Wildland Fire Behavior and "The Course of Science" Flowchart: Is There a Connection?

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I've been involved in wildland fire since 1972. Except for a couple of seasons as a hotshot crew member followed by another season with the Forest Service in wilderness fuel inventory capped off by some slash burning, all that time has been spent in fire research. Even as a wildland fire researcher, I've kept actively involved in observing and analyzing free-burning wildfires over the years, and I've occasionally served as an operational fire behavior specialist on major fires and multifire incidents in northern Alberta and the Northwest Territories. This focused fire background has helped me understand that wildland fires are not always easily observed, monitored, explained, or documented.

I came across "The Course of Science" flowchart on a coffee room bulletin board in 1990 during a 3-year (1989–92) sojourn in Australia. Over the years, I've come to appreciate the humor and cynical nature embedded in the "Course of Science" flowchart more and more. But perhaps of greater value is this flowchart's ability to remind us of the traps to which we, in the research and development community, and in turn the users of the

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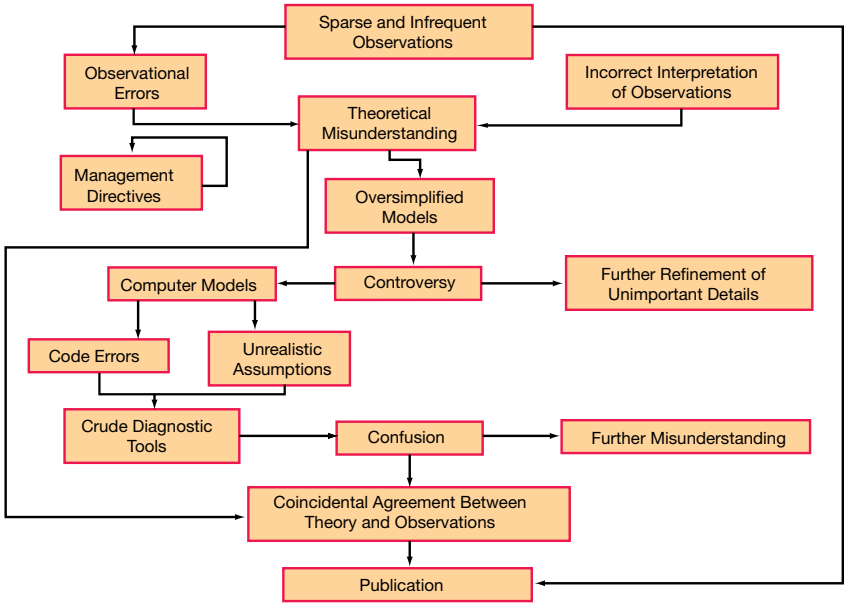
Wildland fires are highly volatile, multidimensional phenomena, not always easily observed, monitored, explained, and documented. Photo: Martin E. Alexander, Canadian Forest Service, Northern Forestry Centre, Edmonton, AB, 1981.

The Course of Science



In this author's opinion, the relevancy of the "Course of Science" flowchart to wildland fire science, and more specifically to fire behavior, is probably a far better fit to the general course of research, development, and application in this field than most of us would care to admit.

knowledge and products generated by fire researchers, can so easily fall victim. As Dr. Mary Omodei (2009), a wildland fire psychologist, has pointed out, this flowchart "characterizes not only everyday intuitive thinking but also science as well in our zeal to understand and our zeal to publish interesting findings."

Usage

I've frequently presented the "Course of Science" flowchart in regional, national, and international fire behavior training courses and in other invited presentations (e.g., Alexander 2000, 2006). My most recent use was in a keynote address that I presented as a member of the international advisory committee member of the Fire Paradox project (<http://www.fireparadox.org/>) on the island of Crete, Greece, in June 2008 (Alexander 2008).

The chart always draws a good laugh and it has been my experience that folks can relate to some of the common flaws to which we, as humans, are prone when it comes to our attempts at trying to understand the complexities associated with wildland fire behavior. This certainly appears to be the case, not surprisingly, when it comes to situations involving extreme fire behavior.

But Where Did It Come From?

Despite its growing world-wide popularity, the origin of the "Course of Science" flowchart remains a mystery. My own search for the original led me to Wergen (2000). When contacted about the "Course of Science" flowchart, Dr. Wergen (2009) stated, "I first spotted the diagram on a notice board at ECMWF [European Centre for Medium-Range Weather Forecasts]. The people there referred me to Science as the source. However, a search in Science was not successful. I have had it translated into German."

Another published user, Bormel (2008), states that he originally found this flowchart "taped to the door of the biostats/computer lab at Harvard's School of Public Health, many years back."

These authors, others from various fields (including meteorology, health care, astronomy, and wildland fire behavior), and I have all found it useful to identify our own linkages and flaws that come up during the course of science.

Developing the Science of Wildland Fire Behavior

Perhaps the mystery of the origin of the "Course of Science" flowchart will be solved one day. In the meantime, I keep a copy of this flowchart prominently displayed in my office as a constant reminder to myself of the pitfalls or general tendency within the wildland fire behavior science community to follow these various paths. I had a copy of the "Course of Science" flowchart handy, for example, as I endeavored to put forth the case that the blowup associated with the 1988 Brewer Fire in Montana was likely caused by a "heat burst," a seemingly rare meteorological phenomenon (Alexander 2002, 2004). Use of the "Course of Science" flowchart is not restricted to members of the wildland fire behavior science community. Operational fire management personnel may find it equally as valuable. I think it provides a useful aid to critical thinking—whether for the fire researcher, the firefighter, or the fire manager—when it comes to reaching conclusions perhaps too

An Example Related to Extreme Wildland Fire Behavior

Williams (2007) reported on an interesting hypothesis regarding extreme fire behavior associated with the wildland conflagrations that descended on Canberra, Australia, on 18 January 2003 (<http://en.wikipedia.org/wiki/2003_Canberra_bushfires>). She suggested that the accumulation of flammable gases ahead of a high-intensity fire might explain why such fires unexpectedly and very rapidly increase their forward movement with explosive speed.

Sullivan and others (2007), however, point out that this "conflicts with the fact that because of the buoyancy of heated gas, the one place that these flammable pyrolysis products cannot be found is downwind of the fire front." They also note that the turbulent flows associated with wildland fires "quickly disperse these gases," so there is no opportunity for them to accumulate.

Arnold and Buck (1954), however, pointed out that "Most fires burn so inefficiently that large quantities of volatile flammable gasses are driven off without being burned. Under certain air conditions these gasses may be trapped near the ground in low inversions or in poorly ventilated basis or canyons."

Additions to the "Course of Science" Flowchart Over Time

In the version of the "Course of Science" flowchart that I came across 29 years ago as presented here, someone had obviously added in by hand to the otherwise unaltered graphic a flowline from the "Theoretical Understanding" box to the "Coincidental Agreement between Theory and Observations" box. I myself have since added a flowline from the "Sparse and Infrequent Observations" box to the "Publication" box. In the version presented by Wergen (2000), Bormel (2008), and Williams (2008), I note that they have included an additional box titled "Cover-up Subsequent Results" flowing out of the "Publication" box. I have elected not to include that addition in the version presented here. Other variants of the "Course of Science" flowchart are now beginning to appear (e.g., Sage 2008).

quickly with regard to wildland fire behavior.

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