



Using Silviculture to Manage Forest Health

***Identification and Management of
Forest Insects and Diseases
Colville WA – December 13, 2003***

Elaine Oneil

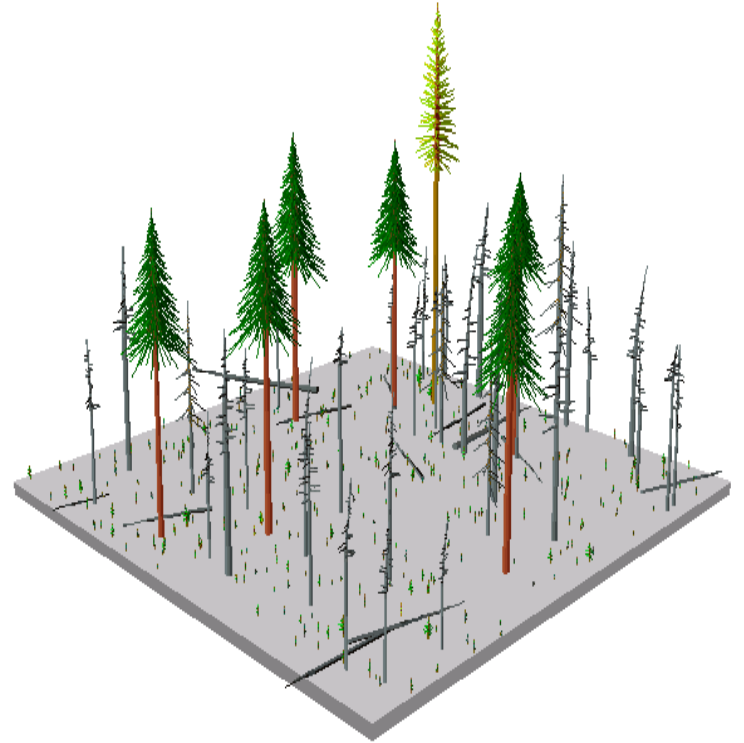
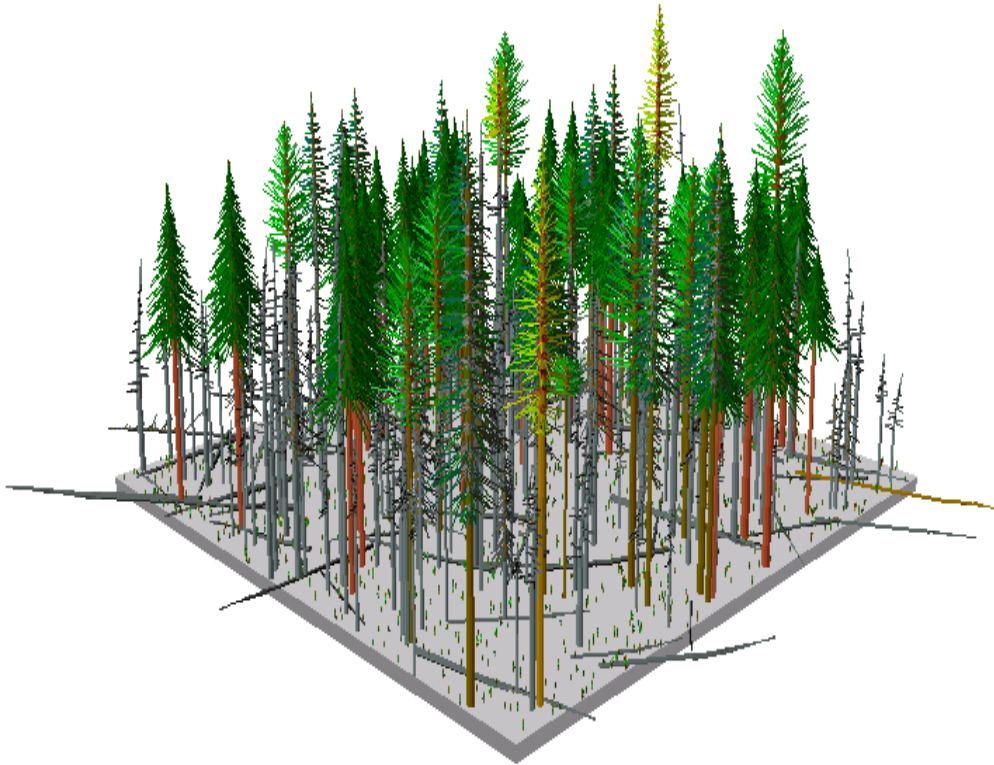
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What is killing my trees?



Could it be.....

- ***Bark beetles?***
- ***Fire?***
- ***Root rot?***
- ***Acid rain?***
- ***Global warming?***

How about

STRESS

?

.....


***From lack of water
and lack of***

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How can silvicultural intervention alleviate that stress?

- ***Thinning - When? To what level? What do I leave behind and/or take?***
- ***Soil amendments to address nutrient deficiencies - How? When? How do I know I need it?***

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Some Nifty Tools

- ***A D-tape***
- ***An increment borer***
- ***A prism***
- ***LMS (landscape management system)***
- ***A growth model - FVS (forest vegetation simulator)***
 - ***Both available through <http://lms.cfr.washington.edu/>***

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Some knowledge about your stands and your sites

Environmental Gradient		
Low elevation	Dry	South
↓	↓	↓
High elevation	Wet	North

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How those influences are categorized in NE Washington

Habitat Type				
	ponderosa			
lodgepole pine	pine	Douglas -fir	grand fir	
				subalpine fir

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Habitat typing as a classification scheme useful to management

Environmental Gradient			Habitat Type				
Low elevation	Dry	South		ponderosa pine			
↓	↓	↓	lodgepole pine		Douglas -fir		
						grand fir	
High elevation	Wet	North					subalpine fir

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Moisture and elevation gradients for selected tree species

Environmental Gradient			Habitat Type					Species				
Low elevation	Dry	South		PP					PP			
					DF	GF				DF	GF	
			LP					LP				
							AF					AF
High elevation	Wet	North										

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So what does classification have to do with mountain pine beetles?

- ***Mountain pine beetle susceptibility threshold values can be correlated to these gradients***
 - ***this enables you to determine site specific management options.***

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Site Index

- *A species specific measure of actual or potential forest productivity and site quality*
 - *found by measuring the height of the dominant trees in the stand and correlating that height to a base age (50 or 100 years)*
- *Tells us something about stand growth independent of stand density.*

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Growth Basal Area (GBA)

- ***A measure of stocking that relates the site carrying capacity to a stand of 100 years of age that maintains a diameter increment of 10 rings/decade (20 rings/inch on your increment borer)***
 - ***Poor sites have lower inherent carrying capacity and therefore a lower GBA***
 - ***GBA has been correlated to bark beetle susceptibility***

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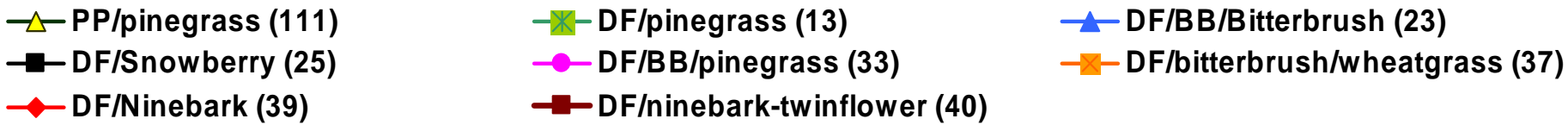
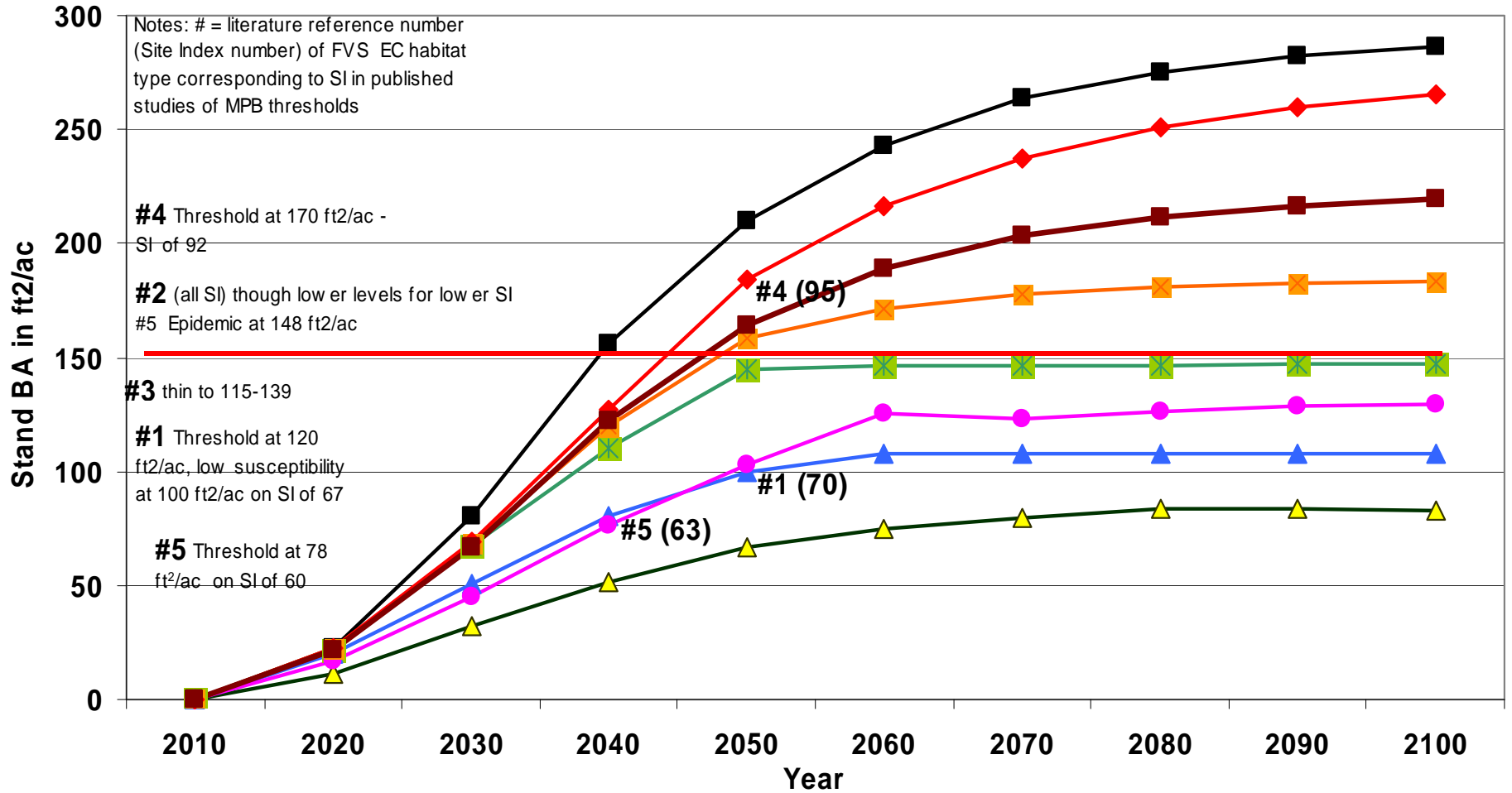
Stand Density Index

- **Stand density index gives a measure of stocking relative to a stand where all trees are 10" in diameter.**
- **Maximum SDI is a theoretical upper limit of SDI.**
 - **Species specific**
- **Max SDI is never reached as self thinning occurs prior to that density level.**
 - **55%-85% of maximum is the usual range**

	SDI	DBHq	TPA	BA
	50	10	50	27
	58	11	50	33
	67	12	50	39
	76	13	50	46
	86	14	50	53
FFR	95	14.9	50	60
	96	15	50	61
	106	16	50	70
	117	17	50	79
	128	18	50	88
	140	19	50	98
	152	20	50	109
	164	21	50	120
	177	22	50	132
	190	23	50	144
	203	24	50	157

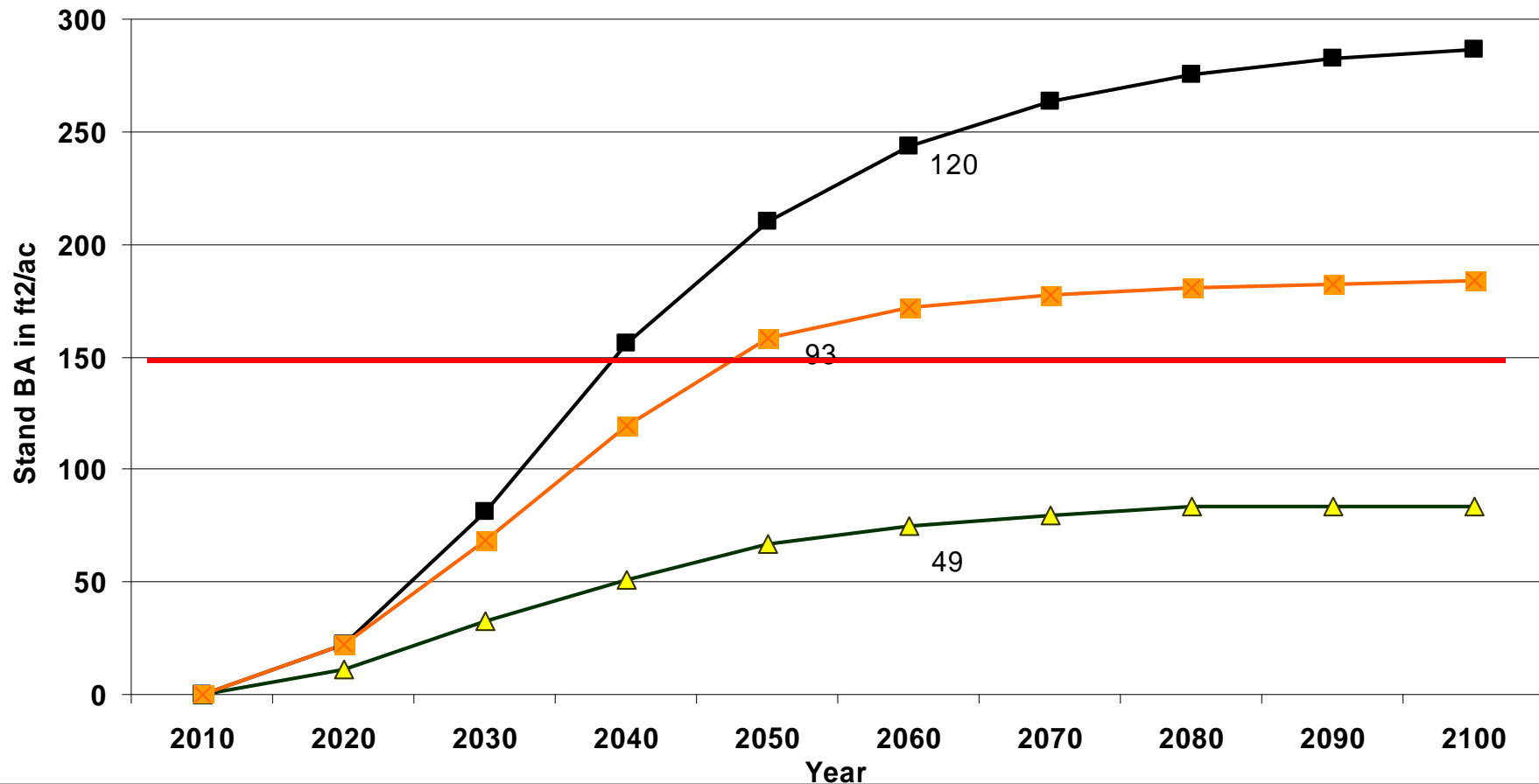
Some Threshold Values for MPB in Ponderosa Pine

BA growth for PP stands at elevation 3750 FVS - EC variant



The range of ponderosa pine site indices by habitat type in the East Cascades

BA growth for PP stands at elevation 3750 FVS - EC variant



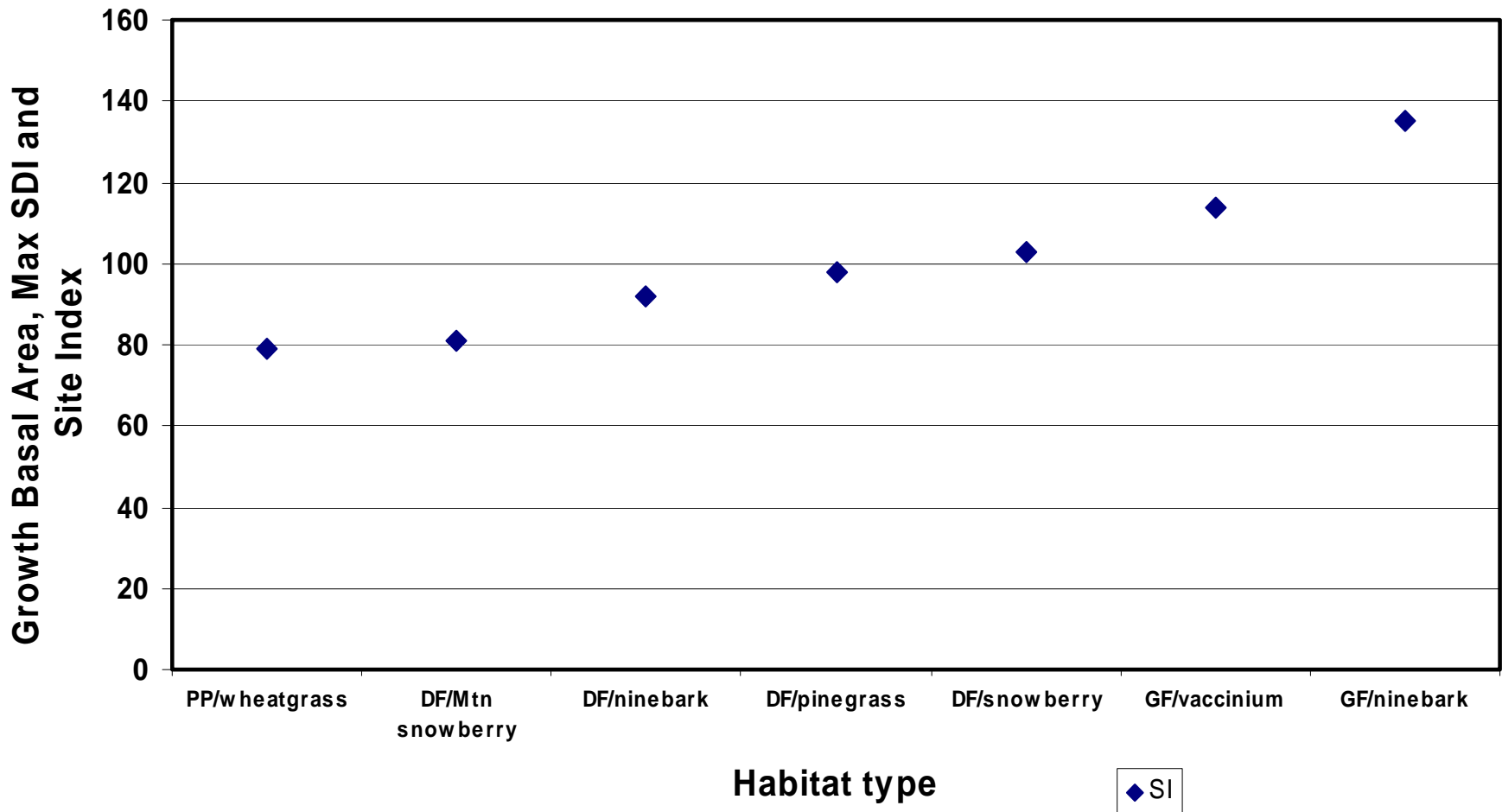
▲ PP/pinegrass (111)

■ DF/Snowberry (25)

■ DF/bitterbrush/wheatgrass (37)

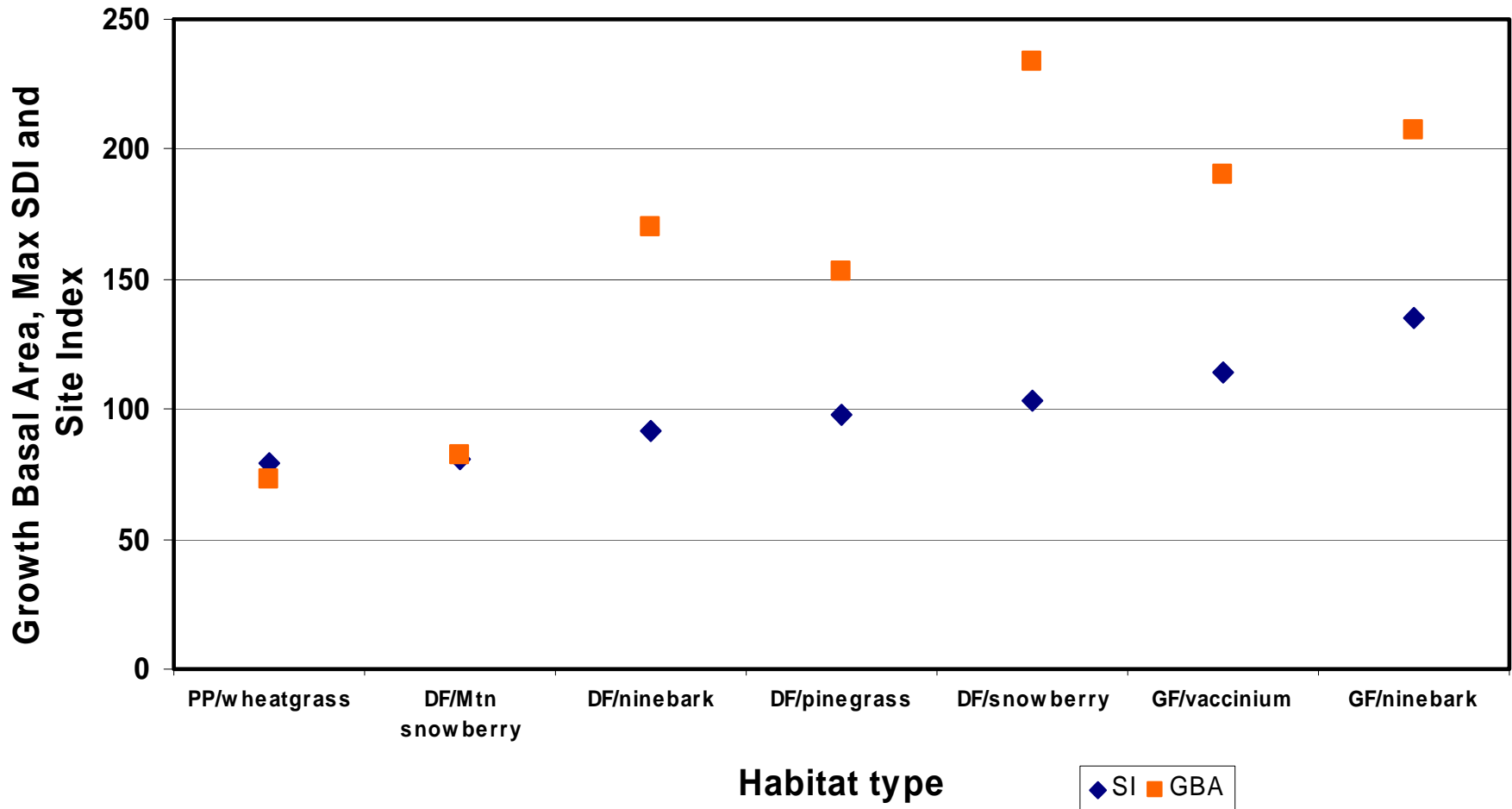
Site quality as determined by height growth

Relationship between GBA, Max SDI and SI for habitat types containing ponderosa pine in the Colville National Forest
(Williams et al. 1995)



Site quality as determined by growth basal area

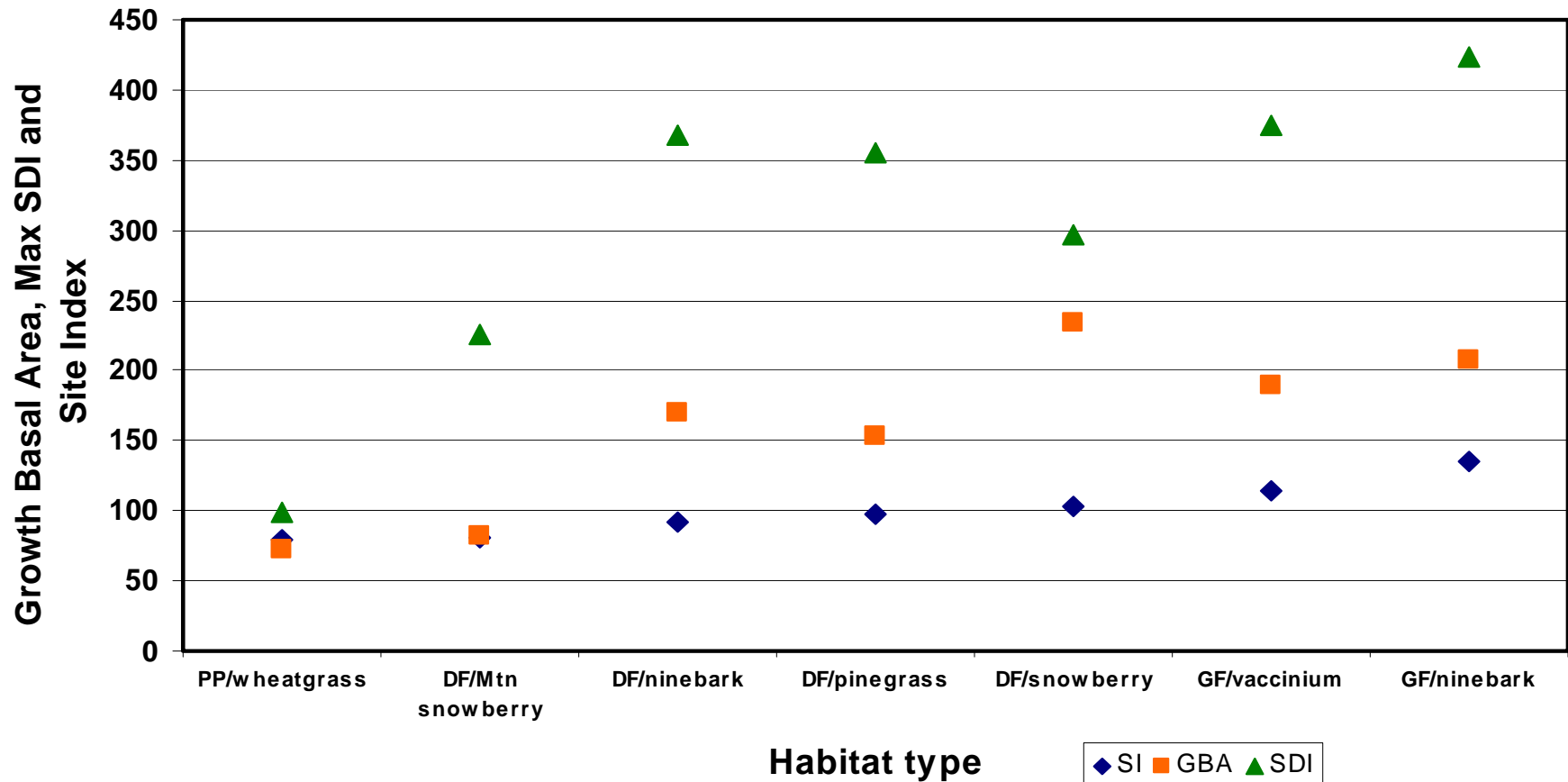
Relationship between GBA, Max SDI and SI for habitat types containing ponderosa pine in the Colville National Forest
(Williams et al. 1995)



Site quality as determined by maximum stand density index

Relationship between GBA, Max SDI and SI for habitat types containing ponderosa pine in the Colville National Forest

(Williams et al. 1995)



Steps to determine if your stand needs thinning to avoid bark beetle infestation

- ***Use those 3 familiar Nifty Tools and take some measurements – ft²/acre, site index, stand age and # rings/inch for your dominant trees to get your current stand conditions.***
- ***Figure out your likely habitat type (overstory/understory) - try to determine your 'rock type' (Soil Surveys are a good option here).***
- ***Get to know someone who can work with simple computer programs (children, grandchildren, etc.) and download the other 2 Nifty Tools for free***

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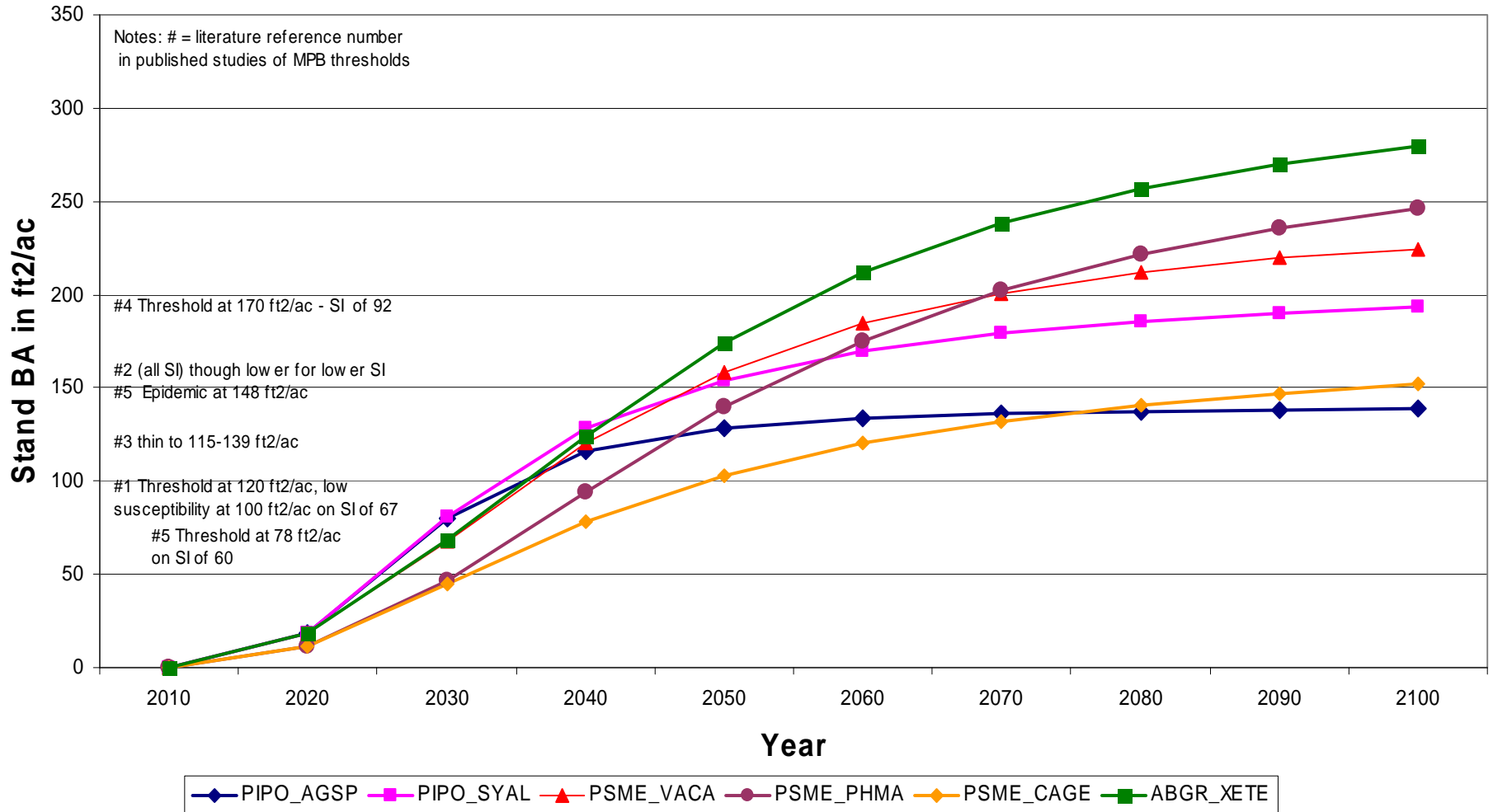
(More) steps to determine if your stand needs thinning to avoid bark beetle infestation

- Plug those measurements and information into the computer, hit a few buttons, and see what sort of growth you'll have at age 100. If it isn't 20 rings/inch - plan on doing a thinning before you get attacked.***
- How much thinning? Look at your site index and your growth curve to get an estimate of when growth rates begin to decline - this is the upper range of basal area you want to carry on your stand.***



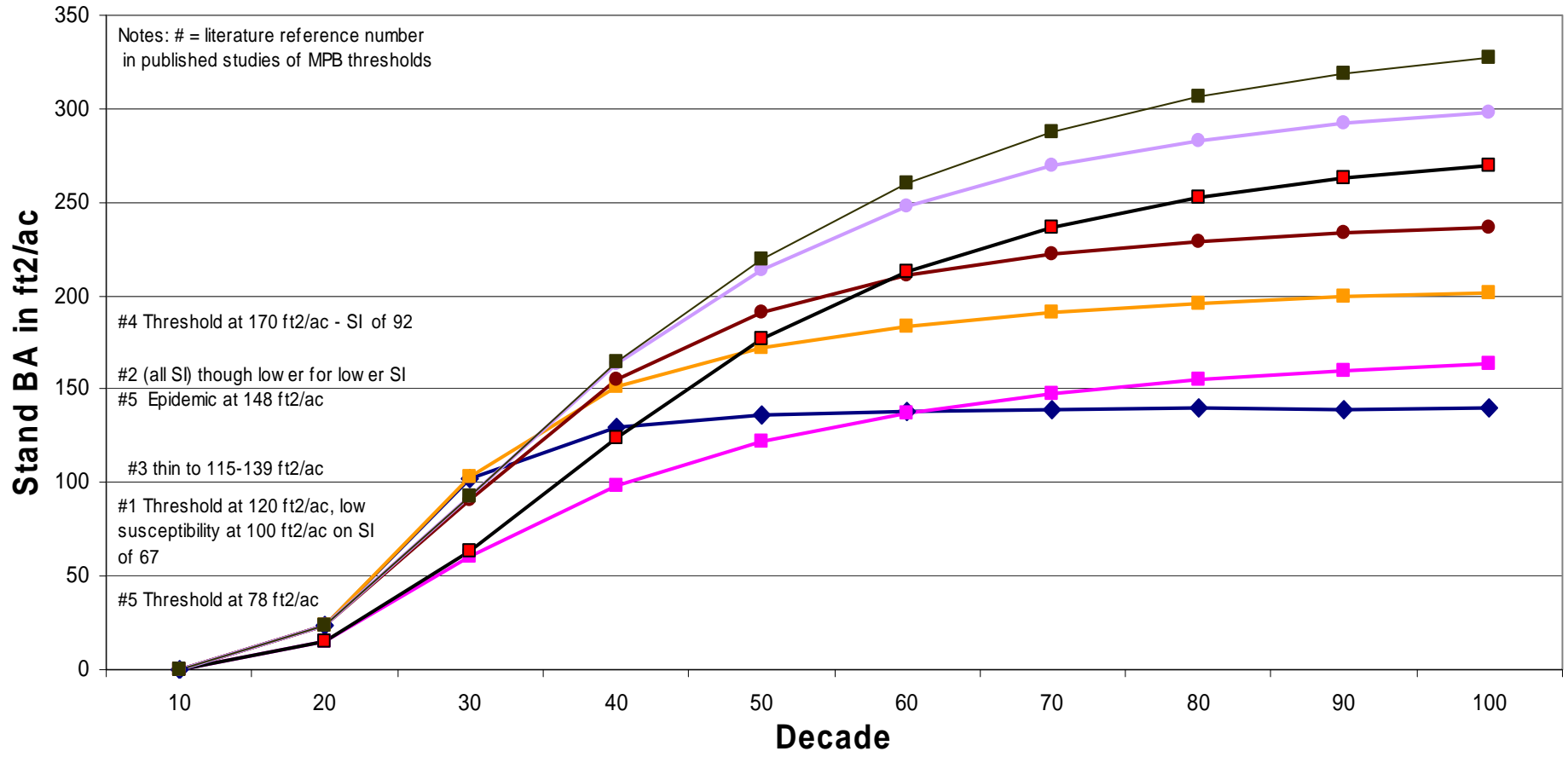
Potential thresholds at low to mid elevations in NE Washington

BA increment for PP stands at elevation 2750 using FVS - NI variant



Potential thresholds at mid to high elevations in NE Washington

BA growth for PP stands at elevation 3750 using FVS - NI variant



◆ PIPO_AGSP
 ■ PSME_CAGE
 ■ PIPO_SYAL
 ● PSME_VACA
 ■ PSME_PHMA
 ● ABGR_XETE
 ■ ABLA_CLUN

What about your nutrient status?

- **Literature specific to your habitat types has linked poor nutrient status to root diseases, and bark beetles**
 - **Nitrogen induced deficiencies on soils with low potassium levels can increase MPB attack in ponderosa pine** (Mandzak and Moore (1994) in MT)
 - **Fertilization success is linked to rock type (bedrock geology)** Moore et al. (1998)
 - **Rock type influences bark beetle incidence in Douglas-fir** (Moore et al. in press)
- **These reports point to the role of stand nutrition on bark beetle susceptibility**

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Addressing nutrient stress

- *If stand densities are within acceptable ranges yet vigor (diameter growth) is low, check on soil nutrient status*
 - *do a foliar analysis to assess nitrogen and potassium levels. (We lose potassium with stand age and lack of fire).*
- *If your stand is starving, feed it (fertilize), and/or under burn it....both will help free up the necessary nutrients to alleviate stand stress and thus reduce susceptibility to bark beetles (and other agents)*

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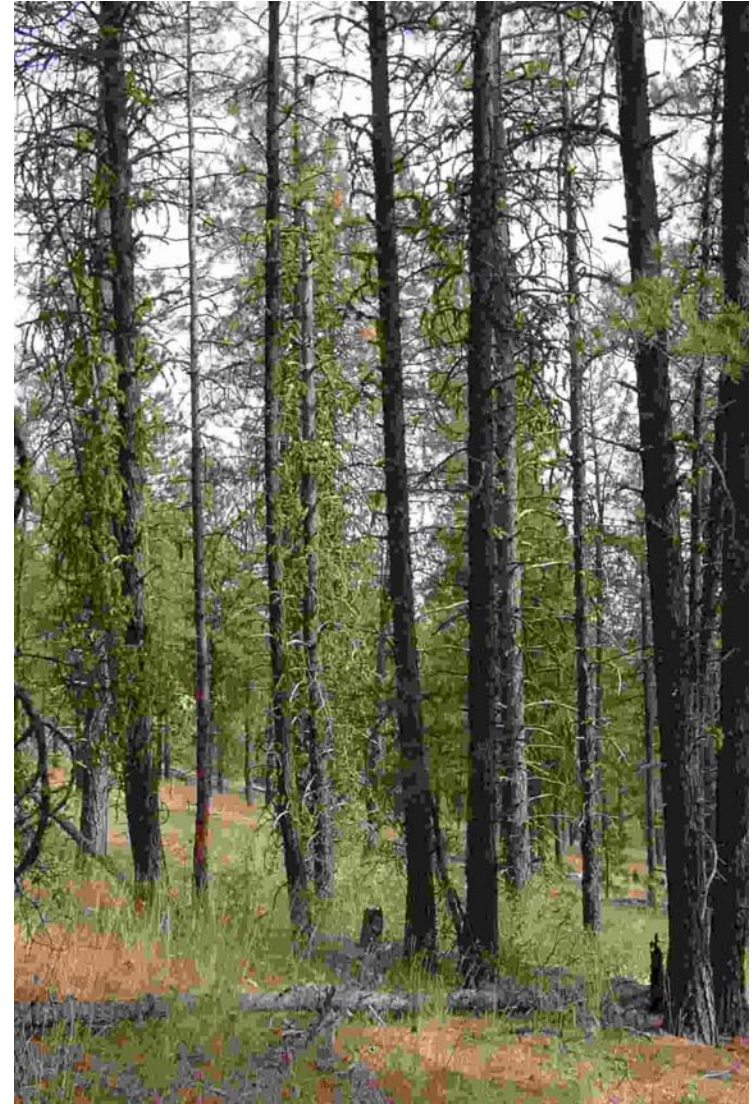
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MPB Infestation on a dry poor site

- ***Mature ponderosa pine with an ongoing MPB infestation***
- ***Stand at 147 TPA***
- ***BA at 110 ft²/ac***
- ***SDI of 196***

- ***The stocking levels are too high for this site***



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Post thinning outcomes

- *Thinned to 72 TPA and 63 ft²/ac*
- *SDI of 108*
- *No mortality from MPB despite beetle pressure from adjacent unthinned stands*



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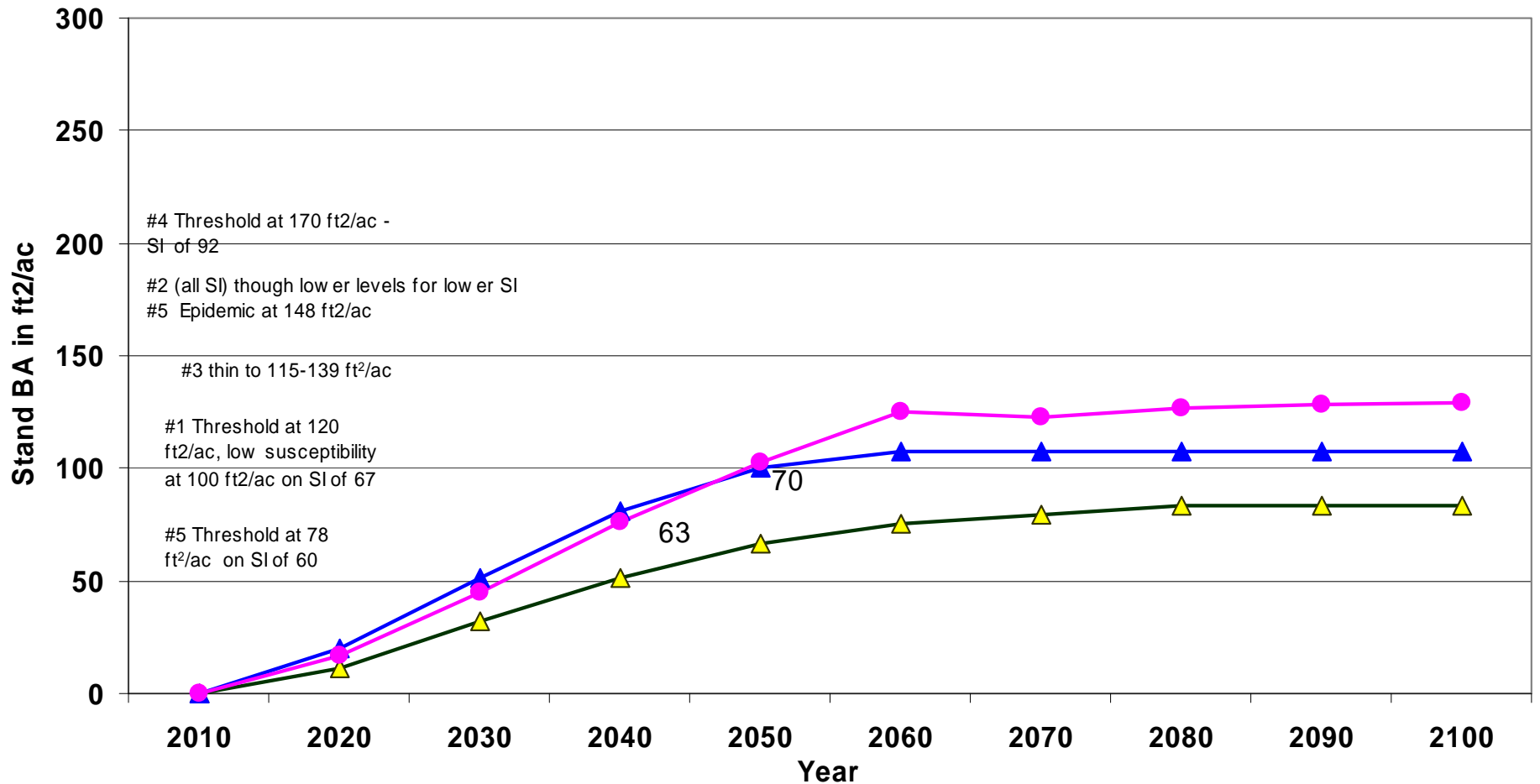


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Likely threshold values for MPB in Ponderosa Pine on example site

BA growth for PP on low site quality stands at elevation 3750 FVS - EC variant



▲ PP/pinegrass (111)

▲ DF/BB/Bitterbrush (23)

● DF/BB/pinegrass (33)

Take home notes

- *Silvicultural tools exist to treat stands to reduce the risk of MPB.*
- *The tools work best if applied on a site specific basis – so learn about your site*
- *Think about both stocking and soil conditions*
- *Timely treatments are necessary to avoid additional problems such as root rots and reduced crown length which hinders growth response to treatment*
- *Growth modeling tools can help you to refine your estimates in the absence of long term knowledge of your sites....use them to give you the estimates you need, but don't consider them a panacea.*



A note about endemic versus epidemic bark beetle conditions

- All bets are off when bark beetles move into epidemic conditions....the bark beetles behave differently, and your vigorous healthy trees are a banquet so....***

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– Treat early, be aggressive, and help your neighbor



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***That
you
may
avoid
this***



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- ***Riparian zone of old growth spruce and sub alpine fir with prior insect attack burned in 1994***
- ***Upland lodgepole pine remained fire free***

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