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*PATHWAYS TO HUMAN COMMUNITY ADAPTATION TO WILDLAND FIRE RISK*

**NON-TECHNICAL SUMMARY:** To determine the pathways that communities in the wildland urban interface (WUI) can take to become adapted to wildfire and risk of wildfire. Previous research indicates there are four broad types of communities in the WUI relative to the types of actions they are likely to be able to take in becoming for fire adaptive. This research is designed to flesh out the details of these pathways.

**OBJECTIVES:** Our goal is to provide generalizable lessons about the various ways that diverse western communities can become fire adapted. To achieve this goal, we will:Objective 1. Identify community archetypes using readily available social and economic data. Building on the detailed community-level data in our community archetype dataset, we will develop a scheme to classify communities by archetype using readily available secondary socioeconomic data. The outcome of this objective will be useful to community leaders, fire managers, and policy makers needing to understand the different types of policy and planning interventions that may be useful in different communities, and will complement Cohesive Wildland Fire Management Strategy county-level socio-economic clusters and resiliency classes (WFEC 2013).Objective 2. Create a systematic understanding of individual-level wildfire-adapted behaviors and the community-level social dynamics that influence the development of fire adapted communities.We will use the results from Objective 1 to sample communities, from each archetype category, and survey individual homeowners in each community. In addition to illuminating attitudes towards wildfire risk and mitigation actions taken, our survey will focus on collective efforts at wildfire risk reduction, influence of and engagement with local wildfire risk planning and programs, perceptions about the local community, and impacts of recent socio-demographic trends. Analysis of the survey data will focus on the development of internal validity by examining similarities and differences within and between the archetype categories. Results will help community leaders, fire managers, and policy makers better understand: (1) the social conditions that constrain and enable performance of fire adapted actions at the community level; and (2) the archetype categories most associated with different types of social processes and collective risk reduction behaviors.Objective 3. Create rich understanding of how social processes influence the local goals of fire adapted communities.We will conduct focus groups of key informants in half of the communities sampled in Objective 2, two from each archetype category. Focus groups will convene local community leaders, representatives

from land management agencies, and emergency managers to discuss survey findings and engage a conversation of how community characteristics enable and constrain local adaptation to wildfire. Results will focus on the qualitative similarities and differences within and between archetypes. Outcomes from this objective will describe the common approaches that different communities take towards becoming fire adapted and the common set-backs backs they encounter, which we refer to as a pathway towards becoming fire adapted.Objective 4. Synthesize the benefits and consequences of different pathways to becoming fire adapted for the different community archetypes, and disseminate to wildfire planning and fire adapted communities networks.By triangulating between data and findings from Objectives 1, 2, and 3, we will synthesize how specific pathways are likely to lead to different adaptive actions taken by communities, and the potential challenges for communities of pursuing pathways associated with other community archetypes. We will use a variety of written documents, presentations to scholarly and practitioner audiences, and webinars or other networking opportunities to disseminate findings from all phases of our research broadly and strategically.

**APPROACH:** Objective 1: Identify community archetypes using readily available social and economic data.A dataset previous developed includes communities that have experienced recent large wildfires. Data includes a diverse set of metrics, including recent wildfire history (i.e., various attributes derived from ICS-209 incident reports), institutional implementation of wildfire mitigation measures (i.e., surveys of community leaders, wildfire managers, and fuel treatment planners), key informant assessment of adaptive capacities operating in each community (i.e. surveys of community leaders, wildfire professionals and emergency managers), wildfire planning accomplishments (i.e., coding of over 175 community wildfire protection plans), and demographic vulnerabilities (i.e., secondary data from the US Census Bureau's American Community Survey). We are using cluster analysis on this complex set of data to assign archetype categories to each community in the dataset. For this project, we will collect basic socioeconomic data (e.g., labor and housing statistics), related to the archetype categories and use discriminant analysis to identify the secondary data that best predicts the archetype categories, thereby developing a simple, generalizable method to identify fire adapted community types.Objective 2: Community SurveysTask 1: Select communities for further study. Predictions made by the discriminant analysis in Objective 1 will be used to randomly select 4 communities from each archetype category. Case selection will be reviewed by: (1) asking practitioners in the Coalition of Fire Adapted Communities and the relevant Joint Fire Science knowledge consortia networks to identify whether these cases are likely to be useful examples of particular archetypes; and (2) making initial contact in each community to confirm archetypes and suitability for in-depth study. Any communities that vetting suggests do not fit the archetype well will be discarded from case selection and will be replaced via random selection and iteratively vetted. We will continue this process until we have selected 16 cases that include four representative communities for each archetype.Task 2. Survey households within each selected community. Within each community, the sample frame for the survey will be heads of households for properties within the most recent wildland urban interface map defined by the SIVLIS lab at the University of Wisconsin. Community boundaries will be defined as any property with a centroid 5 miles from borders of a community or place as defined by US Census Bureau. Selection will occur using Geographic Information Systems software (ArcGIS) and will allow survey responses to be geocoded for analysis of spatial patterns. We will randomly draw a sample of 250-300 homeowners in each of 16 study communities. We will conduct surveys using a modified Dillman (2009) four contact total design method. We expect a 40% response rate, or approximately 100 responses for each community and 400 responses for each archetype. Targeting this number of responses would allow researchers to minimize sampling error at the archetype level (<5%), while maintaining an acceptable sampling error at the community level (<10%).We will ask respondents about: (1) experience with wildfire; (2) attitudes and beliefs about wildfire risk and perceived ability to adapt; (3) the local relationships and engagement in with risk

planning and programs that enable or constrain their ability adaptation planning; (3) place-based understandings of the local community and environment; (4) perceptions about recent demographic and structural (e.g. road infrastructure, building materials and access to resources) trends; and (5) performance of adaptive behaviors (e.g., defensible space, structural upgrades, wildland fuel treatments) or planning (e.g., emergency preparedness, evacuation plans, etc.).Analysis of the survey data will focus on modeling of the complex set of psychological, social, and community traits that explain adaptive behaviors. We expect to use multivariate statistical methods such as classification and regression trees and structural equation modeling to identify important criteria and indicators that explain adaptive behaviors and the complex interactions among individual psychological traits and social and community perceptions. Survey analysis will also test for internal validity by examining responses for differences within and between the archetype categories.Objective 3: Key Informant Focus GroupsWe will conduct one focus group of 12-15 individuals in each of eight communities selected for study. We will randomly select the eight focus group communities from the list of 16 communities generated inObjective 2, Task 1 so that each archetype is represented by two communities. We will adapt existing focus group protocols (Paveglio et al 2012) of open-ended questions to ask how local social processes and relationships have led to different strategies for achieving FACs. We will share preliminary survey results specific to each community with members of the focus groups, and discussion questions will focus on validation or explanation of patterns in survey results. We will ask participants about the local social conditions, adaptation actions, and perceptions that enable or constrain progression toward fire adaptation in the community.We will select our key informants through purposive sampling (Linlof and Taylor 2010). We expect our key informants to include county planners, fire marshals, natural resource or fire managers as well as volunteers and staff from community organizations, fire protection and neighborhood associations, volunteer fire departments, conservation organizations, collaborative groups and others who are involved in wildfire or wildlands management. Focus groups will be video and audio recorded. At least two members of the research team will be present at each focus group to ensure consistency of facilitation across cases and for preliminary analyses directly following focus groups. Audio transcripts of focus groups will be transcribed verbatim. Qualitative analysis of data will consist of analytic induction (Glaser & Strauss, 1999). Analysis of transcripts would be conducted using Atlas.ti.Objective 4: Synthesis and dissemination. Task 1. Synthesize results across methods. Using data from each of the first three objectives in a research team workshop, we will analyze the potential outcomes of the different pathways for each community archetype, and the potential challenges for communities of pursuing pathways associated with other community archetypes. This data integration and triangulation will help us understand how multiple community-level factors, such as community culture and identity, place-based attachments, communication networks, and other local social processes for addressing wildland fire risks, interact to create the conditions under which different adaptation pathways become successful or obstructed.Task 2. Disseminate results to diverse audiences. Drawing from our synthesis and the results of the individual objectives, we will disseminate our research findings to a broad audience of wildfire planning and FAC networks as well as scholarly audiences. Our dissemination activities will include peer reviewed journal articles and conference presentations designed to accelerate wildfire social science. In addition, we will create a research brief and webinars in collaboration with two fire consortia and conduct briefings on key findings with Forest Service, USDA, and other mangers and policy makers involved in implementation of the Cohesive Strategy.

**PROGRESS:** 2016/10 TO 2017/09
Target Audience:Target Audiences addressed this year include fellow fire researchers, federal

wildland land managers, state wildland managers, and ordinary residents of the Wildland Urban Interface in Northeast Washington State and Northern Idaho Changes/Problems:The only real change to report is our having developed a cooperative relationship with other fire social scientists working on the USDA Forest Service projectmentioned above which will likly provide additional resources to conduct additional community case studies. What opportunities for training and professional development has the project provided? Nothing Reported How have the results been disseminated to communities of interest?The two publications listed above and the main means by which results were presented this reporting year. What do you plan to do during the next reporting period to accomplish the goals?We plan at least two (lilkey3) additional case studies, likely in the Wenatchee Washington area, to further advance our understanding of differences in community pathways. We are currently in negotiation with the Rocky Mointain Research Station of the USDA forest Service for additional suppoer for case study work.

**IMPACT:** 2016/10 TO 2017/09
What was accomplished under these goals? We conducted two field projects, one in Western Montana and one in Northeast Oregon which advanced progress on objectives 1, 2 and 3. One publication in particular (Paveligo, Carroll et.al In press) advanced progrss on Objective 4 by beginning to flesh out the details of pathways linked to different types of WUI communities.

**PUBLICATIONS (not previously reported):** 2016/10 TO 2017/09
1. Type: Journal Articles Status: Published Year Published: 2017 Citation: Paveglio, T.B., A.D. Boyd, and M.S. Carroll. 2017. Re-conceptualizing community in risk research. The Journal of Risk Research 20(7): 931-951
2. Type: Journal Articles Status: Accepted Year Published: 2018 Citation: Paveglio, T.B., M.S. Carroll, A. Stasiewicz, D.R. Williams, D. Becker. In press. Incorporating social diversity into wildfire management: Proposing 'pathways' for fire adaptation. For publication in Forest Science.

**PROGRESS:** 2015/10/01 TO 2016/09/30
Target Audience:Scholarly colleagues in the fire research world Real world practioners (fire fighters and community leaders) Policy makers in the area of wildfire management. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? Nothing Reported How have the results been disseminated to communities of interest? Two professional presentations deliered to practitioner audiences by Drs. Carroll and Paveglio. What do you plan to do during the next reporting period to accomplish the goals?We plan to conduct focus groups in at least 4 cases study sites and combine the data from those with data already in hand for purposes of scholarly publication.

**IMPACT:** 2015/10/01 TO 2016/09/30
What was accomplished under these goals? Three case studies were completed and the data is currently being analyzed for publication.

**PUBLICATIONS:** 2015/10/01 TO 2016/09/30
1. Type: Conference Papers and Presentations Status: Other Year Published: 2016 Citation: Carroll, M.S. and T Paveligo 2016 (invited) After The Fire: Understanding post-fire event social responses. Presented at the 24th Annual Family Forester?s Workshop Spokane WA Jan 15.
2. Type: Conference Papers and Presentations Status: Other Year Published: 2016 Citation: Carroll, M.S. and T. Paveligo. 2016 (invited) Creating fire adapted communities: An ?archetype approach. Presented at the annual ?Spring Fire meeting of the Idaho Department of Lands Post Falls, Idaho April 12.

**PROGRESS:** 2015/07/01 TO 2015/09/30

Target Audience:Scholarly peers, Public land policy makers, Public land managers, residents of communities in the Wild land Urban Interface. Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? Nothing Reported How have the results been disseminated to communities of interest?I gave an invited presentation on this work to a by-invitation-only conference sponsored by the Royal Society at Chicheley Hall, Buckinghamshire, England. What do you plan to do during the next reporting period to accomplish the goals?To use funding from the US Forest Service, Rocky Mountain Research Station to conduct additional case studies of communities at risk of wildfire in furtherance of the goal of better understanding how different types of Communities in the Wild land Urban Interface can become more fire adapted.

**IMPACT:** 2015/07/01 TO 2015/09/30
What was accomplished under these goals? This project has been ongoing only since July, 2015. During that time I have completed two case studies concerning wildfire in the WUI.

**PUBLICATIONS:** 2015/07/01 TO 2015/09/30
1. Type: Conference Papers and Presentations Status: Other Year Published: 2015 Citation: Carroll, M. S and T.P Paveligo . 2015. Adaptive Capacity for Wildfire and Community ? Archetypes:? The Importance of Local Context Across Cases. Presented at the International Symposium for Society and Natural Resources.Charleston South Carolina. June 17.
2. Type: Journal Articles Status: Published Year Published: 2015 Citation: Abrams, J.M., M. Knapp, T. Paveglio, A. Ellison, C. Moseley, M. Nielsen-Pincus, M. Carroll. 2015. Re-envisioning community-wildfire relations in the U.S. West as Adaptive Governance. Ecology and Society. 20(3); 34-46
3. Type: Journal Articles Status: Published Year Published: 2015 Citation: Paveglio, T., M. Carroll and H. Brenkert-Smith.T. E. Hall 2015. ?Put the wet stuff on the hot stuff?: The legacy and drivers of conflict surrounding wildfire suppression. Journal Of Rural Studies. 41:72-81
4. Type: Conference Papers and Presentations Status: Published Year Published: 2015 Citation: Creighton, Janean, Keith A. Blatner and Matthew S. Carroll.2015. For the Love of Land: The Influence of Generational Land Transfer on Forest Fragmentation in Washington State. Small-scale Forestry. DOI 10.1007/s11842-015-9301-2.
5. Type: Conference Papers and Presentations Status: Published Year Published: 2015 Citation: Carroll, M.S. 2015 (invited) The ?Wildfire Problem:How Did We Get Here and What?s Next? Presented at the Thomas S. Foley Institute for Public Policy and Public Service Ongoing lecture Series. Washington State University. Sept 8.
6. Type: Conference Papers and Presentations Status: Other Year Published: 2015 Citation: Carroll, M.S.,and T.Pavegilo. 2015. (invited) Understanding Local Social Context in Human-Fire-Climate Relationships. Presented at : Contradiction, conflict and compromise: addressing the many dimensions of sustainability in human-fire-climate relationships; A conference hosted by the Royal Society., Chicheley Hall, Buckinghamshire, England, Sept 16.
7. Type: Journal Articles Status: Published Year Published: 2015 Citation: Paveglio, T.B., C. Moseley, M.S. Carroll, D.R. Williams, A.P. Fischer, E.J. Davis. 2015. Categorizing the social context of the Wildland Urban Interface: Adaptive capacity for wildfire and community ?archetypes.? Forest Science. 61(2)298-310