Local Ecological Knowledge and Fire Management: What Does the Public Understand?

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Acknowledgment of Co-Authors

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Outline

- Introduction
- Literature Review
- Methods and Conceptual Framework
- Findings
- Discussion & Implications
- Conclusion



Introduction

- *Situation*: Declining vegetative health and increasing population in the wildland-urban interface (WUI)
- National Policies
  - Priority: Locally-based efforts
  - Shifting research focus

- Community-based programs
  - Firewise and Fire-Adapted Communities
  - Local resident participation

Literature Review

- Local Ecological Knowledge & Fire Risk, Fire Ecology & Fire Management

- Formal Education, Ecological Knowledge & Fire Management

Local Ecological Knowledge and Fire Risk, Fire Ecology and Fire Management

- Knowledge about local ecological systems (Berkes et al. 2000)
  - Framework for interpreting and responding to local environment



- Importance of local ecological knowledge in creating place-based solutions (McCaffrey and Olsen 2012, Brenkert-Smith 2011)
  - Acceptance of appropriate practices for mitigating fire risk
  - Integration of local and science based ecological knowledge

Local Ecological Knowledge and Fire Risk, Fire Ecology and Fire Management

- Empirical research provides a continuum of how local ecological knowledge relates to wildland fire.
  - 1st Link: Local ecological knowledge to fire risk
    - Residents in fire prone ecosystems have a good understanding of the relationship between forest health and fire risk (Burns & Cheng 2007)

  - 2nd Link: Understanding of forest conditions to specific risks (McCaffrey 2008, Ray et al. 2012, Weisshaupt et al. 2007)
    - Public understands how forest related conditions contribute to conditions that increase flammability

Local Ecological Knowledge and Fire Risk, Fire Ecology and Fire Management

- 3rd Link: Fire management strategies fit into wildfire response

(Ryan 2012, Brenkert-Smith 2011, Toman and Shindler 2006, Cohn et al. 2008)

  - Local communities have intricate knowledge of how forest related conditions contribute to fire risk and dictate appropriateness of management strategies

- Research Question
  - Is there a relationship between the local ecological knowledge and fire management understanding in the context of wildfire response?

Local Ecological Knowledge and Fire Risk, Fire Ecology and Fire Management

Hypotheses

- *Hypothesis 1a*: Accuracy in LEK will be positively related to higher proficiencies in identifying the specific management strategy used during local wildfire response.
- *Hypothesis 1b*: Accuracy in LEK will be positively related to resident satisfaction and perceived appropriateness related to the fire management used on a local wildfire.

Formal Education, Ecological Knowledge & Fire Management

- Research divided on its effect on wildland fire management perception
  - Significant relationship between education and fire management perception (Asher and Vask 2006, Erickson and Gill 2010, Lim et al. 2009, Ostergen et al. 2006, Semeza et al. 2008, Winter and Cvetkovich 2008)
    - Wildlife concerns
    - Increased fire-mitigation approval
    - Advocacy for fire management in rural landscapes
    - Behavioral change associated with climate change
    - Agency trust

Formal Education, Ecological Knowledge & Fire Management

- No significant association between education level and fire management perception (Fried et al. 2006, Lim et al. 2009, Loomis et al 2002, Shindler and Toman 2003, Toman et al. 2011)
  - Fire management acceptance and understanding
  - Possible result of the influence of community engagement and group membership

Formal Education in Local Ecology and Fire Management Knowledge

- Research Question
  - Does education level affect fire management acceptance and understanding?

Formal Education in Local Ecology and Fire Management Knowledge

Hypotheses

- *Hypothesis 2a*: The education level of local residents will be positively related to their satisfaction with and perception of the appropriateness of fire management strategies used on a local wildfire.
- *Hypothesis 2b*: The education level of residents will be positively related to higher proficiencies in identifying the fire management strategy used on a local wildfire.
- *Hypothesis 2c*: The education level of residents will be positively associated with greater proficiencies in identifying accurate forest-related conditions.

Conceptual Framework and Methods

- Mixed methods
  - Key informant interview: District Rangers
  - Document analysis: ICS-209 reports
  - Quantitative surveys: Local Residents
    - Piloted in 2009 & revised based on participant recommendations
- Fire Chasing Criteria
  - Response by Type I or II Federal Incident Management Team
  - Proximity/Threat to local community
  - Evacuations & road closures
- Team Deployment
  - 40% to 60% containment

FIRE CHASERS PROJECT

Advancing the science of adaptive capacity toward more disaster resilient communities

Methods

- Sample frame
  - 2010 Wildfires: Tecolote Fire (New Mexico), Shultz Fire (Arizona), & Bull Fire (California)
  - Resident sample: 5-10 mile perimeter of each fire

Conceptual Framework and Methods

RQ: **Is there a relationship between the local ecological knowledge and fire management understanding in the context of wildfire response?**

Satisfaction with FM
Understanding of FM
Appropriateness of FM
Strategy Match

= f(Importance of Ecological Needs)
= f(Ecological knowledge Index)**

**Forest related conditions for both indices: Beetle kill, blowdown, drought, tree density, steep terrain, erodible soils, & age of forest.

Conceptual Framework and Methods

RQ: **Does education level affect fire management acceptance and understanding?**

Satisfaction with FM
Understanding of FM
Appropriateness of FM
Strategy Match
Ecological knowledge Index

=

f(Education Level)

Results

- Most survey respondents:
  - felt “very satisfied” with fire management decision-making (57%; n = 258)
  - “somewhat understood” the strategy utilized (55%; n = 244)
  - felt the strategy was “very appropriate” to manage the fire (55%; n = 266)
- Direct suppression was utilized
  - 50.4% correct identification (n = 240)
  - 26.7% incorrect identification (n = 127)
  - 22.9% didn’t know (n = 109)

Results: Local Ecological Knowledge

- Key point: Findings robust across several measurements. Ecological knowledge is positively associated with better understanding of fire management
  - 86% (n=352) identified ecological needs as “somewhat” or “very important” in the acceptance of fire management strategies
    - 54% (n=219) stating it was “very important”

Results: Local Ecological Knowledge

- Correlation analysis identified significant relationships
  - Ecological knowledge index, appropriateness, satisfaction, understanding & education level
- Linear regression: ecological knowledge only significant variable

Model		B	t	Sig.
1	(Constant)	2.939	24.473	.000
	Ecological knowledge Index	.055	2.629	.009
	Education Level	-.005	-.198	.843

To what extent do you feel you understood the strategy that was taken in managing the fire?

Results: Local Ecological Knowledge

Chi-Square Logistic Regression Output Ecological Knowledge Index and Strategy Match

Chi-Square	df	Sig	Cox & Snell R Square	Nagelkerke's R Square
31.696	3	.000	.062	.083

Logistic Regression Output Predicting Relationship between Ecological Knowledge Index and Strategy Match

Predictor	B	Waldx^2	P	Odds Ratio
Eco-knowledge	.198	12.385	.000	1.219
Tecelote		15.527	.000	
Shultz	-.988	9.125	.003	.372
Bull	.249	0.069	.793	1.068

*Logistic Regression Equation: e^a + bx
**a= B (constant); b= B (Ecoknowledge, Tecelote, Shultz, Bull); x = eco-knowledge index

- Nagelkerke's R^2 : 0.083
- P= 0.000
- Odds ratio: 1.219 (probability of identifying strategy)

Results: Local Ecological Knowledge

- The more ecological conditions accurately identified = higher probability of correct identification of fire management strategy.

Probability of Identifying Correct Fire Management Strategy Based on Number of Correct Ecological Condition Match

Ecological knowledge Index	Probability of Correct Fire Management Identification
0	38%
1	43%
2	48%
3	53%
4	57%
5	62%
6	67%
7	71%

*Ecological knowledge index based on correct match of District Ranger Assessment of ecological conditions prevalence.
* Correct fire management identification based on strategy match variable.

Results: Formal Education

- No significant relationship with satisfaction, understanding, appropriateness
- No statistical difference: strategy match.
- Significant relationship with Ecological knowledge index

Non-parametric correlation output for education level

Variable		How satisfied were you with management of the fire?	To what extent do you feel you understood the strategy that was taken for managing the fire?	To what extent do you feel this strategy was appropriate for managing the fire?	Ecological knowledge index
What is the highest level of formal education you have received?	Correlation Coefficient	-.001	-.008	.019	.223**
	Significance (2-tailed)	.977	.858	.650	.000
	N	554	548	592	471

* p= .05
**p <= .01

Results: Formal Education

- Significant predictor of local ecological knowledge

Chi-Square Output for Eco-knowledge >=4 and Education Level

	Value	Df	Asymp Sig (2-sided)
Pearson Chi-Square	22.180	3	.000
Likelihood Ratio	22.424	3	.000
Linear-by-Liner Association	16.368	1	.000
N of Valid Cases	471		

Percentage of Respondents That Identified <= 3 Conditions or >= 4 Conditions

		Eco-knowledge >= 4	
		.00	1.00
What is the highest level of formal education you have completed?	Some HS/HS graduate/GED	65%	35%
	Some College	43%	57%
	Bachelor's Degree	46%	54%
	Some graduate school	41%	59%

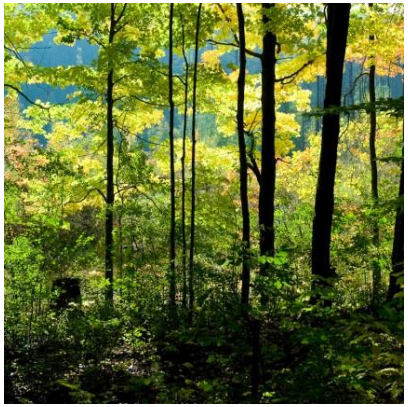
*.00: 3 or less conditions correctly identified
**1.00: 4 or more conditions correctly identified

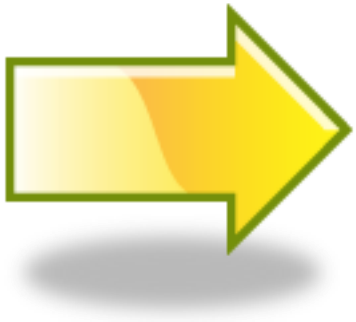
Some college experience relates to higher success rate

Discussion

- ***Collaborative efforts should focus on improving knowledge of ecological conditions***
  - Respondent accuracy identifying specific conditions increased odds of strategy identification
  - LEK relationship with acceptance of fire management strategies
  - Greater LEK = more informed and more critical stakeholders in the process

Local ecological knowledge





Better understanding of fire management

Discussion

- ***No Relationship: Fire management and education level***
  - Did not rate fire management differently or have a better understanding of the specific strategies utilized
  - Builds upon division within existing body of research

Education Level

Better understanding of Fire Management

Discussion

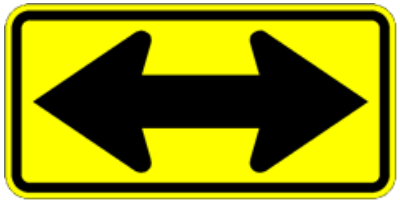
- ***Relationship: Education level and local ecological knowledge***
  - Significant predictor for local ecological knowledge
  - Residents' opportunity of participating in collegiate studies had a higher proficiency in identifying forest related conditions.
  - May play mediating role in understanding complex environmental issues

Education Level

Local ecological knowledge

Management and Policy Implications

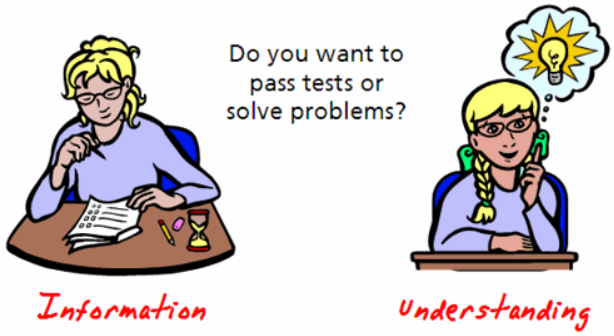
- LEK, framework for interpreting and responding to feedback from local environment
  - Increase a community's understanding of actual strategy used
- Ability to implement flexible fire management
  - Implement multiple strategies dependent on fire risk, fire behavior and ecological conditions
- Policy implications
  - Greater tolerance and appreciation of fire management
  - Collaborative planning, implementation, and adaptive management



Conclusion

- National Cohesive Wildland Fire Management Strategy
  - "Taking a proactive, collaborative approach to solving the Nation's wildfire problem and involving all stakeholders provides the best opportunity to restore and maintain landscapes, protect communities from wildfire and effectively respond to wildfires when they occur"

- Fostering shared ways of knowing
  - Increased complexity of fires in the WUI
  - Important for implementation of flexible fire management
  - What information sources lead to increased understanding?



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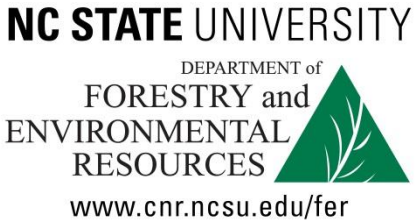

THANKS!!

Questions???


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