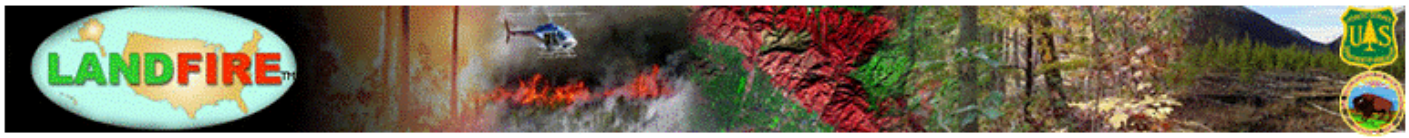


LANDFIRE Product Assessment: Alaska and Hawai'i Super Zone Analysis and Report

Introduction

The interagency LANDFIRE project worked to produce quality products from available data sets. The Alaska and Hawai'i Milestone Assessment followed the processes outlined in the LANDFIRE Product Quality Control and Assessment Plan (PQCA Plan), which was approved by LANDFIRE leadership and presents full disclosure of all pertinent information concerning the approach to assess quality of the LANDFIRE products. The project completed two reports describing results for the various Alaska and Hawai'i Milestone mapping zones, an "Overall" report, and this "Super Zone" report. All LANDFIRE agreement reports for all milestones are available at:

http://www.landfire.gov/products_dataquality.php

What follows is a report of the outcomes of the Alaska and Hawai'i Milestone (AK_HI) product quality assessment process for the LANDFIRE National Existing Vegetation Type (EVT). The purpose of this report is to provide as much information as possible to potential users to support the analysis and application of certain LANDFIRE National products, such as:

- a general understanding of the quality and characteristics of certain products,
- information that will help users apply the data appropriately, or understand how they might have to adjust the data to utilize it locally, and
- sample sizes across assessment geographies and mapped categories to allow users to evaluate the agreement assessment results themselves.

The LANDFIRE Product Quality Team is responsible for this report and for defining, coordinating and conducting the product quality assessment procedures. Please contact the LANDFIRE Help Desk (helpdesk@landfire.gov) with any questions or issues. For more information on the Product Quality Team and the procedures used, please review the material available at www.landfire.gov/products_dataquality.php.

Assessment Process

LF National (LFNA) EVT in the AK_HI Milestone can be assessed with a quantitative process because this product was directly generated from geo-referenced field plots contained in the LANDFIRE Reference Data Base (LFRDB). However, we could not use the same procedure to analyze other LFNA spatial layers, such as Biophysical Setting, Fire Regimes, etc., because they were derived using rule sets, simulation methods, or there were insufficient plots available for a useful quantitative assessment. The assessment process evaluated the agreement between the mapped LANDFIRE products and hold-out plots. Because there are always

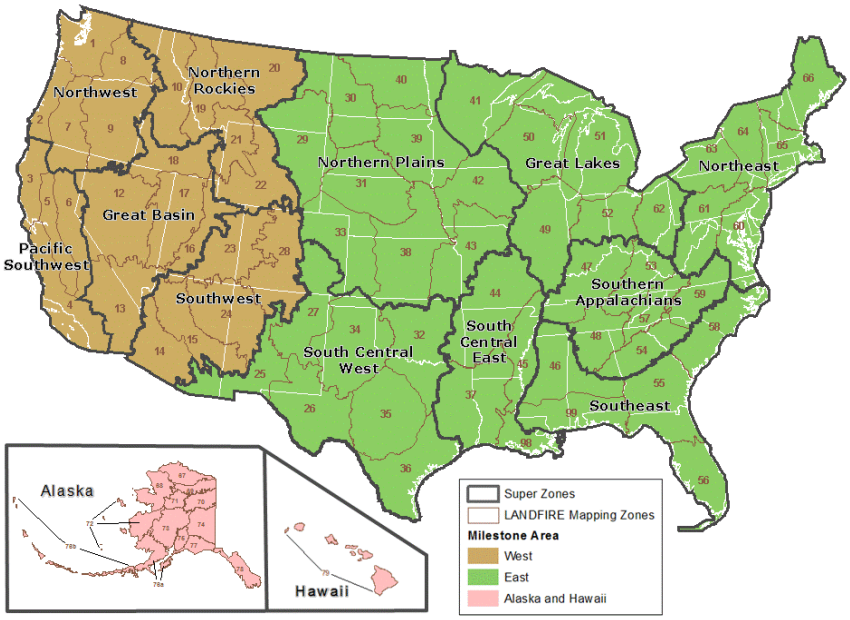
numerous issues with the holdout plots, such as total sample size, plot classification methodology, variable plot quality, etc., we chose to use the term “agreement” rather than “accuracy”. This distinction is common in the literature.

EVT

A 2% systematic areal sample of 3 km by 3 km blocks was used to select the holdout sample of LFRDB plots that formed the foundation of the assessment process for EVT. Every holdout plot was attributed with a “Reference” Ecological System using an automated sequence table process, and compared to the corresponding value from the LANDFIRE product. Results were summarized in standard contingency tables.

Even with the tens of thousands of plots that comprise the LFRDB, the geographic distribution and number of plots available in the 2% holdout sample presented problems (see “PQCA Plan” on this website for more detail on the sample design). Some map zones had few plots (even though the holdout sample was a systematic geographic design), and within every individual map zone the less commonly occurring map classes had few or no holdout sample plots selected. Because the sample size of holdout plots was not adequate to support precise estimates of agreement at the map zone level, map zones were aggregated into geographic groups known as Super Zones (Figure 1). In the case of Hawai’i, there is only one map zone, making it a Super Zone for the purposes of this report.

Figure 1: LANDFIRE Agreement Assessment Super Zones for CONUS



Individual Map Zone Results

Individual map zone contingency tables will be provided as a separate product at a later date, but users are ***strongly cautioned*** against using individual map zone results because of sample size and sample distribution issues which severely limit the inferences that can be reliably made from them. Individual map zone results may

be interesting and useful to researchers, but probably not to LANDFIRE National (LFNA) product users.

Canopy Fuels

Canopy Fuels cross-validation statistics were developed for Super Zones in the Lower 48 states. However, there were insufficient plots with canopy information available to create a canopy fuels layer in Alaska and Hawai'i, so a different approach (based upon expert knowledge) was utilized to develop these products. This accuracy of the products developed using this new approach cannot be quantitatively assessed without significant additional expense and time.

5x5 Spatial Assessments

As in the Western and Eastern Milestones, "center pixel" agreement and "5 pixel by 5 pixel window" agreement were very similar (generally only 1-3% different) in the Alaska and Hawai'i Milestone. Thus, the 5x5 agreement results will not be included in this report. These 5x5 spatial window contingency tables are available for download www.landfire.gov/dp_quality_assessment.php.

Agreement Metrics

Standard agreement metrics were utilized in the LFNA assessment, namely Overall Agreement, Producer Agreement and User Agreement. Overall agreement is the percentage of total reference plots that had the same map and reference class. Producer Agreement is the percentage of holdout plots in Class "i" that were mapped as Class "i". User Agreement is the percentage of holdout plots mapped as Class "i" that actually are Class "i" plots in the reference data. Full contingency tables can be examined to identify specific disagreements between classes, often resulting in a more thorough understanding about the types of error, not just the quantity. Refer to the summary tables below for specific examples of each metric.

Assessment Notes

The LFNA agreement assessment process will eventually be one of the largest such processes ever conducted. The LANDFIRE project is large, and the issues are numerous. The purpose of this section of the report is to provide information that will help readers understand potential issues with the assessment results, and ultimately to help LFNA product users apply the results of the assessments appropriately.

Holdout Sample Size and Distribution

- At the map zone level, the sample size in many map classes is too small to permit reliable (precise) class-specific estimates of agreement. Consequently, LFNA Super Zones are the most appropriate level of analysis for the agreement results below the milestone level.
- Even at the Super Zone level, the sample sizes for the less common map classes are still often quite small, and a significant number of map classes have no sample plots. Accordingly, many of the class-specific estimates of agreement at the Super Zone level are not precise.
- Users are strongly urged to pay attention to sample sizes, and use that information when applying the agreement results.

Class Specific Agreement

- Agreement assessments are based on comparisons between mapped values of EVT at specific locations and the corresponding values assigned to holdout plots

in the reference database (i.e., reference values) at the same locations, based on field information.

- Class specific agreement values for classes with low sample size are suspect and unreliable. For example, a class with 2 samples has only 3 possible agreement values: 0%, 50% and 100%. Because of the aggregate sample size and sample distribution among classes, there are many such situations. Thus, class specific agreement will only be reported to categories with at least 5 holdout assessment plots. The full contingency tables, including classes with low numbers of assessment plots, are available for download at www.landfire.gov/dp_quality_assessment.php.
- Ecological Systems are at times difficult to classify on the ground and on imagery since they are "systems" not "cover types". They are not necessarily mutually exclusive and they tend to grade from one system to another on the ground, sometimes resulting in lower agreements when assessed quantitatively.
- Holdout plots are the best way to evaluate product quality, but they do have limitations. These limitations do not invalidate the agreement assessment, but they should be understood and factored into user inferences.
    - Some holdout plots are relatively old (20-30 years) but still passed basic imagery QA/QC (no major canopy change seen). It is possible that non-agreement is due to plot changes over the time lag.
    - Reference values of EVT are largely assigned to holdout plots using an automated process, based on the vegetation composition data associated with the plots. This process could have errors that are translated into the map and/or the agreement assessment.
    - All plots used in LANDFIRE were geo-referenced (most with GPS), but there is considerable variation in the quality of the final location. Mis-registrations between the LFNA product and the plot location would reduce agreement estimates.

Crosswalks

Crosswalks to other classification units can facilitate evaluation of mapping results at different levels of thematic resolution and provide additional insight to users about how LFNA products can be applied. In the Western Milestone Reports, we reported agreement results for a number of other classifications systems that might be of interest to particular users. In the Alaska and Hawai'i Milestone, however, we did not report the results of the WUS crosswalks because of the interest in using a crosswalk to NVCS, which was not yet approved. If time and resources are available, the LANDFIRE PQWT will compute and report the agreement results once the crosswalks to NVCS Group and Macrogroup are available.

EVT Agreement Results

On the pages that follow, tables summarizing the agreement results for each product in each Super Zone are provided. Information contained in these tables includes, by class:

- LFRDB Plots – The number of holdout plots identified as class "i" in the LANDFIRE Reference Data Base.
- Mapped Plots – The number of holdout plots mapped as class "i".
- Plots with Agreement – The number of holdout plots in class "i" " that were mapped as Class "i".

- Producer Agreement – The percentage of holdout plots in class “i” that were mapped as Class “i”. Calculated as: (Plots with Agreement) / (LFRDB Plots) * 100.
- User Agreement – The percentage of holdout plots mapped as class “i” that are identified as class “i” in the reference database. Calculated as: (Plots with Agreement) / (Mapped Plots) * 100.
- LFRDB Percent - Percentage of all holdout plots in the Super Zone that are identified as class “i” in the reference database. Calculated as: (LFRDB Plots) / (Total number of holdout plots) * 100.
- Mapped Percent – Percentage of all holdout plots in the Super Zone that were mapped as class “i”. Calculated as: (Mapped Plots) / (Total number of holdout plots) * 100.
- DIFF – The difference between Mapped Percent and LFRDB Percent. Calculated as: Mapped Percent – LFRDB Percent.
    - If this number is positive, then there is more area of the class in the map than in the plot database (as indicated by mapped values at holdout point locations); i.e. – a sample from holdout plot locations suggests that it may be over-mapped.
    - If this number is negative, then there is less area of the class in the map than in the plot database (as indicated by mapped values at holdout plot locations); i.e. – a sample from holdout plot locations suggests that it may be under-mapped.
    - The value of this number suggests the degree to which the class may be over- or under-mapped.

The tables below are intended to be class-specific summaries of agreement within each Super Zone. Full contingency tables for each Super Zone can be downloaded at the same web location as this report for users interested in viewing the full assessment data. Full contingency tables can be examined in-depth to identify specific disagreements between classes, often resulting in a more thorough understanding about the types of error present in a map, not just the quantity of errors. Users interested in a broader level summary are encouraged to download and review the LANDFIRE National Alaska and Hawai’i Milestone Agreement Summary Report, which is a summary of overall agreement by LFNA Super Zone.

Alaska (Map Zones 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78)

Table 1. Alaska Super Zone Summary for Existing Vegetation Type-Ecological Systems (5 or more assessment plots)

		Class Specific Holdout Plot Agreement					Proportional Agreement		
Name	Code	LFRDB Plots	Mapped Plots	Plots with Agreement	Producer Agreement	User Agreement	LFRDB Percent	Mapped Percent	DIFF
Western North American Boreal Mesic Birch-Aspen Forest	2605	44	37	16	36.4%	43.2%	6.6%	5.6%	-1.1%
Western North American Boreal Mesic Black Spruce Forest	2604	40	37	17	42.5%	46.0%	6.0%	5.6%	-0.5%
Alaska Arctic Scrub Birch-Ericaceous	2682	35	34	11	31.4%	32.4%	5.3%	5.1%	-0.2%

Shrubland									
Western North American Boreal Black Spruce Dwarf-Tree Peatland	2621	31	35	6	19.4%	17.1%	4.7%	5.3%	0.6%
Western North American Boreal White Spruce Forest	2600	23	32	7	30.4%	21.9%	3.5%	4.8%	1.4%
Western North American Boreal Black Spruce Wet-Mesic Slope Woodland	2622	23	8	1	4.4%	12.5%	3.5%	1.2%	-2.3%
Western North American Boreal Low Shrub Peatland	2620	22	16	3	13.6%	18.8%	3.3%	2.4%	-0.9%
Alaskan Pacific Maritime Western Hemlock Forest	2646	22	16	11	50.0%	68.8%	3.3%	2.4%	-0.9%
Western North American Boreal White Spruce-Hardwood Forest	2603	21	36	8	38.1%	22.2%	3.2%	5.4%	2.3%
Western North American Boreal Mesic Scrub Birch-Willow Shrubland	2610	19	48	8	42.1%	16.7%	2.9%	7.2%	4.4%
Western North American Boreal Treeline White Spruce Woodland	2601	18	7	3	16.7%	42.9%	2.7%	1.1%	-1.7%
Western North American Boreal Sedge-Dwarf-Shrub Bog	2619	16	4	0	0.0%	0.0%	2.4%	0.6%	-1.8%
Western North American Boreal Alpine Ericaceous Dwarf-Shrubland	2635	14	8	1	7.1%	12.5%	2.1%	1.2%	-0.9%
Alaska Arctic Mesic Alder Shrubland	2638	13	14	3	23.1%	21.4%	2.0%	2.1%	0.2%
Alaska Sub-boreal White Spruce-Hardwood Forest	2679	13	23	2	15.4%	8.7%	2.0%	3.5%	1.5%
Western North American Boreal Herbaceous Fen	2618	12	8	3	25.0%	37.5%	1.8%	1.2%	-0.6%
Alaska Arctic Mesic-Wet	2639	12	15	3	25.0%	20.0%	1.8%	2.3%	0.5%

Willow Shrubland									
Alaska Arctic Shrub-Tussock Tundra	2693	12	25	3	25.0%	12.0%	1.8%	3.8%	2.0%
Western North American Boreal Montane Floodplain Forest and Shrubland	2614	11	8	0	0.0%	0.0%	1.7%	1.2%	-0.5%
Western North American Boreal Low Shrub-Tussock Tundra	2628	10	2	0	0.0%	0.0%	1.5%	0.3%	-1.2%
Alaska Arctic Polygonal Ground Wet Sedge Tundra	2706	10	0	0	0.0%	0.0%	1.5%	0.0%	-1.5%
Alaska Sub-boreal Avalanche Slope Shrubland	2608	9	0	0	0.0%	0.0%	1.4%	0.0%	-1.4%
Alaska Arctic Polygonal Ground Mesic Shrub Tundra	2700	9	6	3	33.3%	0.0%	1.4%	0.9%	-0.5%
Alaska Arctic Sedge Freshwater Marsh	2705	9	9	1	11.1%	0.0%	1.4%	1.4%	0.0%
North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest	2178	8	19	8	100.0%	42.1%	1.2%	2.9%	1.7%
Western North American Sub-boreal Mesic Bluejoint Meadow	2611	8	4	1	12.5%	25.0%	1.2%	0.6%	-0.6%
Western North American Boreal Shrub and Herbaceous Floodplain Wetland	2617	8	6	0	0.0%	0.0%	1.2%	0.9%	-0.3%
Western North American Boreal Wet Black Spruce-Tussock Woodland	2630	8	5	1	12.5%	20.0%	1.2%	0.8%	-0.5%
Alaskan Pacific Maritime Subalpine Alder-Salmonberry Shrubland	2652	8	7	3	37.5%	42.9%	1.2%	1.1%	-0.2%
Alaska Arctic Dwarf-Shrubland	2690	7	5	0	0.0%	0.0%	1.1%	0.8%	-0.3%
Alaska Arctic Wet Sedge	2698	7	15	1	14.3%	6.7%	1.1%	2.3%	1.2%

Meadow									
Alaska Arctic Dwarf-Shrub-Sphagnum Peatland	2703	7	5	0	0.0%	20.0%	1.1%	0.8%	-0.3%
Western North American Boreal Lowland Large River Floodplain Forest and Shrubland	2615	6	1	0	0.0%	0.0%	0.9%	0.2%	-0.8%
Alaskan Pacific Maritime Alpine Dwarf-Shrubland	2643	6	2	1	16.7%	50.0%	0.9%	0.3%	-0.6%
Aleutian Shrub-Sedge Peatland	2647	6	5	3	50.0%	60.0%	0.9%	0.8%	-0.2%
Alaska Arctic Wet Sedge-Sphagnum Peatland	2702	6	4	2	33.3%	25.0%	0.9%	0.6%	-0.3%
Aleutian Mesic Alder-Salmonberry Shrubland	2718	6	7	2	33.3%	0.0%	0.9%	1.1%	0.2%

Table 2. Alaska Super Zone Ecological Systems with 4 or fewer holdout assessment plots.

North Pacific Mesic Western Hemlock-Yellow-cedar Forest
Western North American Boreal Spruce-Lichen Woodland
Alaska Arctic Mesic Sedge-Willow Tundra
Alaska Arctic Non-Acidic Dryas Dwarf-Shrubland
Western North American Boreal Alpine Dwarf-Shrub-Lichen Shrubland
Alaskan Pacific Maritime Wet Low Shrubland
Alaska Sub-boreal White-Lutz Spruce Forest and Woodland
Alaska Arctic Acidic Dwarf-Shrub Lichen Tundra
Alaska Arctic Pendantgrass Freshwater Marsh
Alaska Arctic Polygonal Ground Tussock Tundra
Alaska Arctic Floodplain
Alaska Sub-boreal Mesic Subalpine Alder Shrubland
Western North American Boreal Riparian Stringer Forest and Shrubland
Western North American Boreal Freshwater Emergent Marsh
Alaska Sub-boreal and Maritime Alpine Mesic Herbaceous Meadow
Alaskan Pacific Maritime Mountain Hemlock Forest
Alaskan Pacific Maritime Mesic Herbaceous Meadow
Alaskan Pacific Maritime Mountain Hemlock Peatland
Alaskan Pacific Maritime Poorly Drained Conifer Woodland
Alaska Arctic Tussock Tundra
Alaska Arctic Permafrost Plateau Dwarf-Shrub Lichen Tundra
Alaska Arctic Tidal Marsh
Aleutian Shrub and Herbaceous Meadow Floodplain
Western North American Boreal Dry Aspen-Steppe Bluff
Western North American Boreal Wet Meadow

Western North American Boreal Freshwater Aquatic Bed
Western North American Boreal Tussock Tundra
Western North American Boreal Alpine Dryas Dwarf-Shrubland
Western North American Boreal Alpine Floodplain
Aleutian Mesic-Wet Willow Shrubland
Aleutian Mesic Herbaceous Meadow
Alaskan Pacific Maritime Sitka Spruce Beach Ridge
Alaskan Pacific Maritime Floodplain Forest and Shrubland
Alaskan Pacific Maritime Fen and Wet Meadow
Temperate Pacific Freshwater Emergent Marsh
Alaskan Pacific Maritime Coastal Meadow and Slough-Levee
Alaskan Pacific Maritime Subalpine Copperbush Shrubland
Alaskan Pacific Maritime Alpine Wet Meadow
Alaska Arctic Non-Acidic Dwarf-Shrub Lichen Tundra
Alaska Arctic Tussock-Lichen Tundra
Alaska Arctic Freshwater Aquatic Bed
Alaska Arctic Mesic Herbaceous Meadow
Alaska Arctic Polygonal Ground Shrub-Tussock Tundra
Alaska Arctic Coastal Brackish Meadow
Alaska Arctic Bedrock and Talus
Aleutian Floodplain Wetland
Aleutian Sparse Heath and Fell-Field
North Pacific Maritime Mesic Subalpine Parkland
Western North American Boreal Dry Grassland
Aleutian Kenai Birch-Cottonwood-Poplar Forest
Temperate Pacific Tidal Salt and Brackish Marsh
Temperate Pacific Intertidal Flat
Alaskan Pacific Maritime Alpine Sparse Shrub and Fell-field
Alaska Sub-boreal Mountain Hemlock-White Spruce Forest
Alaska Arctic Mesic Sedge-Dryas Tundra
Aleutian Mixed Dwarf-Shrub-Herbaceous Shrubland
Aleutian Freshwater Marsh
Aleutian Wet Meadow and Herbaceous Peatland
Aleutian Volcanic Rock and Talus

Hawai'I Super Zone/Map Zone (Map Zone 79)

Table 3. Hawai'i Super Zone/Map Zone 79 Summary for Existing Vegetation Type-Ecological Systems

		Class Specific Holdout Plot Agreement					Proportional Agreement		
Name	Code	LFRDB Plots	Mapped Plots	Plots with Agreement	Producer Agreement	User Agreement	LFRDB Percent	Mapped Percent	DIFF
Hawaiian Managed Tree Plantation	2855	11	12	10	90.9%	83.3%	23.4%	25.5%	2.1%
Hawaii Montane Rainforest	2810	9	4	1	11.1%	25.0%	19.2%	8.5%	-10.6%
Hawaiian Introduced Deciduous Shrubland	2847	8	1	0	0.0%	0.0%	17.0%	2.1%	-14.9%
Hawaii Montane-Subalpine Mesic Forest	2816	5	3	1	20.0%	33.3%	10.6%	6.4%	-4.3%

Table 4. Hawai'i Super Zone/Map Zone 79 Ecological Systems with 4 or fewer holdout assessment plots.

Hawaii Lowland Rainforest
Hawaiian Introduced Perennial Grassland
Hawaii Lowland Mesic Forest
Hawaiian Introduced Wet-Mesic Forest
Hawaii Montane-Subalpine Dry Grassland
Hawaii Wet-Mesic Coastal Strand
Hawaiian Introduced Dry Forest
Hawaii Lowland Dry Forest
Hawaii Montane-Subalpine Dry Shrubland
Hawaiian Introduced Evergreen Shrubland


USGS
FireLab
The Nature Conservancy