

Final Project Report to the JFSP Governing Board

for

Joint Fire Science Program Project #99-1-2-10

Demographic and geographic approaches to predicting
public acceptance of fuel management at the wildland-
urban interface

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Purpose

This report summarizes the accomplishments and lessons learned from the Joint Fire Science Program funded project, “Demographic and geographic approaches to predicting public acceptance of fuel management at the wildland-urban interface,” relates these accomplishments to the deliverables anticipated in the project proposal, and is accompanied by a CD-ROM containing the project deliverables, mainly articles that detail what was learned. This report and all project deliverables can also be viewed on the Social Acceptance of Fuel Treatments web site at <http://www.fire-saft.net/> by those with Internet access.

Project Description

A conceptual model of how people living at the wildland-urban interface evaluate acceptability of three fuel management approaches (prescribed fire, mechanical treatment, and enforcement of defensible space ordinances) was developed from focus group interviews, and a set of standardized, nationally applicable measurement scales and indicators was developed. Now tested in interface communities in three states, these scales and indicators enable cost-effective, manager-directed surveys to assess local perceptions, understanding and support for fuel management. Survey results were also useful for comparing acceptance, attitudes and beliefs of interface residents in distinctly different parts of the U.S., with different cultural norms and prevailing fire regimes.

The study also attempted to develop models for predicting acceptance from demographic and geographic characteristics of interface residents that could be used to predict acceptance at un-surveyed locations. Unfortunately, this proved infeasible because our research found that statistically significant relationships between acceptance and these attributes did not exist. Spatial continuity of perception, understanding and acceptance were explored in an effort to design spatially unbiased sampling frames and to evaluate the feasibility of interpolating sparse sample data to produce spatially comprehensive maps of fuel treatment acceptance that could support targeted education and outreach intervention activities.

Original Project Objectives

1. Identify the issues related to fire management generally, and fuel management specifically, which are salient to residents of fire-prone wildland-urban interface areas.
2. Test individual questions and scales (sets of questions) to develop a set of reliable and valid measures of knowledge, attitudes, beliefs and individual characteristics (e.g., demographics, past experience) relevant to fire and fuel management.

3. Develop and test a model of the causal factors and processes by which individuals evaluate the acceptability of a fuel management policy or plan.
4. Design a computer aided method for assessing and mapping the spatial distribution of causal factors (e.g., knowledge, attitudes, past experience) that influence fire management policy acceptance.
5. Refine, standardize, and automate survey research procedures to facilitate low-cost, manager-directed surveys of local residents regarding fire policy acceptability and related issues.

A Summary of What We Learned

Concerns that emerged from analysis of the focus group data undertaken to address Objective #1 revealed commonly encountered acceptance factors that fire managers have some power to influence. Acceptance will likely be enhanced by inclusion of information on the following topics in communications and public involvement processes:

Prescribed burning

1. Technical competence of personnel and how the agency incorporates lessons learned from past escaped fires
2. Specific planning and preparation steps taken prior to implementation, including stakeholder involvement
3. Plans that recognize certain conditions must be met (i.e., weather conditions) or else the prescription could be delayed and possibly not occur in the scheduled year
4. Availability of resources necessary to successfully implement the program
5. Mitigation measures employed to reduce the air quality and aesthetic impacts
6. Contingency measures in place to respond in the event of escape
7. Cost effectiveness of the program versus alternative fuel reduction strategies

Mechanical treatment

1. Specific planning and preparation steps taken prior to implementation, including stakeholder involvement
2. Mitigation measures employed to reduce aesthetic impacts
3. Cost effectiveness of the program versus alternative fuel reduction strategies

Defensible space

1. Specific “how-to” instructions tailored to local conditions that consider diverse homeowner site characteristics (slope, development density, etc.) and tell homeowners where assistance can be obtained
2. Mitigation measures homeowners can employ to reduce aesthetic impacts
3. Where applicable, equitable regulation and enforcement of ordinances

Objectives #2 and #3 were addressed via the development and testing of a survey of beliefs about, attitudes towards and support for three fuel treatment approaches. Results showed strong regional differences in attitudes toward prescribed burning, mechanical fuel reduction, and defensible space ordinances. For all three states and fuel management approaches the greatest number of respondents held positive attitudes. However, there are sizable segments of homeowners who hold neutral or negative attitudes about one or more fuel management approach. In both Florida and Michigan, 58 percent of respondents held either neutral or negative attitudes about defensible space ordinances and in Michigan, 58 percent of respondents were neutral or negative towards prescribed burning, too.

Consistent with the theory of reasoned action, we found beliefs about fuel management to be a strong predictor of attitudes toward fuel management and attitudes to be a strong predictor of support intentions toward fuel management. Personal importance (a measure of perceived relevance) of the fuel management approach is a good predictor of attitude across all three approaches and study areas. Trust in the government to manage wildland was also a good predictor of attitudes particularly in understanding homeowners with a negative attitude toward a fuel management approach. Beliefs about the cost-effectiveness of each of the fuel treatments were positively related to attitudes toward them. Past experience with a fuel management approach was not a reliable predictor of attitude. In California and Michigan, home owners who actually practiced defensible space on their property were more likely to hold positive attitudes toward defensible space; however, there were also homeowners who practiced defensible space (with an ordinance in effect) and did not approve of the approach.

For this project, the scales developed for beliefs, attitudes and intent to support fuels management, held true to the Theory of Reasoned Action/Planned Behavior. Measurement on experience levels or voting for support of fuels techniques, scaled as absolute measures– yes/no, were found to not work particularly well in advanced regression models with Theory of Reasoned Action scales, which use relative or more psychometric scaling. Our research efforts on the Mark Twain NF will provide an opportunity to further develop scales for social science factors such as personal importance of fuel reduction approaches and trust in those agencies working on fuels. We anticipate that additional refinement of scales will be possible as the survey is implemented at additional sites.

Objectives #4 and #5 presupposed that human dimensions attributes such as support for, attitudes towards, and beliefs about fuel treatments could be predicted from demographic and geographic factors, and that consequently, these attributes would exhibit some degree of spatial continuity (also known as spatial dependence or spatial autocorrelation) that would enable better predictive modeling of these attributes and help target survey efforts so as to more efficiently sample interface homeowners. One of the biggest surprises of the study was finding that these relationships are all but absent, and that there is little or no spatial continuity in these human dimensions attributes.

We used exploratory geographic data analysis to evaluate hypothesized spatial dependency in attitude towards and approval of each fuel treatment approach using indicator variograms with multiple thresholds, and with neutral responses censored. Similar analysis was conducted for the other variables collected in the survey (e.g., personal importance, beliefs, agency trust). No consistently significant spatial autocorrelation was found for any variable, thus precluding the use of any spatial interpolation approach based on spatial association to map likely support for fuel management and dashing hopes for developing more efficient sampling frameworks.

A large number of GIS derived variables intended to capture relevant environmental attributes were derived, including road density (within 1/6th, 1/3rd, 1/2, and 1 mile), house density (within 1/8th, 1/4th, 1/2, and 1 mile), distance to Low, Medium, and High Risk fuel classes, percent of Low, Medium, and High Risk fuel class (within 1/8th, 1/4th, 1/2, and 1 mile), number of fires since owner acquired property (within 1/8th, 1/4th, 1/2, 1, and 2 mile), number of large (>40 ac) fires (within 1/8th, 1/4th, 1/2, 1, and 2 mile), and distance to the perimeter of the closest large fire. While very modest improvements in the predictive models for attitude towards prescribed burning in California developed in Phase II were obtained by including nearby fire frequency, and for approval of prescribed burning in California by including road density, proximal public land fraction, or distance to high hazard fuels, California was the only study area where this occurred, and the explanatory power these spatial variables added was extremely limited.

Deliverables

Reports published and in progress

1. Winter, G.J., C. Vogt, and J.S. Fried. 2001. Demographic and Geographic Approaches to Predicting Public Acceptance of Fuel Management at the Wildland-Urban Interface, Focus Group Report. On file at University of California, Berkeley, Dept of Environmental Science, Policy and Management, and available via <http://www.fire-saft.net/publications/index.htm> electronically. June 2001.
2. Winter, G.J., C. Vogt, and J.S. Fried. 2002. Fuel treatments at the wildland-urban interface: common concerns in diverse regions. *Journal of Forestry* 100:15-21.

3. Winter, G.J., C. Vogt, and J.S. Fried. 2002. Demographic and Geographic Approaches to Predicting Public Acceptance of Fuel Management at the Wildland-Urban Interface, Phase II Project Report, Final Survey Data Report. On file at University of California, Berkeley, Dept of Environmental Science, Policy and Management, and available at http://www.fire-saft.net/publications/Final_Phase_II_project_report_092502.pdf electronically. September 2002.
4. Winter, G.J. 2002. Social Acceptance of Fuel Treatments. 1-pager, color Research Finding brochure, distributed to Forest Service Washington Office Deputy Chiefs, Directors and their staffs interested in the research.
5. Vogt, C., G. Winter, and J.S. Fried. 2003. "Antecedents to Attitudes toward Prescribed Burning, Mechanical Thinning and Defensible Space Fuel Reduction Techniques (pp74-83)" *In People and Wildfire -Proceedings from the 9th International Symposium on Society and Resource Management (Pam Jakes, Ed). Gen. Tech. Report NC-231 - St. Paul, MN: US Dept. of Agriculture, Forest Service, North Central Research Station. P. 74-83.*
6. Winter, G.J., C. Vogt, and S, McCaffrey. 2004. Examining social trust in fuel management strategies. *Journal of Forestry* 102:8-15.
7. Vogt, C.A., G. Winter and J.S. Fried. 2005. Predicting homeowners' approval of fuel management at the wildland-urban interface using the Theory of Reasoned Action. *Society and Natural Resources*. 18(4):337-354.
8. Fried, J.S., G. Winter and C.A. Vogt. 2005. Demographic and geographic approaches to predicting public acceptance of fuel management at the wildland-urban interface: Final Project Report to the JFSP Governing Board for Joint Fire Science Program Project #99-1-2-10 [**this report**]. 11 p. July 2005.
9. Gatzolis, D. and J.S. Fried. In preparation. Geographic modeling of fuel treatment acceptance at the wildland-urban interface: local context counts less than personal beliefs. To be submitted to *Journal of Forestry*.
10. Fried, J.S., D. Gatzolis, J.K. Gilless, C. Vogt, and G. Winter. In preparation. A prescription for fostering support for fuel treatments at the wildland interface: change beliefs, build trust. To be submitted to *Fire Management Today*.

Presentations

11. 10/3/00 “Demographic and geographic approaches to predicting public acceptance of fuel management at the wildland-urban interface: status report 2000”, paper presented at the 2000 Joint Fire Science Principle Investigator’s Workshop, Reno, NV.
12. 11/7/01 “Homeowner Acceptance Of Fuel Treatments At The Wildland-Urban Interface”, presented by C. Vogt, G. Winter and J. Fried at the Wildland-Urban Interface: Sustaining Forests in a Changing Landscape Conference, Gainesville, FL.
13. 3/12/02 “Understanding Public Acceptance of Fuel Treatments at the Wildland Urban Interface: 2001 Progress Report to the Joint Fire Sciences Program Board”, presented by J.S. Fried, G. Winter and C. Vogt, at the Joint Fire Science Program Principle Investigators’ Workshop, San Antonio, TX.
14. 12/16/02 “Predicting Public Acceptance of Fuel Management at the Lake States Forest Interface”, presented by C. Vogt, G. Winter, D. Gatziolis and J.S. Fried at the NC Research Station Fireplan funded social science research workshop, Evanston, IL.
15. 6/2002 “Antecedents to attitudes toward prescribed burning, mechanical thinning and defensible space fuel reduction techniques”, presented by C. Vogt, G. Winter and J.S. Fried at the ISSRM Conference, Bloomington, IN.
16. 3/11/03 “Fuel-treatment at the wildland-urban interface: No shortcuts to predicting social acceptance”, presented by J. Fried, G. Winter, C. Vogt and D. Gatziolis at the Joint Fire Science Program Principle Investigators’ Workshop, Phoenix, AZ.
17. 12/16/03 “Common factors affecting the social acceptance of fuel management techniques”, to be presented by G.J. Winter, C. Vogt, and J.S. Fried. At the 2nd International Wildland Fire Ecology and Fire Management Congress, Orlando, FL.
18. 2/4/04 “Common factors affecting the social acceptance of fuel management techniques”, presented by G.J. Winter. At Mark Twain National Forest Team Leadership Meeting, Rolla, MO.
19. 4/7/04 “Predicting social acceptance of fuel-treatments: You have to ask, they have to trust,” presented by J.S. Fried, D. Gatziolis, G. Winter, C. Vogt at the Joint Fire Science Program Principle Investigators’ Workshop, Phoenix, AZ.

Follow-on Grants

Two follow-on grants allowed us to leverage the Joint Fire Science Program funds and extend analysis to additional areas, as well as refine survey methods learning from our experience with the California and Florida survey testing sites.

- 2001 U.S.D.A. Forest Service North Central Research Station, Natural Environments for Urban Populations, fire research grants competition. Predicting public acceptance of fuel management at the Lake States forest interface (C. Vogt, G. Winter and J. Fried). \$63,200. This grant leveraged the JFSP funds to allow administration of the survey and collection of spatial data at a third site, in Michigan's jack pine region.
- 2003 USDA Forest Service, North Central Research Unit. "Social Assessment of Fuel Management: Case Study of Popular Bluff Following the Blowdown." (C. Vogt and G. Winter). \$11,750.

Anticipated versus actual deliverables

The following deliverables were anticipated in the initial grant application:

1. Focus group reports for the regions in Phase One
2. Survey reports for two communities in Phase Two
3. Predictive models of acceptance (based on geographic and demographic characteristics) for the two Phase Two study regions
4. Maps of understanding and acceptance for the two Phase Two study regions
5. Manuscripts to be submitted to peer-reviewed social scientific journals
6. Manuscript to be submitted to Wildfire or Fire Management Notes

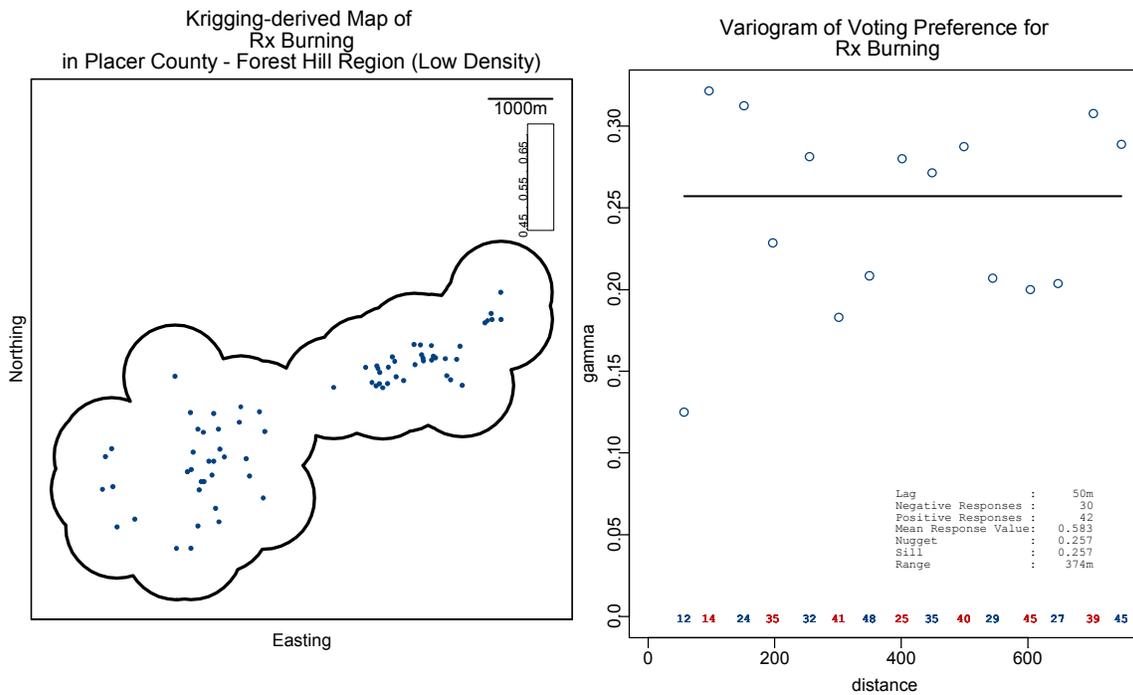
Deliverable #1 was completed in 2001 as publication #1 and was the basis for publication #2, an article published in the *Journal of Forestry* in 2002.

Deliverable #2 was completed in 2002 as publication #3 and was the basis for publication #4, a 2003 article in Proceedings from the 9th International Symposium on Society and Resource Management.

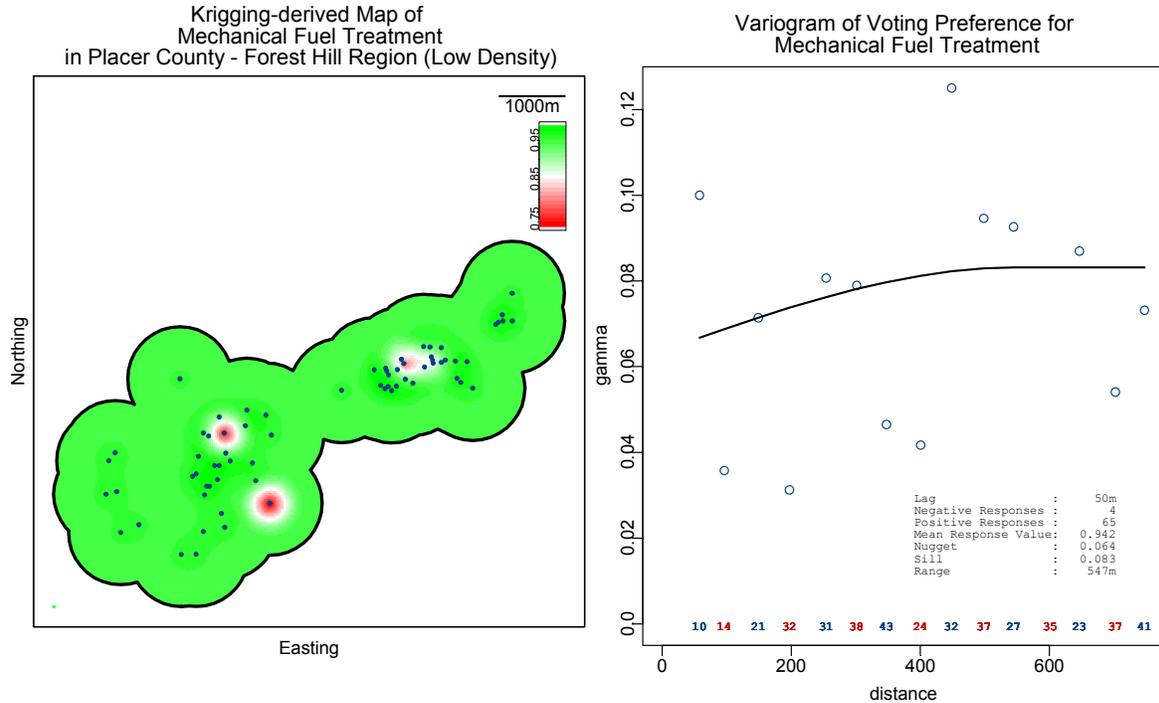
Deliverable #3 was completed in 2005 as publication #5, an article in *Society and Natural Resources*.

Deliverable #4 proved infeasible because the data told a different story. While it is technically possible to generate "prediction" maps of fuel treatment support or attitudinal attributes from spatial variables alone, they would have so little predictive value (because so little of the variation is explained) that a manager would be better off

regarding these variables as constants, i.e., the average value from the survey responses, which would produce one-color maps. Maps founded on spatial continuity (i.e., kriging) are equally unhelpful, because the exceedingly low spatial autocorrelation produces maps that either a) have the mean value almost everywhere except at sampled points, or b) exhibit some variation, but there is no basis for rejecting the patterns as spurious- for example in map B below, the sample represents less than 25 percent of the WUI homeowner population, and one can easily imagine new red “hot spots” of low acceptance of mechanical fuel treatment popping up in the predominant green regions of high acceptance (and disappearance of the existing “hot spots”) had a different set of households been in the sample. Neither predicting from geographic variables nor interpolating from a survey sample, appears promising for predicting acceptance or its antecedents.



A



B

Deliverable #5, publication in peer-reviewed journals, is represented in completed publications #2, 5, 6 and pending publication #7, a manuscript for submission to *Journal of Forestry*.

Deliverable #6, a technology transfer piece, is represented in pending publication #8, a manuscript for submission to *Fire Management Today* (draft version included on deliverables disk).

In addition to these deliverables, as part of this research project we have developed the web site <http://www.fire-saft.net/> where these deliverables can be easily accessed, made numerous presentations to researchers and managers, and heightened awareness of the issues and the role that social science can play in the areas where we have worked.

Please don't hesitate to contact me or the other project staff if you have any questions (contact information below).

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