

March Fiscal Year 2011 Federal Land Assistance, Management and Enhancement (FLAME) Act Suppression Expenditure Forecast For the Department of the Interior

Jeffrey P. Prestemon, Krista Gebert, Karen Abt

February 1, 2011

Executive Summary

Fiscal year 2011 emergency suppression expenditures for the DOI are forecast to fall with 90 percent confidence between \$161 million and \$400 million, with a median forecast of \$279 million. This forecast is based upon historical DOI fire suppression spending patterns from FYs 1995-2009. Therefore, it does not reflect any possible cost savings that might occur in FY 2011 due to changes in spending patterns brought about by management goals or operational efficiencies. Actual FY 2011 fire suppression expenditures may vary from the forecasted confidence interval.

Overview

The Rocky Mountain Research Station (RMRS) has been providing monthly forecasts of annual FS suppression expenditures since FY 1998 and annual DOI suppression expenditures since FY 2005. These updated monthly forecasts are provided during the fire season months of June through September. In addition, starting in FY 2003, the RMRS and the Southern Research Station (SRS) have collaborated to provide "early warning" forecasts of annual FS suppression expenditures in the fall and spring of the fiscal year.

With the passage of the FLAME Act in FY 2009, both federal land management agencies are now tasked with providing forecasts of annual suppression expenditures several times during each fiscal year (March, May, July, and September). Since the March and May requirements fall outside of the current time frame for providing DOI forecasts (June through September), the SRS and the RMRS were asked by the DOI to develop additional forecast models for use earlier in the fiscal year. The current report was produced in early February, in time for review and in compliance with the March due date for the forecast.

Modeling Framework for the 2011 DOI March Current Year Model

The development of this forecast was constrained by lack of expenditure data. The only DOI suppression expenditure data currently available for developing this forecast were annual DOI suppression expenditures for fiscal years 1985 through 2009. The lack of geographic specificity in the data and the low number of observations led to a parsimonious modeling framework, wherein annual DOI suppression expenditures are forecast as a function of forecast Forest Service emergency suppression expenditures. Specifically, the DOI forecast includes a Forest Service March Current Year Forecast (MCYF) Model forecast of this fiscal year's FS expenditures. Despite having data on DOI suppression expenditures dating from 1985, the use of FS forecasted suppression expenditures as the independent variable further constrained the estimation to observations from 1995 to 2009. Consistent data of FS suppression expenditures date only from FY 1995, due to changes in FS accounting at the regional level.

The MCYF itself derives from a multi-equation model of expenditures by region of the United States. The expenditures in each region are related to drought measures, Atlantic and Pacific Ocean

temperature and pressure indices, and (for Region 5 only) a time trend. The general approach to these models has been peer reviewed and published ^{1,2}.

Variations of the DOI suppression expenditure forecast model were tested, which attempted to include drought or ocean temperature and pressure indices directly in the DOI forecast model. However, by various measures, a very simple model that includes a September Palmer Drought index from Region 1 of the Forest Service and the MCYF forecast performed best. The model explains 74% of the variation ($R^2 = 0.74$) in annual DOI suppression expenditures (Table 1). This is a substantial improvement over the previous version of this DOI model, mainly because of the improved accuracy of the Forest Service MCYF, but also partly due to the addition of recent drought information.

FY 2011 Results

Fiscal year 2011 emergency suppression expenditures for the DOI are forecast to range, with 90% confidence, from \$161 million to \$400 million, with a median forecast of \$279 million (Table 2). The 80% confidence band spans \$185 million to \$371 million. The median forecast is \$76 million less than the median forecast produced by the DOI September out-year forecast model (issued August 31, 2010). Compared to the September model, the 90% confidence band is narrower by \$90 million, reflecting the lower uncertainty contained in a model containing the most recent information on climate and drought.

Model Evaluation

A jackknife or “leave-one-out” cross-validation approach was used to evaluate the forecast accuracy of the forecast model. This analysis shows that the root mean squared error (RMSE) of the forecast is \$62 million (in 2004 constant dollar terms), calculated over 1995 to 2009 (Table 3). The mean absolute percent error (MAPE) of the forecast is 18%. The model has a small positive bias, about 1%, meaning that it tends to over-predict by about \$3.5 million. Finally, the forecast model correctly predicted the direction of change in DOI emergency suppression expenditures compared to the previous year 80% of the time since 1996. The performance of the forecast model can be further appreciated by observing its point estimates (approximately the median forecast amount) compared to observed amounts for 1995-2009 (Figure 1).

Contact Information for this Report

Karen L. Abt, Research Economist	Krista Gebert, Regional Economist	Jeff Prestemon, Research Forester
Forestry Sciences Laboratory, SRS USDA Forest Service PO Box 12254 Research Triangle Park, NC 27709 kabt@fs.fed.us Tel: 919-549-4094 Fax: 919-549-4047	Northern Region USDA Forest Service P.O. Box 7669 200 E. Broadway Missoula, MT 59807 kgebert@fs.fed.us Tel: (406) 329-3696 Cell: (406) 370-6436	Forestry Sciences Laboratory, SRS USDA Forest Service PO Box 12254 Research Triangle Park, NC 27709 jprestemon@fs.fed.us Tel: 919-549-4033 Fax: 919-549-4047

¹ Prestemon, J.P., K.L. Abt, and K. Gebert. 2008. Suppression cost forecasts in advance of wildfire seasons. *Forest Science* 54(4):381-396.

² 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.

Table 1. Equation Estimate Used in the FY 2011 Forecast

Variable	Coefficient	Standard Error	t-Statistic	Probability
Intercept	61,168,294	30,875,184	1.98	7.10E-02
Total Forest Service Costs (January Out-Year Forecast Model)	0.261	0.047	5.55	1.26E-04
Palmer H-Index, Region 1, September (t-1)	-17,462,946	3,373,903	-5.18	2.31E-04
Observations	15			
R-squared	0.74			
Equation Error	60,000,441			
Durbin-Watson Statistic	2.27			

Table 2. DOI Forecast, FY 2011 (current 2011 dollars)

	2011 Dollars (million)
Median Estimate	279
Lower Bound, 80% Confidence Limit	185
Upper Bound, 80% Confidence Limit	371
Lower Bound, 90% Confidence Limit	161
Upper Bound, 90% Confidence Limit	400
Lower Bound, 95% Confidence Limit	141
Upper Bound, 95% Confidence Limit	418

Table 3. Jackknife Forecast Evaluation

Diagnostic	
RMSE (Real 2004 \$)	62,144,485
Bias (Real 2004 \$)	3,531,318
Bias (%)	1.31
MAPE (%)	18.32
Direction of Change Prediction (% Correct)	80.00

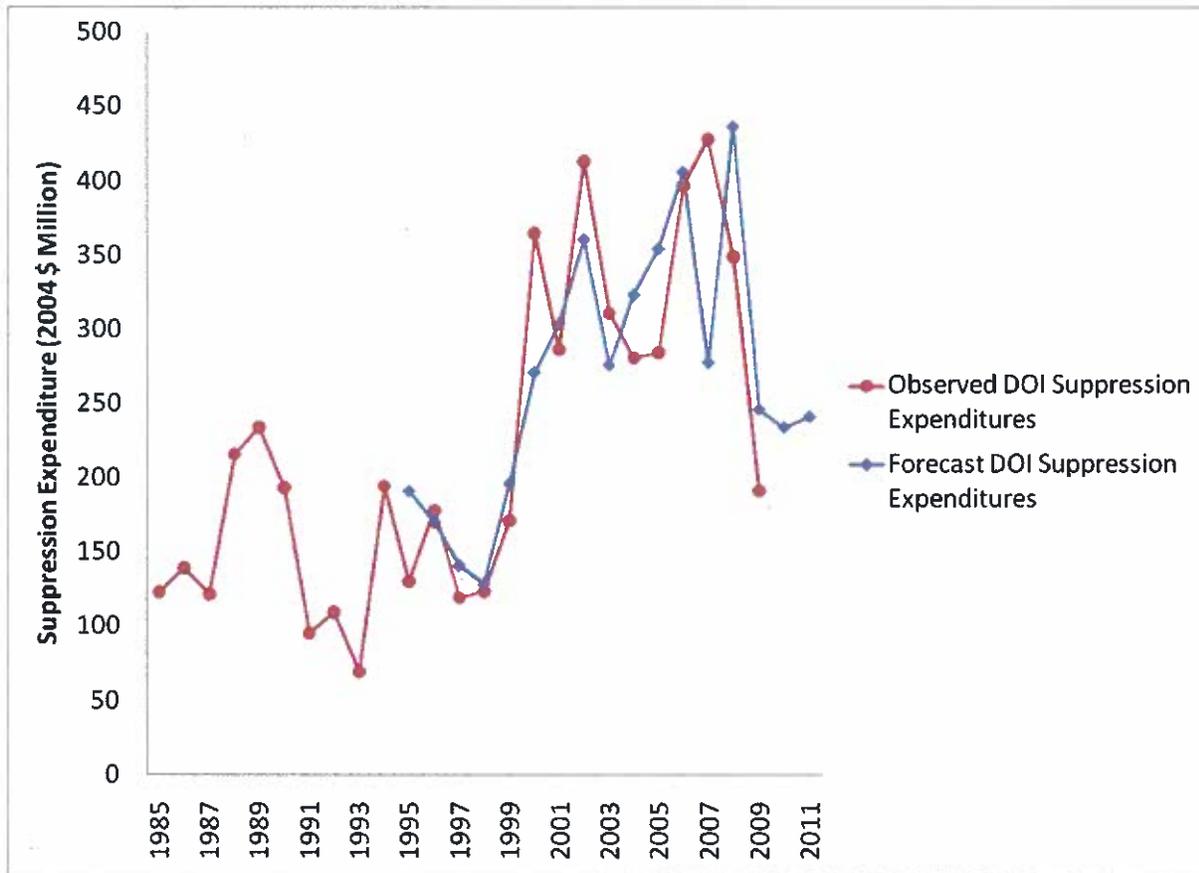


Figure 1. Actual Department of the Interior emergency suppression expenditures and the March 2011 forecasts of those expenditures for the current fiscal year made using a jackknife procedure. (Note: values are in constant 2004 dollars).