Assessment of Link Between Existing Vegetation Map and Inventory (FY12)

Boise National Forest

FY 2012

Contents

Assessment of Link Between Existing Vegetation Map and Inventory (FY12)

FY12 Inventory Assessment

There are a total of 728 A and B-grid locations across the Boise NF. For several years, the Forest has been validating the B-grid data to develop a plan to fill in missing information and to make it and the A-grid more consistent. Over time, missing data will be added to the inventory database. This includes data for the non-forest locations for which sampling was initiated in 2011. Therefore, as of 2011 the most complete dataset is for the forested locations. Between the A and B-grid, 520 sample points have enough data to generate Appendix A and Appendix E estimates for forested vegetation though some plots are currently missing large coarse woody debris information.

Forest Plan Appendix A Assessment

Desired conditions in the 2010 Forest Plan are presented by PVG. Table 1 displays the current tree size class estimates for the forest compared to the Appendix A desired conditions for each PVG grouped by fire regime. Based on an assumption that 40 plots are the minimum needed to develop statistically reliable estimates, there are insufficient numbers of plots to compare all but three PVGs to the desired conditions. The PVGs that met the 40 plot criterion were PVG2, PVG 4 and PVG 7. Therefore, inventory data were pooled to the fire regime using weighted averages based on number of plots in each PVG. Desired conditions were pooled using the same method. However, even with this pooling, the lethal fire regime is one plot short of meeting the criteria (Table 2). As missing data (including PVG information) are collected in the future it is likely sufficient data will be available to develop statistical tests for all fire regimes including the lethal. It is unlikely though that the additional plots will provide enough information to make up the 40 minimum plots for those PVGs that currently do not meet this goal.

Table 1—Current Conditions for Tree Size Class Compared to the Appendix A Desired Conditions by PVG and Fire Regime

PVG	N	GFSS		Sapling		Small		Medium		Large	
		DC	2010	DC	2010	DC	2010	DC	2010	DC	2010
Nonlethal Fire Regime											
1	17	1-12	35	2-12	12	2-18	12	3-19	29	47-91	12
2	137	4-5	26	3-7	3	5-21	10	7-35	29	59-80	32
5	5	3-4	40	3-7	0	4-22	0	7-30	20	66-84	40
Mixed1 Fire Regime											
3	37	9	22	9	5	18-27	5	23-36	30	23-41	38
6	33	7-8	3	7-9	0	11-27	3	18-36	18	28-56	79
Mixed2 Fire Regime											
4	51	14-15	14	7-9	0	19-22	6	24-36	45	20-34	35
7	177	7-16	28	11-15	2	21-22	13	32-36	36	10-21	21
11	24	9-15	33	14-15	4	19-22	21	22-38	38	14-27	4
Lethal Fire Regime											
8	10	15-17	10	11-15	0	22-23	20	28-29	50	18-21	20
9	9	13-15	22	8-15	0	17-22	11	25-29	44	31-37	22
10	20	16-23	20	11-16	25	46-48	30	11-20	25	N/A	N/A

Table 2-- Current Conditions for Tree Size Class Compared to Appendix A Desired Conditions by Fire Regime

PVG	N	GFSS		Sapling		Small		Medium		Large		Meets DC
		DC	2010	DC	2010	DC	2010	DC	2010	DC	2010	
Nonlethal	159	4-6	27	3-8	4	5-21	10	7-34	29	58-81	30	No
Mixed1	70	8-9	13	8-9	3	15-27	4	21-36	24	25-48	56	No
Mixed2	252	9-16	26	10-14	2	20-22	12	29-36	38	12-24	22	No
Lethal	39	15-20	18	10-16	13	33-36	23	19-24	36	12-14	10	N/A[a]

[a]Insufficient number of plots to conduct statistically reliable tests

Tree size classes and other Appendix A attributes were compared to desired conditions using the Chi-square Goodness-of-fit Test at the 0.05 significance level by fire regime. Based on this test, none of the fire regimes meet desired conditions. The nonlethal, mixed1 and mixed2 fire regimes exceed the high end of the range of desired conditions for the grass/forb/shrub/seedling (GFSS) tree size class. The nonlethal fire regime is below the low end of the desired condition range for large tree size class, the mixed1 fire regime exceeds the high end, and the mixed2 fire regime falls within. The distribution of other tree size classes relative to the desired conditions also varies by fire regime.

Appendix A desired conditions for canopy cover and species composition are for the large tree size class. The nonlethal and mixed2 fire regimes had enough large tree size class plots to run the Chi-square Goodness-of-fit Test which is displayed in Table 2. The mixed1 fire regime was one plot short so the data for the large tree size class is presented in Table 2 without the analysis for whether or not it meets the desired condition. There were only 12 plots (9 large tree size class in PVGs 8 and 9 and 3 medium tree size class in PVG10) in the lethal fire regime and due to the small number, data for this fire regime are not presented.

Though the amount of area across the forest is below the desired condition for the large tree size class in the nonlethal fire regime, the distribution of the large tree canopy cover class meets desired condition (Table 3). The mixed 2 fire regime does not meet the desired condition because there is too much in low and not enough in moderate. Though the Chi-square test was not conducted for the mixed1 fire regime, it is similar to the mixed2 fire regime in that there is too much canopy cover in low and not enough in moderate canopy cover class.

Table 3-- Current Conditions for Large Tree Size Class Canopy Cover Compared to Appendix A Desired Conditions by Fire Regime

PVG	N	Low		Moderate		High		Meets DC
		DC	2010	DC	2010	DC	2010	
Nonlethal	48	60-80	65	20-40	33	0	2	Yes
Mixed1	39[a]	3-23	36	77-97	59	0	5	--
Mixed2	57	4-20	63	80-96	35	0	2	No
Lethal	12[a]	--	--	--	--	--	--	--

[a]Insufficient number of plots to conduct statistically reliable tests

Large tree size class species composition also does not meet desired condition for the nonlethal and mixed2 fire regime (Table 4). It is also unlikely it would meet desired condition for the mixed1 fire regime had there been enough plots to calculate the Chi-square goodness-of-fit Test. In the nonlethal fire regime, there is not enough early seral ponderosa pine and there is too much late-seral/climax Douglas-fir. This is also the case for the mixed1 fire regime in that early seral western larch and ponderosa pine are under-represented while Douglas-fir, which is a mid-seral species in the mixed1 fire regime, is over-represented. In the mixed2 fire regime, early seral whitebark

pine and lodgepole pine are under-represented. Douglas-fir, which is an early to mid-seral species in the mixed2 fire regime, is over-represented.

Table 4-- Current Conditions for Large Tree Size Class Species Composition Compared to Appendix A Desired Conditions by Fire Regime

PVG	N	PIAL		LAOC		PICO		PIPO		PSME		Meets DC
		DC	2010	DC	2010	DC	2010	DC	2010	DC	2010	
Nonlethal	48	--	--	--	--	--	--	83-88	74	9-15	25	No
Mixed1	39[a]	--	--	7-14	0	--	--	25-41	18	32-48	52	--
Mixed2	57	3-4	0	--	--	23-36	1	--	--	30-40	84	No
Lethal	12[a]	--	--	--	--	--	--	--	--	--	--	--

[a]Insufficient number of plots to conduct statistically reliable tests

Overall, none of the fire regimes meet desired conditions (Table 5). While some individual attributes are within the desired ranges for some fire regimes, no one fire regime meets all the attributes in combination. In the nonlethal fire regime, though the canopy cover class distribution meets the desired condition for the large tree size class, the amount of large tree size class is below the desired range as is the representation of ponderosa pine, the early seral species in this fire regime. In the mixed1 fire regime, though the amount of large tree size class exceeds the desired condition, there is too much in the low canopy cover class and early seral species like western larch and ponderosa pine are under-represented. The same is true for the mixed2 fire regime though the amount of large tree size class meets the desired condition.

Table 5—Relationship of Large Tree Size Class, Large Tree Size Class Canopy Cover, and Large Tree Size Class Seral Species to Desired Conditions by Fire Regime

Fire Regime	Large Tree Size Class	Low Canopy Cover Class	Moderate Canopy Cover Class	Early Seral Species	Meets Appendix A DC
Nonlethal	Below	Meets	Meets	Below	No
Mixed1	Above	Above	Below	Below	No
Mixed2	Meets	Above	Below	Below	No
Lethal	Below	--	--	--	

As was the case with the live tree components, data and desired conditions for snag and coarse woody debris were pooled to the fire regime to conduct statistical analysis. Forest-wide based on the fire regime pooling, the number of medium sized snags per acre exceeds the high end of the desired conditions (Table 6). The number of large sized snags is within desired ranges for all fire regimes except the lethal, which exceeds the high end of the range. Relative to the fire regimes, the number of snags per acre in both size classes is lowest in the nonlethal and highest in the lethal fire regime. The mixed1 and mixed2 are intermediate in that order.

Table 6-- Current Conditions for Snags per Acre and Coarse Woody Debris with 95% Confidence Intervals Compared to Appendix A Desired Conditions by Fire Regime and Earlier versus Later Successional Stages

		Snags (Number per Acre)				Coarse Woody Debris (Tons per Acre)			
PVG	N	Medium 10.0-19.0 inches		Large ≥20 inches		≥3 inches		≥15[d] inches	
		DC	2010	DC	2010	DC	2010	DC	2010
Nonlethal	151	1.7-2.6	5.3±2.1	0.4-2.9	1.6±0.6	3.9-13.6	3.7±0.9	2.9-10.2	1.5±0.6
Earlier[a]	62		9.2±4.4		2.3±1.2		4.0±1.5		1.0±0.6
Later[b]	89		2.6±1.7		1.2±0.7		3.4±1.1		1.9±0.9
Mixed1	68	1.8-4.8	7.0±2.8	0.2-3.1	2.4±1.0	4.0-14.0	5.0±1.6	2.6-9.1	1.9±1.0
Earlier[c]	13[c]		11.1		2.1		6.2		2.8
Later	55		6.0±2.6		2.5±1.1		2.4±1.1		1.7±1.0
Mixed2	235	1.8-4.6	13.2±2.4	0.2-3.3	2.9±0.7	4.7-17.5	4.5±0.8	2.4-8.8	1.6±0.5
Earlier	94		19.2±4.9		3.6±1.2		4.3±1.2		1.4±0.7
Later	141		9.1±2.2		2.4±0.9		4.5±1.1		1.8±0.7
Lethal	38[c]	1.8-7.6	20.6	0.1-1.4	3.4	5.0-19.0	9.4	1.3-4.8	5.0
Earlier[c]	20		28.4		4.2		8.0		3.8
Later[c]	18		8.9		1.7		11.0		7.1

[a]Earlier successional: GFSS, Sapling, Small

[b]Later successional: Medium and Large tree size class

[c]Insufficient number of plots to develop confidence intervals

[d]12 inches and greater for PVG10 in the lethal fire regime

Since 2004 about 580,000 acres of the forest have burned by wildfire. In the 10 year period prior to and including 2004 (1995-2004) insect and disease levels across the State of Idaho were the highest ever recorded (2004 Idaho Forest Health Monitoring Highlights). Because the desired conditions in Appendix A are to provide snags and coarse woody debris in "green" versus "black" stands, plots were assigned to earlier successional (based on whether they were GFSS, sapling or small tree size class) and later successional (based on whether they were medium or large tree size class) to determine how the recent disturbances may have contributed to the forest-wide snag and coarse woody debris numbers (Table 6). In all but one case there are more medium and large sized snags in the earlier successional stages than in later successional stages. This relationship is flipped for large sized snags in the mixed1 fire regime. The association of snags to the earlier successional stage likely reflects the disturbance processes that created this stage. Stand-replacing disturbances such as wildfire would produce large numbers of snags that would be more evident in this stage. Overtime, many of these would fall. Snags present in the later successional stage are generally the result of persistent snags created from stand-replacing disturbance, or snags created during stand development.

Coarse woody debris is within the desired conditions in the mixed1 and lethal fire regimes and below the low end in the nonlethal and mixed2 fire regimes (Table 6). All fire regimes except lethal are below the low end of the range for coarse woody debris over 15 inches. The relationship of coarse woody debris to earlier and later successional stages is less obvious than for snags. For all but the lethal fire regime coarse woody debris in earlier and later successional stages is similar. In the lethal fire regime, later successional stages have more coarse woody debris than earlier. One caveat for this coarse woody debris analysis is that the dataset for coarse woody debris is less robust than the dataset for snags. Up to the past few years, coarse woody debris data was less consistently

collected, particularly on the A-grid than it is now and over time trends may become more obvious or better substantiated.

Forest Plan Appendix E Assessment

Old forest habitat is a condition within the large tree size and definitions for old forest habitat apply to all PVGs except PVG10. Large tree size class plots were assessed to determine whether any met the attributes for old forest habitat.

None of the plots currently meet all old forest habitat definitions in combination though some meet individual attributes (Table 7). Overall, the attribute least often met is canopy cover of live trees greater than or equal to 20 inches. For all PVGs, this is defined as greater than 30 percent canopy cover. In total, 15 of the 144 large tree size class plots meet this criterion. However, of these only one had the desired species composition, which for all PVGs is defined by a preponderance of early seral species. The one plot that met the definition for canopy cover and species composition is in PVG4. Though forest-wide large snag numbers per acre are within desired conditions, only a small proportion of large tree size class stands contain the desired number of snags per acre to meet the old forest habitat definitions and even fewer meet the desired conditions for large coarse woody debris.

Table 7—Percentage of Large Tree Size Class Plots that Meet or Do Not Meet Selected Old Forest Habitat Definitions by Fire Regime

Fire Regime	Canopy Cover of Live Trees ≥20 inches		Number of Snags ≥ 20 inches		Tons of Coarse Woody Debris ≥15 inches	
	Percent of Plots Meeting or Not Meeting Definitions					
	Meeting	Not Meeting	Meeting	Not Meeting	Meeting	Not Meeting
Nonlethal	8%	92%	21%	79%	19%	81%
Mixed1	18%	82%	38%	62%	26%	74%
Mixed2	7%	93%	39%	61%	26%	74%
Lethal [a]	--	--	--	--	--	--

[a] Insufficient number of plots to conduct statistically reliable tests

The total average number of large trees and percent canopy cover varies only slightly between the fire regimes (Table 8). The nonlethal fire regime averages the lowest number of large trees per acre and the mixed1 fire regime the most. This pattern is the same for the average percent canopy cover, and for the range of canopy cover values. To meet the large tree canopy cover definition for old forest habitat, average canopy cover for all fire regimes would need to increase between 40 and 69 percent of current. This would require on average an increase of 8 to 12 large trees per acre from current levels.

Table 8—Number of Plots, Total Average Large Trees Per Acre and Percent Canopy Cover in the Large Tree Size, with 95% Confidence Interval and Range of Values by Fire Regime

Fire Regime	Number of Plots	Total Average Number of Large Trees (≥20 inches dbh) Per Acre For Plots Defined as Large Tree Size Class (Mean ± Confidence Interval, Range)	Total Average Large Tree (≥20 inches dbh) Canopy Cover Percent for Plots Defined as Large Tree Size Class (Mean ± Confidence Interval, Range)
Nonlethal	48	16.2 ± 1.8 (6.0 – 30.0)	17.7 ± 1.9 (10.1 – 34.7)
Mixed1	39	20.2 ± 3.4 (9.8 – 54.0)	21.5 ± 3.4 (10.7 – 47.3)
Mixed2	57	18.5 ± 3.0 (6.0 – 48.1)	18.5 ± 1.9 (10.0 – 36.4)
Lethal [a]	--	--	--

[a] Insufficient number of plots to conduct statistically reliable tests

Assessment of Link Between Existing Vegetation Map and Inventory

Findings from the Accuracy Assessment Using FIA

This section summarizes the findings of the accuracy assessment component that evaluated how closely the percent of area for different mapped classes matched the percent of area represented by the FIA based on A-grid data (the B-grid data is not included in this assessment). The FIA data were processed using the same definitions as the mapped definitions, which as described above for a tree size class, may vary from the 2010 Forest Plan Appendix A. A plus (+) indicates that more was mapped than was estimated using the FIA data and a minus (-) means less was mapped than estimated by FIA (Table 9).

Table 9—Comparison of Classes Mapped to the FIA A-Grid Estimates

Map Class: Map Group	Difference (%) Map to FIA	Map Class: Tree Size	Difference (%) Map to FIA	Map Class: Canopy Cover	Difference (%) Map to FIA
Deciduous	-0.26	TS1-Seedling	-0.1	TC1-Low	+9.1
Conifer	+5.66	TS2-Sapling	+3.2	TC2-Medium	-1.1
Shrubland	-6.94	TS3-Small	+8.2	TC3-Low to Medium	-10.2
Herbland	+0.50	TS4-Medium	+13.4	TC4-Medium to High	+1.8
Riparian	-0.99	TS5-Large	-17.2	TC5-High	+0.4
Non-vegetated	+3.67	TS6-Very Large	-7.7	SC1-Low	+1.5
Burned	-1.63			SC2-Medium	-10.2
				SC3-High	+8.7

Overall the class with the greatest deviation between the map and FIA is the large tree size class (TS5). The FIA tree size class estimate for Large (TS5) was 24.5 percent and for Very Large (TS6) was 7.9 percent. The map estimate for Large is 7.3 percent and for Very Large is 0.2 percent. As described above for the accuracy assessment as a whole, a large share of the areas that are Large and Very Large on the ground were mapped as Medium tree size class. Of the accuracy assessment plots that were, on the ground Large or Very Large tree size class, 63 percent of those that did not map to the Large or Very Large class mapped as Medium. Conversely, 23 percent of the area mapped as Medium tree size class met the Large or Very Large tree size class definition on the ground. The next greatest area of confusion in the tree size classes was between Small and Medium. The comparison of the FIA data to the map shows the same trends in agreement and dis-agreement as described by the accuracy assessment as a whole.

Relationship Between Forest Plan Tree Size Class Definitions and the Existing Vegetation Map

Tree size class definitions from the 2010 Forest Plan were assigned to the field visited training plots, accuracy assessment plots and inventory plots based on the canopy cover data collected for each plot type. Between the various data sources there were a total of 2,214 plots with enough information to assign a Forest Plan tree size definition (Table 10). Within this pool the largest share of the plots met the Forest Plan definition for medium tree size class definition followed by the GFSS.

Table 10. Number of Training, Accuracy Assessment and Inventory Plots and Percent of Total Assigned to the 2010 Forest Plan Tree Size Class Definitions

2010 Forest Plan Tree Size Class Definitions	Number of Plots	Percent of Total
Grass/Forb/Shrub/Seedling (GFSS)	552	25%
Sapling	118	4%
Small	300	14%
Medium	876	40%
Large	368	17%
Total	2,214	100%

Plots that met the Forest Plan definition of sapling and small have a high correlation with plots that met the map definition of TS2 (sapling) and TS3 (small) (Table 11). Most of the plots (98 percent) that meet the Forest Plan definition of sapling met the map definition of sapling (TS2). For the small tree size class, 91 percent of the plots that meet the Forest Plan definition of small met the map definition of small (TS3). However, as the tree size classes increase, the correlation between the Forest Plan definitions and the map definitions is less consistent. Though 55 percent of the plots that meet the Forest Plan definition of large met the large/very large (TS5 and TS6) map definitions, 38 percent met the medium (TS4).

Table 11. Relationship Between Plots Assigned to 2010 Forest Plan Tree Size Class Definitions and Map Definitions

Forest Plan				Map Definition
Sapling	Small	Medium	Large	
98%	8%	3%	3%	TS2 (Sapling)
0%	91%	13%	4%	TS3 (Small)
1%	<1%	83%	38%	TS4 (Medium)
1%	<1%	1%	55%	TS5/6 (Large and Very Large)

The proportion of plots that meet the Forest Plan definitions of sapling and small, and the proportion mapped as sapling and small are similar (Table 12). For example, 18 percent of the plots meet the Forest Plan definition of small and 19 percent mapped as small tree size class. However, as has been the case for other comparisons, the proportion of plots that meet the medium and large tree size class and the proportion mapped as medium and large/very large are less similar. The percentage of plots that meet the Forest Plan definition of large tree size class, though lower than estimates displayed in Section 4 from the inventory (e.g. Table 2) and in the accuracy assessment report, are still more than is displayed on the map (Table 13 and Table 12). Again, a greater proportion of the mapped area is in medium and less is in large tree size class than would have been expected based on estimates from other data sources. Based on the accuracy assessment (Existing Vegetation Mapping Summary: Boise National Forest, Table 4.2.4, page F:49) about 23 percent of the accuracy assessment plots that met the definition of large or very large tree size class fell into medium tree size class polygons on the map.

Table 12. Percent of Total Training, Accuracy Assessment and Inventory Plots Assigned to the 2010 Forest Plan Tree Size Class Definitions and Proportion of Area Mapped in Tree Size Classes TS2 through TS6

Proportion of Plots as Defined by the Forest Plan					Proportion of Area Mapped			
Sapling	Small	Medium	Large		TS2	TS3	TS4	TS5 and TS6
7%	18%	53%	22%		8%	19%	66%	7%

Table 13. Tree Size Classes for Tree Dominance Types for Existing Vegetation Map and Appendix A

Tree Size Class Name	Acres	Percent of Total Acres for Existing Vegetation (new map)	Percent of Total Acres for Montana Landsat (old map)
Seedling	1,530	>1%	>1%
Sapling	99,280	6%	10%
Small	331,560	21%	41%
Medium	1,008,700	65%	35%
Large	113,890	7%	14%
Very Large	2,260	>1%	

By putting together the Table 19 and the information from the training and accuracy assessment plots, it is possible to identify tree size class map units most likely to meet the 2010 Forest Plan definitions. For example, there is a relatively high correlation (83 percent) between the reference plots that met the 2010 Forest Plan and map definition of medium tree size class (Table 14). Of the plots that met the map definition of medium tree size class, 80 percent are mapped as medium tree size class. Therefore, there is a relatively high probability (0.73) of finding areas that meet the Forest Plan definition of medium tree size class in areas mapped as medium tree size class (Table 15). However, there is also a relatively high probability (0.64) of finding areas that meet the Forest Plan definition of large tree size class in areas mapped as medium.

Table 14. Relationship Between Plots Assigned to 2010 Forest Plan Tree Size Class Definitions, Reference Data and Accuracy Assessment

Forest Plan				Map Definition	Tree Size Class Mapped			
Sapling	Small	Medium	Large		TS2	TS3	TS4	TS5 and TS6
98%	8%	3%	3%	TS2	51%	21%	27%	1%
0%	91%	13%	4%	TS3	6%	56%	35%	3%
1%	<1%	83%	38%	TS4	2%	12%	80%	6%
1%	<1%	1%	55%	TS5/6	3%	9%	59%	29%

Table 15. Probability of Forest Plan Defined Tree Size Class Occurring in Mapped Tree Size Class

Forest Plan Tree Size	Mapped Tree Size Class			
	TS2 (Sapling)	TS3 (Small)	TS4 (Medium)	TS5 and TS6 (Large and Very Large)
Sapling	0.50	0.21	0.28	0.01
Small	0.09	0.53	0.34	0.04
Medium	0.04	0.18	0.73	0.05
Large	0.05	0.13	0.64	0.18