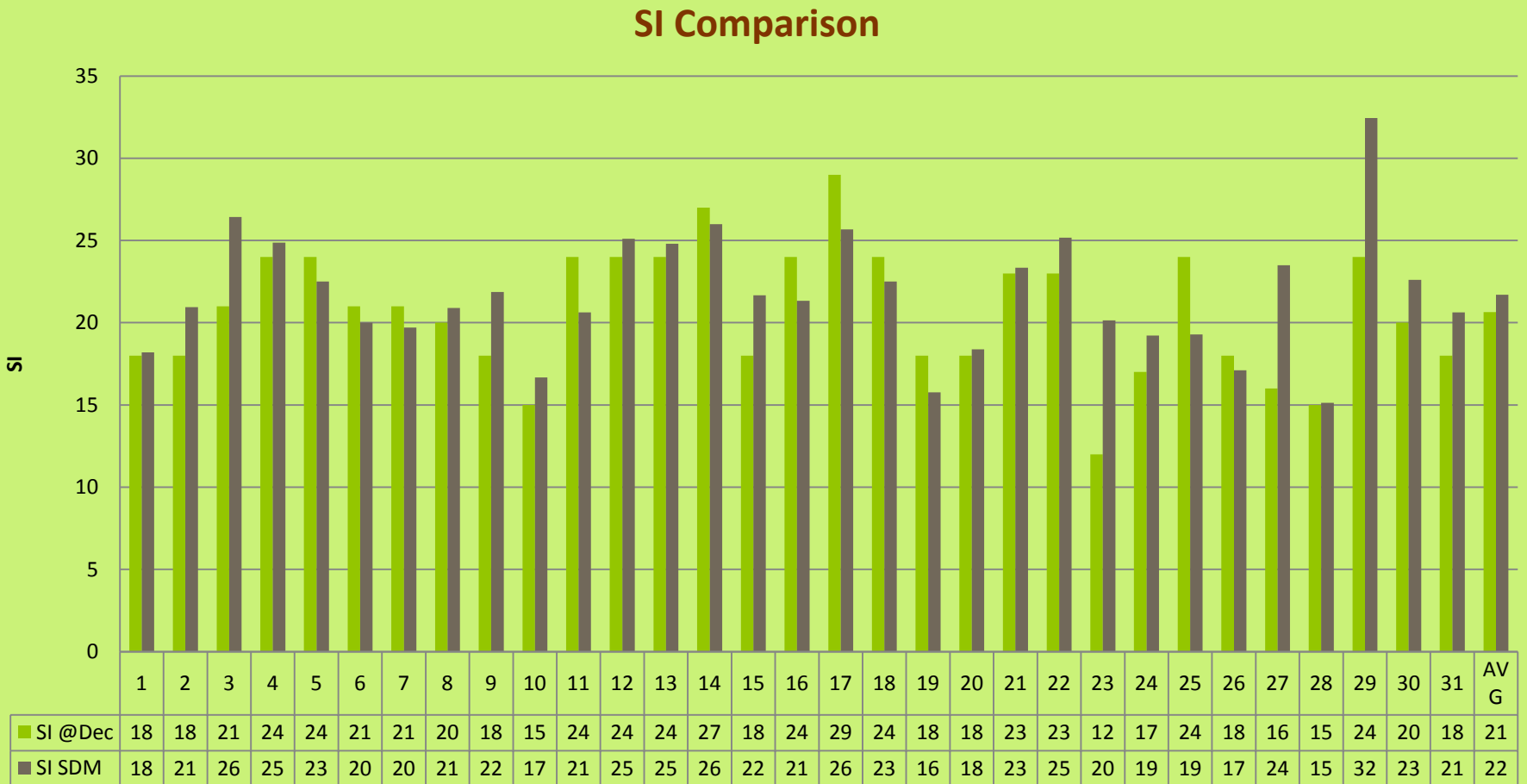
- Wilson Creek – Unit 31 – Natural  
1040 FG stems/ha

# Total Trees versus total conifers



Unit 3 and unit 12 both had Manual brushing carried out and decid was mostly sprouts

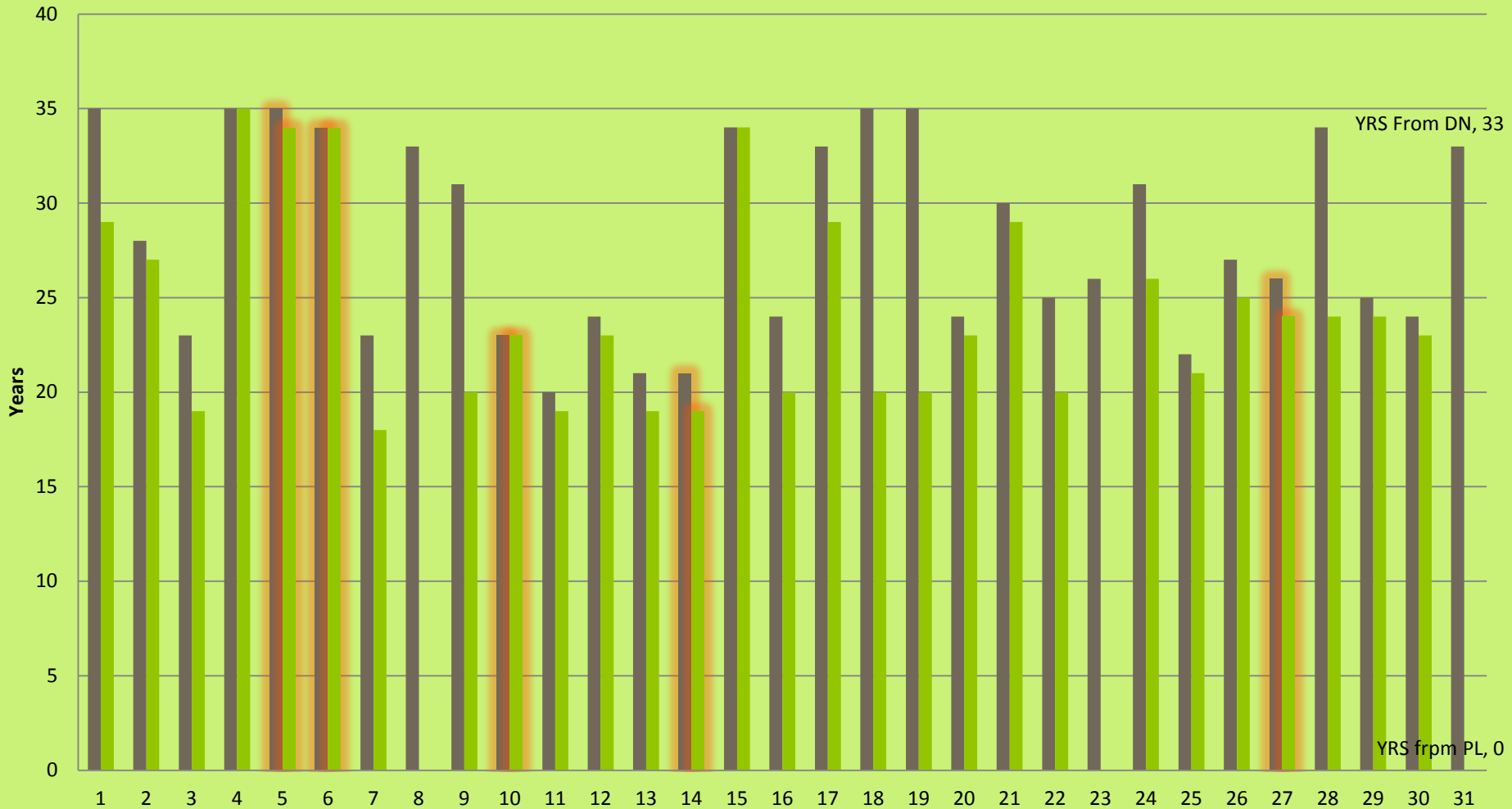
# SI Comparison between FG Declaration and SDM



GI trees can be hard to find in the ESSF

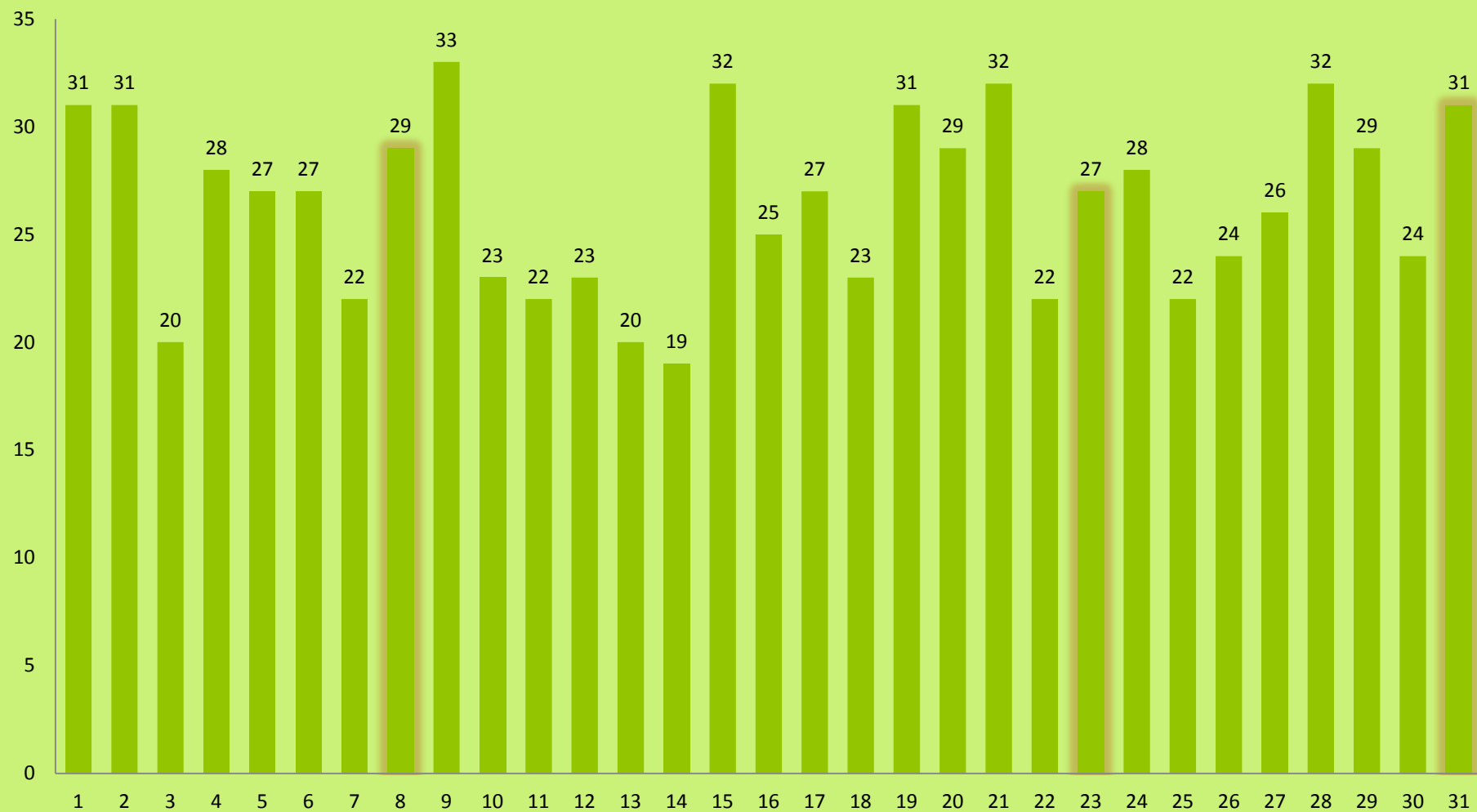


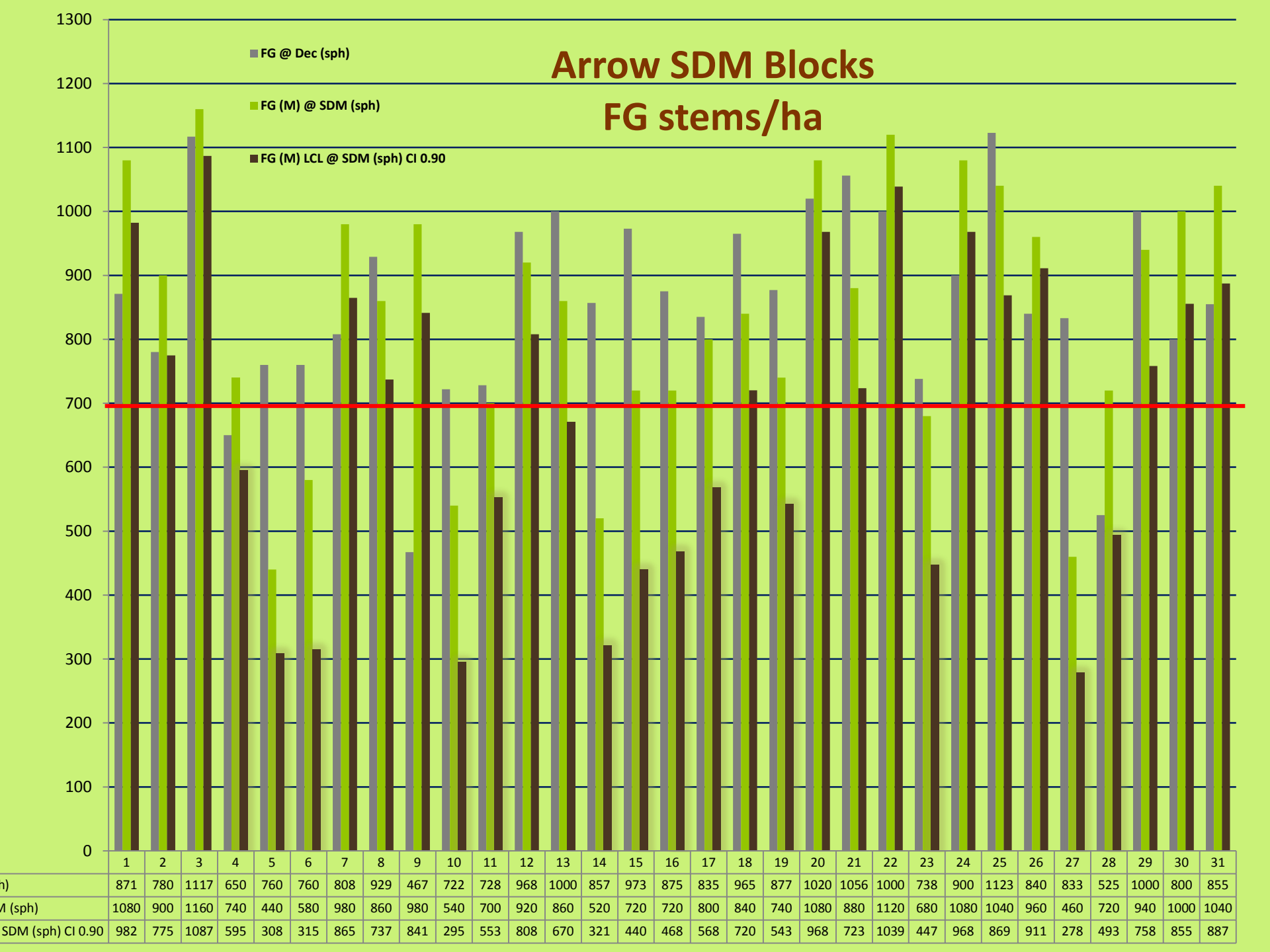
Average Number of years since Harvest = 28  
3 blocks left for natural – 28 were planted



Red glow are NSR stands

## Age of Blocks using corrected GI ages





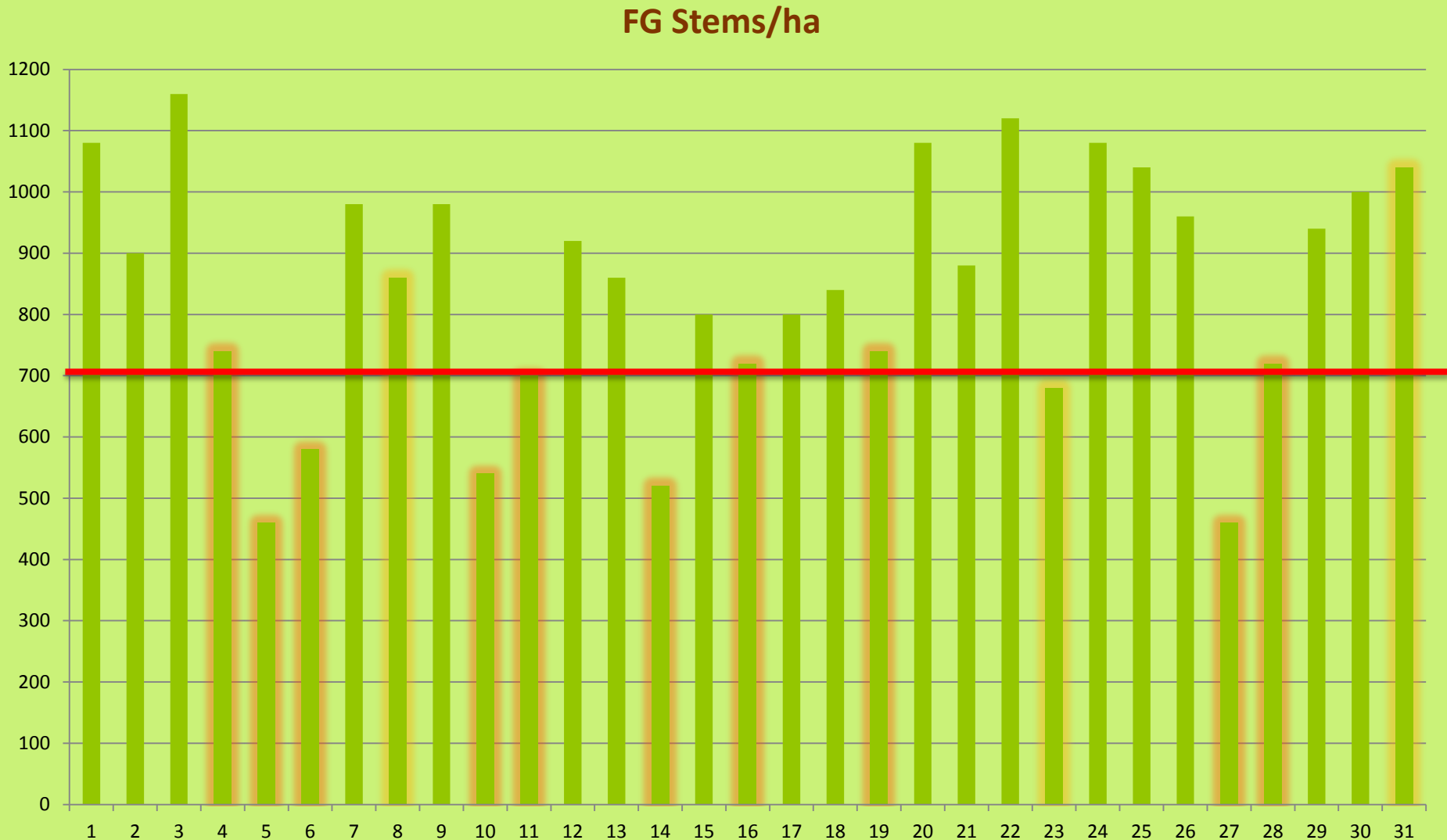
# Blocks with the lowest stocking – Units 5 and 6 Charbonneau area ICH dw1



440 and 580 FG stems/ha



35% of the blocks have very low stocking



# Shannon Lake Unit 28 – low stocking 720FG/ha ESSFwc4



Logged 1980 Planted 1990 to Sx – 1200 stems/ha

Silverton Unit 27 ICH mw2 – 460 FG stems/ha  
FTML block logged 87-88 and planted in 1990 to Fdi and Pli

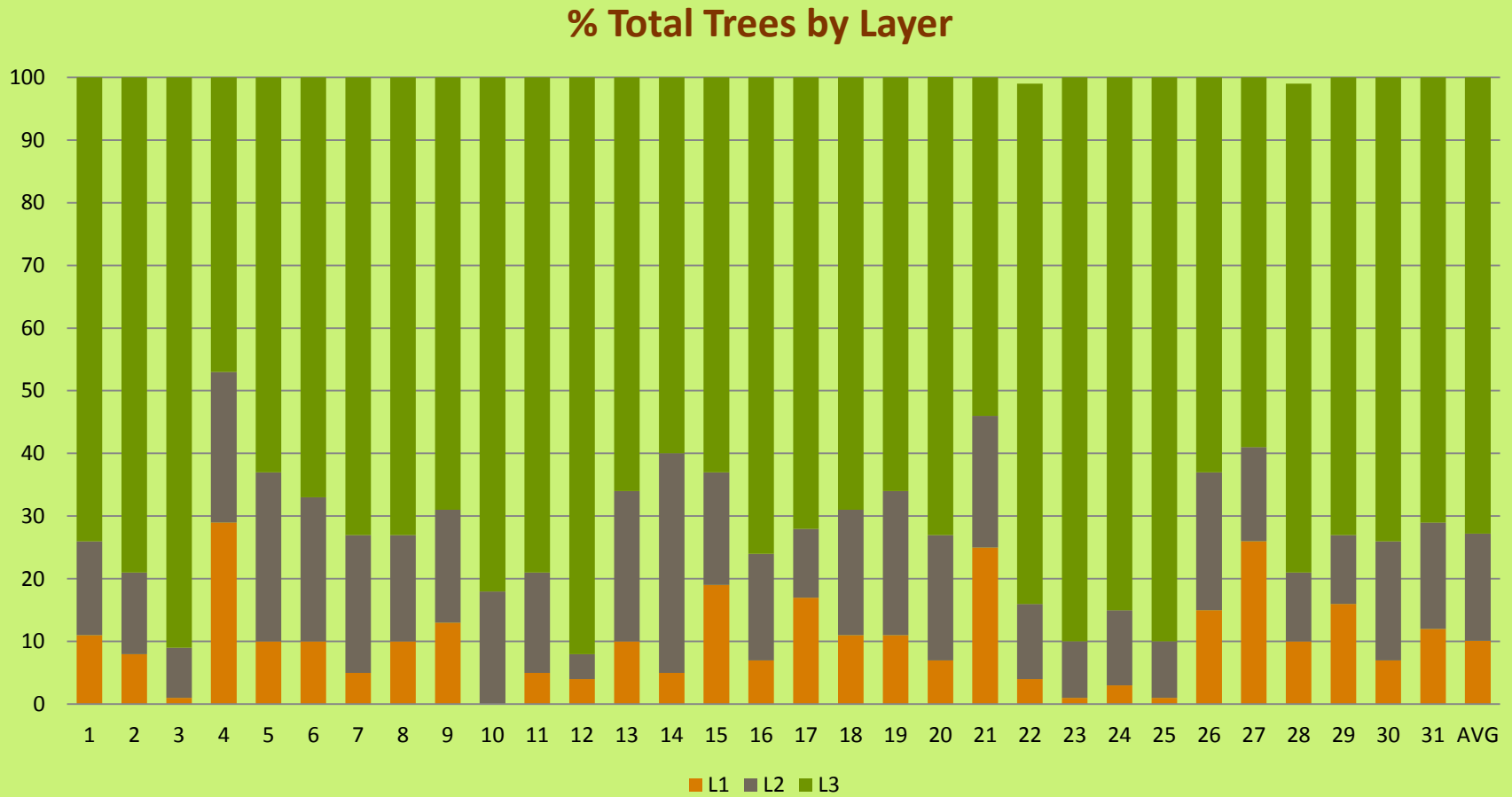


Declared FG in 2003 with 1996 survey  
showing 833FG stems/ha.  
Planted to 1600 stems/ha



# Breakdown of Total Trees by layer – expressed as a %

## On average 70% of the trees are L3



Shannon Lake Unit 10 ESSF wc4 – 540 FG stems/ha  
FTML block logged in 1990 planted in 1991 - No Layer 1 trees in  
block



No area was typed out for wet area in  
Middle of the block



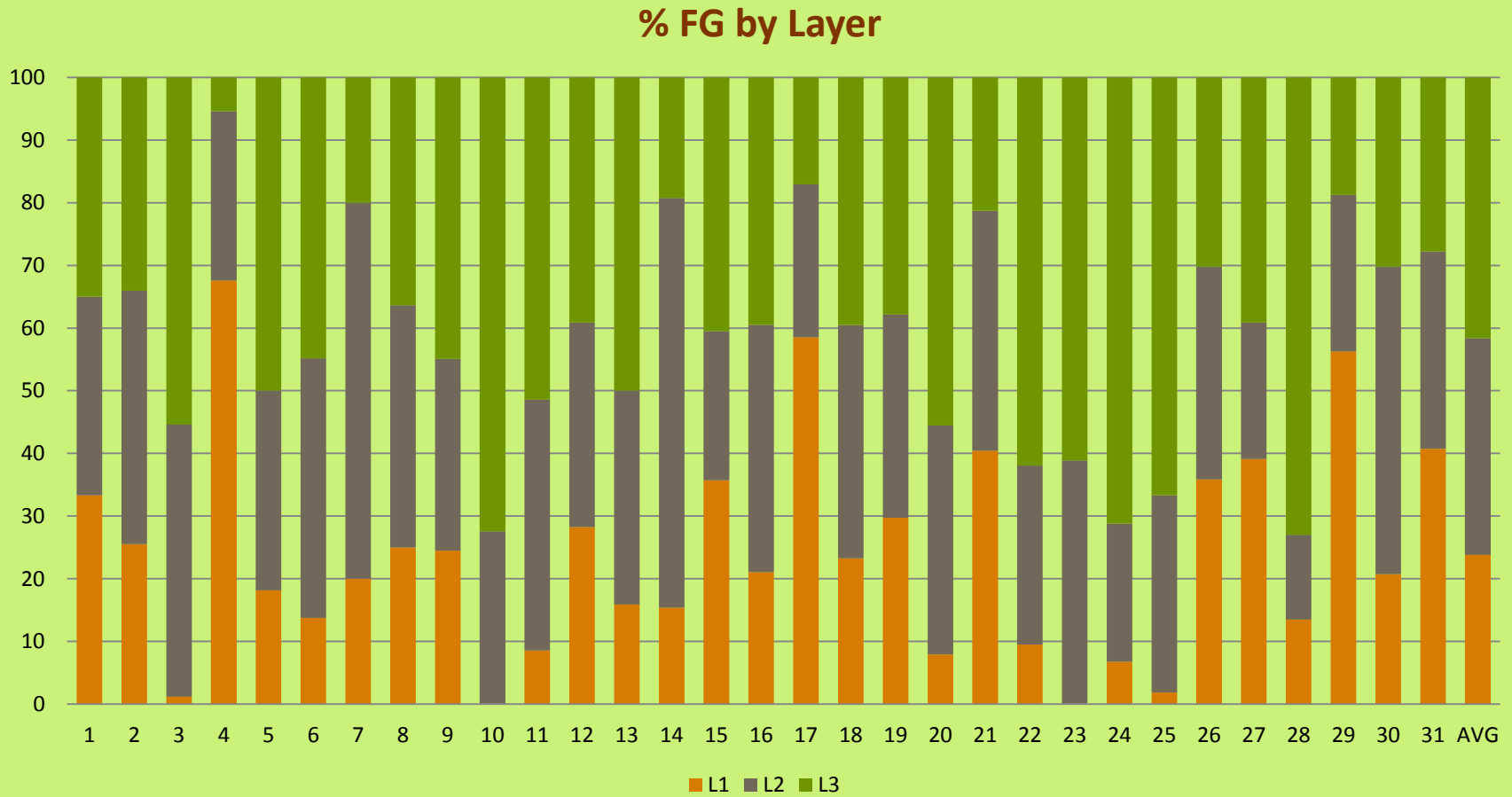
Never declared FG – last FG survey  
was 2003 with 722 FG stems/ha  
Trees about 23 yrs old SI 16.7

Rialto Unit 23– ICH mw2 – 680 FG stems/ha  
Logged 1988 left for natural Trees about 25 years old



# Breakdown of FG Trees by layer – expressed as a %

On average 40% of the trees are L3



Fish River Unit17 ICH wk1  
P87 block logged 81-83 Planted to Cw Fdi and Sx in 1985



Only 20% of the FG trees are Layer 3

Unit 1 Shields Creek – P87 block logged 78-79  
Called FG in 1993 with 871 FG stems/ha – SDM shows 1080FG  
stems/ha



## What are the consequences of having L3 trees in the WS count?

At the age of the stands in the SDM sample - L3 trees are naturals or 'loser' planted trees

TIPSY assumes there are planted trees at a very regular spacing

Genetic Gain is applied to all the crop trees

Regen Delay is assumed to be 2yrs

The L3 trees have a much longer regen delay and have no genetic



This is a L3 planted Lw Most of the Lw are L1  
Example SI tree 16.7 dbh and 15.3 M ht

## Example of a TIPSy planted block

This block had very regular spacing:  
1620 Total conifers & 1140 WS

It was planted to Pli and Lw in 1987

This block was planted at a density of  
2500 stems/ha

However this stand is not very diverse  
– the L3 trees provide options

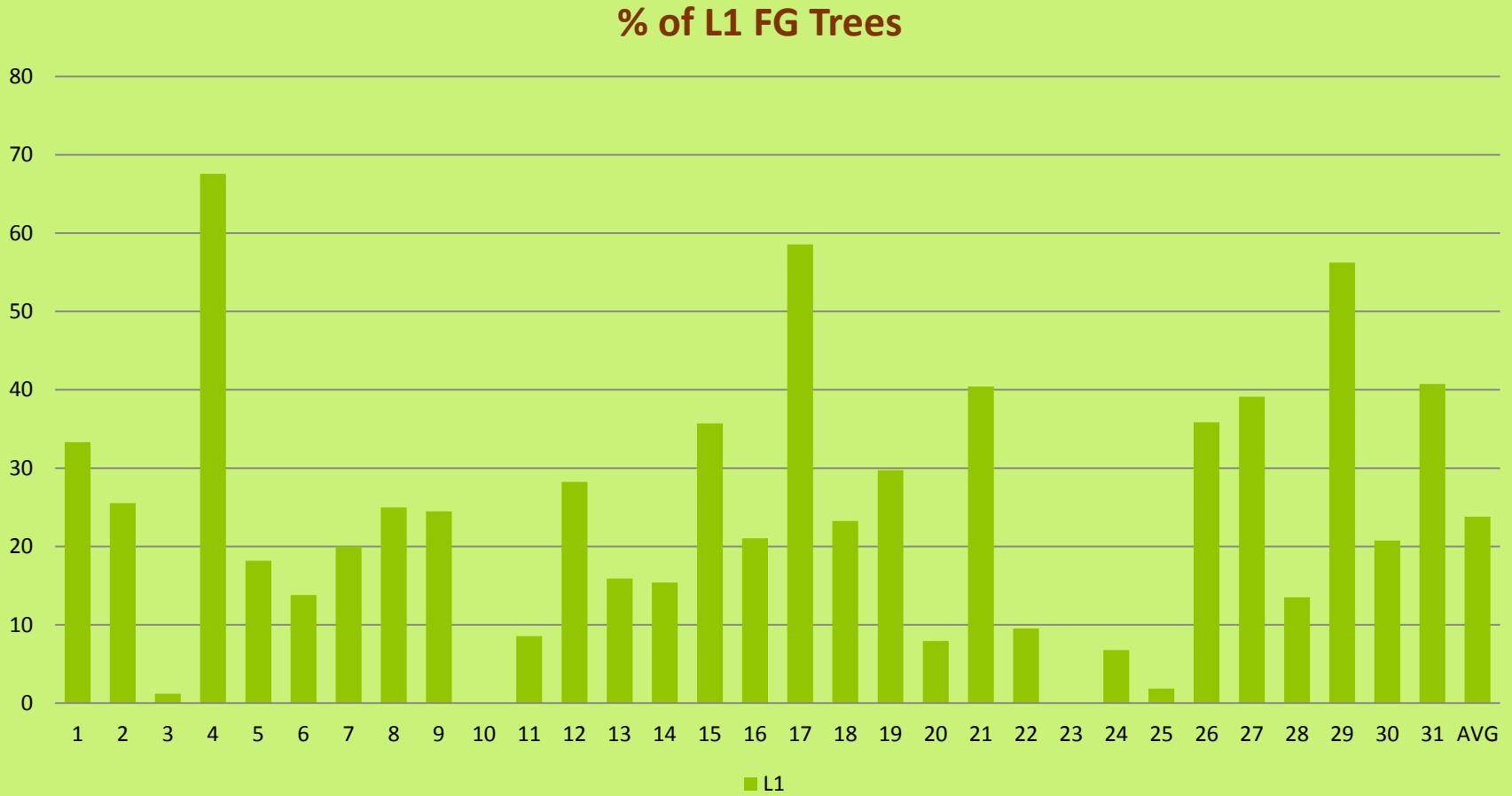


Do we have as many large trees as TIPSy assumes?

- Looking at the distribution of large diameter stems in the stands is very interesting
- Analyzing the number of large trees present in the stands should also help to calibrate TIPSy

# % of trees that are L1 Free Growing

## The average is 24 %



## Custom TIPSy Table

With the SDM data collected you can match the BGC Zone, Site Index , Leading Species, and with Breast Height Age – match an exact line in the TIPSy table.

Then direct comparisons can be made to determine if our stands “look like” the TIPSy model we have chosen for TSR.

SDM #20 – BGC Zone - MS

From Inventory Label – Pl80 Sx20

SI from GI = 21

Average age at Breast Ht = 20

TIPSy table for DCO TSR Managed Stand Analysis Units

FILE : SDM#20TSR.Tip

Feb 26/2010

AGENCY : MOFR Research Branch

TIPSy Version 4.2a14

PROJECT : SDM#20TSR

SINDEX Version 1.42

STAND

GEOGRAPHY: Southern Interior/Columbia/MS/10% Slope

ESTABLISHMENT: Regen delay = 2; Target Density = 2000 trees/ha (Planted)

OPERATIONAL YIELD ADJUSTMENTS:

OAF 1

Age: 0.0 100.0 300.0

Factor: 0.85 0.85 0.85

OAF 2

Age: 0.0 100.0 300.0

Factor: 1.00 0.95 0.85

Combined Operational Yield Adjustment @ 100 years: 0.81

SPECIES

80% LODGEPOLE PINE; Site Index = 21.00

Site curve: \*Thrower (1994)

Top Ht @ bh age 50 (m) = 21.00 (base)

Stock ht = 13cm

20% WHITE SPRUCE; Site Index = 20.68

Site curve: \*Goudie (1984ac) (plantation)

Top Ht @ bh age 50 (m) = 20.68 (base)

Stock ht = 21cm

Multiple Species option aggregates pure stands for forest-level planning.

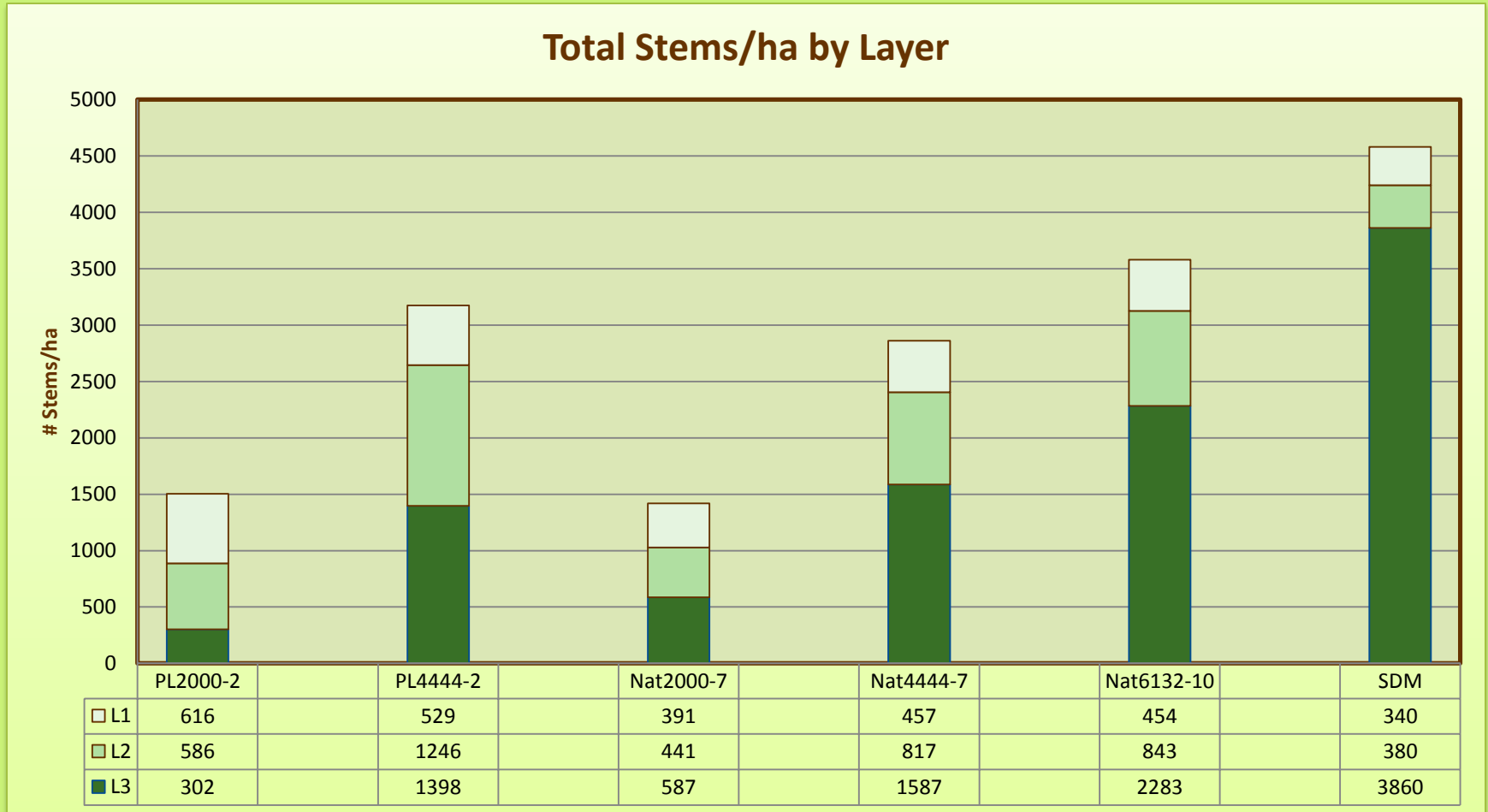
It is NOT VALID for mixed-species SILVICULTURAL applications.

CUSTOM TABLE

| TIPSy Age (yr) | Top Ht (m) | Age (yr) | Ht (m) | CC (%)    | LC (%)             | Trees (#/ha) |      |       | Well-Spaced Trees (#/ha) |
|----------------|------------|----------|--------|-----------|--------------------|--------------|------|-------|--------------------------|
|                |            | BH       | Predom | All Trees | Prime 250 trees/ha | 0.0+         | 7.5+ | 12.5+ | All MITD                 |
| 2.0            | 0.1        | 0.0      | 0.0    | 1         | 0                  | 1695         | 0    | 0     | 0                        |
| 3.0            | 0.3        | 0.0      | 0.0    | 1         | 0                  | 1690         | 0    | 0     | 0                        |
| 4.0            | 0.5        | 0.0      | 0.0    | 2         | 0                  | 1683         | 0    | 0     | 0                        |
| 5.0            | 0.9        | 0.0      | 0.1    | 4         | 0                  | 1673         | 0    | 0     | 0                        |
| 6.0            | 1.2        | 0.8      | 1.0    | 8         | 0                  | 1662         | 0    | 0     | 0                        |
| 7.0            | 1.5        | 1.8      | 1.3    | 12        | 0                  | 1654         | 0    | 0     | 0                        |
| 8.0            | 1.9        | 2.8      | 1.6    | 17        | 0                  | 1644         | 0    | 0     | 0                        |
| 9.0            | 2.3        | 3.8      | 1.9    | 22        | 0                  | 1635         | 0    | 0     | 0                        |
| 10.0           | 2.7        | 4.8      | 2.3    | 29        | 0                  | 1624         | 0    | 0     | 0                        |
| 11.0           | 3.2        | 5.8      | 2.7    | 36        | 0                  | 1614         | 0    | 0     | 0                        |
| 12.0           | 3.6        | 6.8      | 3.1    | 43        | 0                  | 1603         | 0    | 0     | 0                        |
| 13.0           | 4.1        | 7.8      | 3.5    | 49        | 0                  | 1593         | 5    | 0     | 0                        |
| 14.0           | 4.6        | 8.8      | 3.9    | 54        | 0                  | 1583         | 40   | 0     | 0                        |
| 15.0           | 5.1        | 9.8      | 4.3    | 59        | 0                  | 1573         | 135  | 0     | 0                        |
| 16.0           | 5.6        | 10.8     | 4.7    | 63        | 0                  | 1564         | 293  | 1     | 0                        |
| 17.0           | 6.2        | 11.8     | 5.2    | 66        | 0                  | 1555         | 494  | 8     | 0                        |
| 18.0           | 6.7        | 12.8     | 5.6    | 68        | 0                  | 1547         | 659  | 28    | 0                        |
| 19.0           | 7.2        | 13.8     | 6.0    | 70        | 0                  | 1539         | 776  | 75    | 0                        |
| 20.0           | 7.7        | 14.8     | 6.5    | 72        | 0                  | 1533         | 870  | 154   | 0                        |
| 21.0           | 8.2        | 15.8     | 6.9    | 73        | 0                  | 1526         | 942  | 263   | 0                        |
| 22.0           | 8.7        | 16.8     | 7.3    | 74        | 71                 | 1520         | 1027 | 372   | 0                        |
| 23.0           | 9.2        | 17.8     | 7.7    | 76        | 72                 | 1514         | 1117 | 480   | 0                        |
| 24.0           | 9.7        | 18.8     | 8.1    | 77        | 73                 | 1509         | 1172 | 558   | 0                        |
| 25.0           | 10.2       | 19.8     | 8.5    | 78        | 74                 | 1504         | 1202 | 616   | 0                        |
| 26.0           | 10.6       | 20.8     | 8.9    | 79        | 74                 | 1500         | 1232 | 675   | 0                        |
| 27.0           | 11.1       | 21.8     | 9.3    | 80        | 72                 | 1495         | 1260 | 740   | 0                        |
| 28.0           | 11.5       | 22.8     | 9.7    | 81        | 70                 | 1491         | 1287 | 796   | 0                        |
| 29.0           | 12.0       | 23.8     | 10.1   | 81        | 69                 | 1486         | 1310 | 839   | 0                        |
| 30.0           | 12.4       | 24.8     | 10.5   | 82        | 67                 | 1481         | 1332 | 880   | 0                        |
| 31.0           | 12.9       | 25.8     | 10.9   | 82        | 66                 | 1477         | 1344 | 930   | 0                        |
| 32.0           | 13.3       | 26.8     | 11.2   | 83        | 64                 | 1473         | 1355 | 979   | 0                        |
| 33.0           | 13.7       | 27.8     | 11.6   | 83        | 62                 | 1467         | 1366 | 1013  | 0                        |
| 34.0           | 14.1       | 28.8     | 11.9   | 83        | 61                 | 1462         | 1376 | 1040  | 0                        |
| 35.0           | 14.5       | 29.8     | 12.2   | 83        | 59                 | 1457         | 1382 | 1063  | 0                        |
| 36.0           | 14.9       | 30.8     | 12.6   | 83        | 58                 | 1452         | 1383 | 1083  | 0                        |

# Comparison of 5 TIPSy runs to SDM block #20

The left column is how this stand was modelled in TSR



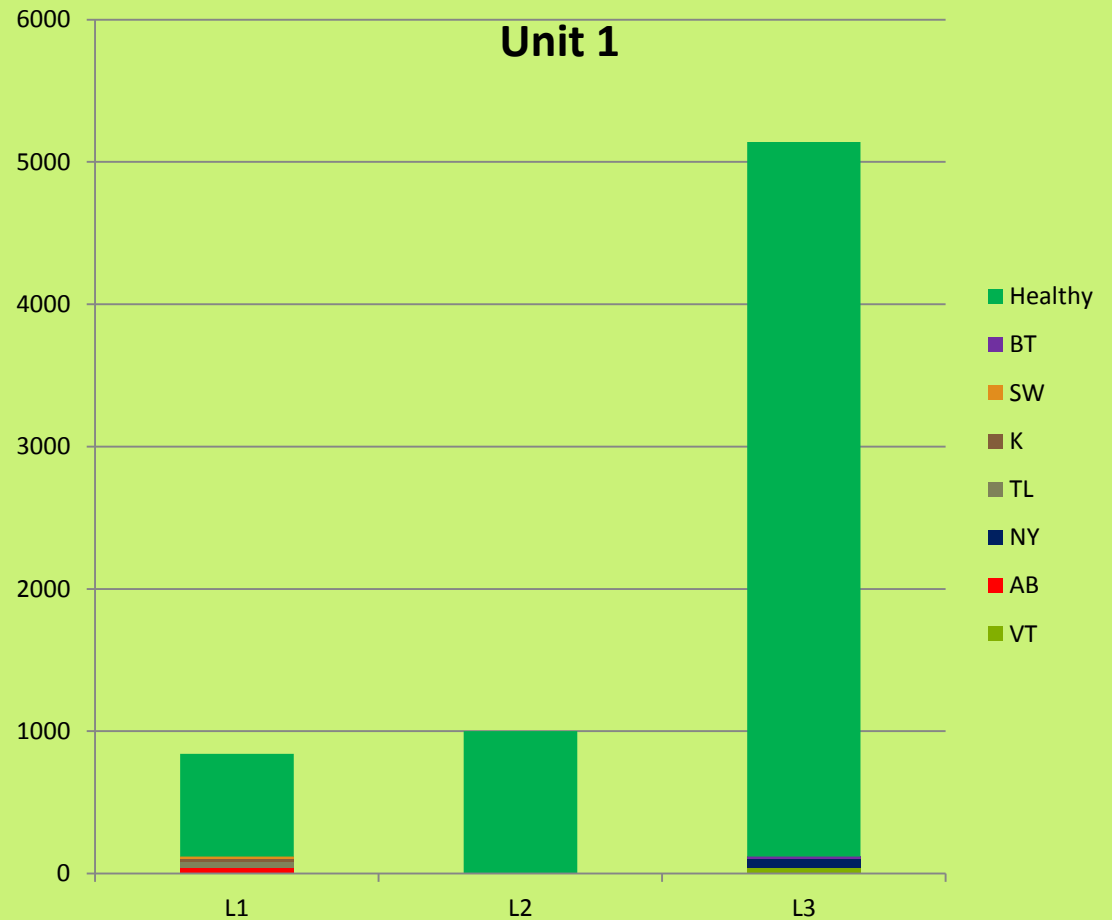
# Forest Health

- The Forest Health Information can be analyzed many different ways
- Because the FH factors are collected by layer for both live and dead trees - it makes is easier to look at trends by species

## Example of FH factors by layer

- L1 14.3 %
- L2 0.0 %
- L3 2.3 %
- Stand 3.4%

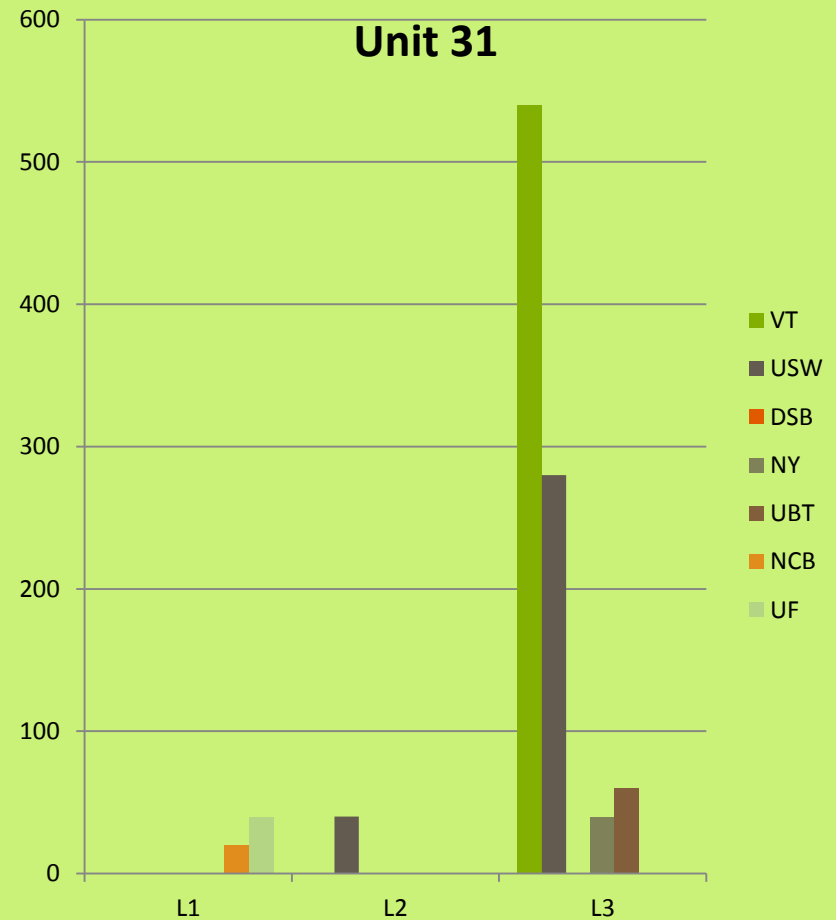
|    | LIVE_FH | DEAD_FH | Healthy | TotalLive |
|----|---------|---------|---------|-----------|
| L1 | 120     | 20      | 640     | 760       |
| L2 | 0       | 20      | 1000    | 1000      |
| L3 | 120     | 160     | 4960    | 5080      |
|    | 240     | 200     | 6600    | 6840      |



Most of the L3 stems have physical damage ie snow press or vegetative competition

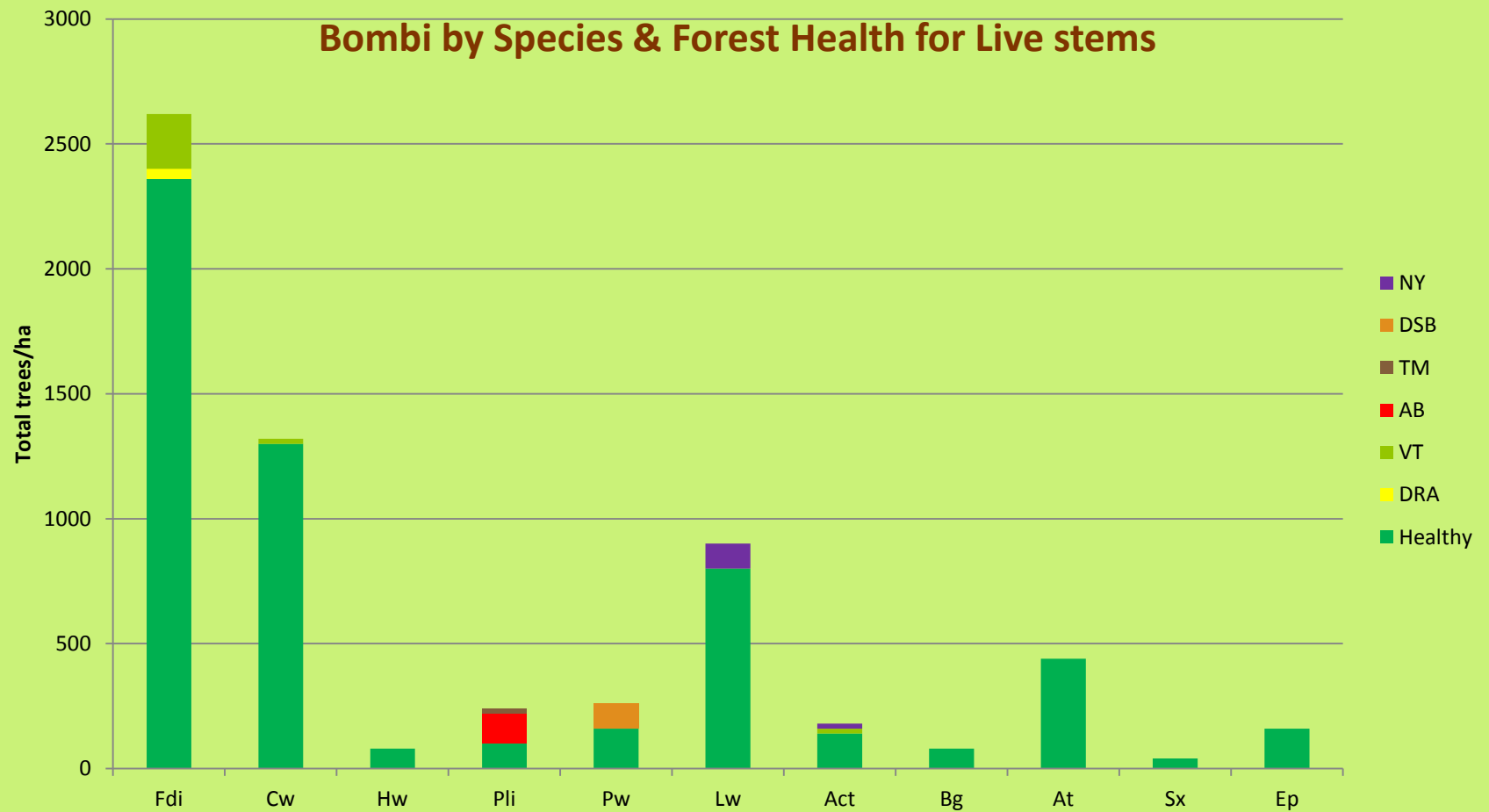


Unit 31 – Wilson Creek

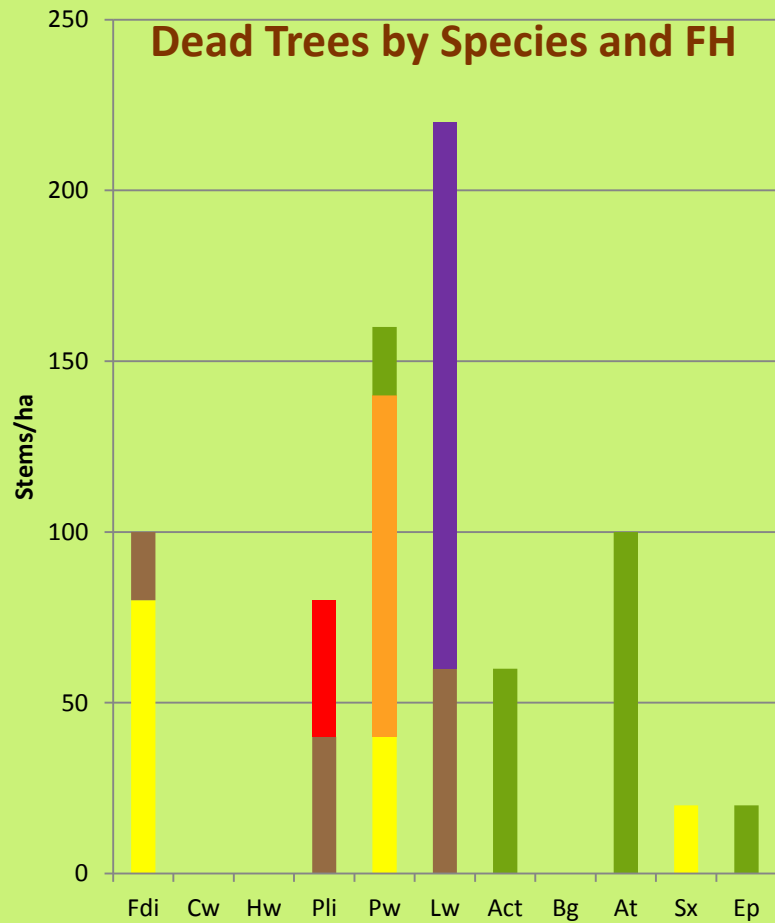
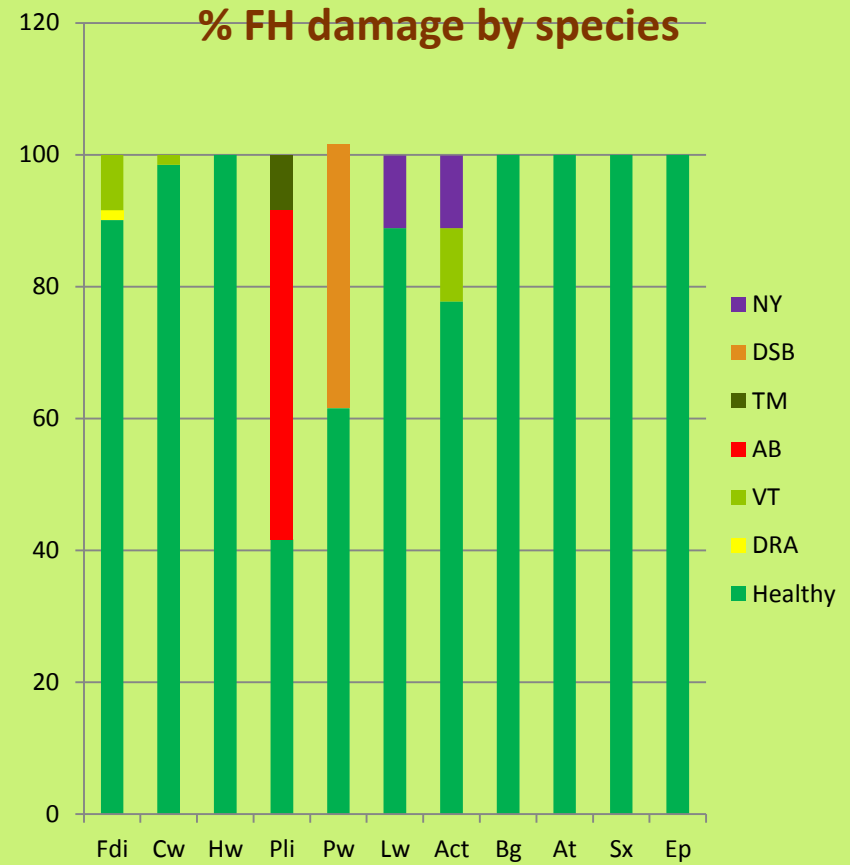


# Bombi - Unit 22 ICH dw1 – 1120 FG stems/ha

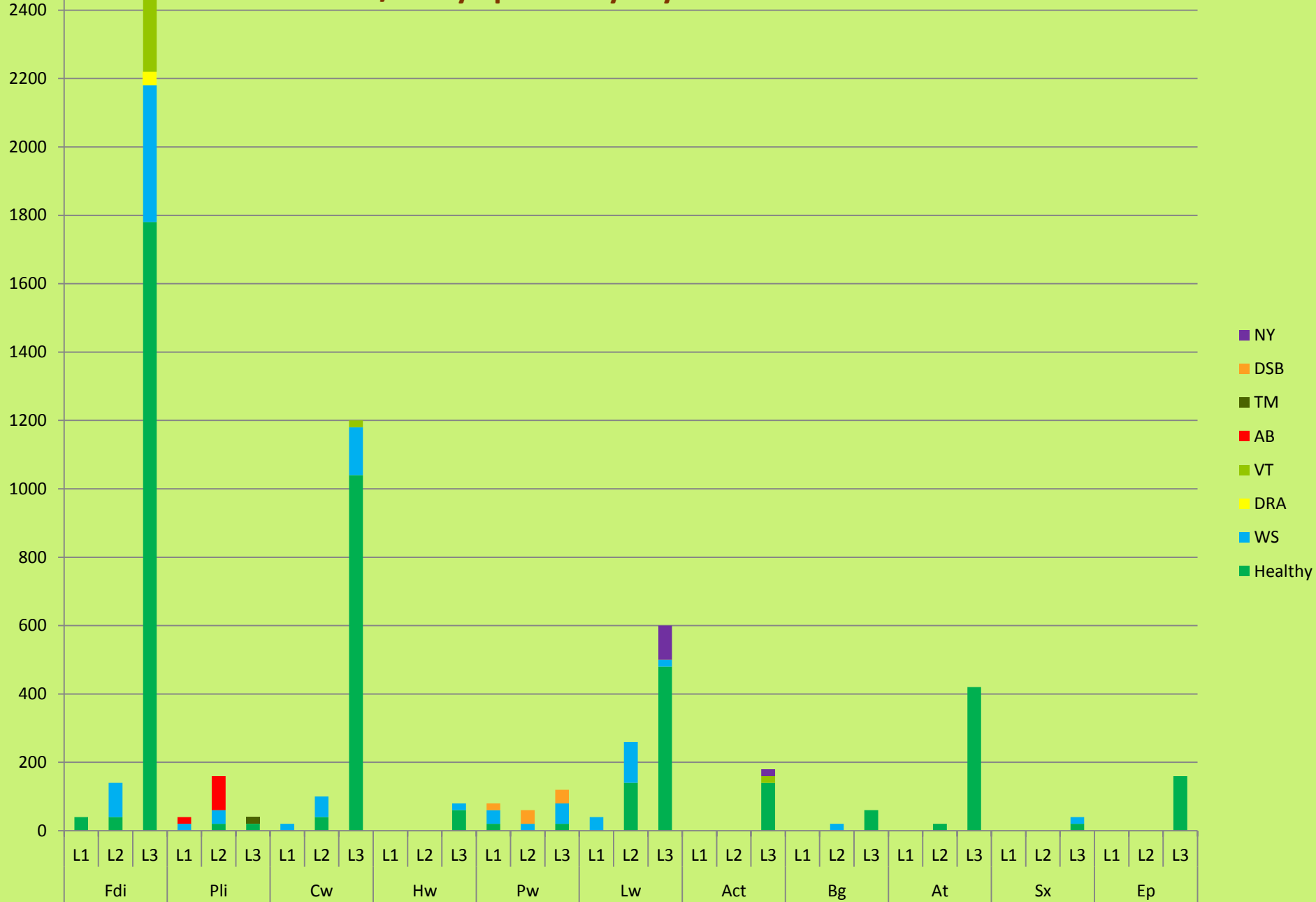
## Can look at the species and FH factors



# Bombi Unit 22



# Total Stems/ha by Species by Layer with FH factor and FG stems



# Bombi Unit 22



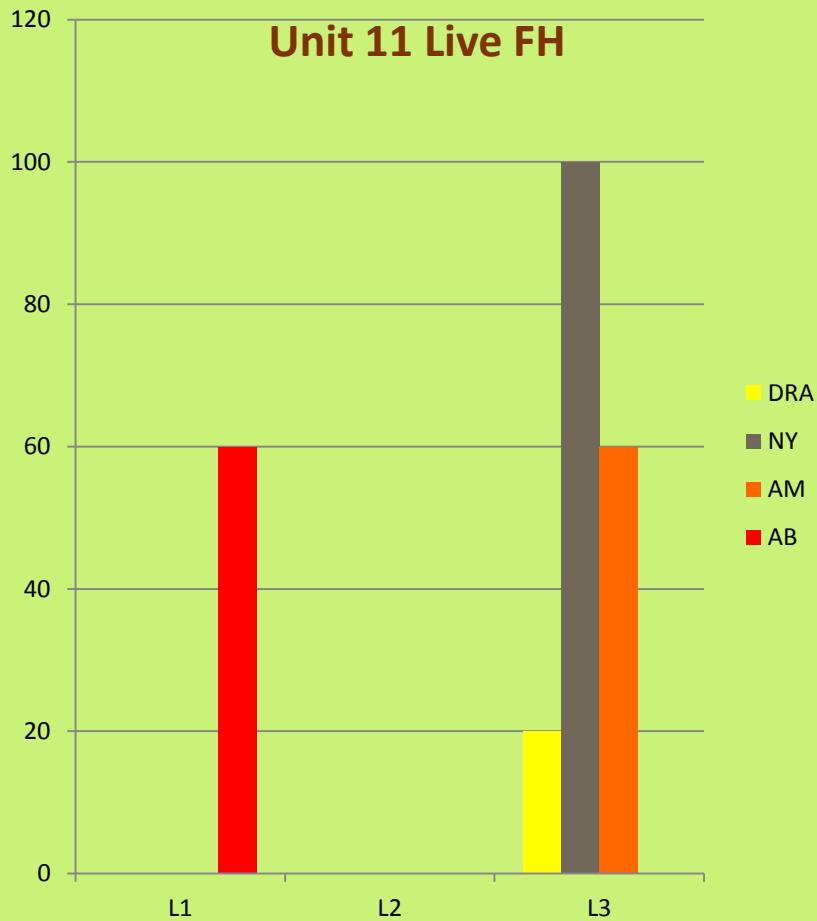
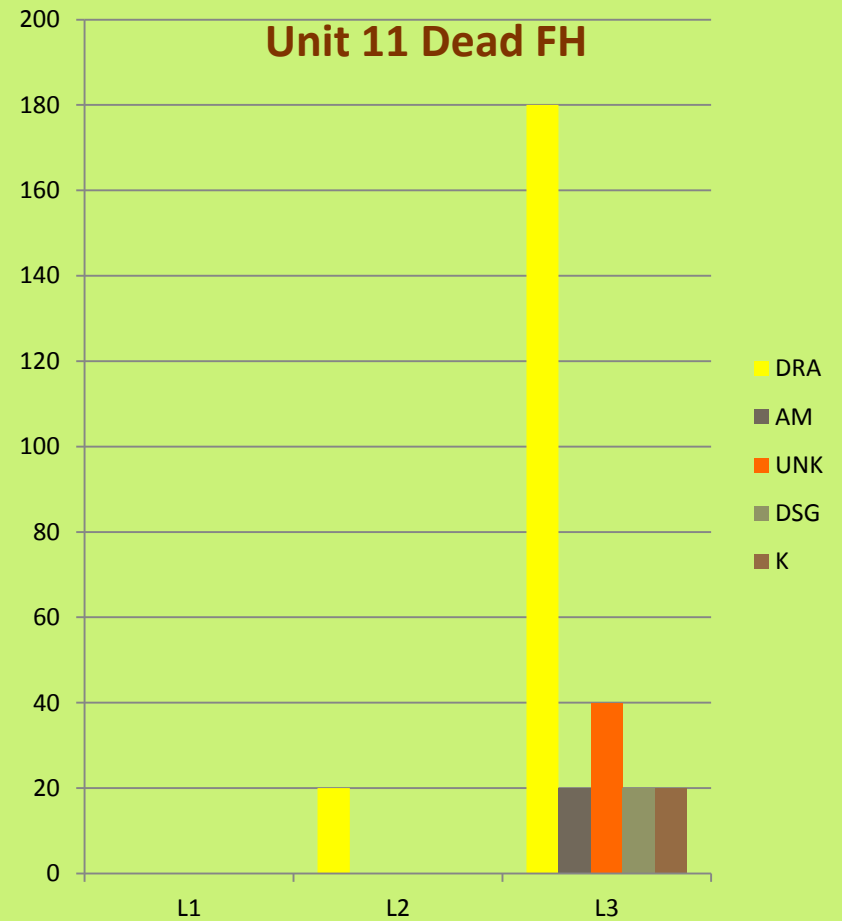
- Pw shows DSB in all layers
- Is it high risk to have counted them as FG?

## Caribou Unit 11 ICH mw2 700 FG stems/ha



We have learned looks are deceiving

# Unit 11 Live and Dead FH factors



# Caribou Unit 11



# Ottawa Hill



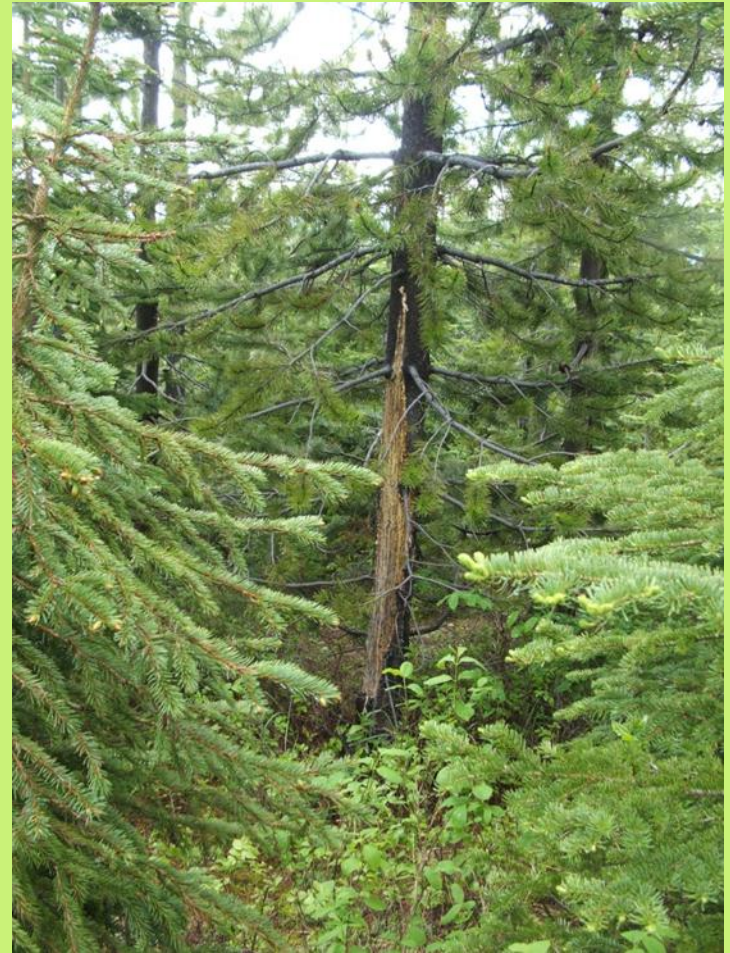
## Wilson – Unit 31



# Ottawa Hill



# Cortiana



## Amazing Stand – Logged 1960 planted 62, 63, 64 and 65



# Huge 534 ha block ICH mw2

