End-User Group Review and Summary of Completion of the

Service Level Agreement

For
Remapping of LANDFIRE National Geo-Spatial layers to reduce the over-mapping of Pinyon-Juniper communities and the under-mapping of non-native grass communities

Between

The Bureau of Land Management

and

LANDFIRE Project
[USDA FS – Missoula Fire Sciences Lab / USDOI USGS Earth Resources Observation Systems Data Center]

Date: May 18, 2007

I. Background

As initial LANDFIRE maps were created for areas in the Great Basin and Southwest, informal reviews raised concerns related to the accuracy of certain data products. The perceived inaccuracies were principally confined to two specific layers: (1) Biophysical Settings (BpS); and (2) Succession Class (S Class). These LANDFIRE products, along with Fire Regime Group and Existing Vegetation Type, will be highlighted in a before and after comparison process in this paper. It is important to note, however, that these inaccuracies had effects on seven key mapping production steps or mapped products. Discussion within LANDFIRE leadership led to a request for courtesy peer review from scientists with expertise in Southwestern and Great Basin ecology. The comments from their review supported the perception that several trends were inaccurate in the initial maps. The comments of both LANDFIRE employees and independent scientists suggested that:

i. the BpS layer over-mapped the historic distribution of pinyon and juniper (PJ) species, while under-mapping that of native shrub communities;
ii. the S Class layer under-mapped uncharacteristic species. Uncharacteristic vegetation conditions include a wide range of non-natural seral stages, which include exotic annual grasses, advanced succession, or other conditions not part of the reference setting.

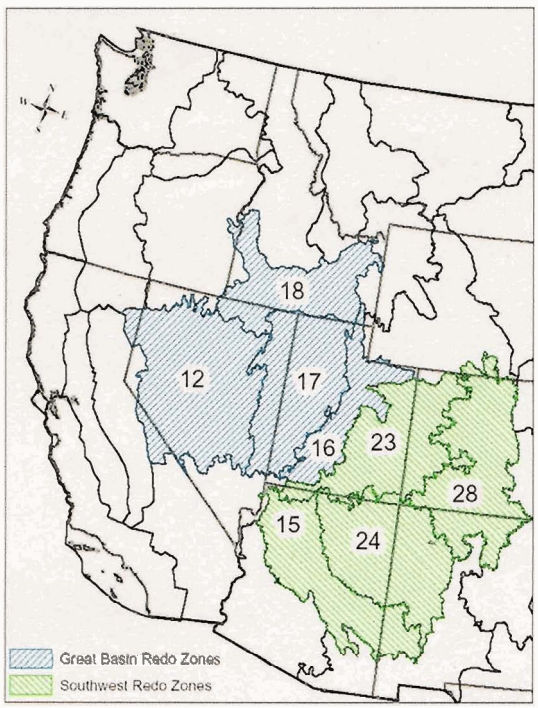
These findings resulted in the development of a LANDFIRE change request. This document outlined the issues, correction methods, timing and cost considerations for re-mapping the identified areas. This document was reviewed by the LANDFIRE Business Leads. The issue was presented and discussed with the LANDFIRE Executive Oversight Committee (EOC). Since the affected areas within the Great Basin and Southwest principally covered lands managed by the Bureau of Land Management (BLM), the BLM wanted these inaccuracies corrected. Based upon these discussions, LANDFIRE leadership and the EOC elected to remap the relevant map zones, with a schedule for completion by March 31, 2007. A formal Service Level Agreement (SLA) was developed between BLM and the LANDFIRE project outlining expectations and methods. The SLA also ensured that the proper elements and commitment within the organizations were in place to successfully complete the re-mapping in a timely and efficient manner (See the attached Service Level Agreement, Appendix A).

This document fulfills the end-user group review requirement outlined in the SLA. The review addresses methods and mapping improvements, lists key revision steps, and presents the results or changes that occurred between the initial pre-redo maps and the completed redo maps.

II. SLA - Description of Services and Review

The Service Level Agreement addressed the need to re-map certain LANDFIRE geo-spatial layers to more accurately reflect vegetation present under natural disturbance regimes (BpS layer) and in the current condition (S Class and Existing Vegetation layers). Re-mapping and general LANDFIRE production were directed to occur simultaneously. The following steps were identified for re-map completion. 1. Revise Biophysical Settings (BpS), 2. Revise Existing Vegetation Type (EVT), 3. Develop Exotics Map, 4. Rectification, 5. Simulate Fire Regime Groups, 6. Revise Successional Class (SClass) map, and 7. Revise Fuels.

The Service Level Agreement defined the terms and provisions for the expected level of service principally remapping the Biophysical Settings (BpS) and Succession Class (S Class) layers. Although the focus was on these two layers there were dependencies with some of the other products as listed above. The products from steps 1, 2, 5, and 6 [(1.) Biophysical Settings (BpS), (2.) Existing Vegetation Type (EVT), (5.) Fire Regime Groups, and (6.) Successional Class (SClass)] were analyzed for this review and are presented in section three. The products from steps 3 and 4 [(3.) Exotics Map and (4.) Rectification], are intermediate processes and as such are not presented in an individual analysis in this review. Step 7 products to revise fuels were a necessary step based upon changes to preceding layers. Fuels are not presented in this review as this was not the focus of the SLA. The revisions to the fuel layers are incorporated in the annual LANDFIRE fuels update to be completed and delivered on May 5, 2007. The dates and events associated with the SLA are outlined in Appendix B.



Zone 12 – Western Great Basin	Zone 17 – Eastern Great Basin	Zone 18 – Snake River Plain
Zone 15 – Mogollon Rim	Zone 16 – Utah High Plateaus	Zone 23 – Colorado Plateau
Zone 24 – Navajo Plateau	Zone 28 – Southern Rocky Mtns.	

Figure 1. Map zones affected by Service Level Agreement (blue = Great Basin, green = Southwest).

III. Remapping of BpS, SClass, Fire Regime Group, and Existing Vegetation Type

1. Biophysical Settings

a. Observed Issues

The BpS map displays historic, disturbance-maintained vegetation. This layer is important in that it describes the patterns and composition of vegetation which were maintained by natural processes prior to European settlement. The initial BpS maps did not accurately reflect BpS for several widely occurring ecosystems (e.g., pinyon, juniper, and sagebrush). Most of the scientific information suggests that throughout much of the Great Basin and Southwest, many communities were maintained in an herbaceous or shrub-steppe condition due to recurring fire. Generally, the initial mapping did not constrain the historic distribution of Pinyon and Juniper species to the appropriate landforms and sites. Rather, the LANDFIRE maps predicted the occurrence of PJ to a wide range of mountain slopes, ridges, and valley bottoms. Conversely, the extent of shrub communities was confined to relatively small, fragmented areas. The general issues were an over-prediction of Pinyon-Juniper and an under-prediction of shrub steppe extents.

b. Results - Remapping of BpS - Area Changed

Biophysical Setting	Pre-Redo Acreage (all zones)	Post-Redo Acreage (all zones)
Great Basin PJ Woodland	12,712,000	5,339,000
Colorado Plateau PJ Woodland	36,269,000	12,239,000
Intermountain Basins Big Sagebrush Shrubland	23,602,000	47,230,000
Intermountain Basins Mixed Salt Desert Scrub	18,319,000	26,348,000
Intermountain Basins Montane Sagebrush Steppe – Mtn. Big Sagebrush	497,000	1,571,000
Intermountain Basins Montane Sagebrush Steppe	5,556,000	6,874,000
TOTAL REDUCTION in PJ acreage	31,403,000 (13% of area)	
TOTAL INCREASE in Shrub acreage	82,023,000 (34% of area)	

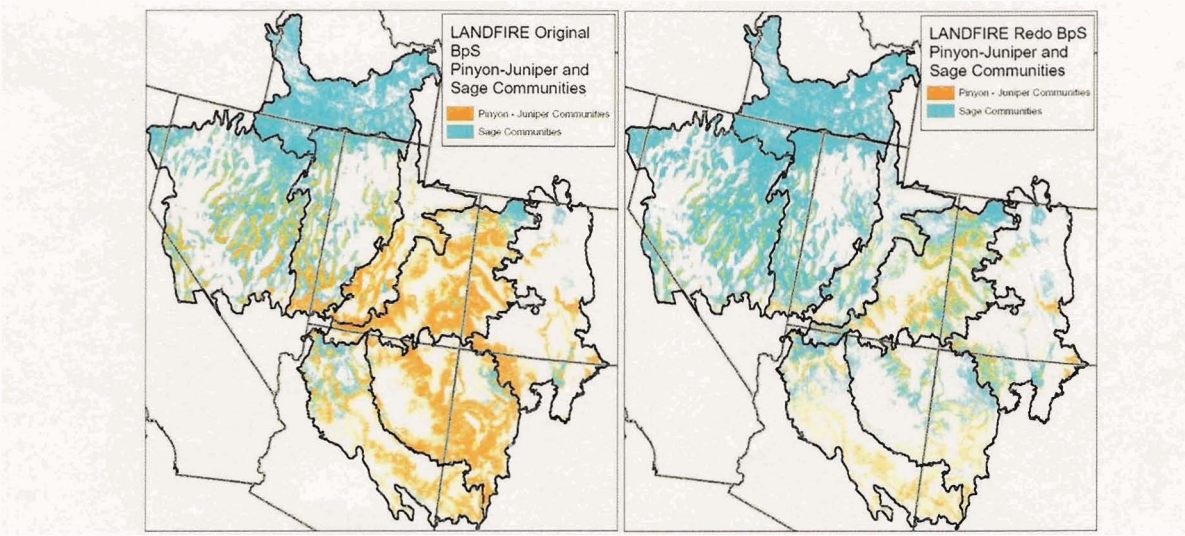


Figure 2. Comparison of pre- and post-correction Pinyon-Juniper and Sagebrush distribution. White areas are barren, water, or unaffected vegetation types not changed by the remapping.

c. Methods and Mapping Improvements

Improvements to the BpS layer resulted from the following changes in methods:

Development of rules to constrain the spatial distribution of PJ BpS's using criteria of elevation, slope, and landform class. Specific criteria were developed for each PJ BpS in each map zone that reflected the information in the vegetation models provided by LANDFIRE project partner, The Nature Conservancy (TNC). Information from published and unpublished literature was also used to refine these criteria.

- Development of an alternate, internal layer of select non-forest BpS's, based on reclassifying existing LANDFIRE field training plots. BpS's selected for this layer were those thought to possibly occur adjacent to PJ BpS's historically and included savanna, shrub, steppe, and herbaceous vegetation groups.
- Replacement of PJ BpS's mapped previously in inappropriate portions of the landscape with BpS's from the alternate non-forest layer.

2. Succession Class

a. Observed Issues

The S Class layer depicts current seral stages on the landscape, usually defined by species composition and structure (height and cover). This layer plays an important role in describing both "natural" seral stages, and also "uncharacteristic" vegetation. Characteristic, or natural, seral stages are the vegetation communities which occurred under historic disturbance regimes. Denoted as "Class U", uncharacteristic types correspond to any seral stage which would not occur under

natural ecological conditions. The initial S Class maps appeared to under-represent the extent of uncharacteristic vegetation. Examples of uncharacteristic vegetation include exotic annual grasses (e.g., cheatgrass), non-native vegetation (e.g., tamarisk, knapweed, rush skeletonweed), or seral stages which have advanced in succession beyond a historical range (e.g., PJ woodlands).

b. Results – Remapping of S Class - Area Changed

Succession Class Uncharacteristic Types	Pre-Redo Acreage (all zones)	Post-Redo Acreage (all zones)
Great Basin Class "U"	7,624,000	37,554,000 (33% of Great Basin)
Southwest Class "U"	3,400,000	17,893,000 (14% of Southwest)
Total	11,024,000	55,447,000 (23% of total area)

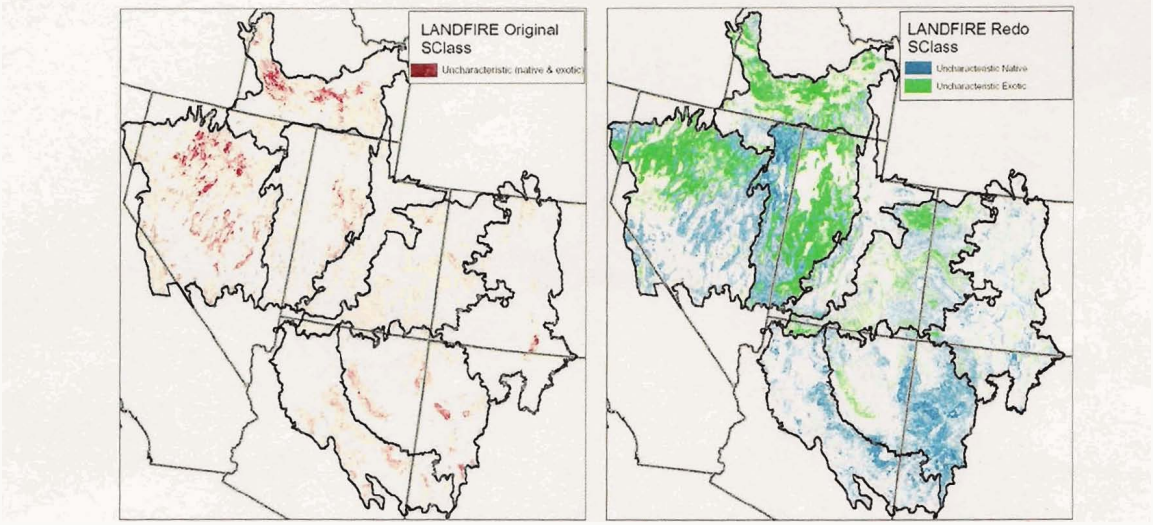


Figure 3. Comparison of pre- and post-correction S-Class distribution. White areas are barren, water, or unaffected vegetation types not changed by the remapping.

c. Methods and Mapping Improvements

Improvements to the S Class layer resulted from the following changes in methods:

- Development of an intermediate exotics input based on reclassifying existing and new LANDFIRE field training plots to better capture areas impacted by exotic species.
- Subdivided Uncharacteristic S Classes into exotic and native vegetation classes for improved interpretation by customers.
- Development of an improved review process during S Class mapping to better calibrate the S Class map to current existing conditions.

3. Fire Regime Group

a. Observed Issues

The Fire Regime Group (FRG) layer depicts pre-settlement fire regimes, and uses fire frequency and severity as the key indicators. Each BpS is classified into a fire regime group based upon its simulated fire frequency and severity. The FRG maps were updated not because there was a perceived error in the initial maps, but because FRG is directly tied to the Biophysical Setting. Thus, because the BpS layers were updated, it was necessary to revise the FRG maps concurrently.

b. Results – Remapping of Fire Regime Group - Area Changed

	Fire Regime Group	Pre-Redo Acreage	Post-Redo Acreage
Great Basin	FRG I	1,416,000	1,875,000
	FRG II	233,000	357,000
	FRG III	29,367,000	25,042,000
	FRG IV	31,551,000	42,686,000
	FRG V	37,182,000	32,068,000
Southwest	FRG I	11,239,000	15,364,000
	FRG II	837,000	836,000
	FRG III	74,985,000	54,292,000
	FRG IV	18,145,000	29,259,000
	FRG V	12,707,000	15,077,000
Total	FRG I	12,655,000	17,239,000
	FRG II	1,070,000	1,193,000
	FRG III	104,352,000	79,334,000
	FRG IV	49,696,000	71,944,000
	FRG V	49,890,000	47,145,000

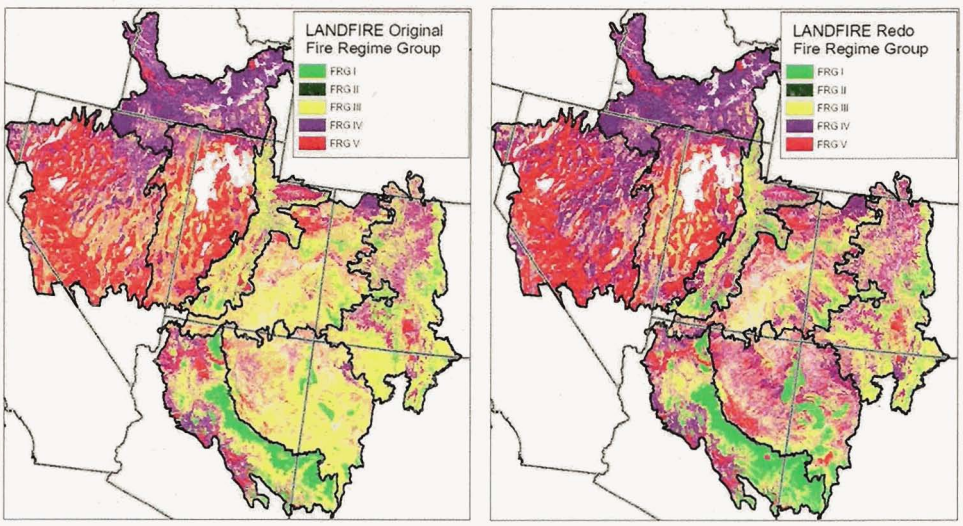


Figure 4. Comparison of pre- and post-correction Fire Regime Group distribution. White areas are barren, water, or unaffected vegetation types.

c. Methods and Mapping Improvements

There were no significant changes to the methods used in fire regime group mapping as part of the SLA.

4. Existing Vegetation Type

a. Observed Issues

The existing vegetation type (EVT) layer displays current plant communities. It was determined through the peer review process that this layer had two general inaccuracies. First, the extent of current Pinyon-Juniper systems appeared to be over-mapped. Second, the extent of existing herbaceous communities, including cheatgrass, was under-mapped. To better predict the distribution of tree, shrub, and herb communities, the EVT remapping process entailed development of a new "lifeform" mask. This mask effectively reduced the extent of forest lifeforms, and increased that of non-forest lifeforms.

b. Results – Remapping of Existing Vegetation Type - Area Changed

Lifeform	Pre-Redo Acreage	Post-Redo Acreage
Forest	91,000,000	76,000,000
Non-Forest	121,000,000	133,000,000

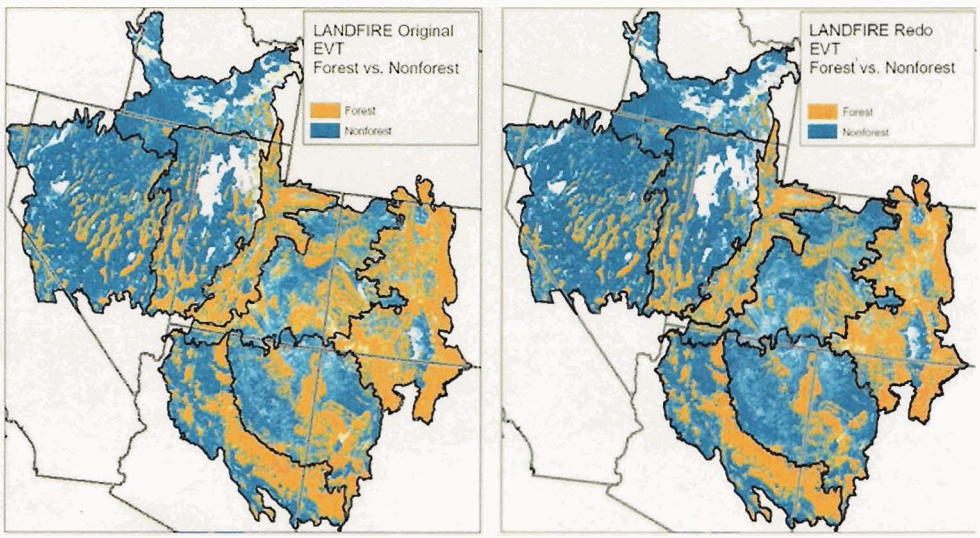


Figure 5. Comparison of changes in forest and non-forest lifeforms resulting from EVT remapping. White areas are barren, water, or unaffected vegetation types not changed by the remapping.

c. Methods and Mapping Improvements

Improvements to the EVT mapping resulted from:

- Removing certain tree plots from the decision tree process;
- Using "pseudo-plots" based on herbaceous characteristics to reduce the extent of forest EVTs and increase that of non-forest EVTs; and
- Remapping existing vegetation height and canopy cover based upon the new EVT and lifeforms.

IV. Conclusion

Based upon more detail on the remapping procedures described in the Change Control Request Document and the requirements outlined in the Service Level Agreement, requirements one through seven listed in section II (SLA – Description of Services) have been met by the LANDFIRE project team. However, simultaneous production of the re-mapping work and general LANDFIRE production occurred at a reduced rate.

The results or changes that occurred between the pre-redo maps and the completed redo maps as presented in the figures and tables of this document show some significant improvements in the LANDFIRE products for the Great Basin and Southwest U.S. Because the BpS methods were improved to constrain PJ occurrence to certain elevations, landforms, soils, and slopes, the resulting layer depicts a considerable improvement in the historic distribution. Also, the extent of shrub communities is more accurately mapped by increasing the range of sites where they would be expected to occur. The S Class layers are greatly improved by a substantial increase in the "uncharacteristic" class, which depicts any seral stage not present under natural ecological conditions. Collectively, these refinements to the BpS and S Class maps are responsive to the independent peer review comments. In addition, the products now have a far greater utility. As a result of the improvements, end-users can now better map FRCC, display invasive plant locations, and describe historic vegetation patterns.

It is important to recognize that the "accuracy" of the maps varies with the scale of observation and intended use of the data. The primary driver influencing the decision to remap these zones was to display an improved accuracy in the general trend for S Class and BpS at the scale they were meant to be applied. All layers which were remapped can be applied at the state and regional scales. In addition, when local data is not available, the S-Class, BpS, and EVT layers can be applied at the National Forest, BLM District, or other large ownership scale. In this context, the post-redo data is more accurate than the initial maps, and more consistent with the majority of the scientific information for these landscapes. As such, they meet the intent and requirements stated in the Service level Agreement.

This user-group review document of the remapping effort was presented to the LANDFIRE Executive Oversight Committee on Wednesday the 30th of May 2007. It will then be routed for review, acceptance, and signature by the appropriate LANDFIRE EOC SLA representatives.

V. Agreement Completion Signatures

Dave Cleaves
USDA Forest Service
Director
Rocky Mountain Research Station

10-3-07 David A. Cleaves
Date *Signature*

Bruce Jones
DOI – USGS
Chief Scientist for Geography

9-7-2007
Date *Signature*

Bud Cribley
DOI – BLM
Deputy Assistant Director
Renewable Resource and Planning

8-20-07 Todd S. Christensen Acting
Date *Signature*

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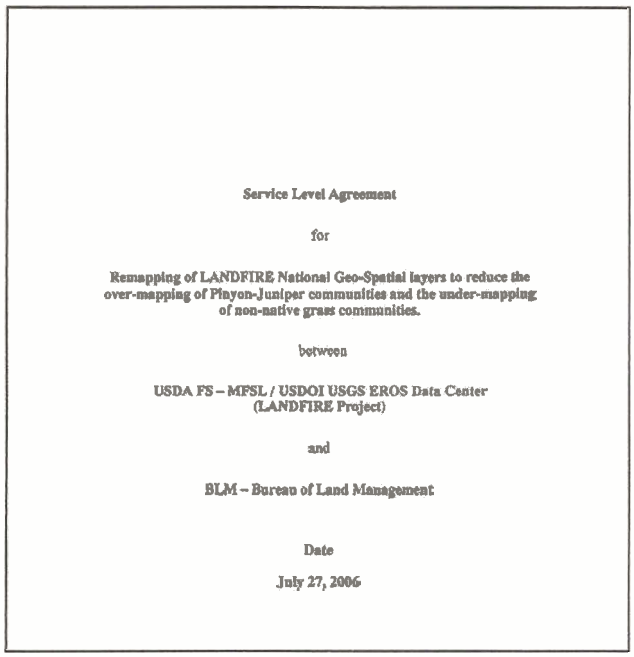
Appendix A. Service Level Agreement



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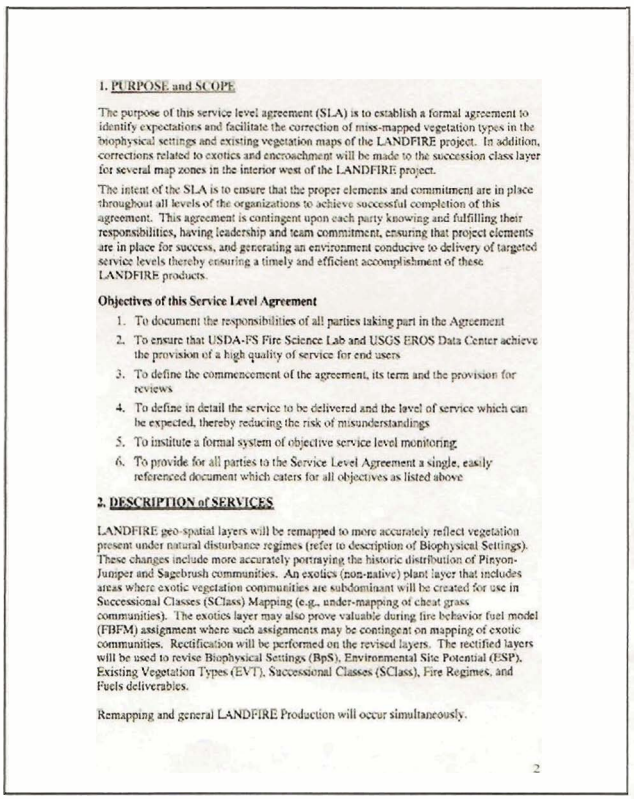
USDA FS – MFSL / USDOI USGS EROS Data Center (LANDFIRE Project)

and

BLM – Bureau of Land Management

Date

July 27, 2006



1. PURPOSE and SCOPE

The purpose of this service level agreement (SLA) is to establish a formal agreement to identify expectations and facilitate the correction of miss-mapped vegetation types in the biophysical settings and existing vegetation maps of the LANDFIRE project. In addition, corrections related to exotics and encroachment will be made to the succession class layer for several map zones in the interior west of the LANDFIRE project.

The intent of the SLA is to ensure that the proper elements and commitment are in place throughout all levels of the organizations to achieve successful completion of this agreement. This agreement is contingent upon each party knowing and fulfilling their responsibilities, having leadership and team commitment, ensuring that project elements are in place for success, and generating an environment conducive to delivery of targeted service levels thereby ensuring a timely and efficient accomplishment of these LANDFIRE products.

Objectives of this Service Level Agreement

1. To document the responsibilities of all parties taking part in the Agreement
2. To ensure that USDA-FS Fire Science Lab and USGS EROS Data Center achieve the provision of a high quality of service for end users
3. To define the commencement of the agreement, its term and the provision for reviews
4. To define in detail the service to be delivered and the level of service which can be expected, thereby reducing the risk of misunderstandings
5. To institute a formal system of objective service level monitoring
6. To provide for all parties to the Service Level Agreement a single, easily referenced document which caters for all objectives as listed above

2. DESCRIPTION of SERVICES

LANDFIRE geo-spatial layers will be remapped to more accurately reflect vegetation present under natural disturbance regimes (refer to description of Biophysical Settings). These changes include more accurately portraying the historic distribution of Pinyon-Juniper and Sagebrush communities. An exotics (non-native) plant layer that includes areas where exotic vegetation communities are subdominant will be created for use in Successional Classes (SClass) Mapping (e.g., under-mapping of cheat grass communities). The exotics layer may also prove valuable during fire behavior fuel model (FBFM) assignment where such assignments may be contingent on mapping of exotic communities. Rectification will be performed on the revised layers. The rectified layers will be used to revise Biophysical Settings (BpS), Environmental Site Potential (ESP), Existing Vegetation Types (EVT), Successional Classes (SClass), Fire Regimes, and Fuels deliverables.

Remapping and general LANDFIRE Production will occur simultaneously.

2

The following steps will be taken to provide for the re-map revisions.

1. Revise BpS
   a. Create Remap Mask
   b. Reclassify Training Plots and Produce New BpS Layer
2. Revise EVT
   a. Recreate a 3-lifeform mask
   b. Recreate the EVT using pre-existing classification trees. The current procedures include the life-form/life-zone mask as a predictor, but reuse of the previous classification trees should not cause major issues.
   c. Recreate Canopy Cover and Canopy height layers using new lifeform masks. Existing Cubist and See5 outputs for canopy height and cover (pre-masking) may be used directly. Additional processing will be required to perform per-pixel normalization, adjustment, and binning into canopy and height categories.
3. Develop Exotics Map
   a. Key Exotics training plots
   b. Create Exotics Layer
4. Rectification
5. Simulate Fire Regimes Using Original Procedures and Modified BpS Layer
6. Revise SClass Map
7. Revise Fuels deliverables

Development and refinement of methods and rulesets for the BpS/EVT changes has begun and these methods will be implemented once the western milestone is completed or as soon as the labs have the opportunity/time based on production workloads while still meeting the western milestone deadline.
As described above, (Information from the LANDFIRE Change Control Request) EVT remapping will begin simultaneously to the development of BpS mapping. Once remapping starts, there will be 8 map zones that need to be revised while production continues at the same time as the eastern map zones are being worked on.

The 8 mapping zones in question are:

12 – Western Great Basin	17 – Eastern Great Basin	18 – Snake River Plain
15 – Mogollon Rim	16 – Utah High Pleateaus	23 – Colorado Plateau
24 – Navajo Plateau	28 – Southern Rocky Mountains	

The BpS, ESP, EVT, SClass, Fire Regimes, and Fuels layers will be recreated, for a total of 17 deliverables. For specific details on how this process will be implemented please reference the 2-2006 Change Control Request Document.

Since these revisions affect the Bureau of Land Management (BLM) lands the most the BLM will provide the LANDFIRE team with a prioritized list of the mapping zones. This list is needed to ensure that critical lands are delivered early in the re-mapping process for use during the 2007 field season. The prioritized list of mapping zones will be provided to the LANDFIRE teams by September 1, 2006 from the BLM.

3

5. SERVICE DEADLINE (Tracking, Reporting, and Periodic Review)

Deadline for final delivery including review and quality control / quality assurance processes is April 1, 2007.

The re-map effort will be tracked and reported on the LANDFIRE business call on a weekly basis by the LANDFIRE Project Manager.
On a monthly basis the lab line officers and approving officials will be notified of the remap progress.

To meet periodic review requirements the re-mapped zones will be reviewed individually by the LANDFIRE technical leads and the National Interagency Fuels Technology Transfer leads as each re-mapped zone is completed. This will occur at a minimum of once a month.

6. COMPLETION of AGREEMENT

This service level agreement will be deemed terminated upon the successful completion of this remapping effort once the data products have been delivered, reviewed by an end-user group, and posted for available use. End-user group review will be led by Doug Havlina (BLM –Fire Ecologist).

7. AGREEMENT SIGNATURES

Dave Cleaves
USDA Forest Service
Director
Rocky Mountain Research Station

9/8/06 (Date) — (Signature)

Barbara J Ryan
DOI – USGS
Associate Director
Geography

8/24/06 (Date) — (Signature)

Ed Shepard
DOI – BLM
Assistant Director
Renewable Resource and Planning

8/7/06 (Date) — (Signature)

4

Appendix B.
Dates and events for the Service Level Agreement

Date	Event	Participants, Location
November 2005	Internal courtesy review of initial Great Basin maps	MFSL, NIFTT Missoula, MT
November - December 2005	Courtesy peer review	Peter Brown, Robyn Tausch, Louis Provencher, Mike Babler
January 26, 2006	BpS, SClass meeting – Resulted in development of Change Request Document	MFSL, NIFTT
March 2006	Business Leads – Discussions with EOC membership	LF EOC
April 28, 2006	LF Business Meeting to discuss methods	LF Business Leads, MFSL, NIFTT Salt Lake City, UT
May 8 – 11, 2006	EOC Meeting. Includes discussion of FRCC, BpS, and SClass data quality	EOC, LF Business Team, MFSL, EROS, NIFTT Warm Springs, OR
July 17 – 20, 2006	Meeting to evaluate methods for FRCC, SClass, BpS	MFSL, NIFTT Missoula, MT
August/September, 2006	Service Level Agreement signed by EOC members	Barbara Ryan, Ed Shepard, Jim Saveland (Dave Cleaves)
January – March, 2007	Courtesy reviews of updated maps	Dillon, Ward (MFSL), Havlina (NIFTT) Remote review
December 2006	Remapping of EVT completed	EROS
April 1, 2007	Completion of all remapping elements outlined in SLA	MFSL
May 5, 2007	Annual Fuels update completed	MFSL