Inventing LANDFIRE: Q & A with USFS Research Ecologist Bob Keane

Robert (Bob) E. Keane has been a Research Ecologist with the USDA Forest Service, Rocky Mountain Research Station at the Missoula Fire Sciences Laboratory since 1994. His recent research includes developing ecological computer simulation models for the exploring landscape, fire, and climate dynamics; conducting basic research in wildland fuel science; and investigating the ecology and restoration of whitebark pine. He received his B.S. degree in forest engineering from the University of Maine, Orono; his M.S. degree in forest ecology from the University of Montana, Missoula; and his Ph.D. degree in forest ecology from the University of Idaho, Moscow.

Bob was one of three principal investigators in the LANDFIRE Prototype Project that was conducted from 2000 to 2005, when the procedures, protocols, and scientific underpinnings of the LANDFIRE program were developed.

You've been with LANDFIRE since the beginning. Tell us about it.

In the late 1990's, Colin Hardy and his team at the Missoula Fire Sciences Laboratory (Fire Lab) developed a set of coarse-scale fire and fuel GIS layers for use in wildland fire management. The Washington Office of Fire and Aviation Management (FAM) loved these layers but hated that they had such low resolution - 1km pixel size. Then FAM Director Denny Truesdale and some of his staff got together and realized that United States fire management really needed a set of GIS layers at a much finer scale to help with planning and operational fire actions.

I became affiliated with LANDFIRE sometime in 2000 when Dave Bunnell, then Fuels Specialist in FAM, and Wendel Hann, then National Fire Ecologist, approached several of us at the Fire Lab about developing a project to quantify Fire Regime and Fire Regime Condition Class (FRCC) across the entire US at a 30m resolution. These people had a wonderful idea and wanted a way to implement the idea into an operational program. They selected the Fire Lab because of the high success in collaboration during the Interior Columbia River Basin Ecosystem Management Project. We developed several proposals for this project and, eventually, Bunnell's successor Rich Lasko decided to fund a preliminary stage to prototype the methods and develop protocols for an operational program. Finally, in early 2001 the leadership of FAM, the US Department of the Interior, and the USDA Forest Service met at the Fire Lab to hammer out the specifics of what would be the beginnings of LANDFIRE; the agreement to fund the prototype was signed in the fall of 2001.

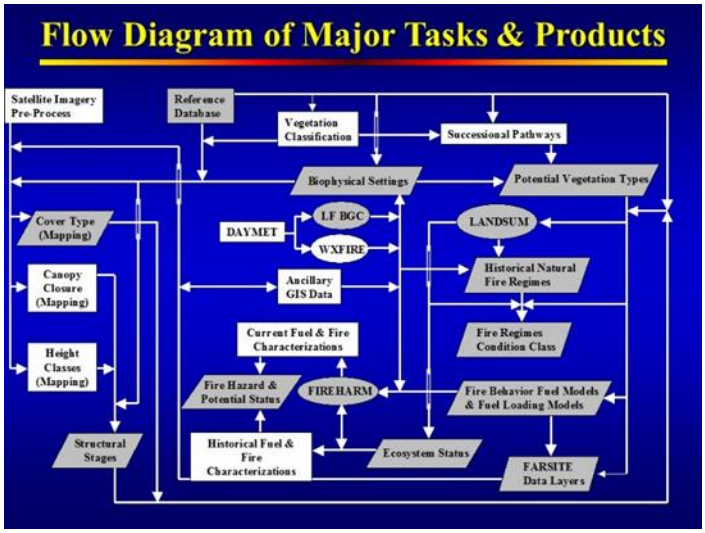
What were the original design requirements for the LANDFIRE project?

Both the USDA and USDOI were quite specific regarding the LANDFIRE design. They wanted it to be replicated every ten years so that it could be used as a monitoring tool. They wanted a 30m resolution for fine-scale analysis at local scales. All lands had to be mapped using the same methods so that a pixel

in a forested environment had the same degree of resolution and detail as a non-forest pixel or a pixel in Maine is mapped the same as a pixel in Montana. LANDFIRE had to be wall-to-wall, e.g. all agencies, all lands. And, finally, it had to fit within the coarse-scale data layers. To reassure local land managers that LANDFIRE products were not intended to replace previously developed digital maps, we designed it to be the "safety net" for federal land management spatial data needs.

What was the LANDFIRE Prototype Project?

The three-year Prototype Project developed the preliminary methods to derive the products needed to quantify FRCC across the US. The USFS research organization recognized that there was no way we could do the remote sensing that was needed, so we quickly invited USGS EROS Data Center scientists, led by Dr. Zhilang Zhu to help develop tools and protocols to perform the remote sensing tasks.



The intermediate products of the prototype workflow, such as fuels, vegetation maps, and biophysical settings, were immediately recognized as valuable tools for enlightened land management; therefore, significant energies were put into the enhancement of these intermediate products. Many products and publications were generated from the LANDFIRE Prototype Project.

The Prototype Project has an interesting "origin story." Something to do with wilderness?

In the summer of 2000, Wendel Hann and I organized a 10-day pack trip into the Big Prairie Ranger Station in the Bob Marshall Wilderness Area, Montana, for the ten people who would eventually become the principal leads for the various prototype activities. It was in Big Prairie where most of the details of the Prototype Project were decided, including deciding on two regions, Northern Rocky Mountains and Central Utah, as test areas. We worked out the methods to map fuels, fire regimes, and FRCC and the identification of the tools needed to complete the project. That pack trip not only solidified the planning of a very complex project, it created a cohesive group that remains committed to LANDFIRE to this day.

What other products came out of the LANDFIRE Prototype Project?

As mentioned, the main goal was to create a national FRCC map that would be used to prioritize areas for fuels treatment at multiple scales. However, it quickly became evident that the LANDFIRE work flow could be used to generate many other very useful products for fire management. Once it was obvious that the FARSITE fire growth program was becoming a staple in wildfire management, a comprehensive fuel mapping effort was added to create the inputs for FARSITE. To support the fuel mapping, we developed a new set of fire behavior fuel models (Scott and Burgan 2005) and a new set of fuel loading models (Lutes et al. 2007) to map surface fuels for fire behavior and effects simulation. The original

FUELCALC software was developed to compute the canopy fuels inputs needed by FARSITE. The maps of vegetation composition and cover and of biophysical settings that we used to model landscape dynamics were quickly identified as important wall-to-wall maps to support natural resource management activities across all agencies and organizations, especially those that had no existing vegetation maps. We developed the FIREHARM and FLEAT programs to use LANDFIRE layers in day to day activities and algorithms from these programs made it to various programs in IFTDSS. The landscape simulation model LANDSUMv4 was created specifically for the LANDFIRE prototype project and it has been used for many other research and management projects.

Looking ahead, what do you think might improve LANDFIRE's usefulness?

There are several things that can be done to improve product quality and usefulness. First, an easy-to-use key to identify the National Vegetation Classification Standard (NVCS) vegetation types that are implemented in LANDFIRE is sorely needed. Also, the names of each vegetation type should be abbreviated to fit on map legends and tables. Creating an abbreviated nomenclature for NVCS will facilitate its adoption by management, which is very spotty right now.

Next, the accuracies of all vegetation, fuels, and biophysical layers must be improved. New advancements in mapping technology, coupled with an abundance of new plot data, should allow development of more accurate and comprehensive map products. The parameters of the successional model should be redone and moved from 5-box models to more comprehensive state-and-transition models suitable for land management. The quantification of HRV is becoming increasingly important under the new planning rule and LANDFIRE could play a major role in delivering these time series data to local agencies. Finally, we need to post the historical time series of these state-and-transition models for landscapes so that managers can download them.

What has been most rewarding about working on the LANDFIRE project?

I have been amazed at the wide use of products in both research and management. I have read hundreds of journal articles that used LANDFIRE layers as a primary part of their analysis. In fact, a search in Google Scholar using "LANDFIRE" results in thousands of hits, and these don't include the use of LANDFIRE by managers. More importantly, it has been extremely rewarding to me to see LANDFIRE become a primary layer used by management in many planning activities. Some land management units ONLY have LANDFIRE for spatial data products. LANDFIRE layers are also critical inputs to the WFDSS package that is used universally on most wildfires – to think that these layers may save lives and property is very gratifying.

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