Wildfire Suppression Expenditures for USDA Forest Service: May 2012 Forecasts of Monthly Expenditures for the Remainder of Fiscal Year 2012

Report Date: June 20, 2012

Executive Summary

As of April 30, 2012, the USDA Forest Service had spent $108m on wildfire suppression. This is below the average for the last 9 years. We forecast that expenditures for fiscal year (FY) 2012, with 80% confidence, will be between $729m and $1.091b in FY 2012. The median forecast for the USDA Forest Service is $910m, which is below the budgeted amount of $948m, and is below average for the last 9 years. This is the first monthly forecast issued for FY 2012. Figure 1 shows the May forecast for each remaining month of FY 2012, as well as the 80% confidence band, the wildland fire suppression FY 2012 budget, and the May 2012 annual forecast.

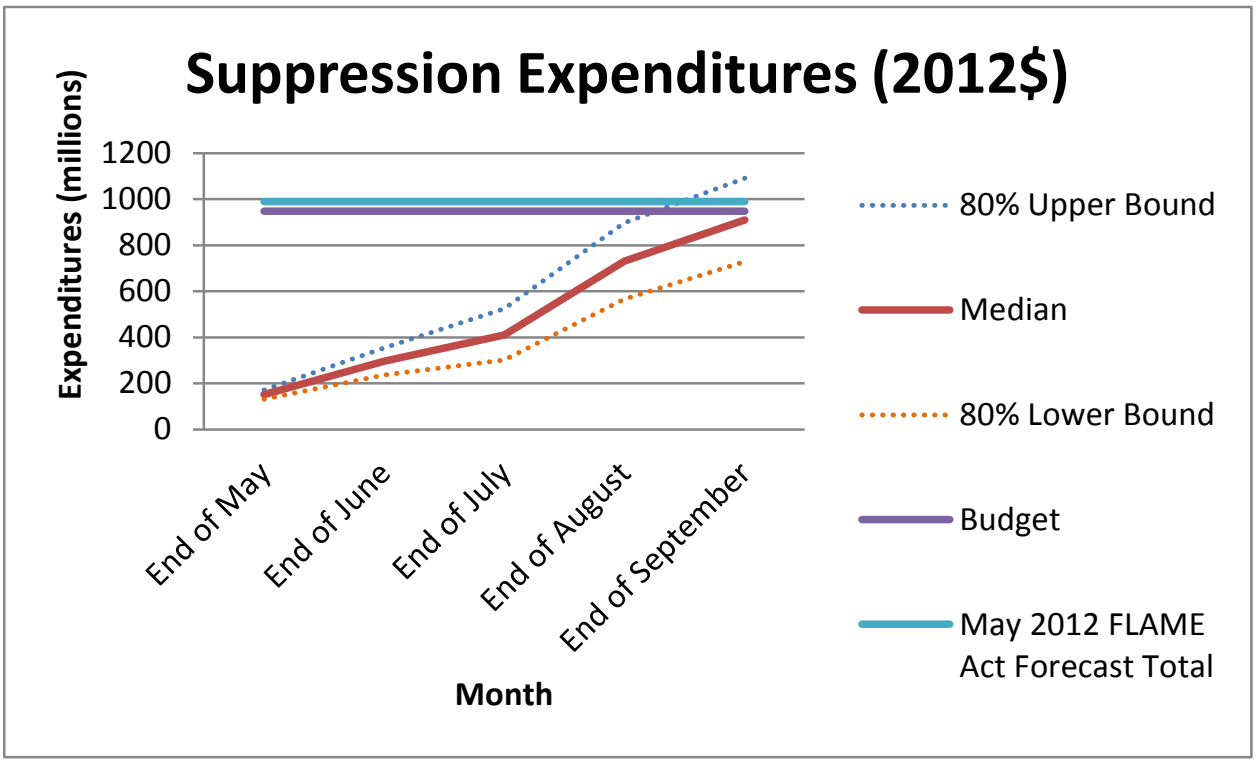

Figure 1. Forecasted median value of USDA Forest Service suppression expenditures by month with 80% confidence intervals compared with FY 2012 budgeted amount and May 2012 annual forecast. (Note: Includes spending to date at the end of April and wildland fire suppression cost pool spending monthly).

May Forecast of Monthly Wildfire Suppression Expenditures

FY 2012 suppression expenditures are forecast to range, with 80% confidence, between $729m and $1.091b. The median forecast is $910m. These costs include $47m in estimated wildland fire suppression cost pool contributions[1], an estimated $81m spent to date[2], and an estimated $80m in presuppression costs[3] (Figure 1 and Table 1). Figure 1 shows the forecasted wildfire suppression expenditures by month (with 80% confidence intervals) for FY 2012 compared to the FY 2012 wildland fire suppression budget[4] and May's annual forecast amount[5]. Table 1 shows these same data in tabular format, and includes the confidence levels of 90% and 95% by month and in total.

Uncertainty in the forecasts is represented by the forecast probability density (Figures 2 and 3) and the not-to-exceed levels at a range of probabilities (Table 2). Figure 2 shows the probability density for the sum of the monthly forecasts, the estimated wildland fire suppression cost cool contribution, plus spending to date. Figures 3a-3e shows the probability density for cumulative costs for each of the months individually. As expected, as the date of the forecasted expenditures is further out, the confidence interval increases, as shown in figures 1-3. As Table 2 shows, this model forecasts a 1% chance that USDA Forest Service suppression expenditures, including the cost pool, will fall below $578m. In contrast, there is a 70% chance that these expenditures will fall below $986m.

An analysis of historical real dollar expenditures in suppression contains information about the likely financial magnitude of spending for FY 2012 (Table 3), by month, and in total. Note that cost pool spending is not included in the analysis for this table. When compared to expenditures since 2003, May and June are expected to have expenditures in the upper tercile in 2012. July and August expenditures in the middle tercile, and September expenditures in the lower tercile. When compared with spending since 2003, total costs for the year are forecast to be in the middle tercile in 2012.

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[1] Lichtenstein, Mark, Branch Chief, Budget and Planning, Fire and Aviation Management, USDA Forest Service. Emails dated August 25, 2011 and May 22, 2012 and on file with the Southern Research Station, 3041 Cornwallis Rd, Research Triangle Park, NC. The cost pools are drawn at the end of every month, except for October which is drawn at the end of November.

[2] Lichtenstein, Mark, Branch Chief, Budget and Planning, Fire and Aviation Management, USDA Forest Service. Email dated May 29, 2012 and on file with the Southern Research Station, 3041 Cornwallis Rd, Research Triangle Park, NC.

[3] The data used for the monthly forecasts includes the total costs to category NIFC WF (1302) rather than half the value that is included in the data for the annual forecasts.

[4] Personal communication, Mark Lichtenstein, Branch Chief, Budget and Planning, Fire and Aviation Management, USDA Forest Service.

[5] Prestemon, J.P and others. 2012. Federal Land Assistance, Management and Enhancement (FLAME) Act Suppression Expenditures for Interior and Agriculture Agencies: May 2012 Forecasts for Fiscal Year 2012. http://fsweb.rtp.srs.fs.fed.us/local/fire/May 2012 FLAME Act Forecast Final 5/22/12(Post-Review).pdf [Date accessed: May 31, 2012].

The forecast evaluation is shown in Table 4. The root mean squared error of the model used in this forecast of FY 2012 expenditures, when applied to the 2004-2011 period, was $191m and had a 2.5% positive bias, tending to under-forecast by about $24m. This bias was not used to adjust the May 2012 forecast for FY 2012. The model had a mean absolute percent error of about 17.2%, meaning that the typical forecast averaged 17.2% above or below expenditures actually incurred during the 2004-2011 period. Finally, this model correctly predicted the direction of change in suppression expenditures by the USDA Forest Service 100% of the time, year over year. Thus, the model always correctly predicted whether each year was higher or lower than the year before. The forecasted direction of change for FY 2012 is down meaning wildfire suppression expenditures are expected to be less than they were in FY 2011.

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Table 1. May 2012 monthly forecasts of FY 2012 suppression expenditures of the USDA Forest Service, cumulative by month in current (FY 2012) dollars

	May	June	July	August	September
		2012 $ Million			
Median	151	295	411	731	910
80% Confidence Lower Bound	132	236	301	566	729
80% Confidence Upper Bound	170	354	524	896	1,091
90% Confidence Lower Bound	126	218	270	517	679
90% Confidence Upper Bound	176	371	553	942	1,144
95% Confidence Lower Bound	121	203	241	476	631
95% Confidence Upper Bound	180	385	579	985	1,192

* Note: This table includes spending through April 2012 and the FY 2012 contributions to the wildland fire suppression cost pool payments, expected to be $47 million, which are added to the Region 10 + Rest of Forest Service forecast and the agency-wide total.

Table 2. FY 2012 totals from May 2012 monthly forecasts of FY 2012 suppression expenditures of the USDA Forest Service, by percentiles, current (FY 2012) dollars.

Probability (%) of Falling Below Indicated Dollar Amount	Realized Amount ($ Million 2012)
1	578
5	679
10	729
20	792
30	837
40	875
50	910
60	946
70	986
80	1,031
90	1,091
95	1,144
99	1,248

* Note: This table includes the FY 2012 contributions to the wildland fire suppression cost pool, expected to be $47 million.

Table 3. May 2012 monthly forecasts of FY 2012 suppression expenditures of the USDA Forest Service, by tercile.*

Time Period	Tercile of Costs Expected, Since 2003
May	Upper
June	Upper
July	Middle
August	Middle
September	Lower
Total	Middle

* Note: Historical wildland fire suppression cost pool expenditures are assumed to be zero in all year expenditure totals used in these rankings.

Table 4. Jackknife forecast evaluation of the ordinary least squares regression model used in the May 2012 monthly forecast of FY 2012 suppression expenditures of the USDA Forest Service, calculated over 2004-2011.

Diagnostic	Calculated 2004-2011
Root Mean Squared Error, 2004-2011 (2012$)	190,709,702
Bias, 2004-2011, Predicted Minus Actual (2012$)	23,623,502
Bias (%)	2.5
Mean Absolute Percent Error, 2004-2011	17.2
Correct Direction of Change %, 2004-2011	100

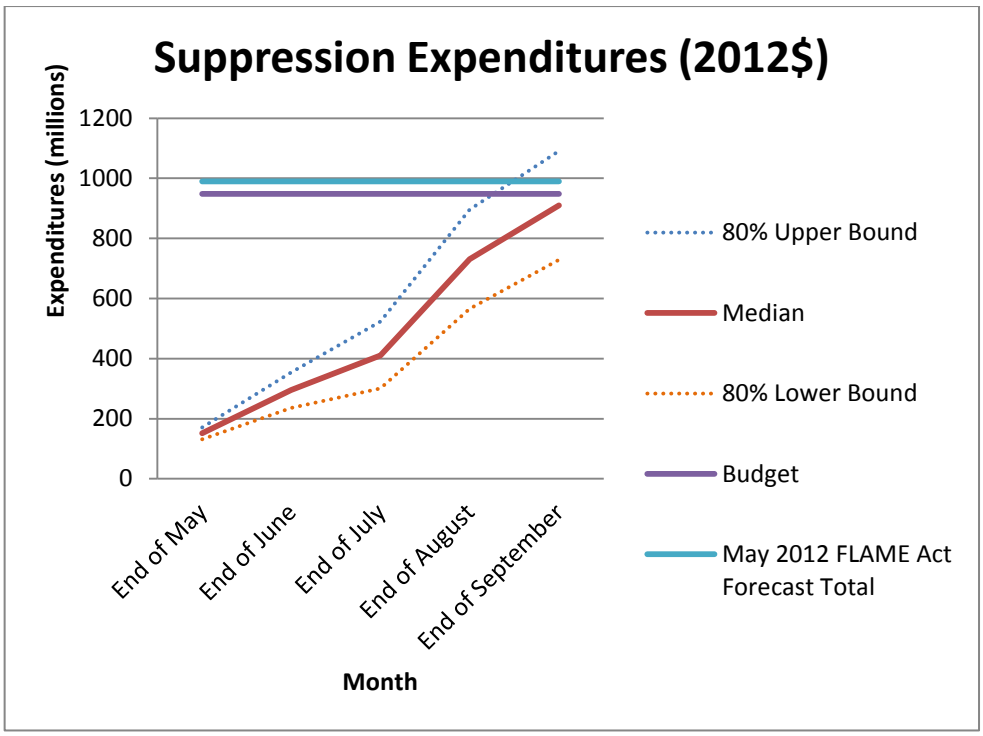

Figure 1. Forecasted median value of USDA Forest Service suppression expenditures by month with 80% confidence intervals compared with FY 2012 budgeted amount and May 2012 annual FLAME forecast. (Note: Includes spending to date at the end of April and wildland fire suppression cost pool spending monthly).

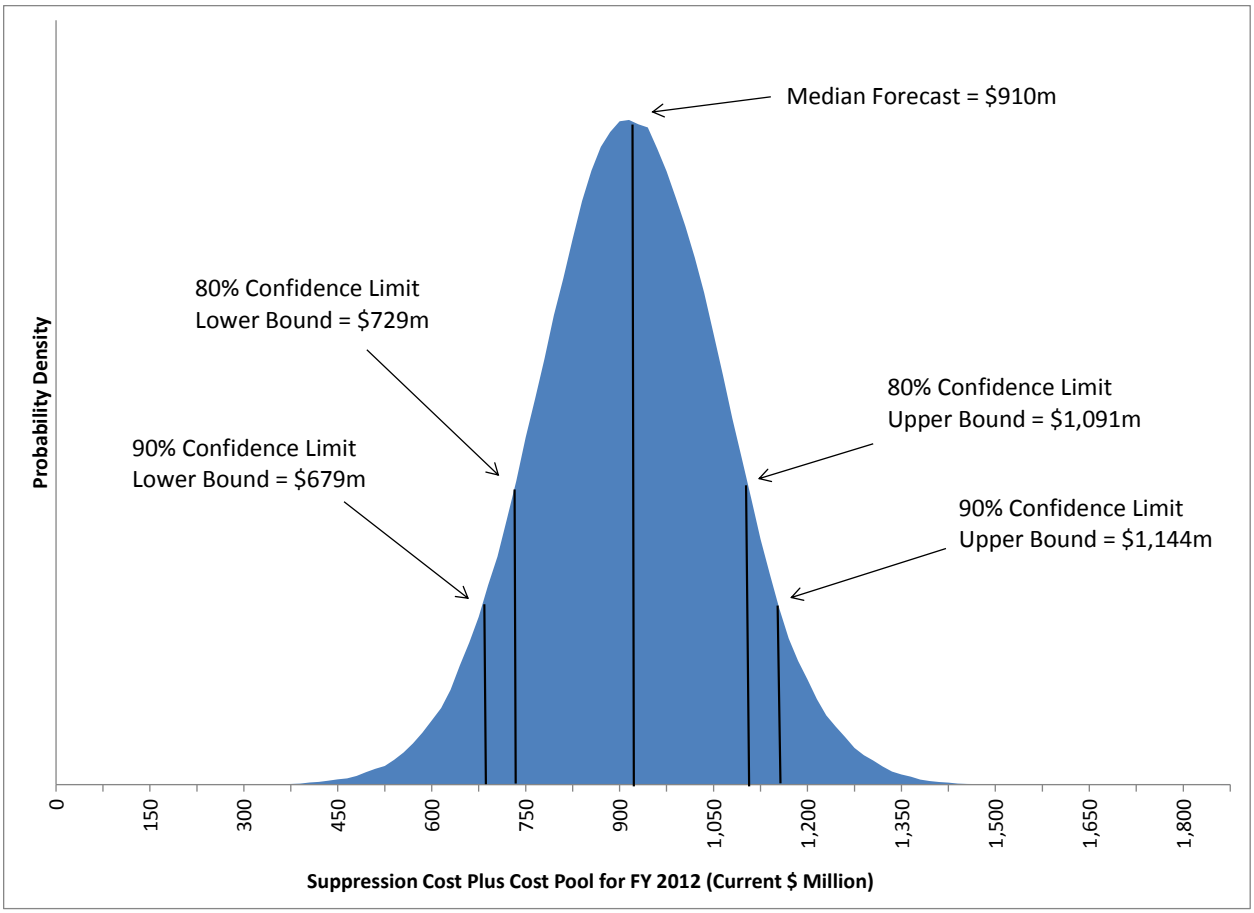

Figure 2. USDA Forest Service suppression expenditure forecast probability density for all regions and months of FY 2012, completed in May 2012. (Note: FY 2012 wildland fire suppression cost pool expenditures are included at their expected level of $47 million in this probability density display.)

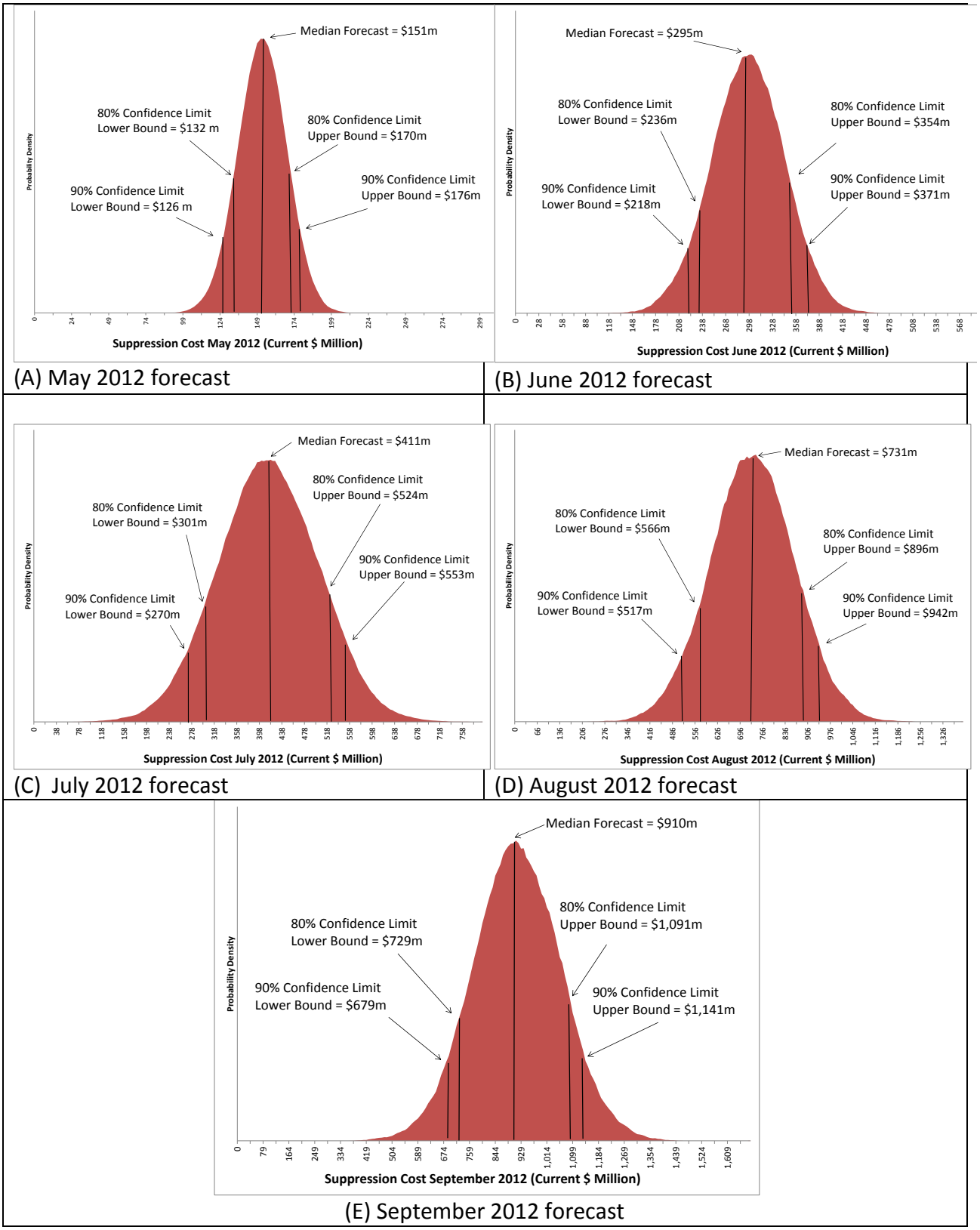

Figure 3. USDA Forest Service cumulative monthly forecast distributions for May to September 2012 from the May 2012 monthly forecast model.

Appendix: Model Estimates and Forecast Evaluation

Background

USDA Forest Service wildland fire suppression expenditure forecasts have been made for summer fire seasons since 1998 and for annual totals since 2003. The Anti-Deficiency Act[6] requires that the USDA Forest Service expenditures for all activities stay within the budget allocation. To meet this requirement, the Rocky Mountain Research Station began providing monthly forecasts of annual USDA Forest Service suppression expenditures in 1998 for June, July, August and September. Since FY 2003, the Rocky Mountain Research Station and the Southern Research Station have collaborated to provide early warning forecasts of annual USDA Forest Service suppression expenditures in the fall and spring of the fiscal year (Abt et al. 2009, Prestemon et al. 2008). With the passage of the Federal Land Assistance and Management (FLAME) Act in 2009[7], both the USDA Forest Service and the Department of the Interior are required to produce forecasts of annual suppression expenditures three times during each fiscal year: March, May, and July, with a September outlook for the next fiscal year required when the next fiscal year budget is not approved by Congress and the President by that date. These FLAME forecasts are developed at the Southern Research Station for both departments. The forecast reported in this paper utilizes a new modeling system that provides monthly forecasts prepared each month from May to August of suppression expenditure totals for the end of May to the end of September in the current FY.

Modeling

Data

Data for modeling were monthly expenditures by USDA Forest Service region, and included FY 2003 to FY 2011, the only years for which consistent region-level data have been assembled. These data were retrieved from the Foundation Financial Information System (FFIS) database at the USDA National Finance Center obtained from Albuquerque Service Center Reports (see footnotes 1 through 4). To erase the effects of general price inflation, all costs were deflated to the value of a dollar in 2004 using the gross domestic product deflator—that is, models were estimated and costs were forecast in real dollar terms. After the forecast, we adjusted the forecast values to put them in current dollars. In estimating models to forecast the monthly expenditures by region, variables that significantly influenced expenditures included spending in previous months and years as well as current year-to-date spending (see footnotes 1 through 4) , weather and climate data from the US Department of Commerce, National Oceanic and Atmospheric Administration, including lagged measures of drought using the Palmer drought severity indices (2012a) and lagged measures of the Niño-3 sea surface temperature anomaly (2012b), and a time trend.

[6] Public Law 97-258 (September 13, 1982), 96 Statute 923, codified by 31 U.S.C. Section 1341.
[7] Public Law 111-88 (October 30, 2009), Title V, Sec. 502.h.3.

Modeling Framework for the May 2012 Monthly Forecast of FY 2012 USDA Forest Service Expenditures

The modeling framework for the monthly forecasts includes ordinary least squares regressions of expenditures by month by region for the remainder of FY 2012 (Table A1); forecasts made from the regression equations with the most recent data; a forecast distribution simulation (Tables 1-3); and a forecast evaluation (Table 4 and Figure A1). The USDA Forest Service wildfire suppression expenditure regression models were developed for the months of May, June, July, August, and September for each region (or aggregate). Each of the equations contained in the current modeling system represents a statistical relationship between historical costs for that month and a set of predictor variables for that region and that month.

The next step was to generate a forecast distribution so that we can incorporate the errors in the regression estimates and the other forecast variables. When generating a forecast distribution (Figure 2), we randomly sampled from equation error and coefficient distributions in ways that accounted for the uncertainties in the forecast. These Monte Carlo forecasts, which are repeated 15,000 times for the USDA Forest Service forecast, do not produce a precise estimate. Rather, they generate a distribution of estimates. This distribution can be summarized in many ways. The forecasts emanating from the Monte Carlo simulation are shown in the forecast density distributions (Figures 2 and 3), a table reporting a median forecast and the lower and upper bounds of likely observed costs (Table 1), a table of not-to-exceed costs by probability levels (Table 2), and a table showing where the median forecast value fell within the observed historical costs for other years, in real dollar terms (Table 3).

Econometric Results

Equations were specified for individual regions, except that two models were estimated for combined regions—Region 8+Region 9, and, Region 10+Rest of Forest Service, which includes expenditures made by the National Interagency Fire Center, Washington Office, and research stations. The statistical relationships relate spending in the coming fiscal month to spending in previous months and years as well as current year-to-date spending, lagged measures of drought (USDOC NOAA 2012a), lagged measures of ocean temperatures (USDOC NOAA 2012b), and a time trend. These variables are used as indicators of dryness and fuel loads.

Equation estimates are shown in Table A.1 which indicates that most models had moderate to high R2's, ranging from 0.31 (Region 5 in August) to 0.96 (Region 2 in May). This means that between 31 and 96% of the variation in the expenditures is explained by the variables included in the regressions. Durbin-Watson statistics, which measure the relationship of the unexplained portion of the expenditures between two consecutive years, were all within the acceptable (insignificant) range. Figure A.1 provides a comparison of the observed historical USDA Forest Service suppression expenditures (2004-2011) with the forecast of these expenditures using the May 2012 monthly forecast model reported here.

References

Abt, K.L., J.P. Prestemon, and K. Gebert. 2009. Wildfire suppression cost forecasts for the US Forest Service. Journal of Forestry 107(4):173-178.

US Department of Commerce, National Oceanic and Atmospheric Administration. 2012a. Palmer drought severity indices. Retrieved on April 9, 2012 from http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/palmer_drought/.

US Department of Commerce, National Oceanic and Atmospheric Administration. 2012b. Niño-3 sea surface temperature anomaly. Retrieved on April 9, 2012 from http://www.cpc.ncep.noaa.gov/data/indices/sstoi.indices.

Prestemon, J.P., K.L. Abt, and K. Gebert. 2008. Suppression cost forecasts in advance of wildfire seasons. Forest Science 54(4):381-396.

Wildand Fire Suppression Cost Pool amount and allocation, Mark Lichtenstein, Branch Chief Budget and Planning (8/25/2011 and 5/22/2012 respectively).

Table A.1. Ordinary least squares regression equation estimates used in the May 2012 monthly forecast of FY 2012 suppression expenditures of the USDA Forest Service.

Month	Dependent Variable	Independent Variables	Coefficient	Std. Error	t-Statistic	Prob.	R^2	Durbin-Watson
May	Region 1 Cost	Constant	-2,556,624	1,658,579	-1.5415	0.1245	0.92	2.63
		Westwide Palmer H-Index Weighted Mean March (t-1)	345,895	145,957	2.3698	0.0186		
		Ln(Region 1 Cost in April (t))	-248,287	40,603	-6.1149	0.0000		
		Ln(Region 1 Cost in May (t-1))	884,180	344,948	2.5632	0.0110		
	Region 2 Cost	Constant	214,541	93,760	2.2882	0.0230	0.96	2.52
		Westwide Palmer H-Index Weighted Mean March (t)	296,006	34,161	8.6650	0.0000		
		Ln(Region 1 Cost in April (t-1))	86,160	14,369	5.9963	0.0000		
	Region 3 Cost	Constant	13,717,538	2,219,846	6.1795	0.0000	0.81	1.74
		Westwide Palmer H-Index Weighted Mean March (t)	4,165,196	1,041,420	3.9995	0.0001		
		Niño-3 SSTA April (t)	-16,860,054	5,273,815	-3.1969	0.0016		
	Region 4 Cost	Constant	339,991	198,059	1.7166	0.0873	0.74	2.63
		Region 4 Cost in April (t)	1.0093	0.2738	3.6862	0.0003		
		Region 4 Cost through April (t-1)	-0.1344	0.0653	-2.0571	0.0407		
	Region 5 Cost	Constant	7,081,247	1,681,389	4.2115	0.0000	0.71	2.34
		Region 5 Palmer H-Index March (t)	-1,602,252	475,886	-3.3669	0.0009		
		Region 5 Cost in May (t-1)	-0.4490	0.2433	-1.8457	0.0661		
	Region 6 Cost	Constant	1,095,587	117,599	9.3163	0.0000	0.95	1.84
		Region 6 Cost in May (t-1)	-0.3213	0.0403	-7.9776	0.0000		
		Region 6 Palmer H-Index March (t-1)	278,216	47,841	5.8154	0.0000		
	Region 8 + Region 9 Cost	Constant	-1,723,204	1,039,760	-1.6573	0.0987	0.93	2.46
		Region 8 + Region 9 Annual Cost (t-1)	0.2107	0.0227	9.2600	0.0000		
	Region 10 + RFS Cost	Constant	44,740,151	5,966,753	7.4982	0.0000	0.73	1.74
		Westwide Palmer H-Index Weighted Mean March (t)	12,108,518	2,804,447	4.3176	0.0000		
		Constant	349,528	100,041	3.4938	0.0006		

Month	Dependent Variable	Independent Variables	Coefficient	Std. Error	t-Statistic	Prob.	R^2	Durbin-Watson
June	Region 1 Cost	Region 1 Annual Cost (t-1)	0.0016	0.0006	2.7275	0.0068	0.69	3.02
		Region 1 Palmer H-Index March (t)	-70,587	36,092	-1.9557	0.0516		
	Region 2 Cost	Constant	1,453,441	435,796	3.3351	0.0157	0.68	2.01
		Westwide Palmer H-Index Weighted Mean March (t)	578,315	189,212	3.0564	0.0223		
		Region 2 Cost through April (t)	0.2401	0.0968	2.4804	0.0478		
	Region 3 Cost	Constant	53,776,882	11,956,142	4.4978	0.0000	0.52	1.05
		Westwide Palmer H-Index Weighted Mean March (t)	15,621,537	5,619,534	2.7799	0.0059		
	Region 4 Cost	Constant	850,659	223,687	3.8029	0.0002	0.82	2.99
		Region 4 Cost in April (t-1)	-0.8943	0.2051	-4.3591	0.0000		
		Westwide Palmer H-Index Weighted Mean March (t)	-334,896	112,072	-2.9882	0.0031		
	Region 5 Cost	Constant	-9,492,374	4,877,007	-1.9464	0.0528	0.82	2.25
		Region 5 Cost in January	6.0173	1.0742	5.6017	0.0000		
	Region 6 Cost	Constant	-1,335,174	818,609	-1.6310	0.1540	0.69	2.39
		Region 6 Cost through April (t)	0.2300	0.0635	3.6251	0.0110		
		Niño-3 SSTA January (t)	-1,539,090	642,261	-2.3964	0.0536		
	Region 8 + Region 9 Cost	Constant	5,554,385	2,428,071	2.2876	0.0230	0.73	1.75
		Region 8 + Region 9 Cost in January (t)	-0.3403	0.0789	-4.3107	0.0000		
	Region 10 + RFS Cost	Constant	-14,700,000,000	5,070,000,000	-2.8992	0.0041	0.79	1.28
		Ln(Region 10 + RFS Annual Cost (t-1))	906,334	390,561	2.3206	0.0211		
		Time	7,310,799	2,531,685	2.8877	0.0042		
July	Region 1 Cost	Constant	2,601,788	2,858,395	0.9102	0.3636	0.74	2.04
		Region 1 Annual Cost (t-1)	-0.0399	0.0158	-2.5255	0.0122		
		Region 1 Cost in April (t)	3.8934	1.9062	2.0425	0.0422		
	Region 2 Cost	Constant	3,320,000,000	496,000,000	6.6984	0.0000	0.88	1.90
		Time	-1,651,484	246,921	-6.6883	0.0000		
		Westwide Palmer H-Index Weighted Mean March (t)	2,298,151	449,539	5.1122	0.0000		
	Region 3 Cost	Constant	27,187,139	3,313,785	8.2043	0.0000	0.66	0.94
		Niño-3 SSTA April (t-1)	45,940,483	12,385,157	3.7093	0.0003		
	Region 4 Cost	Constant	5,938,916	2,778,211	2.1377	0.0335	0.62	1.51
		Westwide Palmer H-Index Weighted Mean March (t)	-2,954,615	1,303,372	-2.2669	0.0243		
		Niño-3 SSTA April (t)	-13,971,715	6,600,354	-2.1168	0.0353		
	Region 5 Cost	Constant	-552,000,000	306,000,000	-1.8036	0.1214	0.66	2.99
		Niño-3 SSTA February (t)	-92,316,360	31,939,759	-2.8903	0.0277		
		Ln(Region 5 Cost through April (t))	78,105,402	40,379,267	1.9343	0.1012		
	Region 6 Cost	Constant	-3,081,380	5,315,728	-0.5797	0.5627	0.81	1.61
		Region 6 Annual Cost (t-1)	0.1029	0.0416	2.4754	0.0140		
		Region 6 Cost in March (t)	-1.5473	0.7595	-2.0373	0.0427		
	Region 8 + Region 9 Cost	Constant	1,490,506	1,371,462	1.0868	0.2782	0.93	2.47
		Westwide Palmer H-Index Weighted Mean March (t)	3,115,857	478,531	6.5113	0.0000		
		Region 8 + Region 9 Annual Cost (t-1)	0.1918	0.0293	6.5557	0.0000		
	Region 10 + RFS Cost	Constant	62,315,665	11,936,463	5.2206	0.0000	0.48	2.84
		Westwide Palmer H-Index Weighted Mean March (t)	14,399,735	5,610,284	2.5667	0.0109		

Month	Dependent Variable	Independent Variables	Coefficient	Std. Error	t-Statistic	Prob.	R^2	Durbin-Watson
August	Region 1 Cost	Constant	30,400,000,000	9,850,000,000	3.0864	0.0023	0.62	1.60
		Time	-15,116,433	4,904,243	-3.0823	0.0023		
		Region 2 Cost in December (t-1)	-16.2952	8.1764	-1.9930	0.0474		
	Region 2 Cost	Constant	3,600,000,000	1,440,000,000	2.5092	0.0127	0.47	2.21
		Time	-1,791,880	715,698	-2.5037	0.0129		
	Region 3 Cost	Constant	14,204,120	2,606,705	5.4491	0.0000	0.55	2.04
		Niño-3 SSTA April (t-1)	28,344,951	9,742,468	2.9094	0.0040		
	Region 4 Cost	Constant	39,539,982	6,578,280	6.0107	0.0000	0.66	0.95
		Region 4 Palmer H-Index March (t-1)	7,845,762	2,990,060	2.6239	0.0092		
		Niño-3 SSTA January (t)	12,345,756	5,781,571	2.1354	0.0337		
	Region 5 Cost	Constant	-345,000,000	230,000,000	-1.5006	0.1772	0.31	1.55
		Ln(Region 5 Cost through April (t))	54,145,640	30,363,744	1.7832	0.1177		
	Region 6 Cost	Constant	17,747,044	12,360,219	1.4358	0.2011	0.63	1.03
		Ln(Region 6 Cost through April (t))	8,335,681	2,694,224	3.0939	0.0213		
		Region 6 Palmer H-Index March (t)	10,180,179	5,537,252	1.8385	0.1156		
	Region 8 + Region 9 Cost	Constant	12,809,021	4,888,728	2.6201	0.0093	0.61	1.03
		Region 8 + Region 9 Cost in April (t)	-1.0108	0.4297	-2.3523	0.0195		
		Westwide Palmer H-Index Weighted Mean March (t)	3,141,442	1,891,838	1.6605	0.0981		
	Region 10 + RFS Cost	Constant	89,384,161	17,414,733	5.1327	0.0000	0.53	1.17
		Westwide Palmer H-Index Weighted Mean March (t-1)	19,828,539	7,055,646	2.8103	0.0053		
September	Region 1 Cost	Constant	24,100,000,000	13,100,000,000	1.8465	0.0660	0.33	1.86
		Time	-12,002,907	6,510,887	-1.8435	0.0665		
	Region 2 Cost	Constant	4,720,903	647,104	7.2954	0.0000	0.67	1.75
		Niño-3 SSTA April (t-1)	9,034,504	2,418,529	3.7355	0.0002		
	Region 3 Cost	Constant	2,876,926	911,606	3.1559	0.0018	0.70	1.93
		Region 3 Cost in March (t)	3.1939	0.7815	4.0866	0.0001		
	Region 4 Cost	Constant	25,422,648	4,206,418	6.0438	0.0000	0.71	1.98
		Region 4 Cost in March (t)	-12.2015	3.2784	-3.7218	0.0002		
		Region 4 Cost in April (t)	-17.7775	7.5002	-2.3703	0.0185		
	Region 5 Cost	Constant	58,917,265	12,663,765	4.6524	0.0000	0.42	1.72
		Niño-3 SSTA February (t-1)	-51,367,010	22,708,602	-2.2620	0.0246		
	Region 6 Cost	Constant	41,228,248	8,087,263	5.0979	0.0000	0.32	2.31
		Niño-3 SSTA April (t-1)	55,468,080	30,225,865	1.8351	0.0677		
	Region 8 + Region 9 Cost	Constant	6,810,215	2,050,495	3.3213	0.0010	0.41	2.10
		Region 8 Palmer H-Index March (t-1)	3,126,208	1,411,028	2.2156	0.0276		
	Region 10 + RFS Cost	Constant	137,000,000	42,042,996	3.2588	0.0013	0.45	1.67
		Westwide Palmer H-Index Weighted Mean March (t)	47,196,499	19,760,725	2.3884	0.0177		

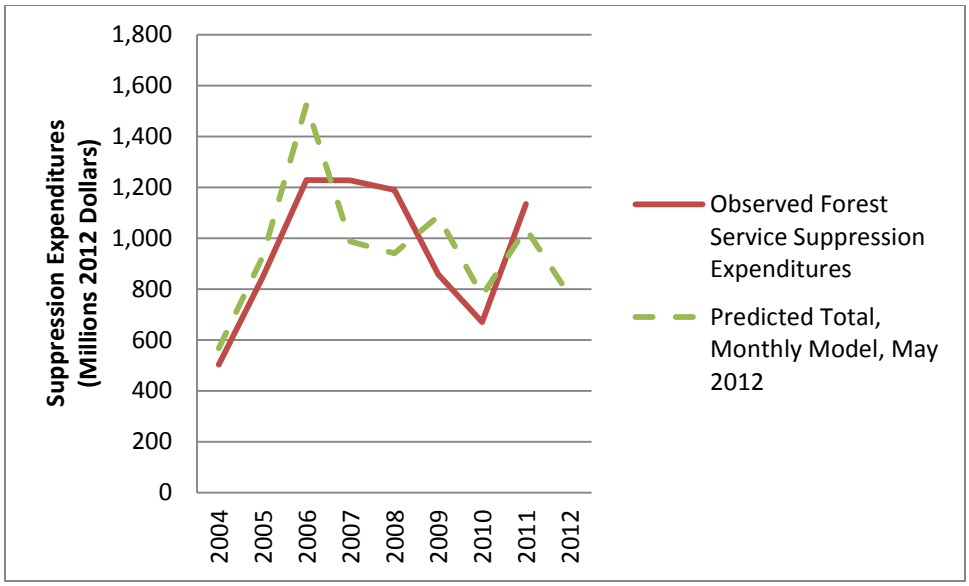

Figure A.1. Observed historical USDA Forest Service suppression expenditures (2004-2011) and the forecast of these expenditures using the May 2012 monthly forecast model. Forecasts of expenditures for each fiscal year are sums across the point estimates of each region or region aggregate's costs generated with a jackknife procedure. (Note: values are in 2012 dollars and include the wildland fire suppression cost pool expenditures.)