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Department of the Interior
U.S. Geological Survey

LF 2014 UPDATE
PROJECT CLOSE-OUT REPORT

Contents

TABLES

FIGURES

GENERAL PROJECT INFORMATION

Project Name: LANDFIRE 2014 Update

Project Description: The scope of the LANDFIRE (LF) 2014 Update project was to deliver a suite of updated LF data products for the conterminous United States (CONUS), Alaska (AK), and Hawaii (HI) current as of 2014. Key objectives for LF 2014 Update included updating the comprehensive suite of LF National data products to account for landscape changes and disturbance information for the years 2013 and 2014. Updated data products include:

- Reference: Events Geodatabase
- Disturbance: Disturbance Grids, Vegetation Disturbance (VDIST), Fuel Disturbance (FDIST), Vegetation Transition Magnitude (VTM)
- Vegetation: Existing Vegetation Cover (EVC), Existing Vegetation Height (EVH), Existing Vegetation Type (EVT)
- Fuels: 13 Anderson Fire Behavior Fuel Models (FBFM), 40 Scott and Burgan FBFM, Canadian Forest Fire Danger Rating System (CFFDRS; AK Only), Forest Canopy Base Height (CBH), Forest Canopy Bulk Density (CBD), Forest Canopy Cover (FCC), Forest Canopy Height (FCH), Fuel Characteristic Classification System (FCCS) [Optional], Fuel Loading Models (FLM) [Optional]: Decision: A number of issues have been identified with the most recent FCCS/FLM data (LF_2001/2008) by the creators of those products. Meetings were held, and a strategy set in place to rectify those issues.
- Fire Regime: Succession Classes (SCLASS) [Optional]

- Focus on relevant and significant landscape changes or disturbances to vegetation, such as those resulting from wildland fire, fuel and vegetation/silvicultural treatments, insects and disease, storm damage, etc.
- Leverage Landsat imagery and point and spatial polygon data for years 2013-2014 and utilize newly available or newly refined institutional data sources, to update data products.
- Retain original information for areas that did not experience a vegetation change or disturbance. No changes will be made to insular areas from LF 2010.

LF 2014 was scheduled to make updated CONUS data products available via the Data Distribution System (DDS) no later than December 31, 2016. These products consisted of databases readable in relational database format or by geospatial database format, as appropriate. Products for the AK and HI were to be available by March 30, 2017.

Project Manager: USGS, Steve Zahn; Kurtis Nelson; Dean Mierau (Current)

	Baseline	Actual	Variance	% Variance
Start Date	2-2-2015	2/2/2015	0	0%
Finish Date	12-20-2016	3/31/2017	+90	+8.9%
Work Days	475	544	+90	+8.9%

LANDFIRE RELEASE APPROVALS

The following is a list of GeoArea Specific approvals for release:

South Central

Delivered for Approval: September 21, 2016

Approved for Release: September 23, 2016

North Central

Delivered for Approval: September 21, 2016

Approved for Release: September 23, 2016

Southwest

Delivered for Approval: September 21, 2016

Approved for Release: September 23, 2016

Northwest

Delivered for Approval: December 20, 2016

Approved for Release: December 22, 2016

Northeast

Delivered for Approval: December 20, 2016

Approved for Release: December 22, 2016

Southeast

Delivered for Approval: December 20, 2016

Approved for Release: December 22, 2016

Alaska

Delivered for Approval: March 31, 2017

Approved for Release: April 13, 2017

Hawaii

Delivered for Approval: March 31, 2017

Approved for Release: April 13, 2017

INTRODUCTION

This is the Project Close-Out Report (PCR) for LF 2014 Update (LF 1.4.0). It provides documentation of the overall LF 2014 Update project scope (objectives), schedule, results, lessons learned, open issues, and closure status and serves as the primary communication vehicle for these items.

While the technical work of LF 2014 was completed in March 2017, it is administratively closed with the publication of this PCR. This report ensures that scope was addressed and accomplished, deliverables were reviewed, accepted, and published, project effectiveness was evaluated, and documentation was completed.

LF 2014 was a project conducted by the LF program. It involved the efforts of a variety of LF partners; however, it was formally a deliverable for the U.S. Geological Survey (USGS) team. LF 2014 scope, as well as project execution, was the sole responsibility of the USGS. The overwhelming bulk of the work was accomplished at the USGS Earth Resources Observation and Science (EROS) Center. Support from other partners, while important, was usually limited in time and magnitude. Therefore, this PCR focuses exclusively on the efforts of the USGS EROS LF team. It addresses the expectations for LF 2014 and the subsequent results.

PROJECT MANAGEMENT OVERVIEW AND PERFORMANCE

Schedule

The LF 2014 Project Kickoff occurred on October 5, 2015; however, several production activities were well underway to make completion deadlines. A detailed LF 2014 schedule was created in Oracle's Primavera P6 Enterprise Project Portfolio Management system for the kickoff and was used to manage subsequent activity. In the schedule, the South Central (SC) reference task for the LF 2014 Update was assigned a start date of February 2, 2015. This became the accepted start date for LF 2014. Beginning in late January 2016, all tasks associated with LF 2014 were formally tracked with the LF 2014 schedule.

LF 2014 was scheduled to make updated CONUS data products available via the DDS no later than September 26, 2016. These products consisted of databases readable in relational database format or by geospatial database format, as appropriate. LF 2014 CONUS was delivered on December 29, 2016, later than originally scheduled. The baseline for AK and HI Geo Areas was December 31, 2016. Due to unexpected processing challenges in CONUS annual disturbance mapping and creation of VDIST and FDIST, the LF Business Leadership Group (BLG) accepted a delayed delivery of April 1, 2017. Products for AK and HI were delivered on March 31, 2017.

Scope

LF 2014 Scope was largely defined as the creation and delivery of updated data products. For LF 2014 this list consisted of:

- **Reference** – Events Geodatabase
- **Disturbance** – Disturbance Grids, VDIST, FDIST, VTM
- **Vegetation** – EVC, EVH, EVT
- **Fuels** – 13 Anderson FBFM, 40 Scott and Burgan FBFM, CFFDRS (AK Only), CBH, CBD, FCC, FCH
- **Fire Regime** –SCLASS, Vegetation Departure (VDEP), and Vegetation Condition Class (VCC)

Additional production objectives for LF 2014 included the following product, listed as optional scope for LF 2014 to be accomplished by alternative teams, if available.

- **Fuels** – FCCS was updated using work performed by staff at Pacific Wildland Fire Sciences Laboratory (U.S. Forest Service) in Seattle, Washington. The alternative teams for FLM were never identified and so the option to implement this product was not realized during the execution of LF 2014.

Quality

As part of the LF 2014 Project, efforts continued to mature and refine the Quality Assurance and Quality Control and product testing processes prior to release to the public. For each data theme, a Data Test was developed per GeoArea. Data checks provided validation evidence for projections, spatial extents, pixel counts and pixel framing (quantitative metrics) summarized by an analysis of overall performance (qualitative review), all aimed at answering the question “do these results meet our expectations?” Integration Tests were created that demonstrated independent validation for technical integrity and a confirmation that the processes/data performed as expected. System Tests were created that validated the product flow through the LF website and the DDS. A summary of these tests, per release, was included in the LF 2014 PAR and delivered to the BLG for review, discussion, and acceptance. As part of the LF 2014 Update close-out process, a final product acceptance report, containing the results of these tests, was produced, and made available to project stakeholders.

Lessons Learned

- **Issue:** A formal Work Breakdown Structure (WBS) document and corresponding detailed schedule was implemented for LF 2014.This detailed schedule allowed the program to identify and quantify the impacts when individual activities slipped or finished ahead of schedule. We found that prototyping and development during production was not captured in the WBS and detailed schedule. The level in which activities were defined and scheduled was captured at too detailed of a level, thus making updates and refinements very difficult. Confusion and miscommunication occurred, requiring additional time to resolve. **Lesson Learned:** It is recommended for future production projects create a WBS that captures an appropriate level of team activities yet allows for adjustment in near real time without a lot of interaction with the scheduler and scheduling tool.
- **Issue:** Disturbance mapping for LF 2014 brought several improvements to the process, resulting in enhanced capability to accurately capture change. One improvement was to improve logic that would allow data from more images to be used in the image composites which would allow for more complete imagery and increase the likelihood that change would be identified. Another change was to implement Burned Area Essential Climate Variable (BAECV) products to identify burned area and assign causality. **Lesson Learned:** It is recommended for future production projects to continue using these changes as an input into LF disturbance as the Imagery has shown to be more complete and causality is more precise.
- **Issue:** Data delivery for LF is essential, so supporting up to date and modern data distribution systems is vital. **Lesson Learned:** The recommendation for future product releases is to be responsive to customer needs. For example, in response to user requests, a web page was added to landfire.gov that provides the LF product codes used on the DDS. Publishing this information allows users to access LF products directly using specialized scripting tools.
- **Issue:** An issue was found with the LF 2010 Biophysical Settings (BPS), which is an input to SCLASS, VDEP, and VCC, that prevented the expected February 2016 release of SCLASS, VDEP, and VCC products for AK. The issue was addressed, and products were released in June 2017. **Lesson Learned:** Although, this was not a LF 2014 issue, it is recommended that the quality checking measures used in the LF 2014 Update process be followed in future production projects. These measures have proven valuable to increasing the quality of LF data.

PROJECT ANALYSIS

Reference

Product Description

The Reference data product suite includes spatial databases containing field referenced point and polygon data describing vegetation, fuel conditions, and landscape change events (natural and anthropogenic disturbances). The vegetation and fuel plot data in the LF Reference Database (LFRDB) support vegetation transition modeling to develop rulesets for modifying vegetation attributes based on disturbance and succession. The Events Geodatabase supports disturbance detection and attribution of disturbance causality. A subset of the LFRDB and Events databases is published for public use. Proprietary, or otherwise sensitive data that LF does not have explicit permission to share, are removed from the public databases prior to dissemination.

Update Process

LF 2014 used the most recent LFRDB. The Events Geodatabase was built from data that were acquired from national databases and since contributed to LF from various land management groups including federal, state, tribal, and local agencies, along with private and non-profit organizations. These data were initially combined into a spatial layer containing all available features. This layer was further processed through a series of steps to identify overlapping features, reduce them through a hierarchical topology process, and sort multiple disturbance types in the same year by the relative impact of the various types. The result was a model-ready spatial layer that contained, at most, one disturbance per year, per location. Where multiple disturbances for one location were reported, the disturbance type with the most impact on vegetation and fuels was retained. For each event, the type, location, and year of disturbance were recorded. Additional attributes, including the magnitude or severity of the event and date of occurrence, were captured if available.

Results

A total of 220,678 raw events were added to the Events Geodatabase for LF 2014 occurring between 2013 and 2014, which were reduced (using the process described above) to 129,134 model-ready events. Events data acquired by LF staff from public clearinghouses or agency database systems accounted for 61% of the total events, while 39% of the total events were contributed by LF data users. The LF 2014 break down of events included the following: 41.9% were mechanical and harvest activities; 17.8% were fire; 25.9% were chemical or biological treatments; and 9.2% were insects or disease events. Remaining events included weather, reforestation, and development. See **Table 1** and **Table 2** for more information on event data types and contributors.

Table 1: Break down of LF 2014 event types by percentage

LF 2014 Event Type	Total Percentage (%)
Mechanical and Harvest Activities	41.9%
Fire	17.8%
Chemical or Biological Treatments	25.9%
Insects or Disease Events	9.3%
Weather	0.2%
Reforestation	4.8%
Development	0.1%

Table 2: Break down of LF 2014 event sources by percentage

LF 2014 Event Agencies	Total Percentage (%)
U.S. Forest Service	61.2%
Bureau of Land Management	6.8%
Multi-Agency	26.1%
State	3.3%
Tribal	0.2%
National Park Service	1.0%
U.S. Fish & Wildlife Service	1.2%
U.S. Department of Defense	0.1%

Disturbance

Product Description

Disturbance products are developed to reflect change on the landscape caused by management activities and natural disturbance and are necessary for updating LF vegetation and fuel products. They are produced by processing and analyzing data from many sources, including: Landsat satellite imagery, operational fire mapping programs, including Monitoring Trends in Burn Severity (MTBS), Burned Area Emergency Response (BAER), Rapid Assessment of Vegetation Condition after Wildfire (RAVG), the LF Events Geodatabase, and other ancillary sources such as National Land Cover Database (NLCD), National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL), and the USGS Gap Analysis Program (GAP) Protected Area Database of the United States (PAD-US). The final products are annual disturbance layers attributed with disturbance type, disturbance severity, confidence in the type and severity, and the source(s) of disturbance information. Subsequently, composite disturbance layers depicting the disturbance type, severity, and time since disturbance are provided for the years 2013-2014.

Update Process: CONUS

Disturbance mapping is multifaceted and involves the processing of several data sources, script writing, management and execution, and manual interpretation. The complete process for updating LF products is detailed in the USGS Open File Report: LANDFIRE 2010: updates to the national dataset to support improved fire and natural resource management (Nelson, et. Al, 2016). Annual Disturbance mapping for LF 2014 Update was modified slightly from the previous version to include lessons learned from LF 2012 and to include new data products that have become available.

Image Composites

Image composites for LF 2014 Update were created using the same tiling scheme as LF 2012 Update.

Contributing Datasets

In addition to fire program and satellite-derived (Remote Sensing of Landscape Change (RSLC)) data, LF disturbance layers consist of updated LF Events Geodatabase, and other spatial data contributing to the update process including NLCD, NASS CDL, PAD-US, and USGS BAECV product (Terrestrial Essential Climate Variables (EVCs)).

Product Development

The general production process for annual disturbance for CONUS remained nearly identical to the LF 2012 Update process with the exception of using the USGS BAECV product as a possible causality for RSLC identified change. The BAECV product applies an algorithm to determine the probability a Landsat pixel has burned. Thresholds were applied to BAECV composites and pixels identified as disturbances that intersected the BAECV data were assigned a fire causality. Once the annual disturbance products were completed, the previous and new layers from 1999 through 2014 were combined and summarized to produce the composite vegetation and fuel disturbance layers.

Update Process: Alaska

There were no changes in the production of annual disturbance for AK in LF 2014 Update.

Update Process: Hawaii

There were no changes in the production of annual disturbance for HI in LF 2014 Update. There were not MTBS fires mapped in HI in either 2013 or 2014.

Results

An effort was undertaken to identify the area and number of disturbances captured on the LF 1.0 product for each year 1999 to 2014. The disturbance statistics were generated from only the final disturbance grids using a series of GIS operations including raster extraction, clumping, polygon conversion, dissolves, erases, and spatial joins. The results were compiled in a database for statistical evaluation. A brief description of the process and selected results are given below:

Create masks disturbance by type and year

The first step was to create masks of disturbance for each type for each year (1999 – 2014):

1. All disturbed pixels
2. All MTBS disturbed pixels
3. All MTBS, Burned Area Reflectance Classification (BARC), and RAVG disturbed pixels
4. All MTBS, BARC, RAVG, and LF Events disturbed pixels

Creating contiguous disturbances

To group areas of contiguous disturbance into one disturbance, a clump operation was performed on the result of each of the results above. The results of the clump operation were converted to polygon, the polygons with a value of zero were removed, and then a dissolve operation was performed on the value field. The results were updated with year and source information.

Quantifying Disturbances Counts by Type

To produce counts of disturbance by type, the following steps were performed for each year 1999-2014.

- Use Erase feature to erase MTBS, BARC, RAVG, and Events from All Disturbance
- Use Erase feature to erase MTBS, BARC, RAVG, from MTBS, BARC, RAVG and Events
- Use Erase feature to erase MTBS from MTBS, BARC, RAVG
- Merge results of above with MTBS polygons

The results of these operations were appended with the polygon files depicting MTBS disturbances. A series of spatial joins were performed so the disturbances could be summarized by Geographic Area, State, and tile. The geometry was also calculated to determine area. The results were combined in the geodatabase and exported to a

Microsoft Access database to be aggregated by year, type, state, tile, and GeoArea. The process was modified for AK as the RSLC process is not used and BARC and RAVG data sets have not been used to map disturbance. The process is also modified some for HI as annual disturbance layers were not produced until LF 2012 and fires large enough to be mapped by MTBS do not occur every year. BARC and RAVG data sets have not been used to map disturbance in HI.

CONUS

Since 1999 LF has mapped more than 1.7 million disturbances covering more than 203 million acres. For the LF 2014 Update, 2013 had the greatest number of disturbances mapped in the annual disturbance product with 144,520 disturbances which affected 14.28 million acres (the 4th greatest since 1999). The annual disturbance product included 127,715 disturbances for 16.04 million acres in 2014, which ranked 5th highest for the same period. **Table *3*** lists the number of disturbances and acres disturbed from 1999-2014.

Table 3: Number of disturbances and acres by year and type for CONUS.

Year and Source	Number of Disturbances	Acres (millions)
1999	**98,415**	**9.19**
Events	17,207	1.62
MTBS	1,140	4.53
RSLC	80,068	3.04
2000	**82,587**	**9.98**
Events	13,612	1.81
MTBS	1,118	5.67
RSLC	67,857	2.51
2001	**90,392**	**7.18**
BARC or RAVG	11	0.05
Events	15,667	1.60
MTBS	944	2.69
RSLC	73,770	2.85
2002	**80,661**	**8.58**
BARC or RAVG	64	0.16
Events	13,856	2.02
MTBS	855	3.99
RSLC	65,886	2.41
2003	**90,681**	**8.27**
BARC or RAVG	92	0.07
Events	19,239	1.94
MTBS	755	3.58
RSLC	70,595	2.68
2004	**100,796**	**6.14**
BARC or RAVG	28	0.02
Events	23,619	2.00

Year and Source	Number of Disturbances	Acres (millions)
MTBS	782	1.33
RSLC	76,367	2.79
2005	**97,565**	**9.28**
BARC or RAVG	57	0.04
Events	20,145	2.00
MTBS	1,543	4.36
RSLC	75,820	2.88
2006	**96,352**	**13.99**
BARC or RAVG	200	0.17
Events	25,343	2.58
MTBS	2,886	8.75
RSLC	67,923	2.49
2007	**92,792**	**13.55**
BARC or RAVG	841	0.34
Events	24,200	2.88
MTBS	3,694	7.86
RSLC	64,057	2.46
2008	**163,958**	**16.95**
BARC or RAVG	170	0.18
Events	44,865	4.87
MTBS	2,231	4.75
RSLC	116,692	7.16
2009	**156,258**	**15.33**
BARC or RAVG	95	0.07
Events	45,310	4.13
MTBS	7,652	4.70
RSLC	103,201	6.42
2010	**145,621**	**11.76**
BARC or RAVG	100	0.05
Events	34,214	2.57
MTBS	4,768	3.07
RSLC	106,539	6.08
2011	**108,842**	**23.61**
BARC or RAVG	545	0.20
Events	19,360	6.56
MTBS	1,499	10.42
RSLC	87,438	6.42
2012	**105,384**	**19.17**
BARC or RAVG	135	0.23
Events	23,299	4.36
MTBS	867	8.95
RSLC	81,083	5.63
2013	**144,520**	**14.28**

Year and Source	Number of Disturbances	Acres (millions)
BARC or RAVG	105	0.08
Events	34,283	4.82
MTBS	627	3.43
RSLC	109,505	5.94
2014	**127,715**	**16.04**
BARC or RAVG	152	0.04
Events	25,453	4.28
MTBS	907	5.73
RSLC	101,203	5.99
Grand Total	**1,782,539**	**203.30**

There has been a general increase in the area mapped as disturbed in the time period 1999 – 2014 (**Figure 1**).The increases have been the result of more contributed events and change identified by Landsat image processing or the RSLC process (**Figure 2)**.

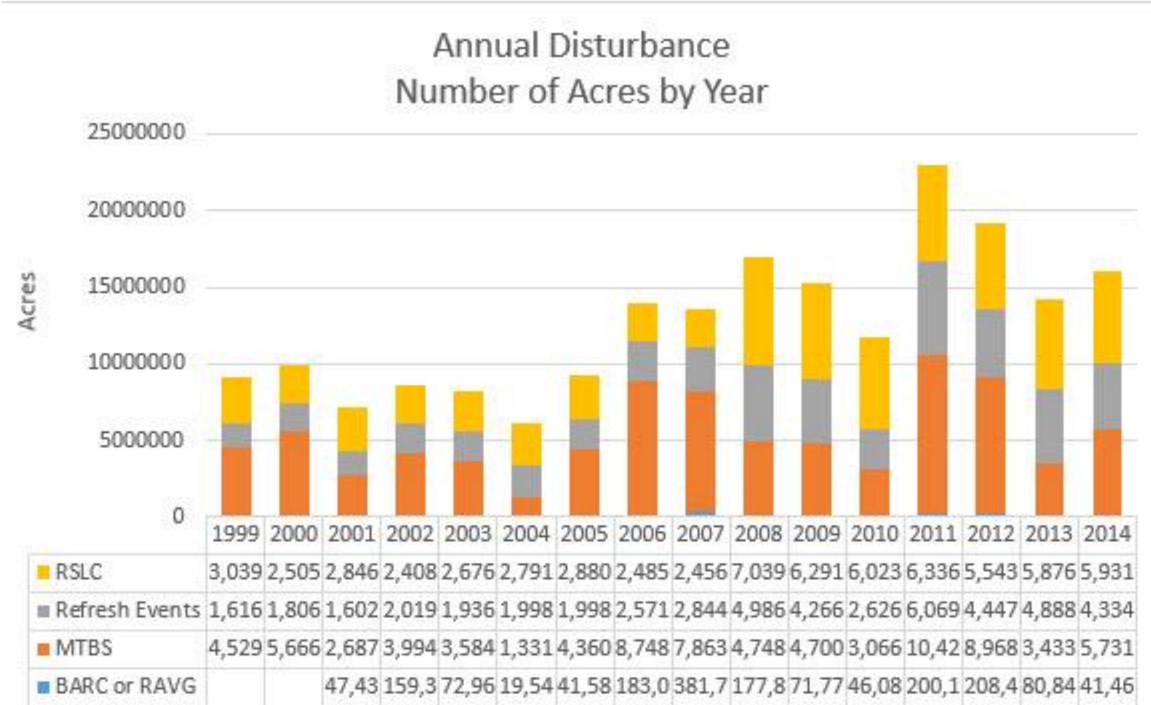


Figure 1: Annual disturbance area by type of disturbance for CONUS.

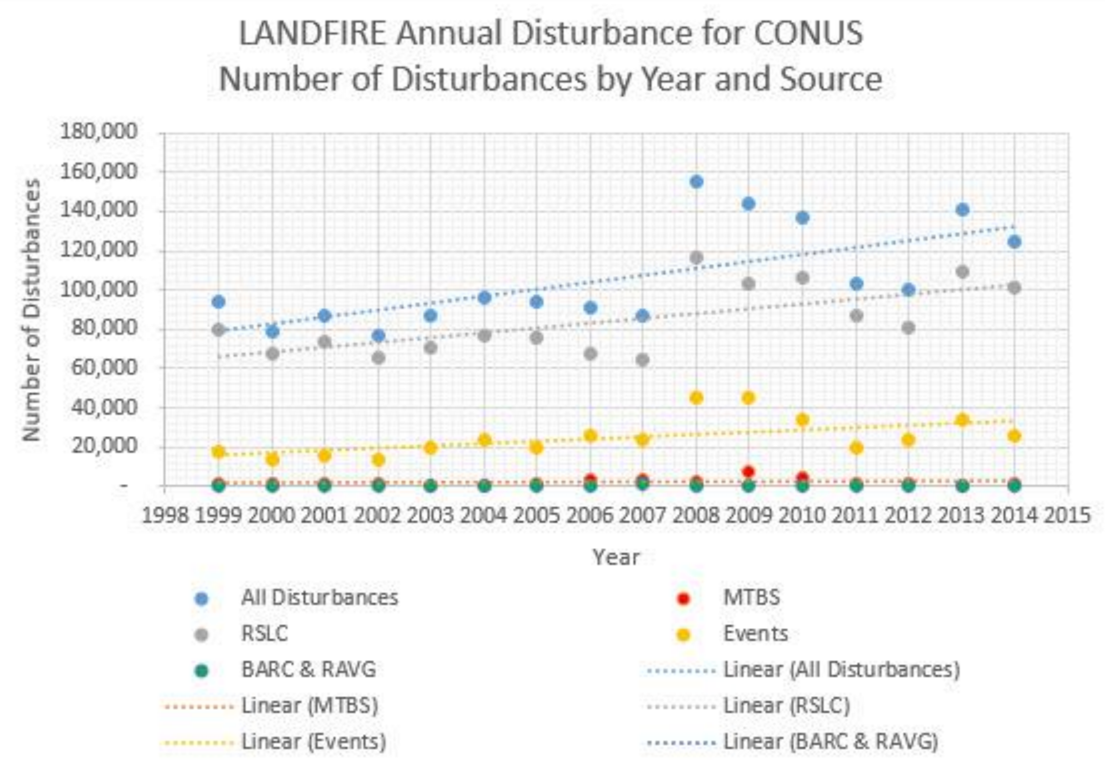
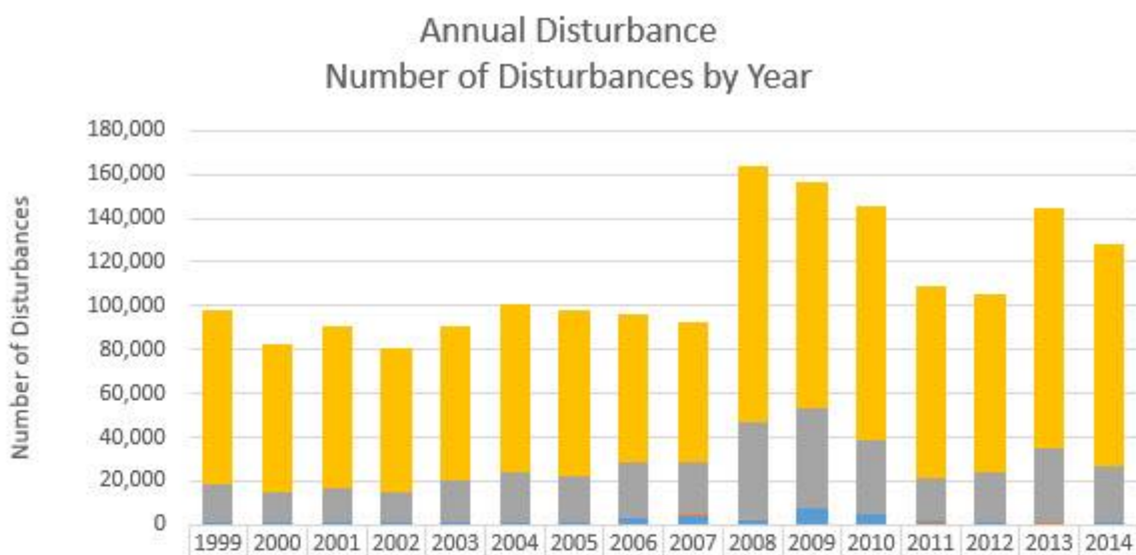


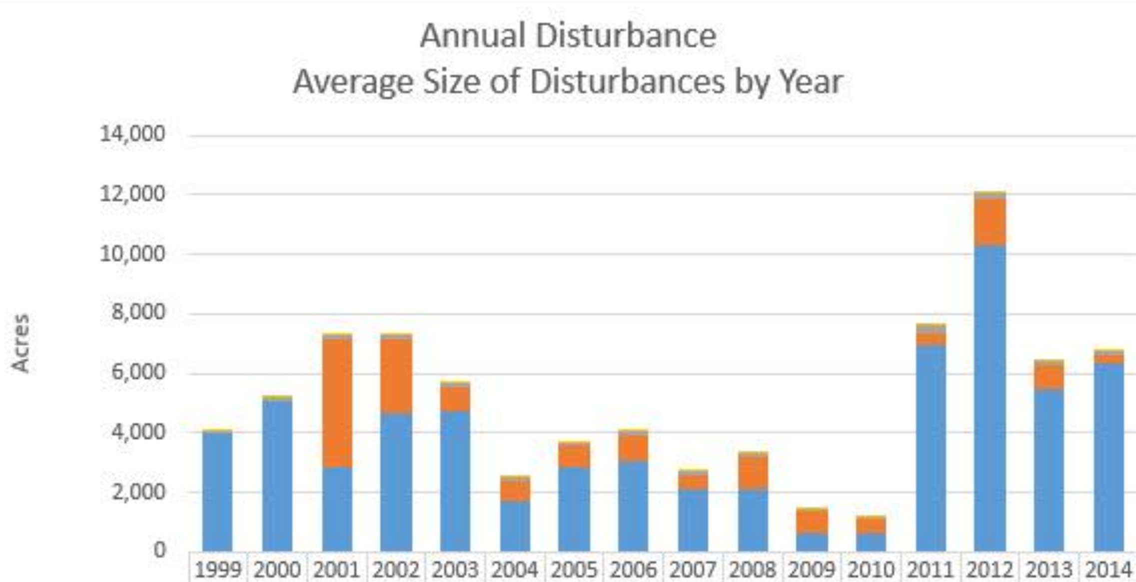
Figure 2: Number of annual disturbances per year 1999 – 2014 for CONUS.

In terms of the number of disturbances identified on the landscape, disturbances identified by the RSLC process is the largest, comprising more than half of the individual disturbances (**Figure 3**).The second largest source of disturbance information is the LF Events Geodatabase, which is a database of contributed treatment events for the benefit of LF. Disturbance data from fire programs, such as MTBS, are an important source of type and severity information and they cover a large area; however, the number of disturbances is very small in comparison to other sources (**Figure 4**).



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
RSLC	80,06	67,85	73,77	65,88	70,59	76,36	75,82	67,92	64,05	116,6	103,2	106,5	87,44	81,08	109,5	101,2
Events	17,20	13,61	15,66	13,85	19,23	23,61	20,14	25,34	24,20	44,86	45,31	34,21	19,36	23,29	34,28	25,45
BARC or RAVG			11	64	92	28	57	200	841	170	95	100	545	135	105	152
MTBS	1,140	1,118	944	855	755	782	1,543	2,886	3,694	2,231	7,652	4,768	1,499	867	627	907

Figure 3: Number of disturbances by year for CONUS.



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
RSLC	38	37	39	37	38	37	38	37	38	60	61	57	72	68	54	59
Events	94	133	102	146	101	85	99	101	118	111	94	77	314	191	143	170
BARC or RAVG			4,312	2,490	793	698	730	915	454	1,046	756	461	367	1,544	770	273
MTBS	3,973	5,069	2,846	4,672	4,747	1,702	2,826	3,031	2,129	2,129	614	643	6,955	10,34	5,475	6,319

Figure 4: Average disturbance size by type and year for CONUS.

Specific to LF 2014 Update, the greatest number of disturbances for CONUS were mapped in the Southeast GeoArea (128,274 disturbances totaling 9.99 million acres). The results are detailed in **Table 4**

Table 4: Number of disturbances and area by Geographic Area

	2013		2014		LF 2014	
Year and Source	**Number of Disturbances**	**Acres (millions)**	**Number of Disturbances**	**Acres (millions)**	**Total Number of Disturbance**	**Total Acres (millions)**
North Central	9,261	0.59	8,345	0.62	17,606	1.21
Northeast	21,496	1.25	21,317	1.21	42,813	2.46
Northwest	28,163	4.54	23,062	4.68	51,225	9.22
South Central	5,296	0.58	6,815	3.04	12,111	3.62
Southeast	68,929	5.06	59,345	4.93	128,274	9.99
Southwest	11,375	2.26	8,831	1.56	20,206	3.81
Grand Total	**144,520**	**14.28**	**127,715**	**16.04**	**272,235**	**30.32**

In terms of area mapped, data distributed from fire programs, such as MTBS, BARC, and RAVG, captured within the disturbance areas:

- The number of fire program disturbances is fractional compared to the number of Event and RSLC-captured disturbances
- Most of disturbances captured come from RSLC processes
- Collectively, fire-related disturbances impacted the most land area.
- The Southeast GeoArea contained the most disturbance in both number and area followed by the Northwest (NW).
- The Southwest and SC GeoAreas showed significant disturbance, as well, mostly driven by fire events.
- RSLC and Events account for approximately 80% of the acres disturbed for both 2013 and 2014.

Alaska

Since 1999 LF has mapped more than 73,000 disturbances in AK, covering more than 36 million acres. For the LF 2014 Update, 2014 had the greatest number of disturbances mapped in the annual disturbance product with 4,461 disturbances which affected 1.1 million acres. **Table 5** lists the number of disturbances and acres disturbed from 1999-2014.

Table 5: Number of disturbances and acres by year and type for AK

Year and Source	Number of Disturbances	Acres (millions)
1999	**3,244**	**1.5**
Events	3,174	0.6
MTBS	70	0.9
2000	**3,290**	**1.1**
Events	3,255	0.3
MTBS	35	0.8
2001	**5,802**	**1.0**
Events	5,793	0.8
MTBS	9	0.2
2002	**3,046**	**2.6**
Events	2,670	0.6
MTBS	376	2.0
2003	**1,789**	**0.9**
Events	1,376	0.4
MTBS	413	0.5
2004	**5,431**	**7.6**
Events	2,592	2.2
MTBS	2,839	5.5
2005	**5,460**	**6.2**
Events	3,013	2.1
MTBS	2,447	4.1
2006	**5,432**	**1.0**
Events	5,218	0.8
MTBS	214	0.2
2007	**6,854**	**1.8**
Events	6,492	1.3
MTBS	362	0.5
2008	**4,674**	**0.7**
Events	4,655	0.5
MTBS	19	0.2
2009	**5,187**	**3.9**
Events	4,907	1.1
MTBS	280	2.8
2010	**7,713**	**2.6**
Events	7,238	1.7
MTBS	475	0.9
2011	**4,592**	**1.0**
Events	4,561	0.7
MTBS	31	0.2
2012	**3,426**	**0.8**
Events	3,401	0.6

Year and Source	Number of Disturbances	Acres (millions)
MTBS	25	0.3
2013	**2,874**	**2.3**
Events	2,810	1.1
MTBS	64	1.2
2014	**4,461**	**1.1**
Events	4,453	0.8
MTBS	8	0.3
Grand Total	**73,275**	**36.2**

There has been a general increase in the number of disturbances mapped between1999 – 2014 as noted in

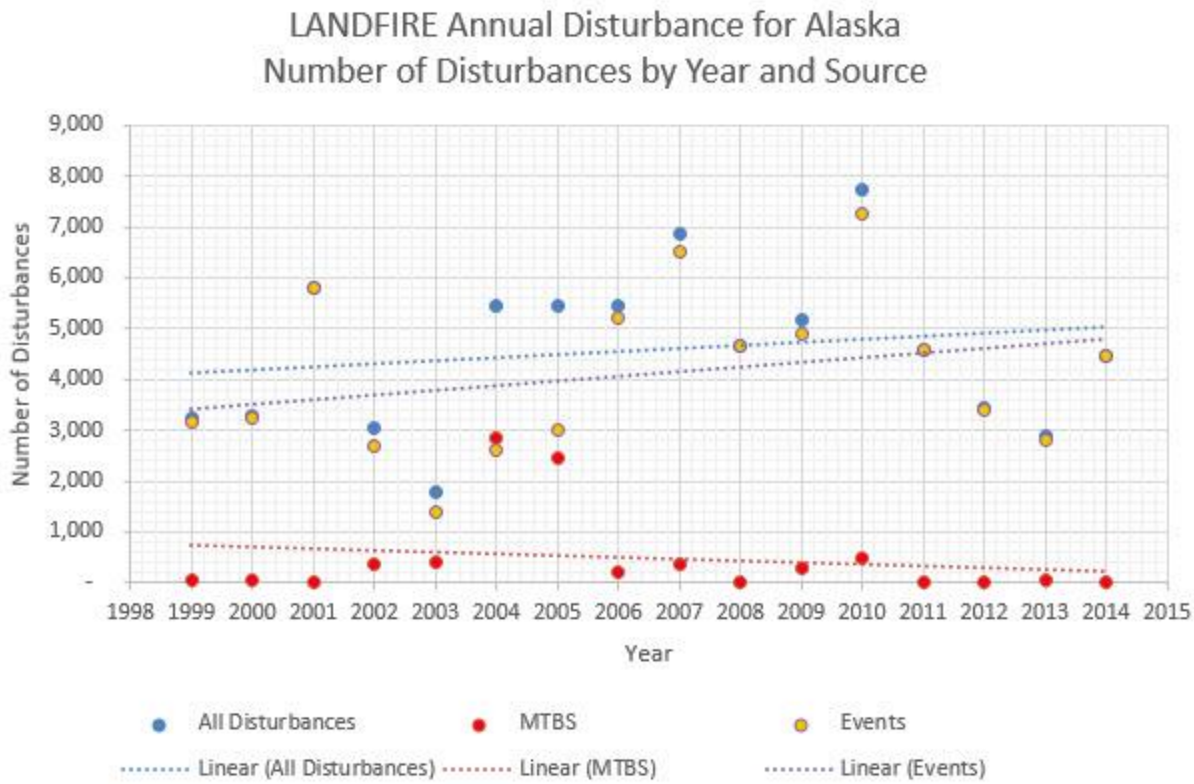


Figure 5. During this time period, the number of MTBS disturbances has decreased and Event disturbances have increased. In terms of area, MTBS was the source for more acres of disturbances in 2013 and contributed events comprised most of the disturbed areas in 2014 (**Figure 6)**.The area mapped as disturbed peaked in 2004 **(Figure 7**).The area of disturbance mapped in 2013 was near the average of all years 1999 – 2014 (2.3 million acres), while 2014 was less the average (1.1 million acres).

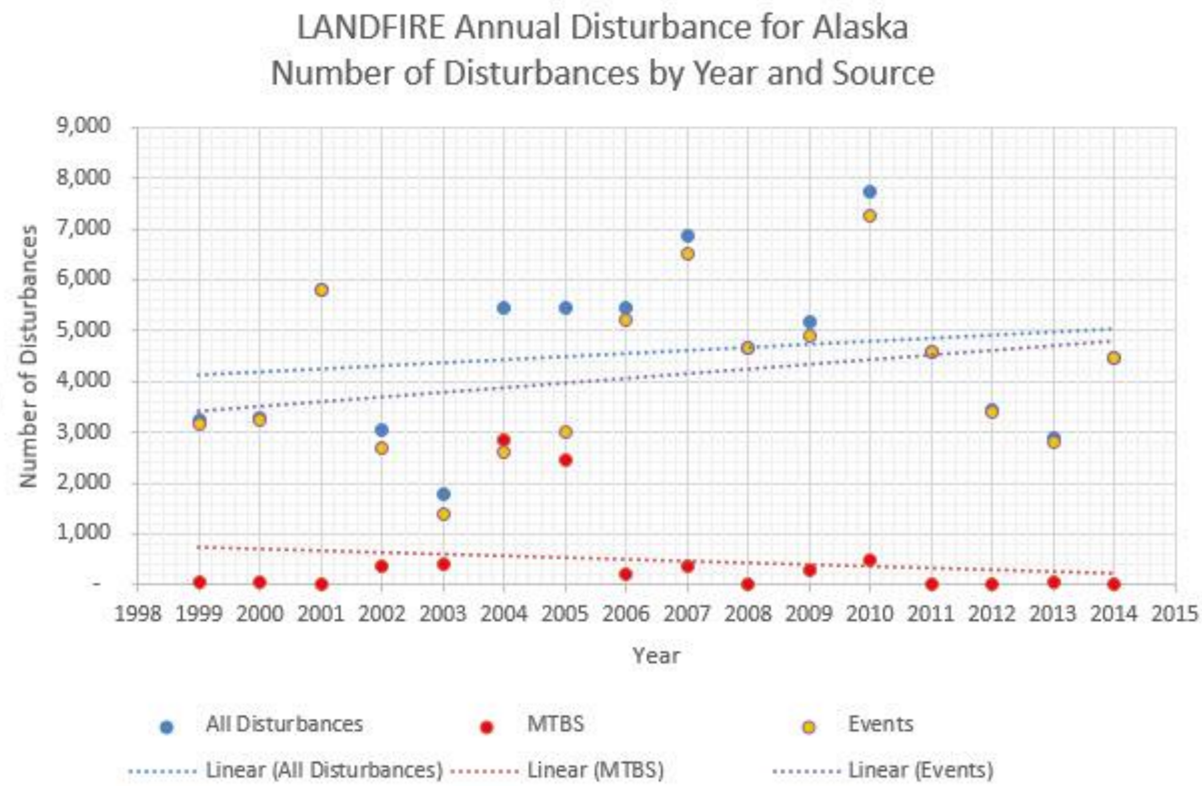
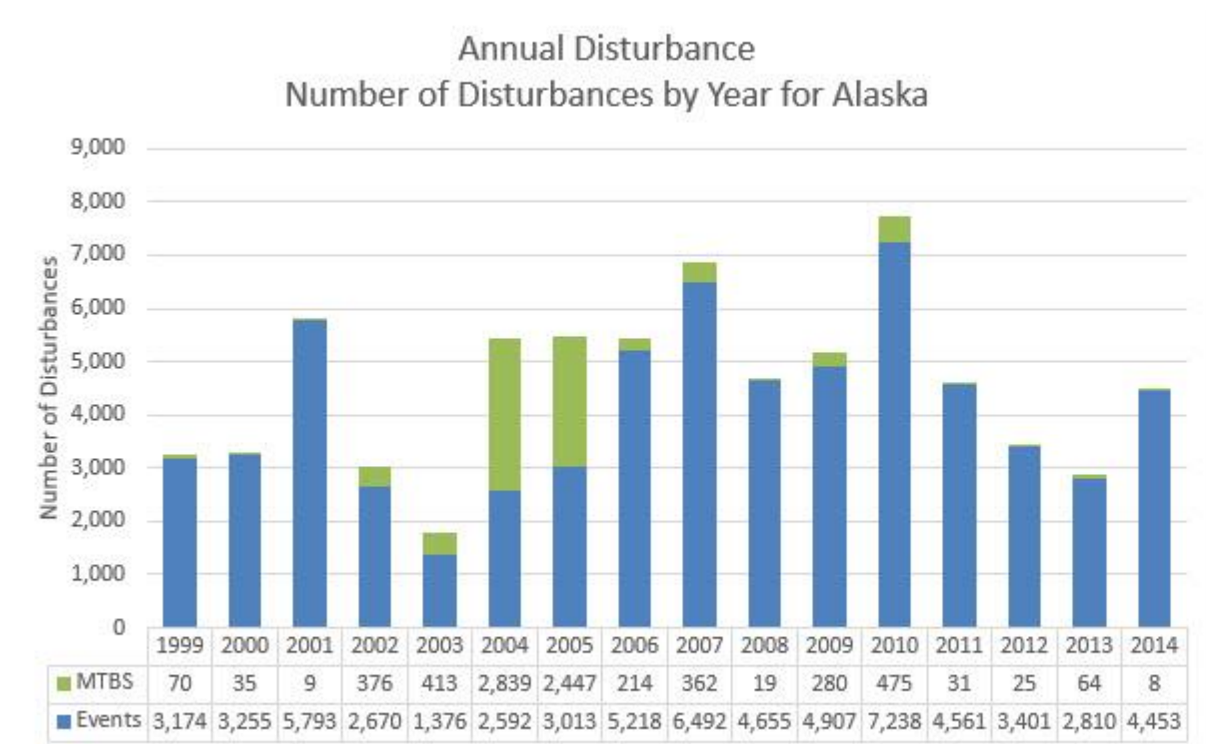


Figure 5. Number of annual disturbances per year 1999 – 2014 for Alaska.



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
MTBS	70	35	9	376	413	2,839	2,447	214	362	19	280	475	31	25	64	8
Events	3,174	3,255	5,793	2,670	1,376	2,592	3,013	5,218	6,492	4,655	4,907	7,238	4,561	3,401	2,810	4,453

Figure 6: Annual disturbance area by type of disturbance for Alaska.

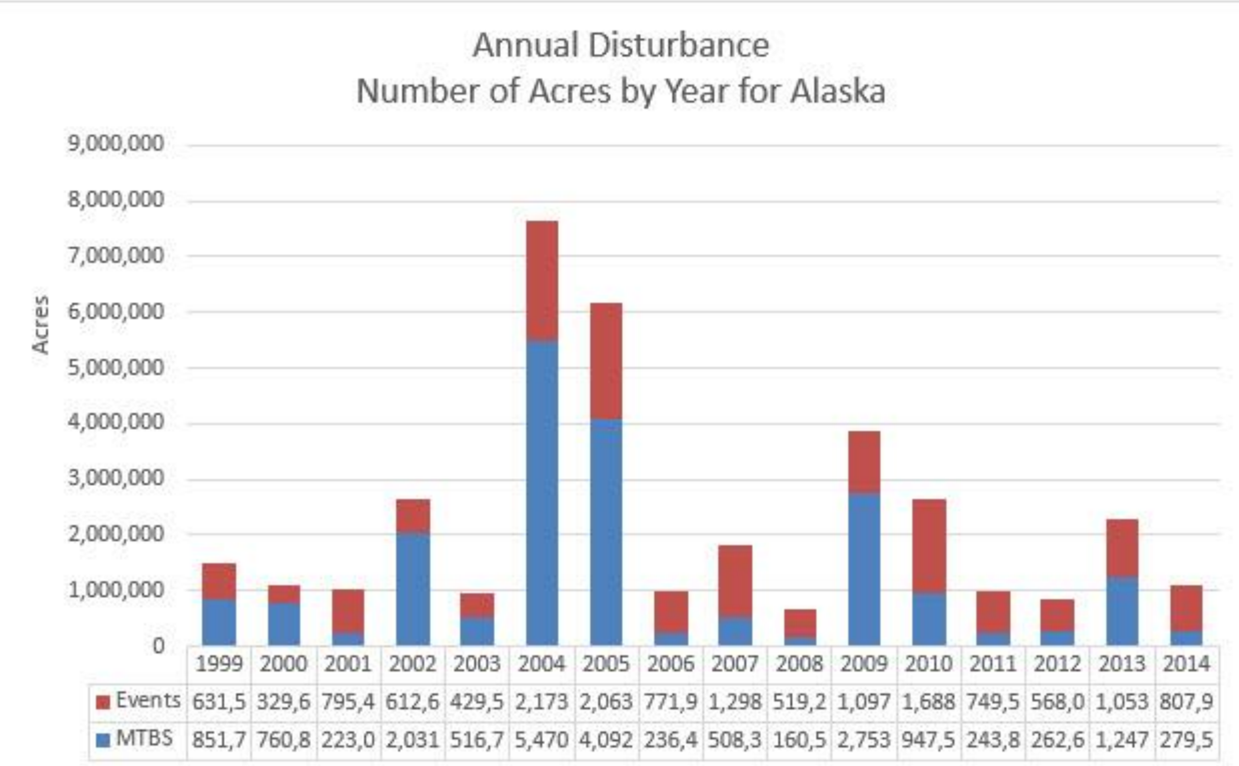


Figure 7: Annual disturbance area by type of disturbance for Alaska.

- The amount of change recorded was greater in 2013, near the average for 1999 – 2014 of 2.2 million.
- Of the 2.3 million acres of disturbance for 2013, 1.1 million acres were contributed to events. The remaining 1.2 million acres were fire-program related.
- Of the 1.1 million acres of disturbance for 2014, 800 thousand acres were contributed to events. The remaining 300,000 acres were fire-program related.

Hawaii

Since 2011 LF has mapped more than 213 disturbances in HI, covering more than 29,000 acres. **Table 6** lists the number of disturbances and acres disturbed from 2011 - 2014. For the LF 2014 Update, 2012 had the greatest number of disturbances mapped in the annual disturbance product with 62 disturbances which affected 10,342 acres (**Figure 8, . Figure 10, Figure 11**).Most of the disturbances are attributed to LF Events for the years 2011 and 2012.The RSLC process is attributed for most disturbances in 2013 and 2014.

Table 6: Number of disturbances and acres by year and type for Hawaii.

Year and Source	Number of Disturbances	Acres
2011	**54**	**8,801**
Events	42	4,698
RSLC	12	4,103
2012	**62**	**10,342**
Events	46	5,257
MTBS	1	2,100
RSLC	15	2,986
2013	**46**	**5,565**
Events	1	1,942
RSLC	45	3,623
2014	**51**	**5,197**
Events	10	336
RSLC	41	4,861
Grand Total	**213**	**29,905**

- Approximately 10,000 acres of disturbance were recorded for 2013 and 2014 combined.
- For 2013, 1,942 acres were contributed events; 3,623 acres were RSLC-captured; there were no MTBS fires.
- For 2014, 336 acres were contributed events; 4,861 were RSLC captured; there were no MTBS fires.

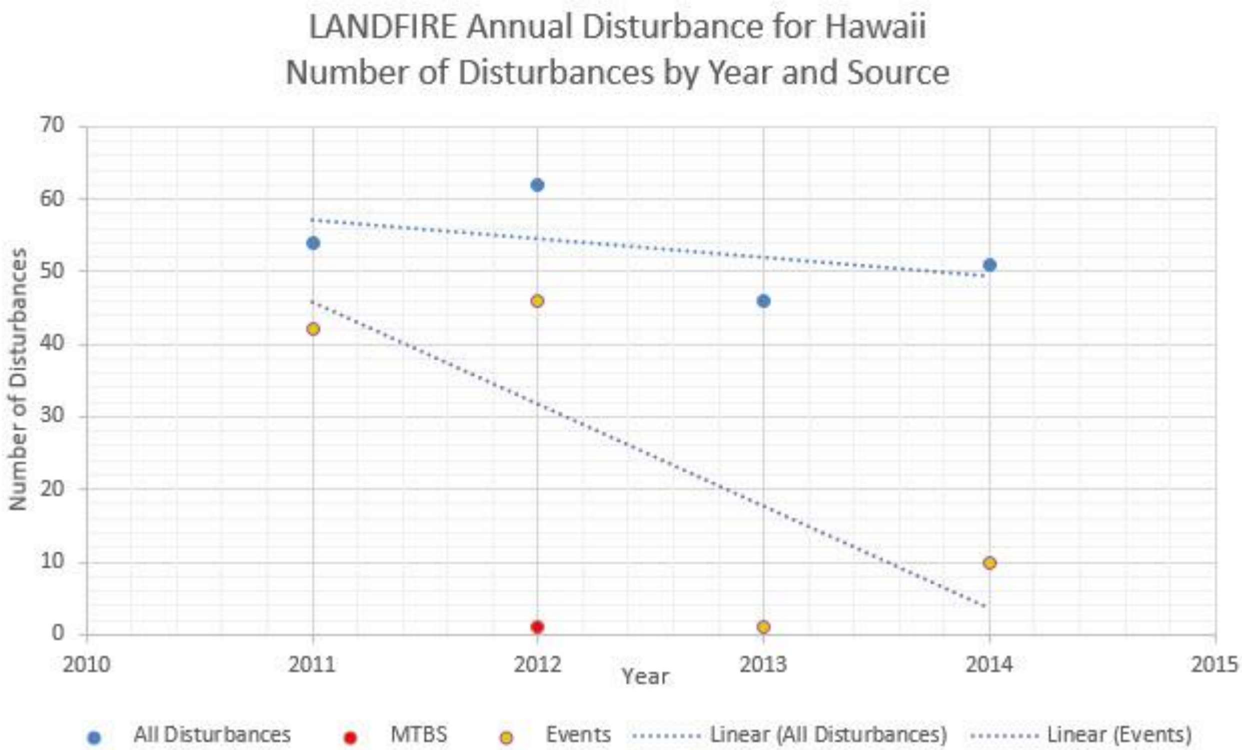
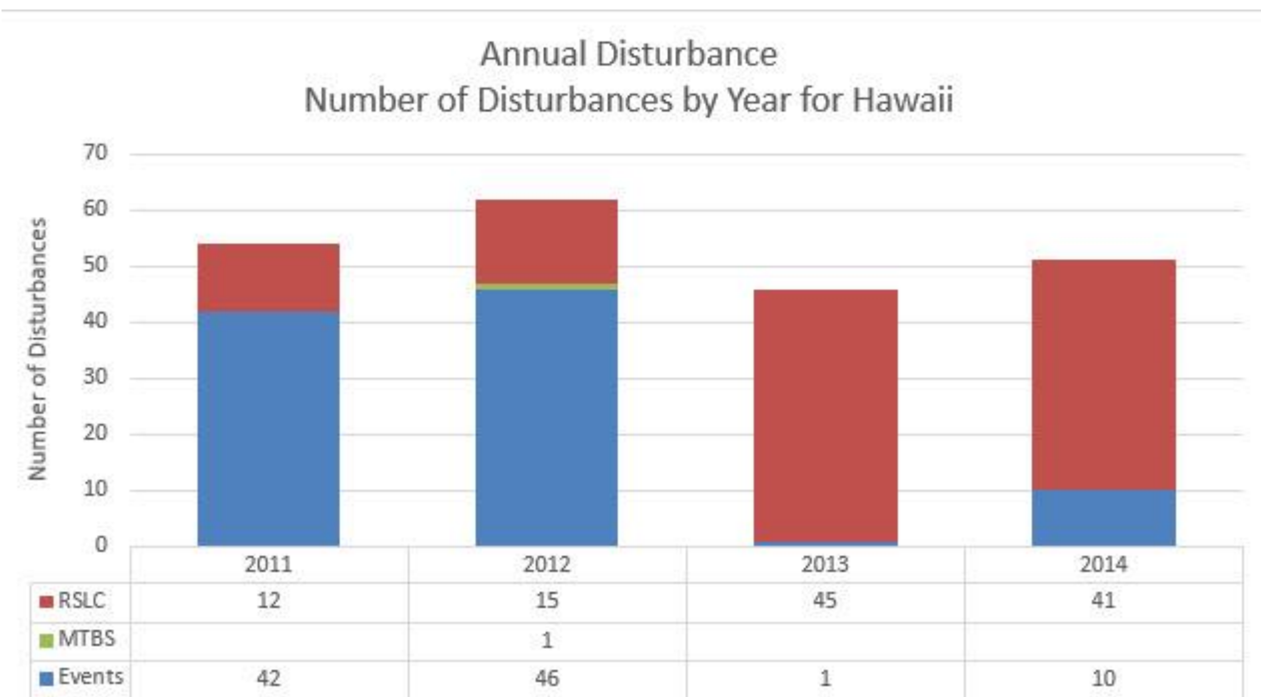


Figure 8: Number of annual disturbances per year 1999 – 2014 for Hawaii



	2011	2012	2013	2014
RSLC	12	15	45	41
MTBS		1		
Events	42	46	1	10

Figure 9: Annual disturbance area by type of disturbance for Hawaii.

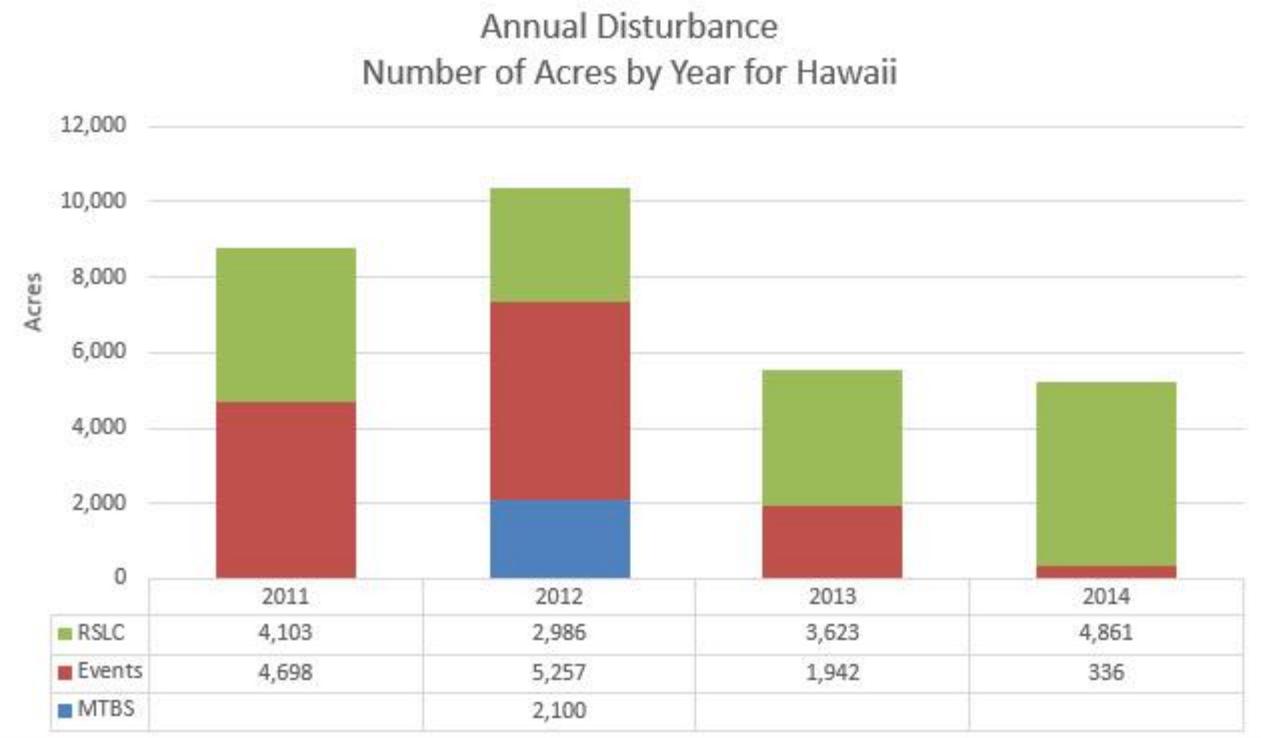


Figure 10: Annual disturbance area by type of disturbance for Hawaii.

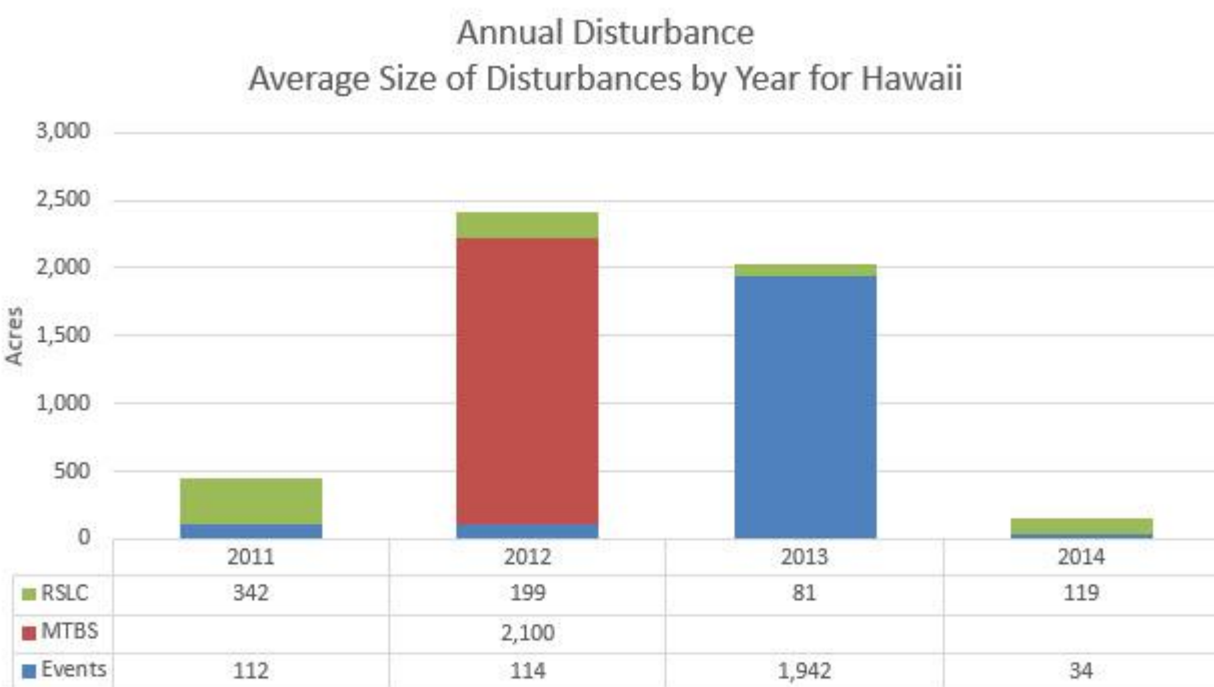


Figure 11: Average disturbance size by type and year for Hawaii.

Vegetation

Product Description

Existing vegetation layers for LF include EVT, EVC, and EVH. All three layers were originally mapped using predictive landscape models based on extensive field- referenced data, satellite imagery, biophysical gradient predictor layers, and classification and regression trees. The EVT layer represents the current dominant vegetation using a blend of map units derived from NatureServe's Ecological Systems vegetation classification for natural vegetation (Comer and others, 2003) with other internally derived map units for non-natural and semi-natural vegetation. The EVC layer represents the average percent cover of the dominant lifeform vegetation of the corresponding EVT for each pixel. The EVH layer represents the average height of the dominant lifeform vegetation of the corresponding EVT for each pixel.

Update Process: CONUS

A brief description of the vegetation update process implemented in earlier LF versions is provided to better highlight the processing changes required for LF 2014. The vegetation data process genealogy explains the processing method, particularly for the EVC layer.

LF 2014 Update existing vegetation products differed slightly from previous versions in the following ways:

- Established 2010 as the new base in which to transition vegetation from going forward (5 year)
- Succession – Areas that were disturbed in previous updates were transitioned back to original EVT

Vegetation Transition Modeling

The LF Vegetation Transition Modeling layer provides a summary of the relationship between disturbance types and resulting effects on the vegetation in terms of changes in lifeform and canopy cover. Information about the disturbance type and the resulting change to vegetation lifeform or tree canopy cover are used to characterize this change. This layer is generated concurrent with the updating process using tables and a series of database queries on a spatial overlay of vegetation and disturbance raster data.

The effects of disturbances on the vegetation are modeled or predicted using a series of tables that link pre-disturbance EVT, EVC, EVH, and a range of possible disturbance types and severities with post-disturbance EVT, EVC, and EVH. For forested vegetation, these tables were informed by computer simulations in the Forest Vegetation Simulator (FVS), Dixon 2002, Crookston and Dixon, 2005,) while for non-forest vegetation, they were informed by a series of simple rule-sets generated heuristically for each individual map zone. Final updating occurred when the tables were linked with a spatial overlay of vegetation and mapped occurrences of disturbance and used to assign LF 2012 EVT, EVC, and EVH. Finally, a unique code was assigned to all pixels that associate them with a particular disturbance type as well as categories of change magnitude expressed either in a change in vegetation lifeform or a change in tree cover.

Update Process: Alaska

Alaska followed the same steps as CONUS in defining rulesets and transitioning vegetation.

Update Process: Hawaii

The vegetation layers for HI were processed the same as CONUS. The transitions were defined by local experts, no FVS runs were done due to lack of appropriate variants and field data.

Results

CONUS

The LF 2014 vegetation update process resulted in the following changes from LF 2012 in cover class (**Table 7**). All anthropogenic EVC classes from LF 2012 and LF 2014 were removed. With the anthrophonic EVC and barren, water, snow/ice and sparse classes removed, the resulting changes based on number of acres occurred between the shrub cover classes and the herbaceous cover classes. Many of the changes occurred in the tree cover classes.

Table 7: Change in the area (acres) mapped in each cover class for CONUS.

Existing Vegetation Cover Class	LF 2012	LF 2014	Difference
Herb Cover >= 10 and < 20%	44,244,410	43,267,138	(977,272)
Herb Cover >= 20 and < 30%	35,351,863	34,577,695	(774,168)
Herb Cover >= 30 and < 40%	61,475,190	59,578,852	(1,896,338)
Herb Cover >= 40 and < 50%	67,828,104	66,334,185	(1,493,919)
Herb Cover >= 50 and < 60%	90,382,185	90,772,133	389,948
Herb Cover >= 60 and < 70%	58,058,152	56,918,114	(1,140,038)
Herb Cover >= 70 and < 80%	54,059,001	53,564,725	(494,276)
Herb Cover >= 80 and < 90%	28,544,379	28,013,501	(530,879)
Herb Cover >= 90 and <= 100%	30,579,164	29,518,329	(1,060,836)
Shrub Cover >= 10 and < 20%	89,026,273	88,095,618	(930,654)
Shrub Cover >= 20 and < 30%	88,651,572	87,902,140	(749,432)
Shrub Cover >= 30 and < 40%	68,474,301	68,230,738	(243,563)
Shrub Cover >= 40 and < 50%	50,753,821	50,533,754	(220,067)
Shrub Cover >= 50 and < 60%	26,755,958	26,443,961	(311,996)
Shrub Cover >= 60 and < 70%	7,683,133	7,626,700	(56,433)
Shrub Cover >= 70 and < 80%	3,383,269	3,344,854	(38,415)
Shrub Cover >= 80 and < 90%	2,629,835	2,610,788	(19,046)
Shrub Cover >= 90 and <= 100%	521,118	519,364	(1,753)
Tree Cover >= 10 and < 20%	37,533,524	28,929,728	(8,603,796)
Tree Cover >= 20 and < 30%	51,830,092	49,212,836	(2,617,256)
Tree Cover >= 30 and < 40%	73,585,377	73,994,299	408,922
Tree Cover >= 40 and < 50%	70,975,513	64,729,879	(6,245,634)
Tree Cover >= 50 and < 60%	65,812,269	66,144,588	332,319

Existing Vegetation Cover Class	LF 2012	LF 2014	Difference
Tree Cover >= 60 and < 70%	76,254,479	67,760,087	(8,494,393)
Tree Cover >= 70 and < 80%	145,781,249	159,721,942	13,940,693
Tree Cover >= 80 and < 90%	115,443,406	132,005,006	16,561,600
Tree Cover >= 90 and <= 100%	3,833,547	4,222,288	388,741

Alaska

The LF 2014 vegetation update process for AK resulted in the following changes from LF 2012 in cover class (**Table 8**). All anthropogenic EVC classes and barren, water, snow/ice and sparse classes were removed for LF 2012 and LF 2014. Most of the changes occurred in the shrub cover classes.

Table 8: Change in the area (acres) mapped in each cover class for Alaska.

Existing Vegetation Cover Class	LF 2012	LF 2014	Difference
Herb Cover >= 10 and < 60%	14,219,330	14,140,010	(79,320)
Herb Cover >= 60 and <= 100%	5,753,290	5,530,860	(222,430)
Shrub Cover >= 10 and < 25%	29,107,874	26,825,177	(2,282,696)
Shrub Cover >= 25 and < 60%	83,278,779	86,703,188	3,424,410
Shrub Cover >= 60 and <= 100%	56,338,896	56,248,216	(90,681)
Tree Cover >= 10 and < 20%	14,459,498	15,018,055	558,557
Tree Cover >= 20 and < 30%	20,458,356	5,181,697	(15,276,659)
Tree Cover >= 30 and < 40%	18,141,141	19,979,994	1,838,852
Tree Cover >= 40 and < 50%	12,059,846	24,999,174	12,939,328
Tree Cover >= 50 and < 60%	22,765,789	14,985,385	(7,780,404)
Tree Cover >= 60 and < 70%	12,221,528	18,595,201	6,373,672
Tree Cover >= 70 and < 80%	5,223,663	5,489,081	265,418
Tree Cover >= 80 and < 90%	6,301,068	6,325,554	24,486
Tree Cover >= 90 and <= 100%	3,031,738	3,339,206	307,468

Hawaii

The majority of disturbed pixels were assigned to the “non-native” vegetation type due the impact of invasive species in HI. The LF 2014 vegetation update process for HI resulted in the following changes from LF 2012 in cover class (**Table 9**). All anthropogenic EVC classes and barren, water, snow/ice and sparse classes removed LF 2012 and LF 2014. Many of the changes occurred in the herbaceous cover classes.

Table 9: Change in the area (acres) mapped in each cover class for Hawaii.

Existing Vegetation Cover Class	LF 2012	LF 2014	Difference
Herb Cover >= 10 and < 20%	2,445	2,443	(2)
Herb Cover >= 20 and < 30%	6,426	6,491	65
Herb Cover >= 30 and < 40%	13,539	13,503	(36)
Herb Cover >= 40 and < 50%	21,760	21,672	(88)
Herb Cover >= 50 and < 60%	30,719	30,633	(86)

Existing Vegetation Cover Class	LF 2012	LF 2014	Difference
Herb Cover >= 60 and < 70%	56,891	56,809	(82)
Herb Cover >= 70 and < 80%	193,914	193,673	(241)
Herb Cover >= 80 and < 90%	327,248	329,836	2,588
Herb Cover >= 90 and <= 100%	80,726	80,926	200
Shrub Cover >= 10 and < 20%	44,473	44,483	10
Shrub Cover >= 20 and < 30%	104,897	104,877	(20)
Shrub Cover >= 30 and < 40%	131,586	131,553	(33)
Shrub Cover >= 40 and < 50%	79,818	79,712	(106)
Shrub Cover >= 50 and < 60%	35,839	35,654	(185)
Shrub Cover >= 60 and < 70%	54,979	55,184	205
Shrub Cover >= 70 and < 80%	37,581	37,428	(153)
Shrub Cover >= 80 and < 90%	47,897	47,767	(130)
Shrub Cover >= 90 and <= 100%	19,726	19,683	(43)
Tree Cover >= 10 and < 20%	23,460	23,448	(12)
Tree Cover >= 20 and < 30%	124,819	125,722	903
Tree Cover >= 30 and < 40%	217,998	217,627	(371)
Tree Cover >= 40 and < 50%	221,048	222,315	1,267
Tree Cover >= 50 and < 60%	324,414	323,050	(1,364)
Tree Cover >= 60 and < 70%	379,558	378,820	(738)
Tree Cover >= 70 and < 80%	290,880	290,032	(848)
Tree Cover >= 80 and < 90%	79,497	78,842	(655)
Tree Cover >= 90 and <= 100%	10,362	10,321	(41)

Fuels

Product Description

The LF fuels data describe the composition and characteristics of both surface and canopy fuel. Geospatial surface fuel products included the 13 Anderson FBFM (FBFM13; Anderson, 1982), the 40 Scott and Burgan FBFM (FBFM40; Scott and Burgan, 2005), and the CFFDRS (Stocks and others, 1989). Canopy fuel layers included CBD, CBH, FCC, and FCH. These data are generally used within simulation models to predict various aspects of wildland fire behavior and are useful for strategic fuel treatment prioritization and tactical assessments of fire behavior.

Update Process

Surface Fuels – Historical Setting

During production of the LF FBFM13, FBFM40, and CFFDRS geospatial products in LF National, a series of rules were developed for mapping fuel models based on input provided by regional fuel specialists and the LF team. In general, surface fuel models were dependent upon the type of vegetation described in the EVT layer, the amount of overstory cover of the vegetation from the EVC, and the height of the vegetation expressed by EVH. At times, the bio-physical setting of the site was leveraged to more accurately portray fuel models on the landscape. For most fuel models, fuel model assignments were given breakpoints of EVC and EVH for each EVT to determine the fuel model. For instance, in a forested EVT in an open condition, a grass or shrub model might be used in the low cover ruleset to describe the surface fuel. As the stand closed, represented by higher EVC classes, a timber understory or timber litter model would often be used in a subsequent ruleset. There are fuel model mapping rule sets for every mapping zone used in the LF National production process.

To efficiently apply these rules geospatially, the LF Total Fuel Change tool was developed. The tool is an ArcGIS toolbar that links to the fuel mapping rules stored in a Microsoft Access database. The tool quickly translates the fuel mapping rules into spatial layers allowing for iterative changes to LF fuels data. The Toolbar can copy and auto-rule fuel rulesets from previous versions of the LF data, as well as edit any of the fuel attributes within each individual ruleset, including the fuel model. All these capabilities within the Toolbar become important when there are changes to the vegetation (EVT, EVC, EVH, BpS, or disturbance) which cause fuel attributes to fall outside previously developed rulesets. Fuel attributes that are outside the previously developed rulesets are identified by the Toolbar where editing is done to address fuel rules. Once edits are completed and all pixels are covered by fuel rulesets the seven primary fuel grids are recreated through a function on the Toolbar.

Results

Two examples of the substantial changes captured in the LF 2014 Update are the SC and NW regions.

South Central

Map zones 32 and 35 showed a marked increase in the Rate of Spread (ROS) and Flame Length (FL) due to a large increase in Conditional Crown Fire in the Fire Type (FTYP) analysis. Because Conditional Crown Fire in gNexus (a risk assessment Tool) considers Conditional Crown Fire with the same fire behavior attributes (in this case ROS and FL) as that of Active Crown Fire. The additional ROS and FL that is applied in the Scott Reinhardt approach to Active Crown Fire activity applies here **(Table 10**).

Table 10: Fire Type Comparison from gNexus for map zone 32 (acres).

Fire Type	LF 2008	LF 2010	LF 2012	LF 2014
no fire	9,931,772	9,319,245	9,602,767	9,579,627
fire no trees	20,340,960	21,528,829	21,295,786	21,229,280
surface fire trees	4,894,081	5,259,612	5,147,653	3,203,524
passive crowning	8,211	52,106	153,623	76,411
Conditional crowning	3,931,681	2,946,220	2,882,700	4,987,788
active crowning	220	913	24,395	30,294
total acres	39,106,924	39,106,924	39,106,924	39,106,924

Due to this increase, combines were performed with EVT, EVH, EVC, FBFM40, along with CBD and FTYP, to find out what was causing escalation in fire behavior in LF 2014.

In map zone 32, EVT 2308 showed an increase in EVC from LF 2012 to LF 2014 from 60% to 70% cover in non-disturbed and disturbed conditions. This increase in EVC caused the CBD to increase from .16 and .17 kg/m^3 to .22 &.24 kg/m^3. The Increase in CBD caused the fire behavior processor to move millions of pixels from Surface Fire to Conditional Crown Fire.

In map zone 35, the increase is in Conditional Crowning and Active Crowning comparing LF 2012 to LF 2014. The increase takes place in EVT’s 2383 and 2308 where CBD increases from .17kg/m^3 to .24 kg/m^3 and the amount of Conditional and Active Crowning grows from 3.6 million acres in LF 2012 to 5.2 million in LF 2014. These increases of EVC- CBD and Crown Fire occurred in areas that were non-disturbed throughout the LF record.

Northwest

Map zones 02, 07, 10, and 29, were assessed for various fire behavior characteristics from LF 2008 thru LF 2014.

The increase in CBD and thus conditional crown fire that was observed in the SC occurred in the western map zones of the NW. Note increase in Conditional Crowning in Table 11. These increases were seen only in the heavily treed areas of the Geo Area.

Table 11: Fire Type Comparison from gNexus for map zone 02 (acres).

Fire Type	LF 2008	LF 2010	LF 2012	LF 2014
no fire	2,492,384	2,323,490	2,298,733	2,364,832
Surface fire no trees	1,494,287	2,178,951	2,465,990	2,078,100
Surface fire trees	2,739,833	3,554,474	2,485,087	2,342,460
Passive crowning	3,130,958	1,987,955	2,985,632	3,068,495
Conditional crowning	782,149	1,061,650	864,866	1,233,139
Active crowning	1,680,857	1,213,946	1,220,157	1,233,440
Total acres	12,320,466	12,320,466	12,320,466	12,320,466

In the analysis of the NW geo area, most of the issues encountered were disturbance and FDist YEAR related. As with the SC GeoArea, succession added some additional cover to treed EVTs, which affected the CBD in those EVT's. Some areas did move from surface into passive crowning and the conditional crown fire class.

Fire Regime

Product Description

The purpose of updating Fire Regime products for LF_2014 Update was to identify and understand broad-scale alterations of historical fire regimes and vegetation conditions across the U.S. landscape. LF produced maps of historical fire regimes and historical vegetation conditions using state and transitional modeling techniques for the original LF National product suite. Not all the products were updated during past updates. For the LF 2014 Update, three products received updates.

The SCLASS product characterizes current vegetation conditions with respect to the vegetation species composition, cover, and height ranges of successional states that occur within each biophysical setting. SCLASS can also represent uncharacteristic vegetation components, such as exotic species, that are not found within the compositional or structural variability of successional states defined for a biophysical setting. Succession classes do not directly quantify fuel characteristics of the current vegetation, but rather represent vegetative states with unique succession or disturbance-related dynamics, such as structural development or fire frequency.

VDEP indicates how different current vegetation on a landscape is from estimated historical conditions. VDEP is based on changes to species composition, structural stage, and canopy closure using methods originally described in the Interagency Fire Regime Condition Class Guidebook but is not identical to those methods. VDEP is based only on departure of current vegetation conditions from reference vegetation conditions, whereas the Guidebook approach includes departure of current fire regimes from those of the reference period.

VDEP is a landscape metric and the range ranges from 0 – 100 which is scale dependent. Every pixel in a unique biophysical setting in a summary unit has the same VDEP value. These large landscape values may not represent smaller areas within a summary unit.

VCC represents a simple categorization of the associated VDEP layer and indicates the general level to which current vegetation is different from the simulated historical vegetation reference conditions. VCC is a derivative of the VDEP layer.

Though not part of the formal LF 2012 Update project, SCLASS, VDEP and VCC were developed to be aligned with LF 2012 Update after LF 2012 Update was complete and prior to LF 2014 Update. As part of this release, the original three VCC classes were divided in half to create six VCC classes to provide additional precision**. Table 12** describes the classes:

Table 12: Reclassification of original three VCC into six classes

LF 2012	LF c2001 National, LF 2001, LF 2008
VCC Ia: Very Low, VDEP 0 - 16	VCC I: Low departure, VDEP 0 - 33
VCC Ib: Low, VDEP 17 - 33	
VCC IIa: Moderate to Low, VDEP 34 - 50	VCC II: Moderate departure, VDEP 34 - 66
VCC IIb: Moderate to High, VDEP 51 - 66	
VCC IIIa: High, VDEP 67 - 83	VCC III: High departure, VDEP 67 - 100
VCC IIIb: Very High, VDEP 84 - 100	

VCC for LF 2014 Update used the same classification as LF 2012.

Update Process

To produce SCLASS, the historical reference conditions of these successional states were derived from the vegetation and disturbance dynamics model VDDT (Vegetation Dynamics Development Tool) The area contained in succession classes is compared to the simulated historical reference conditions to calculate measurements of vegetation departure, such as fire regime condition class.

The successional states represented in SCLASS are based on the BpS descriptions and derived from unique combinations of BpS, EVT, EVC, and EVH. During the LF 2014 Update process, EVT, EVC, and EVH changed to account for disturbances and estimated vegetation transition over time, for example vegetation growth following disturbances. These changes resulted in new combinations of BpS, EVT, EVC, and EVH that require an SCLASS assignment. SCLASS was assigned to all new combinations following rules established in previous versions and the BpS descriptions. The completed SCLASS information was then used to produce the final data layer (Version 1.4.0) using methods similar to LF 2012 Update. SCLASS is an input for VDEP and VCC. Given the changes to SCLASS for LF 2014 Update, similar changes were required for VDEP and VCC.

VDEP and VCC were produced using methods similar to LF 2012 Update. Details of the steps were compiled in a separate procedures document. For VDEP, BpS and SCLASS were used to calculate the amount that current vegetation has departed from estimated historical reference conditions. VDEP values range from 0 to 100% and reflect the percent departure for a given BpS. For VCC, the VDEP values were categorized into same VCC classifications as LF 2012 (**Table 12**).

Results

CONUS

SCLASS results for CONUS from LF 2014 Update are summarized in **Table 13**. Updated agricultural information from NASS resulted in changes to the acres of Burnable Agriculture, Non-burnable Agriculture, and Burnable Urban classes. LF 2014 Updates to EVT, EVC, and EVH resulted in moderate changes in the total acres for individual SCLASS values from 2012 to 2014. Most of the total change involved an increase in Succession Classes B and E and a decrease in Succession Classes A and C and Uncharacteristic Native Vegetation. The slight increase in the Sparsely Vegetated class reflects different SCLASS assignments for a small number of vegetation combinations to maintain consistency within the data. Changes on the landscape due to vegetation removal from disturbance often balance the changes due to vegetation growth post-disturbance with respect to succession classes. However, shifts in succession classes over a two-year period can be expected given the variability in total disturbance acres within a given year. Succession classes are unique to each BpS and meaningful conclusions regarding vegetation condition and overall trends cannot be made by summarizing and comparing SCLASS values among different BpS units.

Table 13: SCLASS - Acre change comparison between LF 2012 and LF 2014 for CONUS

SCLASS	LF 2012	LF 2014	Difference
Succession Class A	165,220,571	161,727,777	(3,492,794)
Succession Class B	369,397,608	377,655,297	8,257,689
Succession Class C	248,137,585	242,035,219	(6,102,366)
Succession Class D	124,579,756	124,022,591	(557,165)
Succession Class E	122,377,877	126,768,976	4,391,099
Uncharacteristic Native Vegetation Cover / Structure / Composition	177,483,108	175,432,934	(2,050,174)
Uncharacteristic Exotic Vegetation	37,121,069	37,172,536	51,467
Water	107,324,505	107,324,505	-
Snow / Ice	429,152	429,152	-
Non-burnable Urban	78,072,627	78,072,627	-
Burnable Urban	112,940,959	112,443,384	(497,575)
Barren	23,094,104	23,094,104	-
Sparsely Vegetated	12,292,989	12,293,108	119
Non-burnable Agriculture	277,115,177	282,103,645	4,988,468
Burnable Agriculture	141,240,962	136,252,197	(4,988,765)

VCC results for CONUS from LF 2014 Update are summarized in **Table 14**. VCC provides a summary of VDEP; therefore, a summary table for VDEP is not included. Changes to SCLASS and VDEP resulted in moderate changes in VCC from 2012 to 2014. Most of the total change involved an increase in High Vegetation Departure and Very Low Vegetation

Departure and a decrease in Low to Moderate Vegetation Departure.

Table 14: VCC - Acre change comparison between LF 2012 and LF 2014 for CONUS

VCC	LF 2012	LF 2014	Difference
Very Low, Vegetation Departure 0-16%	42,892,222	69,098,112	26,205,890
Low to Moderate, Vegetation Departure 17-33%	329,230,596	271,320,119	(57,910,477)
Moderate to Low, Vegetation Departure 34-50%	361,952,468	376,006,953	14,054,485
Moderate to High, Vegetation Departure 51-66%	270,581,587	261,245,451	(9,336,136)
High, Vegetation Departure 67-83%	191,598,862	216,150,484	24,551,622
Very High, Vegetation Departure 84-100%	47,297,827	50,230,315	2,932,488
Snow / Ice	429,152	429,152	-
Non-burnable Urban	78,072,627	78,072,627	-
Burnable Urban	112,940,959	112,443,384	(497,575)
Barren	23,094,104	23,094,104	-
Non-burnable Agriculture	277,115,177	282,103,645	4,988,468
Burnable Agriculture	141,240,962	136,252,197	(4,988,765)

Alaska

SCLASS results for AK from LF 2014 Update are summarized in **Table 15**. LF 2014 Updates to EVT, EVC, and EVH resulted in moderate changes in the total acres for individual SCLASS values from 2012 to 2014. Most of the total change involved an increase in Succession Classes C and E and a decrease in Succession Class D.

Table 15: SCLASS - Acre change comparison between LF 2012 and LF 2014 for Alaska.

Row Labels	LF 2012	LF 2014	Difference
Succession Class A	97,250,950	96,951,148	(299,802)
Succession Class B	87,475,122	87,860,948	385,826
Succession Class C	50,807,085	53,309,489	2,502,404
Succession Class D	44,050,775	39,143,163	(4,907,612)
Succession Class E	26,735,529	29,054,713	2,319,184
Water	36,154,790	36,154,790	-
Snow / Ice	17,829,708	17,829,708	-
Non-burnable Urban	360,539	360,539	-
Barren	29,990,563	29,990,563	-
Sparsely Vegetated	4,299,646	4,299,646	-
Non-burnable Agriculture	83,076	83,076	-

VCC results for AK from LF 2014 Update are summarized in **Table 16**. VCC provides a summary of VDEP; therefore, a summary table for VDEP is not included. Changes to

SCLASS and VDEP resulted in moderate changes in VCC from 2012 to 2014. Most of the total change involved an increase in Very Low Vegetation Departure and a decrease in Low to Moderate Vegetation Departure and Moderate to Low Vegetation Departure.

Table 16: VCC - Acre change comparison between LF 2012 and LF 2014 for Alaska.

Row Labels	LF 2012	LF 2014	Difference
Very Low, Vegetation Departure 0-16%	155,863,232	184,718,094	28,854,862
Low to Moderate, Vegetation Departure 17-33%	82,135,688	65,438,450	(16,697,238)
Moderate to Low, Vegetation Departure 34-50%	47,769,850	35,612,227	(12,157,623)
Moderate to High, Vegetation Departure 51-66%	17,879,202	17,997,182	117,980
High, Vegetation Departure 67-83%	2,671,489	2,553,508	(117,981)
Very High, Vegetation Departure 84-100%			
Water	36,154,790	36,154,790	-
Snow / Ice	17,829,708	17,829,708	-
Non-burnable Urban	360,539	360,539	-
Barren	29,990,563	29,990,563	-
Sparsely Vegetated	4,299,646	4,299,646	-
Non-burnable Agriculture	83,076	83,076	-

Hawaii

SCLASS results for HI from LF 2014 Update are summarized in **Table 17**. LF 2014 Updates to EVT, EVC, and EVH resulted in moderate changes in the total acres for individual SCLASS values from 2012 to 2014. Most of the total change involved an increase in Succession Class B and Uncharacteristic Exotic Vegetation and a decrease in Succession Classes C and E.

Table 17: SCLASS - Acre change comparison between LF 2012 and LF 2014 for Hawaii

SCLASS	LF 2012	LF 2014	Difference
Succession Class A	70,764	70,758	(6)
Succession Class B	428,264	428,721	457
Succession Class C	289,423	288,683	(740)
Succession Class D	288,926	288,710	(216)
Succession Class E	339,586	338,760	(826)
Uncharacteristic Native Vegetation Cover / Structure / Composition	673	673	-
Uncharacteristic Exotic Vegetation	1,538,645	1,539,981	1,336
Water	2,187,227	2,187,227	-
Non-burnable Urban	314,047	314,047	-
Barren	722,249	722,245	(4)

SCLASS	LF 2012	LF 2014	Difference
Non-burnable Agriculture	130,425	130,425	-

VCC results for HI from LF 2014 Update are summarized in **Table 18**. VCC provides a summary of VDEP; therefore, a summary table for VDEP is not included. Changes to SCLASS and VDEP resulted in minor changes in VCC from 2012 to 2014. High Vegetation Departure increased slightly, while all other classes remained constant.

Table 18: VCC - Acre change comparison between LF 2012 and LF 2014 for Hawaii

Vegetation Condition Class	LF 2013	LF 2014	Difference
Very Low, Vegetation Departure 0-16%	9,866	9,866	-
Low to Moderate, Vegetation Departure 17-33%	237,642	237,642	-
Moderate to Low, Vegetation Departure 34-50%	6,996	6,996	-
Moderate to High, Vegetation Departure 51-66%	1,213,031	1,213,031	-
High, Vegetation Departure 67-83%	738,496	738,499	3
Very High, Vegetation Departure 84-100%	750,251	750,251	-
Water	2,187,227	2,187,227	-
Non-burnable Urban	314,047	314,047	-
Barren	722,249	722,245	(4)
Non-burnable Agriculture	130,425	130,425	-

Conclusion

The scope of the LF 2014 Update project was accomplished as directed, 60 deliverables were created over 7 releases. Each was developed, tested, accepted, and published with accompanying website updates. The Project was executed effectively with all required documentation completed and accepted.

ACRONYMS

AK	Alaska
BAECV	Burned Area Essential Climate Variable
BAER	Burned Area Emergency Response
BARC	Burned Area Reflectance Classification
BLG	Business Leadership Group
CBD	Canopy Bulk Density
CBH	Canopy Base Height
CDL	Cropland Data Layer
CFFDRS	Canadian Forest Fire Danger Rating System
CONUS	Conterminous United States
DDS	Data Distribution System
EROS	Earth Resources Observation and Science
ETM	Enhanced Thematic Mapper
EVC	Existing Vegetation Cover
EVH	Existing Vegetation Height
EVT	Existing Vegetation Type
FBFM	Fire Behavior Fuel Models
FCC	Forest Canopy Cover
FCCS	Fuel Characteristic Classification System
FCH	Forest Canopy Height
FDIST	Fuel Disturbance
FL	Flame Length
FLM	Fuel Loading Models
FTYP	Fire Type
FVS	Forest Vegetation Simulator
GAP	USGS Gap Analysis Program
HI	Hawaii
LF	LANDFIRE

LFRDB	LF Reference Database
MTBS	Monitoring Trends in Burn Severity
NASS	National Agricultural Statistics Service
NLCD	National Land Cover Database
NW	Northwest
OLI	Operational Land Imager
PAD-US	Protected Area Database of the United States
PAR	Product Acceptance Report
PCR	Project Close-Out Report
RAVG	Rapid Assessment of Vegetation Condition after Wildfire
ROS	Rate of Spread
RSLC	Remote Sensing of Landscape Change
SC	South Central
SCLASS	Succession Classes
U.S.	United States
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
VDIST	Vegetation Disturbance
VTM	Vegetation Transition Magnitude
WBS	Work Breakdown Structure

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