Ecosystem Management Decision Support (EMDS) Summary of Fiscal Year 2010 Results

OCTOBER 2009

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Ecosystem Management Decision Support (EMDS) Summary of Fiscal Year 2010 Results

**Prepared by FY10 DOI
EMDS Task Team**

OCTOBER 2009

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Contents

I. Executive Summary	1
II. Ecosystem Management Decision Support (EMDS) Model Description and Analytical Components	3
III. DOI FY 10 EMDS Model Overview	5
IV. DOI FY 10 EMDS Data Source Details and Summary	9
V. DOI FY 10 EMDS Results and Sensitivity Analysis	13
VI. DOI FY 10 EMDS Analysis Issues and Recommendations	27
VII. The Future of DOI EMDS Analysis.....	31
VIII. Integration of EMDS Results in the DOI HFPAS Process	33
IX. DOI FY 10 EMDS Team Member Biographies.....	35
Appendixes	37
Appendix 1. Summary of Differences Between FY 09 and FY 10 DOI EMDS Analyses	37
Appendix 2. DOI FY 10 EMDS Metadata Summary Table	47
Appendix 3. DOI FY 10 EMDS Decision Model Sub-Element Contributions.....	57
Appendix 4. BIA FY 10 EMDS Regional Analysis Detail Graphics.....	59
Appendix 5. BLM FY 10 EMDS Regional Analysis Detail Graphics	73
Appendix 6. FWS FY 10 EMDS Regional Analysis Detail Graphics	87
Appendix 7. NPS FY 10 EMDS Regional Analysis Detail Graphics.....	101
Appendix 8. Experimental Nationally Scaled Composite DOI Regional Analysis.....	115

Contents

List of Figures

Figure 1.	Final DOI FY 10 Wildfire Potential Logic Model.....	5
Figure 2.	Final DOI FY 10 Full EMDS Model	6
Figure 3.	Administrative Regions of BIA, BLM, FWS, and NPS	8
Figure 4.	DOI FY 10 National EMDS Analysis Decision Scores by Bureau.....	13
Figure 5.	DOI FY 10 EMDS Analysis Element Contributions to National Decision Score by Bureau	14
Figure 6.	BIA FY 10 EMDS Analysis Decision Scores by Bureau Region	16
Figure 7.	BIA FY 10 EMDS Analysis Element Contributions to Bureau Regional Decision Scores.....	17
Figure 8.	BLM FY 10 EMDS Analysis Decision Scores by Bureau Region	19
Figure 9.	BLM FY 10 EMDS Analysis Element Contributions to Bureau Regional Decision Scores	20
Figure 10.	FWS FY 10 EMDS Analysis Decision Scores by Bureau Region	22
Figure 11.	FWS FY 10 EMDS Analysis Element Contributions to Bureau Regional Decision Scores.....	23
Figure 12.	NPS FY 10 EMDS Analysis Decision Scores by Bureau Region	25
Figure 13.	NPS FY 10 EMDS Analysis Element Contributions to Bureau Regional Decision Scores.....	26

List of Tables

Table 1.	DOI FY 10 EMDS Model with Fire Executive Council Element and Sub-Element Weights.....	7
Table 2.	EMDS Sensitivity Analysis for DOI FY 10 National Results	15
Table 3.	EMDS Sensitivity Analysis for BIA FY 10 Regional Results	18
Table 4.	EMDS Sensitivity Analysis for BLM FY 10 Regional Results	21
Table 5.	EMDS Sensitivity Analysis for FWS FY 10 Regional Results.....	24
Table 6.	EMDS Sensitivity Analysis for NPS FY 10 Regional Results	26

Executive Summary

Since the adoption of the National Fire Plan in 2001, Congress, the Government Accountability Office (GAO), and the Office of Management and Budget (OMB) have regularly expressed concern or issued direction regarding the need for logical, clear, and consistent processes for allocation of hazardous fuels funds in the Department of the Interior (DOI) and United States Department of Agriculture Forest Service (USFS). Congress has expressed similar concerns regarding the DOI allocation process among Bureaus and Bureau Regions.

In response, and based upon use by the USFS, the Ecosystem Management Decision Support (EMDS) system has been used for several years to display national and regional priority areas for hazardous fuels treatments geographically for the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Fish and Wildlife Service (FWS), and National Park Service (NPS) (hereinafter collectively referred to as “the DOI Bureaus”), with the results considered as inputs and a starting point for decision makers in the Hazardous Fuels Prioritization and Allocation System (HFPAS) process. Like USFS, DOI has continued to employ EMDS to support Fiscal Year 2010 (FY 10) allocation decisions, with modifications from the FY 09 analysis.

EMDS is a knowledge-based system that uses tabular and geospatial information. EMDS helps managers evaluate landscapes and has been used to assist organizations with prioritization for planning and budgets. The DOI Bureaus and USFS have independently used EMDS to evaluate hazards, risks, and values in order to prioritize these areas for hazardous fuels allocations.

The FY 10 EMDS analysis was defined and requested by the DOI Office of Wildland Fire Coordination (OWFC), and delegated by the Bureau Fire Directors to the National Wildfire Coordinating Group (NWCG) Fuels Management Committee (FMC). Similar to the FY 09 analysis, the FMC tasked an interagency DOI EMDS Team to assemble and review data, make recommendations regarding data and model structure to the FMC, and conduct the FY 10 analysis based on FMC concurrence. As in previous analyses, key USFS staff provided significant support and consultation. EMDS analyses were conducted (1) by Bureau at the national level, and (2) by Region within each Bureau. The FY 10 analyses were completed on schedule on September 15, 2009.

Although much experience and understanding has been gained and model “stability” is an important ultimate goal, DOI application of EMDS remains at a developmental stage. As such, tradeoffs have continued between consistency of successive models and evolutionary model improvements. For FY 10, as in previous years, progress has been made in achieving incremental improvements in data and methodology, and in increased consistency (as mission-appropriate) with USFS sources and methods. Such evolutionary changes as the availability of new national geospatial data sets; calibrated LANDFIRE surface fuel data; and increased project time for the Team to conduct detailed data evaluations, iterative model runs, and field consultations account for most of the differences between the FY 09 and FY 10 analyses. The Team recommends continued application and improvement of EMDS for FY 11 HFPAS support, and ultimately envisions an Operations and Maintenance (O&M) concept in which a relatively stable EMDS approach could be integrated within a 3–5 year cycle, with technical improvements accumulated between rather than during successive annual analyses, and year-to-year volatility removed.

Key technical recommendations include:

- Continue emphasis on and evolution toward best available, nationally consistent source data and rigorous subject matter expert (SME) review
- Incorporate Alaska in the FY 11 analysis (given emergent data availability)

- Explore model refinements to account more appropriately for spatial co-occurrence of criteria and variables vs. simple aggregate occurrence (e.g., consider spatial overlay of wildfire potential and negative consequences)
- Revisit and technically assess options for common geographic area analysis of DOI lands, and/or mitigation of modeling impacts of administrative unit boundary characteristics
- Continue schedule refinement, with both additional project duration and coordinated project timeline and milestones

This report describes the data and modeling approach used for geospatially assessing and prioritizing DOI hazardous fuels areas for FY 10. Results by DOI Bureau at the national level and within each Bureau by Region will be presented, along with recommendations regarding future EMDS modeling of hazardous fuels priority areas. Additional detail is provided in multiple appendixes.

The results presented in this report represent an objective, interagency Team consensus regarding DOI priority fuel treatment areas that is faithful to congressional and DOI policies and directives, to the extent that these can be appropriately modeled using available biogeophysical state and condition data in conjunction with pertinent fuels management information. As such, these results constitute a key geospatial component (*but only one component*) of the overall HFPAS process.

Ecosystem Management Decision Support (EMDS) Model Description and Analytical Components

Chapter II

The Ecosystem Management Decision Support (EMDS) system is a computer-based framework for knowledge-based decision support of ecological assessments at any geographic scale. EMDS integrates state-of-the-art geographic information system (GIS) as well as knowledge-based reasoning and decision modeling.¹

EMDS integrates the NetWeaver logic engine to perform evaluations of landscape condition, and the decision modeling engine Criterium Decision Plus (CDP) for evaluating associated management priorities. NetWeaver allows partial evaluations of ecosystem states and processes based on available information, making it ideal for use in landscape evaluation, where data are often incomplete. NetWeaver also readily supports analysis of large, complex, and abstract problems typically posed by ecosystem management. CDP is an agreed upon set of rules for scientific inquiry to help users make complex decisions among alternatives involving multiple criteria. CDP also includes sensitivity analysis tools to aid in understanding the relationship between model inputs, model weights, and robustness of outputs.

In this analysis and report, the term robustness refers to the sensitivity of prioritization results; an outcome is considered “robust” if a substantial change would be required in the model to alter a given result. Conversely, a result is not robust if a minor change in the model would alter an outcome. Robustness and sensitivity are effectively opposite concepts: a model element that is robust is “insensitive,” whereas an element that is sensitive indicates lack of robustness.

As in previous analyses, the FY 10 DOI analysis used the logic model component of EMDS at the top (element) level to characterize Wildfire Potential (WFP), and decision models were employed to develop priorities, considering not only WFP, but also Negative Consequences, Performance, and Opportunities elements. (For brevity hereafter, WFP is referred to as the “logic model,” and the latter three elements are collectively referred to as “decision model elements.”)

¹ <http://www.institute.redlands.edu/emdsbeta/aboutemds/tabid/56/default.aspx> [cited October 2009]

DOI FY 10 EMDS Model Overview

The DOI FY 10 EMDS project began with a Team review of FY 09 lessons learned; status and availability of suitable data (in terms of scale, quality, consistency, and currency); and development of recommendations for the modeling approach and structure to be presented to FMC for concurrence. After consultation with FMC, the final composition of the WFP logic model (Figure 1) and the decision model elements were resolved—finalizing the FY 10 overall DOI EMDS Model structure (Figure 2). Input data were assembled and summarized accordingly.

Figure 1. Final DOI FY 10 Wildfire Potential Logic Model

Figure 2. Final DOI FY 10 Full EMDS Model

Data inputs to the logic and decision models were summarized to each Region of each Bureau, and are described in Chapter IV and Appendix 2. Variants of the model were created for each Bureau such that interpretations of each data input were scaled to the data range of the Bureau (i.e., the Bureau variants are Bureau specific).

Elements are the top-level, broad criteria used in the EMDS analysis, shown in the gold boxes in Figure 2 (WFP, Negative Consequences, Performance, and Opportunities). Sub-elements are the next tier, subordinate, more specific model criteria that logically contribute to and categorically fall within an element-level decision model criterion (blue boxes in Figure 2). Elements have typically been consistent in successive DOI

EMDS analyses to date (e.g., in FY 09 and FY 10), whereas most of the technical evolution in the models has occurred at the sub-element level and below.

The DOI FY 09 EMDS analysis included multiple scenarios to allow for and assess variation in element and sub-element weights. Based on that experience, the USFS approach, increased focus on sensitivity analysis capability and outputs, and SME professional judgment, the Team recommended and the FMC accepted running a single set of authoritative weights for the FY 10 analysis. Following receipt of final model weights from the Fire Executive Council (FEC) (Table 1), overall EMDS results were generated.

Table 1. DOI FY 10 EMDS Model with Fire Executive Council Element and Sub-Element Weights (sub-element weights under each element sum to the element weight)

FY 2010 DOI EMDS Model		
Elements	Sub-Elements	Weights
Wildfire Potential		0.31
Negative Consequences		0.45
	WUI	0.2
	Ecosystem Vulnerability	0.22
	Smoke Emissions	0.03
Performance		0.05
	Acres Improved or Maintained	0.01
	CWPP	0.02
	Biomass Made Available	0.02
Opportunities		0.19
	Ecological Maintenance and Restoration	0.13
	Biomass	0.04
	CWPP	0.01
	Insect and Disease	0.01

As tasked for FY 10, the Team conducted the primary DOI analyses at two scales: a national analysis of the four Bureaus (BIA, BLM, FWS, and NPS), and an analysis of Regions within each Bureau (Figure 3). As in previous years, the analyses were limited to the contiguous United States (CONUS) owing to limitations in availability or timeliness of suitable data (e.g., LANDFIRE data for Alaska). Sensitivity analysis was conducted in EMDS and summarized for final model runs.

Figure 3. Administrative Regions of BIA, BLM, FWS, and NPS

There were a number of differences between the FY 09 and FY 10 analyses. Similarities and differences are occasionally touched upon in Chapter IV but are more thoroughly summarized in Appendix 1. Additional background in reference to continued evolution in DOI EMDS analyses is covered in Chapter VII.

DOI FY 10 EMDS Data Source Details and Summary

This chapter provides an overview of data sources and preparation at the sub-element and element levels in the DOI FY 10 EMDS model. Greater detail regarding input data may be found in Appendix 2.

1. Wildfire Potential (WFP) Element (FEC Weight 0.31)

As diagramed above in Figure 1, the NetWeaver logic engine was employed to characterize WFP conditions based on Fire Probability and Fire Behavior data. Respective inputs for these were as follows:

A. Fire Probability

Solar Radiation—A CONUS national data set was developed by the U.S. Department of Energy National Renewable Energy Laboratory (NREL), based on measurements collected in 1998–2005. The highest categories of incident solar radiation were extracted, summarized as a proportion of Bureau area, and incorporated in the FY 10 analysis.

Note: As for FY 09, Energy Release Component (ERC) data was investigated, but nationally consistent and comparable ERC information was not available at the time required for incorporation into the analysis. This will be revisited for FY 11.

Fire Starts—Fire reporting data for the BIA, BLM, and NPS were downloaded from the Wildland Fire Management Information System (WFMIS), and from the Fire Management Information System (FMIS) for FWS. Total fire counts used fire types 11–23 and 49 for the years 1999–2008.

Large Fires—Large fire reporting data was also extracted from WFMIS and FMIS for 1999–2008, again for fire types 11–23 and 49. For the FY 10 analysis, the total number of large fires as a proportion of total fire count was used. As in previous analyses, large fires were defined as 100 or more acres in forested areas and

300 acres or larger in non-forested areas. In the FY 10 analysis, determination of “forest” was based on a composite forest mask, derived from LANDFIRE existing vegetation type (EVT) tree life form (circa 2000) and a USFS Moderate Resolution Imaging Spectroradiometer (MODIS) forest cover data set (circa 2001–2003).

B. Fire Behavior

Crown Fire Potential (CFP)—As in the FY 09 analysis, USFS MODIS-derived (circa 2001–2003) CFP was used. For the FY 10 analysis, “high” CFP received twice the weight of “moderate” CFP, and CFP measurement was constrained to forest cover using the same mask described previously for large fire occurrence.

Surface Fire Potential (SFP)—LANDFIRE Scott and Burgan Fire Behavior Fuel Model (FBFM) 40 data were used for SFP, with moderate and high categories developed and weighted analogously with the CFP approach described previously. Determination of low to high SFP was based on a BehavePlus run of a typical fire day using the FBFM 40. A key improvement for the FY 10 analysis was the availability of calibrated versions of these LANDFIRE data for all CONUS, excluding an area encompassing parts of Illinois, Indiana, Kentucky, Ohio, Tennessee, and West Virginia (for which SME consensus was to proceed with the

uncalibrated data, given the merits of the calibrated FBFM 40 for all other areas).

Insect and Disease—A USFS predictive insect and disease layer (circa 2006) was employed. This layer (applicable to forest cover only) was weighted relatively lower than CFP and SFP to ensure that it alone would not drive fire behavior model results or overwhelm CFP/SFP inputs.

Regional maps of WFP for BIA, BLM, FWS, and NPS are presented in Appendixes 4–7, respectively.

2. Negative Consequences (FEC Weight 0.45)

The Negative Consequences decision model element reflects key potential impacts of wildfire. The element was composed of Wildland Urban Interface, Ecosystem Vulnerability, and Smoke Emissions sub-elements, with inputs as follows:

A. The Wildland Urban Interface (WUI; FEC weight 0.20)—Total area summary was taken from two sources: (1) the Fire Program Analysis (FPA) WUI layer, which is a derivative product of the SILVIS Lab at the University of Wisconsin (circa 2001); and (2) the National Oceanographic and Atmospheric Administration (NOAA) satellite-derived Night Lights data set (circa 2008). The Night Lights data were thresholded to exclude low intensities not correlated with known WUI locations. Supplementation of the SILVIS product

with the thresholded Nights Lights data was intended to make the resulting composite WUI layer a more temporally current representation of the landscape for the FY 10 analysis.

B. Ecosystem Vulnerability (FEC Weight 0.22)—A total area summary of (1) relevant LANDFIRE EVT classes, merged with (2) Succession Class (S-Class) 6 and 7, merged with (3) Fire Regime Condition Class (FRCC) 2 and 3 comprised this sub-element.

C. Smoke Emissions (FEC Weight 0.03)—U.S. Environmental Protection Agency (EPA) data sets for 2.5 micrometer and 10 micrometer particulate matter (PM) non-attainment and maintenance areas (circa 2008) were summarized by total area, with a 30-mile buffer added to account for smoke drift. The inclusion of maintenance areas and PM 10 was a change from the FY 09 analysis, as advised by the NWCG Smoke Committee. Because EPA considers PM 2.5 to have the greater human health impact of the two standards, these areas received twice the weight of PM10 areas. Coincident maintenance and non-attainment areas for *both* PM 2.5 *and* PM 10 received the highest weight of all smoke impact areas.

3. Performance (FEC Weight 0.05)

The Performance decision model element accounted for key outcomes of recent treatment

efforts. For this analysis, it comprised three sub-elements, as follows:

A. Acres Improved or Maintained (FEC Weight 0.01)—Total acres accomplished were taken from the National Fire Plan Operations and Reporting System (NFPORS) for the years FY 06–FY 08.

B. Community Wildfire Protection Plan (CWPP; FEC Weight 0.02)—For the FY 10 analysis, this sub-element consisted of total CWPP and WUI acres treated, taken as a proportion of *total* treatment acres, from NFPORS FY 06–FY 08 data.

Note: WUI data was included in this sub-element owing to inconsistencies among Bureaus' NFPORS CWPP data, and to ensure otherwise analogous areas among Bureaus were comparably analyzed.

C. Biomass Made Available (FEC Weight 0.02)—Total count of pertinent treatments from NFPORS FY 06–FY 08 was used for this sub-element.

Note: Given the timing and deadline for the FY 10 analysis, FY 09 NFPORS performance data were not complete or consistent among Bureaus and were therefore not used. NFPORS data for the FY 10 analysis were pulled on August 27, 2009.

4. Opportunities (FEC Weight 0.19)

The Opportunities decision model element reflects key benefits of near-term planned or potential treatments. It consisted of four sub-elements, as follows:

A. Ecological Maintenance and Restoration (FEC Weight 0.13)—
Proportion of Bureau acres in FRCC 1 and 2, with FRCC 2 receiving twice the weight of FRCC 1 (source: LANDFIRE).

B. Biomass (FEC Weight 0.04)—
Locations of pertinent treatments for FY 10 NFPORS were buffered by 100 miles; total Bureau acreage within this buffer and co-occurring with the LANDFIRE EVT and MODIS composite forest mask (described above for WFP) was used in the analysis.

C. Community Wildfire Protection Plan (CWPP; FEC Weight 0.01)—
Analogous to the CWPP sub-element under Performance, the proportion of planned CWPP and WUI acres out of

total planned treatment acres for FY 10 (NFPORS) was used for this sub-element.

Note: WUI was included in this sub-element owing to inconsistencies among Bureau's NFPORS CWPP data, and to ensure otherwise analogous areas among Bureaus were comparably analyzed.

D. Insect and Disease (FEC Weight 0.01)—Total pertinent DOI area from the 2007 USFS data set (described previously for Fire Behavior input to WFP) was used for this sub-element.

Note: NFPORS data for the FY 10 analysis were pulled on August 27, 2009.

Bar charts showing the contributions of sub-elements to decision model elements for each Bureau are presented in Appendix 3. Similar regional bar charts and other summary graphics for BIA, BLM, FWS, and NPS are presented in Appendixes 4–7, respectively.

DOI FY 10 EMDS Results and Sensitivity Analysis

1. National Results

As described previously, hazardous fuels priorities were modeled in EMDS for the four DOI land management Bureaus. The national, overall EMDS decision score results are shown in Figure 4. The decision scores indicate the proportion of the maximum score possible (given the particular inputs and structure of the FY 10 model). Of the maximum possible, BLM scored 88 percent, BIA 54.5 percent, NPS 31.6 percent, and FWS 8.5 percent.

Figure 4. DOI FY 10 National EMDS Analysis Decision Scores by Bureau

Figure 5 shows the respective contributions of each EMDS model element to each Bureau score.

Figure 5. DOI FY 10 EMDS Analysis Element Contributions to National Decision Scores by Bureau

Given the weights set by the FEC, Negative Consequences and WFP have the greatest influence on the results. Compounding these weights with the use of area summarization throughout Negative Consequences (and in Fire Behavior inputs to WFP) yielded results that reflect land areas managed by the respective Bureaus. The Opportunities element results also reflect the influence of FEC weight and area, but are more evenly matched owing to selective measurement of proportion within the sub-elements. The Performance element received very

little weight from the FEC, and its contribution to NPS results (with relatively modest CWPP and minimal biomass made available) was negligible. FWS had a performance score comparable to BIA, but a negligible contribution from the highly weighted WFP element.

Note: Bar charts found throughout the remainder of this report and in the appendixes may be similarly interpreted in light of FEC model weights as described above for the national results.

Bar charts showing sub-element-level contributions to the national decision model results are presented in Appendix 3.

Sensitivity analysis conducted within EMDS for the national results confirmed the robustness of the model as shown in Table 2.

Table 2. EMDS Sensitivity Analysis for DOI FY 10 National Results

Top-ranked Bureau	Most sensitive criterion	Percent change to replace	Replacing Bureau
BLM	Ecosystem vulnerability	72.3	BIA
BIA	Wildfire potential	29.0	NPS
NPS	Performance	34.0	FWS

Table 2 is interpreted as follows: It would require a 72.3 percent change in the Ecosystem Vulnerability sub-element weight (within the Negative Consequences element) for the results to be altered, in which case BIA would achieve the highest overall EMDS decision score. Similarly, with BLM removed from the analysis, it would require a 29 percent change in the WFP element weight for NPS to achieve a higher overall decision score than BIA. Finally, with BLM and BIA removed from the analysis, it would require a 34 percent change in the Performance element weight for FWS to achieve a higher EMDS decision score than NPS.

Note: Sensitivity analysis tables found throughout the remainder of this report and in Appendix 8 may be similarly interpreted as described previously for the national results.

2. Bureau Results

A. BIA—Overall EMDS decision score results for BIA Regions are shown in Figure 6. The Navajo, Southwest, Western, and Northwest BIA Regions (respectively) scored significantly higher than the remaining Regions.

Figure 6. BIA FY 10 EMDS Analysis Decision Scores by Bureau Region

Figure 7 shows the respective contributions of each EMDS model element to each BIA regional score.

Figure 7. BIA FY 10 EMDS Analysis Element Contributions to Bureau Regional Decision Scores

Further details regarding sub-element-level contributions to the BIA regional results are presented in Appendix 4.

BIA regional sensitivity analysis is shown in Table 3.

Table 3. EMDS Sensitivity Analysis for BIA FY 10 Regional Results

Top-ranked Region	Most sensitive criterion	Percent change to replace	Replacing Region
Navajo	Neg. consequences	9.3	Southwest
Southwest	Performance	12.0	Western
Western	Wildfire potential	15.1	Northwest
Northwest	Wildfire potential	54.5	Rocky Mtn.
Rocky Mtn.	Performance	24.1	Great Plains
Great Plains	Smoke emissions	18.3	Midwest
Midwest	Neg. consequences	7.9	E. Oklahoma
E. Oklahoma	Wildfire potential	10.3	Pacific
Pacific	Opportunities	2.6	S. Plains
S. Plains	Neg. consequences	29.9	Eastern

In this case, it is notable that the difference between Navajo and Southwest is only marginally robust; with a 9.3 percent change in the Negative Consequences element weight required for the Southwest region to achieve the higher decision score. With some exceptions, differentiation of other regions by the model is more robust.

B. BLM— Overall EMDS decision score results for BLM Regions are shown in Figure 8. Nevada scored significantly higher than the remaining Regions, Utah achieved the next highest score, followed closely by California, Oregon, Colorado, and Idaho, with relatively tightly grouped scores.

Figure 8. BLM FY 10 EMDS Analysis Decision Scores by Bureau Region

Figure 9 shows the respective contributions of each EMDS model element to each BLM regional score.

Figure 9. BLM FY 10 EMDS Analysis Element Contributions to Bureau Regional Decision Scores

Further details regarding sub-element-level contributions to the BLM regional results are presented in Appendix 5.

BLM regional sensitivity analysis is shown in Table 4.

Table 4. EMDS Sensitivity Analysis for BLM FY10 Regional Results

Top-ranked Region	Most sensitive criterion	Percent change to replace	Replacing Region
Nevada	Performance	40.1	Oregon
Utah	Wildfire potential	8.4	California
California	Smoke emissions	2.6	Oregon
Oregon	Performance	0.4	Colorado
Colorado	Opportunities	6.3	Idaho
Idaho	Wildfire potential	37.5	Wyoming
Wyoming	Wildfire potential	40.5	New Mexico
New Mexico	Neg. consequences	15.4	Montana
Montana	FRCC 2	4.7	Arizona

In this case, the Nevada result is quite robust. But it is notable that not only are the distinctions between the next several Regions not robust, but also that with Nevada excluded, the *sequence* of regional decision score ranks would be altered by relatively modest weight changes in the elements or sub-elements shown. This suggests that the next several Regions following Nevada in decision scores are of substantially similar priority as measured by the FY 10 EMDS model.

C. FWS—Overall EMDS decision score results for FWS Regions are shown in Figure 10. Region 4 (Southeast) ranks highest; Region 2 (Southwest), second highest; with the remaining Regions forming approximately two other lower score groups.

Note: Region 6 is Mountain-Prairie; Region 1, Pacific Northwest; Region 8, California-Nevada; Region 3, Midwest; Region 5, Northeast. (Region 7—Alaska—was not included in the FY 10 analysis, as discussed previously.)

Figure 10. FWS FY 10 EMDS Analysis Decision Scores by Bureau Region

Figure 11 shows the respective contributions of each EMDS model element to each FWS regional score.

Figure 11. FWS FY 10 EMDS Analysis Element Contributions to Bureau Regional Decision Scores

Further details regarding sub-element-level contributions to the FWS regional results are presented in Appendix 6.

FWS regional sensitivity analysis is shown in Table 5.

Table 5. EMDS Sensitivity Analysis for FWS FY 10 Regional Results

Top-ranked Region	Most sensitive criterion	Percent change to replace	Replacing Region
Region 4	Opportunities	58.2	Region 1
Region 2	Performance	12.3	Region 1
Region 6	Performance	1.9	Region 1
Region 1	Performance	7.4	Region 8
Region 8	Performance	2.9	Region 3
Region 3	Neg. consequences	1.0	Region 5

In this case, the Region 4 result is quite robust. It is notable that if the Opportunities or Performance element weights were changed by the percentages listed (especially considering their relatively low FEC weights), the distinctions between the remaining Regions would be either marginal or not robust.

D. NPS— Overall EMDS decision score results for NPS Regions are shown in Figure 12. The Intermountain and Pacific West Regions (respectively) had substantially high decision scores, with the Southeast Region distinctly below these and distinctly above the remainder in terms of decision scores.

Figure 12. NPS FY 10 EMDS Analysis Decision Scores by Bureau Region

Figure 13 shows the respective contributions of each EMDS model element to each NPS regional score.

Figure 13. NPS FY 10 EMDS Analysis Element Contributions to Bureau Regional Decision Scores

Further details regarding sub-element-level contributions to the NPS regional results are presented in Appendix 7.

NPS regional sensitivity analysis is shown in Table 6 and indicates that the FY 10 model is robust for NPS.

Table 6. EMDS Sensitivity Analysis for NPS FY 10 Regional Results

Top-ranked Region	Most sensitive criterion	Percent change to replace	Replacing Region
Intermountain	Neg. consequences	19.0	Pacific West
Pacific West	WUI	52.7	Southeast
Southeast	Wildfire potential	33.0	Northeast
Midwest	Opportunities	5.1	Northeast
Northeast	Neg. consequences	36.9	National Capital

3. Experimental Nationally Scaled Composite DOI Regional Analysis

In addition to the national and Bureau-level analyses that were tasked, the Team conducted a brief experimental analysis to address comparability of regional units among Bureaus. The background for this exercise along with results and summary comments are provided in Appendix 8.

DOI FY 10 EMDS Analysis Issues and Recommendations

The following issues and recommendations are the result of the FY 10 analysis:

1. Staffing, Schedule, and Scope

Analyst level-of-effort—While the quality of GIS analyst support has been outstanding, the complexity of EMDS analysis and tight schedule constraints limit the capability and flexibility of the Team at current analyst staffing levels. The workload is quite heavy, and the schedule can be placed at unnecessary risk by unexpected occurrences, such as data errors, staff illness, travel problems, and conflict with other duties. Additional staffing of this role beyond a single part-time individual would benefit future analyses. Staffing from more than one agency would also be beneficial.

Continuity of staffing, including leadership, and management—Particularly as EMDS analyses mature to an operational status and/or embrace project management principles, consideration should be given to staffing a permanent Team Lead role. Continuity of other team staff would also be beneficial.

Schedule duration and integration—The FY 11 DOI EMDS Team should begin work in February 2010 to meet a mid-September analysis deadline. This would facilitate technical continuity from preceding analyses while allowing for more rigorous exploration, assessment, and preparation of new or alternative input data sets. It would also allow for advance schedule coordination with NFPORS and other pertinent data management and work planning calendars. Finally, an extended and formal schedule would greatly facilitate SME interaction with Bureau field personnel, NFPORS leads, and more detailed engagement with the Team GIS analyst(s).

Matching scopes of analysis and allocation—The FY 10 analysis was limited to CONUS because of data constraints. Given that adequate data is expected to be available, Alaska should be included in the scope of the FY 11 EMDS analysis, and readiness to include Hawaii and possibly other DOI areas should be revisited.

2. EMDS Data and Model

Modeling effects of Bureau and unit

disparity—Despite emphasis on best available, nationally consistent data, fundamental disparities exist among Bureaus and Regions with respect to size, extent, location, shape, and other attributes that affect, and may produce anomalies in, model results. The FY 11 analysis should investigate methods to mitigate this issue, including revisiting the topic of modeling DOI units at consistent geographic scales, but with explicit consideration of how such results can support allocation decisions consistent with how funds are actually managed in the field (i.e., allocated to actual administrative units). The experimental composite DOI analysis mentioned earlier and described in Appendix 8 may offer useful insights for pertinent data and model refinements. Investigation of project-level EMDS analysis, beyond the existing impetus for such effort, may also partially address this issue.

Logical interactions between (in addition to simply quantifying presence of) appropriate model criteria

Analyses to date have considered such criteria as WFP and Negative Consequences in terms of their aggregate spatial occurrence, but have not considered the relevance of their spatial co-occurrence. For example, a WUI area that also has low fire potential should receive relatively lower priority than one with high fire potential. There are other examples in which spatial co-occurrence among elements and sub-elements could be exploited in the model, and these should be investigated as potential refinements in the FY 11 analysis.

For similar reasons, the FY 11 analysis should also evaluate masking out rock, water, urban, and non-burnable acres from WFP and Negative Consequences.

Persisting national consistency and/or

quality gaps in source data relative to DOI lands—Source data for CFP, Insect and Disease, and for Biomass availability are not optimal representations for DOI lands. In addition, reliance on FRCC data to represent ecological conditions does not fully address all pertinent DOI and Bureau concerns. Alternatives and/or supplemental data should be sought, assessed, and employed as appropriate in the FY 11 analysis, and the Team has begun to explore options and develop recommendations in all these cases.

Continued progress in incorporating fire weather and related data

The solar radiation data set is insufficient by itself for representing fire weather in the model. In addition to seeking a finer resolution data set that could include topographic variation, further development and evaluation of Energy Release Component (ERC) data, and assessment of other inputs such as wind, lightning, and precipitation data should be undertaken. Progress in incorporating weather variables may also facilitate tying climate change effects into EMDS analyses and broadening their application. Similarly, future EMDS analyses might beneficially incorporate new data sets designed for or derived from climate change studies.

The need to assess and address modeling of cooperative efforts and community

assistance—Both inter-Bureau inconsistencies and limits of NFPORS/CWPP-based sub-elements suggest room for improvement in this area. Use of “human caused” fire occurrence data, joint funding data from NFPORS, and data summarization options more resilient to inter-Bureau variations should be considered.

The inclusion of, and approach to, smoke

emissions—Continuing concerns have been expressed within the Team about the smoke emissions sub-element. Aside from technical impacts in the modeling, two fundamental issues are (1) the use of EPA PM2.5 and PM10 data, when wildfire emissions are statutorily exempted in monitoring attainment, and (2) the quality and authority of EPA data sets, given the potential availability of data from the regulatory authority for air quality at the State level. On the other hand, if the EPA data are to be retained, consideration should be given to integrating Class 1 airshed data into the analysis. This sub-element should be revisited by the SMEs, with recommendations and FMC concurrence developed in the FY 11 analysis.

3. Management Considerations

The next two chapters broadly discuss DOI EMDS analyses in the context of a development-to-operations lifecycle and the overall HFPAS

architecture. If future analyses are to trend in the directions contemplated in the next sections, core project management principles should be employed. Among those of most immediate relevance are: firm and stable staffing allocations; clear roles and responsibilities; requirements definition (scope, schedule, and deliverables); documentation and records; configuration and data management; change management; and life-cycle planning and management (including project close-out or continuity processes, as applicable). Many of these underpinnings were more visible and beneficial in the FY 10 analysis than in previous efforts. So the issue is not their complete absence, but rather the critical need to continue building on the FY 10 foundation in the commissioning, implementation, and oversight of future analyses.

From a programmatic standpoint, it is suggested that OWFC and FMC consider and articulate the relationships, synergies, interfaces, and integration envisioned between EMDS and other DOI programs, such as Fire Program Analysis (FPA), Wildland Fire Decision Support System (WFDSS), LANDFIRE, and NFPORS. Potential next steps in the integration of EMDS within the broader HFPAS process are discussed in the next two chapters and are currently under consideration at OWFC.

The Future of DOI EMDS Analysis

1. Ongoing Development and Evolution of DOI EMDS Modeling

"Essentially, all models are wrong, but some are useful."

Dr. George E. P. Box

Professor Emeritus of Statistics, University of Wisconsin

While the DOI EMDS model has been stable for several years at the element level (WFP, Negative Consequences, Performance, and Opportunities), as in every DOI analysis to date there have been substantial changes for FY 10 from the previous FY 09 analysis at the sub-element level and below. A persistent influence in this regard is the significant, ongoing improvement in quality and availability of suitable national data sets. OWFC and FMC have accepted some variation in year-to-year results, in order to allow successive EMDS analyses to capitalize on evolving, best available source data in terms of scientific validity, technical suitability, business rules (in the case of certain NFPORS data), and SME judgment given analysis time constraints. This has enabled pursuit of increased fidelity and usefulness of DOI EMDS models.

A second factor in model evolution derives from improved project organization. Although the FY 10 analysis experienced staffing delays, began later than envisioned, and was afforded less time than optimal, it had more time to acquire and evaluate data sets, incorporate prior lessons learned, discover and correct data processing errors, and run iterative model scenarios (exploring sensitivity) to a degree not possible in previous efforts. The result is a more objective, rigorous analysis; a generally robust model; and strong interagency SME consensus on the scientific and technical merits of the results. Project organization will continue to improve with stable project leadership and continued agency commitment of SMEs.

Finally, a third factor in variation between annual analyses derives from schedule limitations. Analysis deadlines that support annual funding decision-making cycles do not always synchronize ideally with source data management schedules and update cycles. In the most recent cases, the FY 09 EMDS analysis was completed in November 2008 (after NFPORS closeout) and the report delivered in January 2009, whereas the FY 10 analysis concluded as scheduled on September 15, 2009. In addition to science

data improvements that accrued between analyses (e.g., calibration of key LANDFIRE data), differences between the FY 09 and FY 10 analyses owing to NFPORS data status, entry schedules, and business rules were unavoidable.

Vital experience has been gained, and incremental, technically significant progress has been made in successive DOI EMDS analyses over the past several years. As key national data sets near completion, and new sources continue to be explored and developed—and until data sufficient to expand the DOI analysis beyond CONUS become available—it is appropriate that DOI EMDS analyses remain developmental in nature, while tracking toward a goal of routine operational capability and general stability in future models (i.e., with generally consistent elements, sub-elements, and data). In any long-term, cyclical project of this type and scope, a multiyear developmental phase leading to an operations and maintenance (O&M) lifecycle is both common and necessary.

2. Toward Routine Operational Implementation of EMDS

Formal project organization and management principles are hallmarks of an operational program. While DOI EMDS efforts have been relatively small and ad hoc to date, there are many examples both of these attributes and of the development-to-operations lifecycle among contemporary DOI and OWFC programs.

EMDS efforts are exhibiting a similar trend. Some Bureaus will be including EMDS responsibilities within new full-time positions. Project deadlines should be set with data needs considered in advance, and there is strong advocacy for the FY 11 analysis to be scheduled in better synchronization with related DOI activities and relevant management and planning calendars. A project schedule which provides adequate time for source data research and evaluation will also accelerate DOI readiness for routine, stable EMDS operation.

Depending in part on the priority placed by DOI on full EMDS operational capability among other programmatic priorities, and the ability to organize and manage the project accordingly (schedule, staffing, and scope), this point could be reached in 2–3 fiscal years. While recent analyses have required both development and actionable results to be achieved concurrently on an annual basis, the ultimate EMDS O&M concept might entail integration of relatively stable models and/or results into a 3–5 year planning and improvement cycle. In such a concept, data management benefits and technical improvements would be accumulated and tested between rather than during successive analyses, and would be implemented in periodic lifecycle updates of the models. Year-to-year volatility would be removed while facilitating longer-term strategic planning.

Integration of EMDS Results in the DOI HFPAS Process

Paralleling its use at USFS, EMDS has allowed DOI to make great progress in improving coordination and transparency of hazardous fuels allocation decisions consistent with executive branch and congressional direction. Among the advantages of EMDS in this regard are that it rationally and transparently accepts multiple inputs and produces objective, quantitative results at multiple scales. While the process requires SME judgment, modeling decisions are clearly and openly documented, their incremental effects may be iteratively tested and subjected to sensitivity analysis, and objectivity is further enhanced through DOI interagency SME deliberation and consensus.

As the application of EMDS in DOI has matured, interest has grown both in scaling EMDS results in a manner directly proportional to hazardous fuels funding allocations, and in applying this allocation approach to an increasing proportion (or a preponderance) of total DOI hazardous fuels funding. These are good faith inclinations, engendered by the merits of EMDS and its results, and consistent with the direction of higher authority under which these analyses have been and continue to be conducted. Nevertheless, the Team advises against such an unconstrained use of the results. First, considering the development context in which EMDS is employed (described previously), it would be imprudent to allow developmental variations in successive analyses to drive allocation changes directly without constraint. Second, such an approach overlooks not only inherent model and data scale limitations, but also many hazardous fuels allocation considerations that fall outside the scope or capability of the current modeling process.

With respect to inherent limitations, even the best model is merely a best-effort representation of reality—constrained by the availability, accuracy, and consistency of input data. And although EMDS excels for analysis at multiple scales, the DOI Bureaus are in fact substantially disparate entities, with variable spatial attributes, extents, and distributions; administrative characteristics; and missions and business practices. Under these circumstances, the manner in which data are summarized and processed at national and Bureau scales (in this case based on SME best judgment) can have a substantial bearing on how faithfully the model represents reality on the ground. Anomalies in the relationship between a particular analysis unit (e.g., a Bureau Region) and the input data—or cases where presumed consistency across units does not in fact apply—will affect hazardous fuels priorities produced by the model. This should be factored into interpretation of results, and suggests caution regarding direct scaling of current EMDS

model scores to funding allocations. In the longer term, although the EMDS analyses will continue to improve, as models they must and will always remain approximations. This suggests that there will always be an appropriate role for management expertise and discretion in interpreting and applying model results within a broader HFPAS context.

In terms of limitations in modeling scope, the DOI EMDS analyses to date have been fundamentally geospatial in nature, identifying and prioritizing DOI hazardous fuels areas strictly on the basis of biogeophysical landscape variables (e.g., WFP, Ecosystem Vulnerability), policy-related location and proximity considerations (e.g., WUI), and spatially referenced treatment accomplishment, attribute, and planning data (e.g., Performance and Opportunities inputs from NFPORS). Furthermore, limitations in the availability of suitable data have constrained the analysis to a smaller geographic scope (CONUS only) than ultimately desired or relevant for full hazardous fuels allocations. The analyses have not accounted for other considerations—many non-spatial—that may have just as much significance in setting or altering hazardous fuels allocations. Examples include capacity to absorb and implement funding variations (which in turn relate to base funding stability, hazardous fuels staffing and capability impacts and limits, overhead/indirect cost coverage, timeliness in assimilating funding changes and execution of programs of work); capacity for resource flow among units and Bureaus; and variations in treatment complexity, costs, productivity, and cost-effectiveness.

The limitations described previously are among the reasons why, within this report and elsewhere over the course of several analyses, EMDS results have been carefully and consistently characterized not as constituting the basis for allocations, but rather as a HFPAS input. Recent OWFC and FMC protocols for employing EMDS results, while capping maximum resultant funding changes, reflect both a pragmatic sense of the limits of EMDS results and the merits of a broader, multifaceted HFPAS process.

In the short term for HFPAS, it may be both prudent and appropriate to restrict the application of EMDS results to allocation of a defined, discretionary, and evolving portion of hazardous fuels funds (e.g., exclusive of base funding), leaving the balance of the allocation problem to conventional HFPAS decision making. Explicit business rules for such scaling of the funding decision space would increase transparency, and could evolve in parallel with developmental progress made in EMDS. Extending the development-to-operations lifecycle concept to HFPAS, DOI leadership could adaptively manage increasing use of decision support technology (including but not necessarily limited to geospatial EMDS) in the allocation process, balancing the evolving capability of the technology with its limitations. Such an approach could be responsive to continuing direction for improved hazardous fuels allocation processes, without an inferred obligation (for example) to force-fit a greater proportion of the allocation problem than can or should be borne by EMDS geospatial analysis alone.

DOI FY 10 EMDS Team Member Biographies

Gerald Barnes has been a BIA National Management Analyst for the last 3 years (supporting EMDS and FPA), and is a member of the DOI National Southern Burned Area Emergency Response (BAER) team. A former Passamaquoddy Tribe Forest Supervisor (Maine), he has 18 years in wildfire crew and incident management team experience, as well as in GIS (including service as GIS Coordinator for the Penobscot and Passamaquoddy Tribes and the Cerro Grande Fire BAER implementation)—along with 17 years of experience in forest management. Mr. Barnes holds a B.S. degree in Forestry from the University of Maine, Orono.

Krista Gollnick-Waid has been a BLM Fire and Fuels Management Program Lead for the past 11 years, working at the National Interagency Fire Center (NIFC) for the past year after 10 years at the Idaho State Office (Boise). In addition to providing policy and program support to efforts such as FPA, WFDSS, and DOI EMDS-HFPAS, she has represented BLM as a technical expert on several national and regional interagency fire hazard and risk assessments. Since 1999, she has worked as a Long-Term Analyst supporting national Wildland Fire Incident Management Teams, conducting fire behavior analyses. Prior to working for BLM, Ms. Gollnick-Waid was a Fuels Specialist on the Wenatchee and Winema National Forests, starting her career on an Initial Attack Fire Crew in 1984. She holds a Master's Degree from the College of Forestry at Duke University in Environmental Management, and a Master's Degree from the University of Washington in Fire Ecology. She also holds a B.S. degree in Biology with a minor in Economics, from Whitman College in Walla Walla, Washington.

Susan Goodman has been the Fire Management Specialist at the BLM's National Operations Center for the past 17 years. As the Bureau's National Wildland Fire Geospatial Coordinator, she serves as a technical advisor to the WFDSS data group and chairs the BLM State Fire GIS Council. She has also served as the lead analyst for the DOI EMDS-HFPAS team for the past 2 years. Prior to working for BLM, Ms. Goodman was a Fuels Forester on the Plumas National Forest. She holds an M.S. degree in Natural Resources from Humboldt State University; a B.S. degree in Forestry from the University of California, Berkeley; and a Technical Fire Management Certificate from Washington Institute.

Chapter IX

Russell Johnson, currently on detail assignment to the DOI OWFC, has served in diverse project and line management roles at the USGS Center for Earth Resources Observation and Science (EROS) for the past 11 years, including satellite remote sensing projects (such as system development, test, and operations readiness for Landsat 7 and other satellite systems); customer service, applications, and data/information support; and fire science. He led USGS EROS LANDFIRE activities for the final 2 years through charter completion, while also serving as Deputy Chief and Acting Chief of EROS' Fire Science Branch. Mr. Johnson has more than 7 years' experience as a Research Scientist at the Environmental Research Institute of Michigan, specializing in and leading remote sensing and geospatial research; resource monitoring applications; and technology transfer activities. A veteran U.S. Navy line officer, he holds an M.S. degree in Natural Resources and a Master of Public Policy (M.P.P.) degree from the University of Michigan; and a dual B.A. degree in Geology and Natural Resource Studies along with a Certificate in International Relations from the University of Rochester (New York).

Miranda Stuart of NPS is currently Fire Operations Specialist at the National Interagency Prescribed Fire Training Center, Tallahassee, Florida. Prior to this, she began her full-time fire career as Fire Effects Monitor with the Big Thicket National Preserve in Southeast Texas, where she served for 9 years. For the past 8 years Ms. Stuart has contributed to the development of the GIS Specialist for Incident Management (S-341) course, serving as lead and co-instructor in this and many other S-level and Rx-level courses. For the past 2 years, she has been a member of the Southern Area Red Team, and is nearing Division Supervisor and ICT3 qualification. Ms. Stuart holds a B.S. degree in Biology (specializing in Genetics and Endangered Species) from Oregon State University.

Jon Wallace is the Prescribed Fire Specialist for the Arthur R. Marshall Loxahatchee and Florida Keys National Wildlife Refuge complexes in South Florida. He has been with the USFWS for 3 years, following 13 years with the Mississippi Forestry Commission as a Forester and Fire Management Specialist. Mr. Wallace has been a federally qualified firefighter for 23 years and is currently a member of a Type 1 Incident Management Team as a Division Supervisor and Fire Behavior Analyst, and is also a Type 1 Burn Boss. Mr. Wallace is chair of the Southern Region's predictive services group and the DOI Southern Regional WFDSS Coordinator. He holds a B.S. degree in Forest Management from Auburn University.

Appendix 1

Summary of Differences Between FY 09 and FY 10 DOI EMDS Analyses

This appendix describes the differences in the DOI FY 10 EMDS model sub-elements compared to the FY 09 analysis. Figures A1 and A2 below show the respective WFP logic models. Figures A3 and A4 show the changes in overall EMDS model structure. Table A1 describes the changes in data sources and data summarization.

Figure A1. DOI FY 09 WFP Logic Model (from FY 09 report)

DOI FY 10 WFP Logic Model

Figure A2. DOI FY 10 WFP Logic Model

DOI FY 09 Overall EMDS Model

Figure A3. DOI FY 09 Overall EMDS Model

Final DOI FY 10 EMDS Model

Figure A4. DOI FY 10 Overall EMDS Model

Table A1. Data Source and Summarization Differences between DOI FY 09 and FY10 EMDS Analyses

Data Sub-Element or Input	Data Source 2009	Data Source 2010	Data Summarization 2009	Data Summarization 2010	Where used in Model
Bureau Regional Boundaries	Each Agency provided; BLM used Geographic Areas for Regions.	Each Agency provided; BLM used true Regions instead of Geographic Areas.	Total SQ/KM	Total SQ/KM	-Wildfire Potential -Negative Consequences -Performance -Opportunities
Bureau Ownership	National Atlas and BLM land status database	National Atlas and BLM land status database updated and corrected	Total SQ/KM	Total SQ/KM	-Wildfire Potential -Negative Consequences -Opportunities
Solar Radiation	Not Used	National Renewable Energy Laboratory	Not Used	Summarized by proportion. Solar potential values of excellent, very good, and good SQ/KM were counted, and low and moderate values were excluded.	-Wildfire Potential
Fire Starts	Compiled for 1998–2007 from WFMI and USFWS FMIS database; fire types 11–23 and 49; excl. BLM CA type 15 from in 6/08.	Compiled for 1999–2008 from WFMI and USFWS FMIS database, fire types 11–23 and 49.	Total Count	Total Count	-Wildfire Potential
Large Fires	Compiled for 1998–2007 from WFMI and USFWS FMIS database; Fire types 15 and 16 were excluded.	Compiled for 1998–2007 from WFMI and USFWS FMIS database; Fire types 15 and 16 were included.	Large Fires were defined by life form using 2001 NLCD data to determine if a fire occurred in a forest type. Large Fires were defined consistent with NICC reporting for Large Fires: Timber Fires ≥ 100 acres and non-timber fires ≥ 300 acres.	Large Fires were defined by life form using 2000 Landfire EVT data to determine if a fire occurred in a forest type. Large Fires were defined consistent with NICC reporting for Large Fires: Timber Fires ≥ 100 acres and non-timber fires ≥ 300 acres, summarized as proportion of total starts.	-Wildfire Potential

EVT=Existing Vegetation Type
FMIS=Fire Management Information System
NICC= National Interagency Coordination Center

NLCD=National Land Cover Database
WFMI=Wildland Fire Management Information System

Table A1. Data Source and Summarization Differences between DOI FY 09 and FY10 EMDs Analyses (continued)

Data Sub-Element or Input	Data Source 2009	Data Source 2010	Data Summarization 2009	Data Summarization 2010	Where used in Model
Surface Fire Potential	LANDFIRE National (circa 2000) 40 Fire Behavior Fuel Model data (prior to 2009 calibration)	LANDFIRE National 40 Fire Behavior Fuel Model 2009 calibrated data	Summarized by total area (SQ/KM). Holding weather and input parameters constant, BEHAVE was used to rate fuel models as low, moderate, or high. The Hauling chart characteristics for Rate of Spread (ROS) and Flame Length (FL) were used, i.e., FL<=2ft = low, FL<=4ft = moderate, FL>=4ft = high.	Summarized by total area (SQ/KM). Holding weather and input parameters constant, BEHAVE was used to rate fuel models as low, moderate, or high. The Hauling chart characteristics for Rate of Spread (ROS) and Flame Length (FL) were used, i.e., FL<=2ft = low, FL<=4ft = moderate, FL>=4ft = high.	-Wildfire Potential
Crown Fire Potential	MODIS data used. Direct assignment to Cover Type Maps created by MFSL.	MODIS data used. Direct assignment to Cover Type Maps created by MFSL.	Summarized by total area (SQ/KM). Very low and low were rated as 0, moderate as 1, and high and very high as 2.	Summarized by total area (SQ/KM). Very low and low were rated as 0, moderate as 1, and high and very high as 2.	-Wildfire Potential

MFSL=Missoula Fire Sciences Lab

Table A1. Data Source and Summarization Differences between DOI FY 09 and FY10 EMDS Analyses (continued)

Data Sub-Element or Input	Data Source 2009	Data Source 2010	Data Summarization 2009	Data Summarization 2010	Where used in Model
Insect and Disease	USDA FS Rocky Mountain Research Station, National Insect and Disease Risk Map layer from 2005	USDA FS Rocky Mountain Research Station, National Insect and Disease Risk Map layer from 2005	Summarized by total area (SQ/KM). Used total area attributed as "1" = areas at risk of at least 25% mortality of trees >=2 DBH in 15 years.	Summarized by total area (SQ/KM). Used total area attributed as "1" = areas at risk of at least 25% mortality of trees >=2 DBH in 15 years.	-Wildfire Potential -Opportunities
Wildland Urban Interface	Used FPA WUI layer derived from 2000 Census data processed by Silvius Lab, Univ. of Wisconsin, and NE Research Station, USFS.	Used 2008 NOAA Night Lights and FPA WUI layer derived from 2000 Census data processed by Silvius Lab, Univ. of Wisconsin, and NE Research Station, USFS.	Summarized by proportion and total area (SQ/KM). Clipped FPA WUI layer to DOI lands using ownership layer and unmasked agency lands.	Summarized by total area (SQ/KM). Clipped FPA Silvius WUI layer to DOI lands. Used the Summarize Table Tool to calculate area of DOI lands. Used the results of the Silvius clipped layer, which was masked to the NOAA 2008 Night Lights using Extract by Mask to get the overlapping areas with the Night Lights data. The third step used the Night Lights data in the Tabulate Area under Zonal tab of Spatial Analyst Tools along with the land status layer to calculate area. The overlapping areas were then subtracted from the clipped FPA layer and the Night Lights data. The overlap area plus the non-overlapping FPA Silvius plus the non-overlapping Night Lights were calculated in MS Excel table for total area.	-Negative Consequences

DOI=Department of the Interior

FPA=Fire Program Analysis

NOAA=National Oceanic and Atmospheric Administration

WUI=Wildland Urban Interface

Table A1. Data Source and Summarization Differences between DOI FY 09 and FY10 EMDS Analyses (continued)

Data Sub-Element or Input	Data Source 2009	Data Source 2010	Data Summarization 2009	Data Summarization 2010	Where used in Model
Ecosystem Vulnerability	LANDFIRE national (circa 2000) FRCC, EVT, and S-Class layers	LANDFIRE national (circa 2000) FRCC, EVT, and S-Class layers	Summarized by proportion and total area (SQ/KM). FRCC 2 and 3, EVT's introduced vegetation types, and S-Class uncharacteristic exotic and native uncharacteristic. Layers were summarized separately.	Summarized by Area (SQ/KM). From S-Class used values 6 and 7. From EVT, used values 2180, 2181, 2182, 2183, 2185, 2186, 2187, 2536, 2538. From FRCC used values 2 and 3. These subsets were then merged to make up the EVT.	-Negative Consequences
Smoke Emissions	2008 EPA PM2.5 layer of partial and full non-attainment counties	2008 EPA PM2.5 and PM10 layers of maintenance, partial and full non-attainment counties	Summarized by proportion and area (SQ/KM).	<p>Summarized by Area (SQ/KM). Merged EPA PM2.5 non-attainment counties with EPA PM2.5 maintenance counties. Merged layer was buffered 30 miles to account for drifting smoke. Layer was then generalized.</p> <p>Merged EPA PM10 non-attainment counties with EPA PM10 maintenance counties. Merged layer was buffered 30 miles to account for drifting smoke. Layer was then generalized.</p> <p>Generalized 30-mile buffered PM2.5 layer and 30-mile PM10 layer were clipped to each other to create the overlap layer.</p> <p>The overlap areas were then erased from both the generalized 30-mile buffered PM2.5 layer and 30-mile PM10 layer to ensure there was no double counting of area.</p>	-Negative Consequences

EPA=Environmental Protection Agency
FRCC=Fire Regime Condition Class
S-Class=Successional Class

Table A1. Data Source and Summarization Differences between DOI FY 09 and FY10 EMDS Analyses (continued)

Data Sub-Element or Input	Data Source 2009	Data Source 2010	Data Summarization 2009	Data Summarization 2010	Where used in Model
Smoke Emissions	2008 EPA PM2.5 layer of partial and full non-attainment counties	2008 EPA PM2.5 and PM10 layers of maintenance, partial and full non-attainment counties	Summarized by proportion and area (SQ/KM).	<p>Summarized by area (SQ/KM). Merged EPA PM2.5 non-attainment counties with EPA PM2.5 maintenance counties. Merged layer was buffered 30 miles to account for drifting smoke. Layer was then generalized.</p> <p>Merged EPA PM10 non-attainment counties with EPA PM10 maintenance counties. Merged layer was buffered 30 miles to account for drifting smoke. Layer was then generalized.</p> <p>Generalized 30-mile buffered PM2.5 layer and 30-mile PM10 layer were clipped to each other to create the overlap layer.</p> <p>The overlap areas were then erased from both the generalized 30-mile buffered PM2.5 layer and 30-mile PM10 layer to ensure there was no double counting of area.</p>	-Negative Consequences
Total Acres Improved or Maintained	2006–2008 NFORS data	NFORS 2006–2008 treatment acres accomplished used, both WUI and non-WUI acres.	Accomplished acres that "moved toward desired condition" or "maintained desired condition" were summarized by proportion and total acres.	Summarized by total acres accomplished.	-Performance
CWPP Performance	NFORS 2006–2008 treatments accomplished with CWPP or equivalent.	NFORS 2006–2008 treatments accomplished with CWPP or equivalent and WUI acres accomplished.	Summarized by total acres accomplished with CWPP or equivalent and proportion of total acres with CWPP or equivalent divided by total acres treated.	Summarized by proportion.	-Performance

CWPP=Community Wildfire Protection Plan

NFORS=National Fire Plan Operations and Reporting System

Table A1. Data Source and Summarization Differences between DOI FY 09 and FY10 EMDS Analyses (continued)

Data Sub-Element or Input	Data Source 2009	Data Source 2010	Data Summarization 2009	Data Summarization 2010	Where used in Model
Biomass Performance	NFPORS 2006–2008 treatments accomplished with biomass made available.	NFPORS 2006–2008 treatments accomplished with biomass made available and acres accomplished that indicated green tons or MBF.	Summarized by total acres where biomass was made available.	Count of treatments where biomass was made available or with green tons or MBF made available.	-Performance
Maintenance and Restoration Acres	NFPORS 2009 “approved” data	LANDFIRE national FRCC (circa 2000)	Summarized by area and proportion. Used treatment unit acres total in FRCC 1 and 2.	Summarized by proportion. Used Extract by Attribute to create subset of the data containing only FRCC 1 and 2. FRCC 1 total area (SQ/KM) divided by total agency area was given half the weight of FRCC 2 total area (SQ/KM) divided by total agency area.	-Opportunities
CWPP Opportunities	NFPORS 2009 “approved” data	NFPORS 2010 “approved and unapproved” data	Summarized by area and proportion. Used total acres with CWPP or equivalent for area and total CWPP or equivalent acres, divided by total treatment acres planned for proportion.	Used total CWPP or equivalent acres divided by total treatment acres planned.	-Opportunities
Biomass Opportunities	NFPORS 2009 “approved” data	NFPORS 2010 “approved and unapproved” data and LANDFIRE EVT	Summarized by area and proportion. Used total acres with biomass and total biomass acres, divided by total treatment acres planned for proportion.	FY 2010 NFPORS data was imported and treatment lat/longs with “biomass available” were exported. This subset was then split up by bureau, and then each of the bureau layer biomass points were buffered by 100 miles. The bureau buffered layers were dissolved and then clipped to the bureau’s land status.	-Opportunities

Appendix 2

DOI FY10 EMDS Metadata Summary Table

Element	Sub-element	Component	Description	Source	Processing Step	Summary Unit
Wildland Fire Potential	Fire Behavior	Crown Fire Potential	Differentiates vegetation type of crown fire potential based mostly on heat intensity, spotting, and difficulty to control. The crown fire potential was masked to forested areas.	A MODIS product created by the MFSL, Rocky Mountain Research Station, USFS. Forest mask was a merge layer between the MODIS Forest layer Jim Menakis provided and the LANDFIRE EVT layers categorized as tree-dominated. DOI land status layer	Used the FY 2008 crown fire potential processed by Jim Menakis, MFSL. Very low and low were rated as 0, moderate as 1, and high and very high as 2. Used Extract by Mask under Extraction tab of Spatial Analyst Tools to create a subset of the crown fire potential in forested only areas. Used the Tabulate Area under Zonal tab of Spatial Analyst Tools on the subset of the data along with the land status layer to calculate area.	Summarized by the area (SQ/KM).
Wildland Fire Potential	Fire Behavior	Surface Fire Potential	Differentiates surface fire potential off of the hauling charts using BEHAVE Plus.	Recalibrated LANDFIRE National FBFM 40 was source data for the surface fire potential element. DOI land status layer	BEHAVE Plus was used to calculate moderate and high surface fire potential. Each of the 40 fuel models was given a rating of 0 for low, 1 for moderate, and 2 for high, based off of the Hauling charts. Used the Tabulate Area under Zonal tab of Spatial Analyst Tools along with the land status layer to calculate area.	Summarized by the area (SQ/KM).

EVT=Existing Vegetation Type
MFSL=Missoula Fire Sciences Lab

DOI FY10 EMDS Metadata Summary Table (continued)

Element	Sub-element	Component	Description	Source	Processing Step	Summary Unit
Wildland Fire Potential	Fire Behavior	Insect and Disease	The threshold for mapping Insect and Disease risk is: "the expectation that, without remediation, 25 percent or more of the standing live basal area (BA) of trees greater than 1 inch in diameter will die over the next 15 years (starting in 2005) due to insects and diseases."	2006 National Insect and Disease Risk Map http://www.fs.fed.us/foresthealth/technology/nidrm.shtml DOI land status layer	Used only Value = 1 which represents those forested areas that meet the definition of the risk of mortality over the 15-year period (starting in 2005). Used the Tabulate Area under Zonal tab of Spatial Analyst Tools along with the land status layer to calculate area.	Summarized by the area (SQ/KM).
Wildland Fire Potential	Probability	Solar Radiation	Monthly and annual average solar resource potential for 48 contiguous United States	National Renewable Energy Laboratory and other universities for the U.S. Department of Energy DOI land status layer	Used solar potential values of excellent, very good, and good. SQ/KM were counted, and low and moderate values were excluded. Used the Identity Tool under the Overlay tab of the Analysis Tool. Used the Summarize Table Tool to calculate area. In the Summarize Table Tool, added a column for region total SQ/ KM and proportion of solar potential area.	Summarized by Proportion.

FY10 EMDS Metadata Summary Table (continued)

Element	Sub-element	Component	Description	Source	Processing Step	Summary Unit
Wildland Fire Potential	Probability	Fire Starts	Number of fire starts 1/10 th acre or larger	Data was compiled for 1999–2008 from WFMI for BIA, BLM, and NPS. The above data was merged with FWS, which is from the FMIS into a spatial geo-database.	Summarized the number of fires for Fire Type 11–23 and 49.	Number of Fires
Wildland Fire Potential	Probability	Large Fires	Proportion of starts that became larger fires	The Fire Starts geo-database was used.	Large Fires were defined by life form and consistent with NICC reporting for Large Fires: timber ≥ 100 acres are considered Large Fire; all other fires ≥ 300 acres are considered Large Fire. For consistency purposes, the same Forest Mask was used as mentioned under Crown Fire Potential.	Summarized by Large Fire proportion of Fire Starts.
Negative Consequences	Wildland Urban Interface		WUI that overlaps DOI bureau lands	Used the Silvius Lab, Univ. of Wisconsin and NE Research Station WUI layer combined with NOAA 2008 Night Lights DOI land status layer	Clipped FPA Silvius WUI layer to DOI lands. Used the Summarize Table Tool to calculate area of DOI lands. Used the results of the Silvius clipped layer that was masked to the NOAA 2008 Night Lights using Extract by Mask to get the overlapping areas with the Night Lights data. The third step used the Night Lights data in the Tabulate Area under Zonal tab of Spatial Analyst Tools along with the land status layer to calculate area. The overlapping areas were then subtracted from the clipped FPA layer and the Night Lights data. The overlap area plus the non-overlapping FPA Silvius plus the non-overlapping Night Lights were calculated in MS Excel table for total area.	Summarized by the area (SQ/KM).

WIS=Fire Management Information System
ICC=National Interagency Coordination Center

WFMI=Wildland Fire Management Information System
WUI=Wildland Urban Interface

Element	Sub-element	Component	Description	Source	Processing Step	Summary Unit
Negative Consequences	Ecosystem Vulnerability		Merged layer of LANDFIRE National EVT's introduced vegetation with LANDFIRE National S-Class and LANDFIRE National FRCC 2 and 3.	LANDFIRE National EVT raster layer LANDFIRE National S-Class raster layer LANDFIRE National FRCC raster layer DOI land status layer	From S-Class used values 6 and 7. From EVT, used values 2180, 2181, 2182, 2183, 2185, 2186, 2187, 2536, 2538. From FRCC used values 2 and 3. Subsets of above data sets were created by using Extract by Attribute under Extraction in the Spatial Analyst Tools set. These subsets were then merged to make up the EVT. Used the Tabulate Area under Zonal tab of Spatial Analyst Tools on the subset of the data along with the land status layer to calculate area.	Summarized by the area (SQ/KM).
Negative Consequences	Smoke Emissions		Three layers were used: 1. Buffered 30-mile merged PM2.5 non-attainment counties with PM2.5 maintenance areas excluding overlap areas with PM 10. 2. Buffered 30-mile PM10 non-attainment counties with PM 10 excluding overlap areas with PM 2.5. 3. Overlap buffered areas for PM 10 and PM 2.5.	EPA PM2.5 non-attainment counties EPA PM2.5 maintenance counties EPA PM10 non-attainment counties EPA PM10 maintenance counties DOI land status layer	Merged EPA PM2.5 non-attainment counties with EPA PM2.5 maintenance counties. Merged layer was buffered 30 miles to account for drifting smoke. Layer was then generalized. Merged EPA PM10 non-attainment counties with EPA PM10 maintenance counties. Merged layer was buffered 30 miles to account for drifting smoke. Layer was then generalized. Generalized 30-mile buffered PM2.5 layer and 30-mile PM10 layer were clipped to each other to create the overlap layer. The overlap areas were then erased from both the generalized 30-mile buffered PM2.5 layer and 30-mile PM10 layer to ensure there was no double counting of area. The land status layer was then clipped to the three layers, and then the Summarize Table Tool to calculate area was used.	Summarized by the area (SQ/KM).

DOI=Department of the Interior
FRCC=Fire Regime Condition Class

S-Class=Successional Class

Element	Sub-element	Component	Description	Source	Processing Step	Summary Unit
Performance	WUI/CWPP		Calculated the proportion the FY 2006–2008 WUI acres or CWPP acres treated, divided by the total acres treated. All CWPP acres were considered, regardless of being in WUI or not.	NFPORS downloaded on October 12, 2008. Note: new data was not downloaded, as this data is locked each year and does not change once it has been locked down.	<p>FY 2006–2008 NFPORS data was imported into MS Access. The NFPORS MS Access database was then converted to an ArcGIS file geo-database so that the data could easily be summarized using some of the ArcGIS summarization tools. Data was summarized by region and not spatially.</p> <p>The following query was used to calculate the numerator of the proportion: ("FY" = '2006' or "FY" = '2007' or "FY" = '2008') and ("ACT_ACRES" > 0) and ("CAT_NM" = 'Fire' OR "CAT_NM" = 'Mechanical' OR "CAT_NM" = 'Other') and ("CWPP" = 'CWPP' OR "CWPP" = 'CWPP equivalent' OR "IS_WUI" = 'Y') and ("KP_AREA" = 3 AND ("TYPE_NAME" <> 'Fire Use' AND "TYPE_NAME" <> 'Preparation')).</p> <p>The following query was used to calculate the denominator of the proportion: ("FY" = '2006' or "FY" = '2007' or "FY" = '2008') AND "KP_AREA" = 3 and "ACT_ACRES" > 0 and ("CAT_NM" = 'Fire' or "CAT_NM" = 'Mechanical' or "CAT_NM" = 'Other') AND ("TYPE_NAME" <> 'Fire Use' AND "TYPE_NAME" <> 'Preparation').</p>	Summarized by Proportion.

CWPP=Community Wildfire Protection Plan

NFPORS=National Fire Plan Operations and Reporting System

Element	Sub-element	Component	Description	Source	Processing Step	Summary Unit
Performance	Biomass		Number of FY 2006–2008 treatment that had biomass utilized.	NFPORS downloaded on October 12, 2008.	<p>The following query was executed to summarize the count of biomass utilized treatments:</p> <p>("FY" = '2006' or "FY" = '2007' or "FY" = '2008') and ("ACT_ACRES" > 0 and "CAT_NM" = 'Mechanical') and ("BIO_UTILZ" = 'Y' OR BIO_TONS >= 0 OR BIO_BOARDF >= 0) and "KP_AREA" = 3 AND "TYPE_NAME" <> 'Seeding' and "TYPE_NAME" <> 'Preparation' and "TYPE_NAME" <> 'Fire Use').</p>	Count of Biomass Utilized Treatments
Performance	Total Acres Improved or Maintained		Total accomplished acres of hazardous fuels treatments for FY 2006–2008.	NFPORS downloaded on October 12, 2008.	<p>The following query was executed to summarize the total accomplished acres of hazardous fuels treatments:</p> <p>("FY" = '2006' or "FY" = '2007' or "FY" = '2008') AND "KP_AREA" = 3 and "ACT_ACRES" > 0 and ("CAT_NM" = 'Fire' or "CAT_NM" = 'Mechanical' or "CAT_NM" = 'Other') AND ("TYPE_NAME" <> 'Fire Use' AND "TYPE_NAME" <> 'Preparation').</p>	Summarized by the area (acres).

~OI FY10 EMDS Metadata Summary Table (continued)

Element	Sub-element	Component	Description	Source	Processing Step	Summary Unit
Opportunity	Biomass Opportunity		Area of Biomass Opportunities based off the location of NFPORS FY 2010 planned treatments, stating that biomass is available. These treatments were then buffered by 100 miles.	NFPORS 2010 Planned Data – downloaded August 25, 2009. Forest Mask (EVT and MODIS composite described above) Land status	FY 2010 NFPORS data was imported into MS Access. The NFPORS MS Access database was then converted to an ArcGIS file geo-database so that the data could be easily summarized using some of the ArcGIS summarization tools. Data was summarized by region and not spatially. The following query was used to generate a biomass subset of the data: "FY" = '2010' and "KP_AREA" = 3 and "CAT_NM" = 'Mechanical' AND "TYPE_NAME" <> 'Seeding' and "TYPE_NAME" <> 'Preparation' and "TYPE_NAME" <> 'Fire Use' AND "FND_CND_NM" <> 'ARRA'. This subset was then split up by the bureau, and then each of the bureau layer biomass points was buffered by 100 miles. The bureau-buffered layers were dissolved and then clipped to the bureau's land status. Used the Tabulate Area under Zonal tab of Spatial Analyst Tools on the subset of land status/biomass layer with Forest Mask to calculate area of biomass opportunities.	Summarized by the area (SQ/KM).

Element	Sub-element	Component	Description	Source	Processing Step	Summary Unit
Opportunity	Ecosystem Restoration and Maintenance		Proportion of bureau acres in FRCC 1 and 2, with FRCC 2 receiving twice the weight of FRCC 1	LANDFIRE National FRCC layer DOI land status layer	Used Extract by Attribute to create subset of the data containing only FRCC 1 and 2. For the numerator of the proportion: Used the Tabulate Area under Zonal tab of Spatial Analyst Tools on land status layer with FRCC. For the denominator, used total bureau area by region.	Summarized by Proportion.
Opportunity	Insect and Disease		The threshold for mapping Insect and Disease risk is: "the expectation that, without remediation, 25 percent or more of the standing live basal area (BA) of trees greater than 1 inch in diameter will die over the next 15 years (starting in 2005) due to insects and diseases."	2006 National Insect and Disease Risk Map http://www.fs.fed.us/foresthealth/technology/nidrm.shtml DOI land status layer	Used only Value = 1 which represents those forested areas that meet the definition of the risk of mortality over the 15-year period (starting in 2005). Used the Tabulate Area under Zonal tab of Spatial Analyst Tools along with the land status layer to calculate area.	Summarized by the area (SQ/KM).

Element	Sub-element	Component	Description	Source	Processing Step	Summary Unit
Opportunity	CWPP/WUI Opportunities		Calculated the proportion the FY 2010 WUI acres or CWPP acres treated, divided by the total acres treated. All CWPP acres were considered, regardless of being in WUI or not.	NFPORS downloaded on August 25, 2009. Note: new data was not downloaded, as this data is locked each year and does not change once it has been locked down.	<p>FY 2010 NFPORS data was imported into MS Access. The NFPORS MS Access database was then converted to an ArcGIS file geo-database so that the data could be easily summarized using some of the ArcGIS summarization tools. Data was summarized by region and not spatially.</p> <p>The following query was used to calculate the numerator of the proportion: ("FY" = '2010') AND "KP_AREA" = 3 AND ("CAT_NM" = 'Fire' OR "CAT_NM" = 'Mechanical' OR "CAT_NM" = 'Other') AND ("TYPE_NAME" <> 'Fire Use' AND "TYPE_NAME" <> 'Preparation') AND ("CWPP" = 'CWPP' OR "CWPP" = 'CWPP equivalent' OR "IS_WUI" = 'Y' AND "FND_CND_NM" <> 'ARRA').</p> <p>The following query was used to calculate the denominator of the proportion: ("FY" = '2010') AND "KP_AREA" = 3 AND ("CAT_NM" = 'Fire' OR "CAT_NM" = 'Mechanical' OR "CAT_NM" = 'Other') AND ("TYPE_NAME" <> 'Fire Use' OR "TYPE_NAME" <> 'Preparation' AND "FND_CND_NM" <> 'ARRA').</p>	Summarized by Proportion.

Appendix 3

DOI FY10 EMDS Decision Model Sub-Element Contributions

Bureau-level bar charts showing sub-element contributions to DOI FY10 EMDS decision model elements are provided below:

Contributions to Negative Consequences from Level:Level 3

Contributions to Performance from Level:Level 3

Contributions to Opportunities from Level:Level 3

Appendix 4

BIA FY 10 EMDS Regional Analysis Detail Graphics

BIA WFP

Legend

Red=Very High
Pink=High
Orange=Moderate
Lt. Blue=Low
Dk. Blue=Very Low

BIA Fire Probability

BIA Fire Behavior

BIA Solar Radiation

BIA Fire Starts

BIA Large Fires

BIA Insect and Disease

BIA Crown Fire

BIA Surface Fire

BIA Moderate Crown Fire

BIA High Crown Fire

BIA Moderate Surface Fire

BIA High Surface Fire

BIA 2010 CDP Model

Contributions to Negative Consequences from Level:Level 3

BIA 2010 CDP Model

Contributions to Performance from Level:Level 3

BIA 2010 CDP Model

Contributions to Opportunities from Level:Level 3

Appendix 5

BLM FY 10 EMDS Regional Analysis Detail Graphics

BLM WFP

Legend

Red=Very High
Pink=High
Orange=Moderate
Lt. Blue=Low
Dk. Blue=Very Low

BLM Fire Probability

BLM Fire Behavior

BLM Solar Radiation

BLM Fire Starts

BLM Large Fires

BLM Insect and Disease

BLM Crown Fire

BLM Surface Fire

BLM Moderate Crown Fire

BLM High Crown Fire

BLM Moderate Surface Fire

BLM High Surface Fire

BLM 2010 CDP Model

Contributions to Negative Consequences from Level:Level 3

BLM 2010 CDP Model

Contributions to Performance from Level:Level 3

BLM 2010 CDP Model

Contributions to Opportunities from Level:Level 3

Appendix 6

FWS FY 10 EMDS Regional Analysis Detail Graphics

FWS WFP

Legend

Red=Very High
Pink=High
Orange=Moderate
Lt. Blue=Low
Dk. Blue=Very Low

FWS Fire Probability

FWS Fire Behavior

FWS Solar Radiation

FWS Fire Starts

FWS Large Fires

FWS Insect and Disease

FWS Crown Fire

FWS Surface Fire

FWS Moderate Crown Fire

FWS High Crown Fire

FWS Moderate Surface Fire

FWS High Surface Fire

FWS 2010 CDP Model

Contributions to Negative Consequences from Level:Level 3

FWS 2010 CDP Model

Contributions to Performance from Level:Level 3

FWS 2010 CDP Model

Contributions to Opportunities from Level:Level 3

Appendix 7

NPS FY 10 EMDS Regional Analysis Detail Graphics

Contributions to Wildland Fire Potential from Level:Level 2

NPS WFP

Legend

Red=Very High
Pink=High
Orange=Moderate
Lt. Blue=Low
Dk. Blue=Very Low

NPS Fire Probability

NPS Fire Behavior

NPS Solar Radiation

NPS Fire Starts

NPS Large Fires

NPS Moderate Crown Fire

NPS High Crown Fire

NPS Moderate Surface Fire

NPS High Surface Fire

NPS 2010 CDP Model

Contributions to Negative Consequences from Level:Level 3

NPS Negative Consequences

NPS Wildland Urban Interface

NPS Ecosystem Vulnerability

NPS 2010 CDP Model

Contributions to Performance from Level:Level 3

NPS 2010 CDP Model

Contributions to Opportunities from Level:Level 3

Appendix 8

Experimental Nationally Scaled Composite DOI Regional Analysis

The Team was made aware of FMC interest in a means to assess the degree to which Bureaus would make comparable categorical priority determinations (e.g. very high, high, moderate) among their Regions, in their respective allocation processes. Evidently, this had been done previously by assembling a table sorted by decision scores for all Bureau regional units to serve as a reference. The problem with such a table is that Regions are not comparable among Bureaus because analysis and decision scores for each are based on separate Bureau-specific data ranges and scales.

For CONUS, all Regions for the four Bureaus constitute a total of 34 regional units. In a brief, experimental effort to provide a more suitable reference for comparison of Regions among Bureaus, the Team rescaled the data ranges to encompass all 34 units and ran an analysis using the FY 10 EMDS model as built. The resulting decision scores could now be directly compared based on a consistent model. But some anomalies were also encountered, with certain units achieving counterintuitively high decision scores. Brief further investigation suggested these anomalies resulted from the interplay between

national rescaling of data, major disparities in the geographic and geospatial attributes of regional units among Bureaus, and some regional units exhibiting fundamental divergence from the norm in certain input data sets and sub-elements.

The resulting decision score bar chart and a sensitivity analysis table for the first 20 units follow. The bar chart is color-coded for illustrative purposes, based on manual interpretation and grouping of decision scores.

It should be emphasized that given time constraints, the existing FY 10 model was used for expediency in this experiment. A ground up approach to such an analysis, had it been tasked, would have led to different recommendations and approaches to data summarization and model structure. Nevertheless, this exercise provided insight into some potential issues with DOI modeling in general, along with some prospective improvements, especially with regard to disparities among DOI units (discussed in Chapter VI, subsection 2). As such, it will serve as a point of departure for considering certain refinements in the FY 11 analysis.

Top-ranked Region	Most sensitive criterion	Percent change to replace	Replacing Region
BLM Nevada	Performance	32.8	BLM Oregon
BIA Navajo	Negative consequences	1.6	BLM Utah
BLM Utah	Smoke emissions	10.3	BLM California
BLM California	Smoke emissions	9.5	BLM Oregon
BLM Oregon	Performance	4.0	BLM Idaho
BLM Idaho	Opportunities	13.3	BLM Colorado
BIA Southwest	Performance	1.3	BLM Colorado
BLM Colorado	Opportunities	13.4	BIA Northwest
BIA Northwest	Wildfire potential	16.1	NPS Intermountain
BIA Western	Performance	4.9	NPS Intermountain
NPS Intermountain	Wildfire potential	5.9	BLM Wyoming
BLM Wyoming	Wildfire potential	2.8	NPS Pacific West
NPS Pacific West	Wildfire potential	11.4	BLM New Mexico
BLM New Mexico	Performance	9.6	FWS Region 4
BLM Montana	Opportunities	0.7	FWS Region 4
BIA Rocky Mtn.	Opportunities	0.4	FWS Region 4
BLM Arizona	Performance	0.1	FWS Region 4
FWS Region 4	Opportunities	3.3	BIA Great Plains
BIA Great Plains	Wildfire potential	11.9	NPS Southeast
NPS Southeast	Wildfire potential	4.2	BIA Midwest

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