

ABSTRACT OF A DISSERTATION

**CAN COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT IMPROVE
WILDFIRE POLICY PLANNING IN INTERIOR ALASKA? ADDRESSING
VALUE DIFFERENCES, INEFFECTIVE PARTICIPATORY PROCESSES, AND
CONFLICTS OVER TRADITIONAL ECOLOGICAL KNOWLEDGE**

LILY AMELIA RAY

OCTOBER 2010

**Submitted to the faculty of Clark University, Worcester,
Massachusetts, in partial fulfillment of the requirements for the degree
of Doctor of Philosophy in the Department of Geography**

And accepted on the recommendation of

Dianne Rocheleau, Ph.D.

B.L. Turner, II, Ph.D.

Chief Instructors

A climactically-induced increase in wildfires in the Alaskan boreal forest threatens rural indigenous livelihoods, and indicates a need for community involvement in wildfire policy planning. A diverse literature describes community-based natural resource management, but has not been applied to wildfire management. Through three research papers this dissertation investigates conflicts over wildfire management in rural Alaska and considers community participation as a potential solution.

The first paper explores the concept of a “community” perspective on wildfire in the Koyukon Athabascan communities of Galena and Huslia. A Q-sort was used to determine shared perspectives, and showed that Koyukon grouped separately from Caucasian residents or agency employees, and that Koyukon perspectives varied according to age. The study shows that in ethnically homogenous communities tied by kinship relations and sharing networks, “community” continues to be a useful construct, and that age is an understudied axis of resource-use differentiation.

The second paper is a case study of the Galena Community Wildfire Protection Plan (CWPP) participatory process. The results indicate that the CWPP process, which focused on **wildland-urban interface risk**, had low participation and did

not allow community control over goal-setting. This was, however, acceptable to residents, who had little experience with risk management. In contrast, Koyukon residents expressed frustration with **wildfire management policies**, which affected local forests but did not consider local livelihoods or informal institutions. The paper concludes that participation is most appropriate for issues where residents have a history of local use and management strategies.

The third paper investigates knowledge conflicts between wildfire managers and Koyukon residents over the effects of wildfires. An in-depth, ethnographic investigation revealed that conflict came when managers did not recognize the logistical effects of wildfires on Koyukon livelihoods, the effects of climate change on the wildfire regime, or the unpredictability of wildfire effects. The paper concludes that misalignments between local and national narratives of resource change indicate a valuable opportunity to tailor policies to local environments, rather than an insurmountable conflict.

Together, these three papers help bridge the gap between wildfire management and Koyukon communities, using insights from the literature on community-based natural resource management.

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ACADEMIC HISTORY

Name: Lily Amelia Ray

Date: October 2010

Place of Birth: Nashville, TN, USA

Date: April 17, 1979

Baccalaureate Degree: Bachelor of Arts, Geology

Source: Rice University, Houston, Texas

Date: January 2002

Graduate Degree: Master of Arts, Geography

Source: Clark University, Worcester, MA

Date: May 2007

Occupation and Academic Connection since date of baccalaureate degree:

GIS Intern, Environmental Careers Organization/USGS, Menlo Park, California (August 2001-January 2002)

Human Rights Accompanier, Fellowship of Reconciliation, Antioquia, Colombia (February 2002-August 2002)

VISTA Volunteer, AmeriCorps VISTA, Farmworker Service, North Carolina (February 2003-March 2004)

Teaching Assistant, Clark University, Worcester, Massachusetts (August 2004-December 2004)

Research Assistant, Clark University, Worcester, Massachusetts (January 2005-May 2005)

Intern, Student Conservation Association/Bureau of Land Management, Tok, Alaska (May 2005-August 2005)

Teaching Assistant, Clark University, Worcester, Massachusetts (August 2005-May 2006)

Visiting Fellow, Resilience and Adaptation Program, University of Alaska, Fairbanks (June 2006-May 2007)

National Science Foundation Graduate Research Fellow, Graduate School of Geography at Clark University, Worcester, MA and Fairbanks, AK (June 2007-May 2010)

Intern, U.S. Fish and Wildlife Service, Galena, Alaska (May 2007-June 2007)

Adjunct Professor, University of Alaska, Fairbanks, Tanana Valley Campus (September 2008-December 2008)

Subsistence Resource Specialist II, Alaska Department of Fish and Game, Division of Subsistence (April 2009-January 2010)

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DISSERTATION COMMITTEE

B.L. Turner, II, Ph.D.
Chief Instructor

Dianne Rocheleau, Ph.D.
Chief Instructor

F.S. Chapin, III, Ph.D.
Committee Member

Jody Emel, Ph.D.
Committee Member

John Rogan, Ph.D.
Committee Member

DEDICATION

To my parents, Janine and Wayne Ray, for educating me and for believing in me.

To my sister and brother-in-law, Lea Ray and Tracy Feldman, for all of their support along the way.

To my Grandma, Patsy Ray, for her support and for all the fun adventures.

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Chapter 1: Introduction

Since 1990, the annual area burned by wildfires in Alaska has increased significantly, largely due to an increase in extreme fire weather and changing atmospheric circulation patterns (Kasischke and Turetsky 2006). The 2004 and 2005 fire seasons, two of the three largest fire seasons on record for Alaska, burned 10 percent of the state's boreal forest (Hayasakaa 2006). Chapin and colleagues (2008) argue that due to a directionally changing climate, severe fires will continue to increase in Alaska, and it will be impossible to maintain the current level of suppression without significant increases in cost. This trend is echoed in the other parts of the United States, where the severe wildfires of 2000 prompted legislation—including the Healthy Forests Initiative (HFI) and Healthy Forests Restoration Act (HFRA)—at the national level aimed at decreasing the risk posed by wildfire to lives and property (Machlis 2002).

In Alaska, where many indigenous residents live in remote areas and depend on hunting and gathering for both livelihoods and cultural identity, fire threatens more than just homes (Osherenko 1988, Wolfe 2000, Chapin et al. 2008). Wildfires burn large expanses of forest that are used for subsistence, destroying important infrastructure such as trails and cabins (Bifelt 2006). In addition, key subsistence species, such as moose, caribou, and furbearers, may be disrupted for a number of years after a fire event (Chapin et al. 2008, Nelson et al. 2008). As such, the increase of wildfires in Alaska may pose a significant threat to rural livelihoods, and many rural residents have complained about “let-

burn” policies. While officials at both the state and national levels are scrambling to implement policies consistent with the HFI and HFRA that can reduce fire risk, it is unclear how fire policy can best accommodate the unique needs of indigenous Alaskan residents. This challenge constitutes the overarching question guiding the dissertation: *Can the incorporation of local participation into fire planning produce policies that better serve rural communities?*

Policies that neglect the needs of rural communities are relatively common. Political ecologists and others have argued that state or national resource management policies may reflect political priorities rather than ecological realities, or may simply be ill-fitted to local situations, and as such may disadvantage rural people (Blaikie 1985, Omara-Ojunga 1992, Rocheleau and Ross 1995, Escobar 1996, Hecht 2004). Jasanoff (2006), a science and technology expert, argues that knowledge and policy cannot be separated from culture or values, a proposition holding substantial implications for the different stakeholders using Alaskan forests. Resilience researchers and resource management historians have shown examples of government policies, including fire management policies, based on scientific concepts that could not adequately address the complexity of real ecosystems and resulted in disasters or in decisions unfair to local communities (Pyne 2001; Berkes 1998; Osherenko 1988; Holling 1978). Historical research on fire policy has shown that government agencies have made decisions with a bias toward national rather

than local goals, sometimes even falsifying scientific information in the process (Pyne 2001).

Incorporating traditional and local knowledge may be one key to more sustainable and more just resource management (Acheson et al. 1998, Holling et al. 1998, Tsing et al. 2005). Some geographers have argued that there is an ethical imperative to return control of resources to local users and that only this can protect traditional livelihoods (Howitt 2001, McCarthy 2006). According to Tsing and colleagues (2005), not only do local communities have the most detailed knowledge of local livelihoods and ecologies, they also have a vested interest in the survival of both. While the idea of community participation in resource management seems simple, its implementation and evaluation have proven to be very complex, with problems including competing interests within communities, conflicts between local and agency knowledge, and organizations that make projects seem participatory without ever allowing for meaningful input (Rocheleau and Slocum 1995, Agrawal and Gibson 1999, Kellert et al. 2000, Tsing et al. 2005).

Most scholarship has focused on the promise and problems associated with community management of forest or animals, and little work has been done on the potential for community participation in wildfire management. Wildfires, which can completely reorganize forest composition, also have significant consequences for rural livelihoods. Most fire policies, however, are created at a national or state level and implemented without local input.

Currently in Alaska conflicts exist between communities and government agencies over wildfire management, such as standing disagreements between some interior Koyukon Athabascan (Koyukon) residents and agency scientists (Bifelt 2006). In recent years, biologists have come to embrace the role of fire in forest ecosystems. Since fire maintains a landscape with patches of early successional species, such as grasses and deciduous trees, it can provide a habitat for important subsistence species such as moose (Starfield and Chapin 1996, Natcher 2004). Many Koyukon disagree with this assessment, however, arguing that subsistence species do not always return after a fire, and that fire is undesirable because it can destroy cabins and trails important for subsistence activities such as trapping (Bifelt 2006). Chapin and colleagues (2008) suggest that this disagreement may occur because a manager might not worry about a time lag between burning and re-growth sufficient to support subsistence species, whereas a Koyukon hunter needs to hunt every year. Such disagreements suggest that there is a need for greater community participation in the creation of fire policy. Proponents of local participation argue participation needs to go beyond simply allowing people to express that they disagree, and must actively incorporate stakeholder views and knowledge into policy .

The HFI of 2002 and the HFRA of 2003 offer a special opportunity to assess local participation in fire policy. These pieces of legislation are based on the assertion that wildfire suppression and a paucity of active management have made forests on public lands unhealthy. They claim forests are vulnerable to catastrophic wildfires and need fuel

reductions to restore forest structure and reduce risk. The HFI states that extensive litigation with environmental groups and complicated regulations requiring time-consuming environmental impact assessments have prevented agencies from performing fuel reductions. As such, the HFI aims to simplify procedures for approving projects to reduce hazardous fuels and to restore ecosystem health (White House 2002).

The Healthy Forests legislation is controversial, and has been criticized by environmentalists who say that it is a handout to the logging industry (EPIC 2003), especially given that it was established with physical off-take of timber in mind rather than controlled burning. Biologists have questioned the biological basis for forest restoration through thinning, and have also noted that different treatments are appropriate in different ecosystems or that changes in forest structure have not been responsible for recent changes in fire regime in other forest types (Brown et al. 2004, Dombeck et al. 2004, Kauffman 2004, Schoennagel et al. 2004). Although the legislation focuses primarily on fuel reduction through thinning, its narrative of heavy fuel loading has led some managers to consider prescribed burning to restore forest structure. This approach is also problematic, as physical geographers have noted that different ecosystems have different fire histories, and no single structure exists to which forests need to be restored (Platt et al. 2006). For example, both scientists and managers in Alaska have noted that the Healthy Forests Legislation is not well suited to interior Alaskan boreal forests because it is unclear if fuel buildup increases fire risk in stands of black spruce (Chapin 2007, Lambrecht 2007).

While the scientific basis of the Healthy Forests legislation is controversial, these policies also have implications for community participation in resource management. The HFRA makes community participation an essential part of federal fuel reduction projects by encouraging communities to create Community Wildfire Protection Plans, or CWPPs, in collaboration with federal agencies. Federal agencies applying for funding for fuel reduction projects must prove that they have worked with nearby communities to create a CWPP and that the project in question is prioritized by the community in this document (Communities Committee et al. 2004). According to the workbook *Preparing a Community Wildfire Protection Plan*, “This landmark legislation includes the first meaningful statutory incentive for the US Forest Service and the Bureau of Land Management to give consideration to the priorities of local communities....” (Communities Committee et al. 2004: 2).

The HFRA offers clear benefits for communities that create a CWPP, but it does not specify the level of participation needed in the planning process. The minimum requirement includes the local government (county or city), the local fire department, and any state agencies responsible for forest management. Planning committees are encouraged but not required to include “other interested parties”, which implies organized interest groups including community forestry programs, neighborhood associations, environmental organizations, and groups with an economic interest in forests. Inclusion of the opinions of the general public is encouraged, possibly through public meetings. While

the legislation encourages diverse participation, managers are not required to prove that varied perspectives have been considered (Communities Committee et al. 2004). As such, managers across Alaska have adopted different strategies, with some making a major effort to include community perspectives and others drafting the majority of the plan themselves.

Research Specified

This dissertation focuses on the rural, predominantly Koyukon communities of Galena and Huslia, Alaska, and addresses the potential of community participation in wildfire management to improve outcomes for rural stakeholders. It draws on geography's tradition of human-environment studies and in-depth, semi-ethnographic methods and creates a detailed picture of rural Alaskan residents and their relationship to resource management. The dissertation is divided into three articles, each addressing a specific aspect of community/agency interactions over wildfire policy.

Research in community-based natural resource management (CBNRM) has shown that conflicting values between community members and government or conservation organizations and among groups within a community can cripple participatory projects. As such, the first article asks the question "Is there a community perspective on wildfire?" and uses a Q-sort to investigate community and agency beliefs about wildfires and wildfire management. The study shows that Caucasian residents and resource managers grouped

together, separately from Koyukon residents, who separated into two main groups according to age. The findings imply that, while the Koyukon “community” view may not be homogeneous, its aggregation is distinctive from others in the same locale and can remain a useful construct when dealing with rural, resource-dependent communities whose resources are managed by those not part of their community. In addition, age may be an important and under-theorized facet of community differentiation.

The second paper is a case study of the HFRA-mandated Community Wildfire Protection Plan (CWPP) in Galena. In spite of calls for a transition from technocratic, or expert-led approaches, to democratic participation, most wildfire risk reduction is conducted technocratically. In this study, the CWPP process is evaluated through surveys, interviews and participant observation, in order to determine if participation was democratic or technocratic, and how community members felt about the process. Results showed that the process, which only addressed wildland-urban interface risk, was technocratic, but that this was acceptable to both Koyukon and Caucasian residents, who had little knowledge of risk planning. In contrast, Koyukon residents expressed discontent with wildfire policies affecting local forests, as these did not accommodate local livelihoods or informal institutions. The evidence indicates that Koyukon stakeholders perceived wildland-urban interface risk planning and forest management differently, due to their long history of traditional forest use and management. The study argues that participation should be

tailored to local experiences, and that both technocratic and democratic methods can be applied successfully, depending on the situation.

The third paper explores knowledge conflicts between Koyukon residents and agency managers over the effects of wildfires, drawing on literature from sustainability science, political ecology, and resilience and adaptation. Using semi-structured interviews and document analysis, the study shows that Koyukon residents oppose wildfire because of the physical difficulties it causes for their subsistence, the variability of wildfire effects, and a recent climatically induced increase in landscape flammability. Agency policy documents draw on national narratives of forest-change and do not mention these local differences. The study concludes that misalignments between local and national narratives of resource change indicate a valuable opportunity to tailor policies to local environments, rather than an insurmountable conflict.

Together, these three papers bring the insights of CBNRM to wildfire management, and investigate community participation as a tool to improve wildfire outcomes for rural Koyukon communities in Alaska.

Literature Review

A large expert literature exists relative to the problems addressed in this dissertation. It includes that on interaction between wildfire policy and politics, debates over national wildfire policy, community participation in resource management, value differences within communities and between communities and agencies, different visions of the participatory process, and differences between traditional and Western knowledge. Those most relevant to this research are briefly reviewed below.

History and Politics of Fire Policy

Wildfire management in the United States has historically been influenced by political agendas. Pyne (2001) makes a compelling case that the U.S. Forest Service suppressed evidence that fire could be beneficial to ecosystems and could start through non-human ignitions in order to support their policy of opposing all fire (Pyne 2001). Todd and Jewkes' (2006) history of fire policy in Alaska shows that it closely followed political trends in the rest of the United States. Prior to the mid-1940s, managers maintained that fire was always damaging to forests and blamed humans for all ignitions. In 1943, the Alaska Fire Control Service publicly admitted that some fires were started by lightning, and officials began to recognize the role of fires in the boreal forest environment (Todd and Jewkes 2006).

The recent Healthy Forests Legislation fits into a broader narrative arguing that decades of fire suppression has moved forest structure away from a desirable historical state, with potentially devastating consequences (Pyne 2001, Todd and Jewkes 2006). Some ecologists and managers have proposed that forests should be restored to their pre-1850 structure, which supposedly was characterized by infrequent, low intensity fires and low fuel loading (Brown et al. 2004). As the combination of high fuel loadings and extensive human settlement makes it impossible to impose frequent, low intensity fires in many locales, the Healthy Forests legislation advocates mechanical thinning as a safer way to reduce the risk of infrequent, high intensity wildfires, a proposition that has been challenged by environmentalists as a hand-out to the logging industry (White House 2002, EPIC 2003).

Evidence shows there is no simple solution to high intensity wildfire risk. Many ecosystems are historically characterized by infrequent, high intensity fires, and it is not possible to change this condition (Brown et al. 2004, Schoennagel et al. 2004, Platt et al. 2006). In addition, many biologists think that even for forests historically characterized by frequent, low intensity fires, it may not be possible to return them to their historical condition because other characteristics of the ecosystem, such as species composition, have changed (Brown et al. 2004). Ecological experiments indicate that mechanical thinning does not replicate burning because it does not affect ground and surface fuels (Kauffman 2004). One study of a thinned area that burned in a wildfire found that thinning alone

actually increased fire risk because of increased fuel loading on the surface. The authors found that thinning in combination with burning was the only way to reduce fire risk (Raymond and Peterson 2005). Other biologists argue that fire risk is more closely correlated to fire weather than to fuel loading, and suggest that climate change will make larger fires inevitable (McKenzie et al. 2004). According to Schoenagel and colleagues (2004), the idea that recent large wildfires are caused by abnormal fuel accumulations was developed in the ponderosa pine forests, and in many other forests flammability is primarily driven by climate rather than by fuel loading.

While catastrophic fires threaten communities across the United States, there is no universal plan that can reduce risk. Most attempts to get communities involved in fire prevention, however, still focus on making community knowledge of risk line up with larger national narratives of fire behavior. There is little attempt to question the universal applicability of national information on fire or to consider that local users may have something to contribute to understanding fire risk (Shindler and Toman 2003). The Alaskan boreal forests differ significantly from the forests of the continental United States in the role and impacts of burning. Alaskan communities depend significantly on the boreal forest for their livelihoods and have developed extensive local and traditional knowledge of the forest. As such, local incorporation into fire planning has enormous potential to contribute to knowledge of anthropogenic changes to boreal forest structure. It is also essential in order to ensure that any fire planning actions take into account the

specific needs and vulnerabilities of subsistence users. For these reasons, this dissertation uses insights developed in CBNRM to investigate the potential for participation in wildfire management.

Common Difficulties Encountered During CBNRM

Value Differences

Although CBNRM has been proposed as a tool for equality and justice, research has shown that it can also empower certain groups at the expense of others (Kellert et al. 2000).

Within a community, values and knowledge may be divided according to livelihood, gender, ethnicity or class (Rocheleau et al. 1996, Robbins 2000, Tsing et al. 2005). Others have pointed out that even groups united by shared characteristics or territory can have competing interests, and that it is better to focus on groups united by shared norms and interests (Rocheleau and Ross 1995, Agrawal and Gibson 2001). In addition, community environmental values are often different from those of the government or conservation organizations proposing CBNRM (Walters 1997, Schroeder 2005, Tallis et al. 2008). If groups both within and outside of the community cannot agree on project goals, participatory projects such as the CWPP process may not succeed. As such, the first paper of this dissertation investigates shared perspectives on wildfire among Koyukon and Caucasian stakeholders, and resource managers.

Different Visions for the Participatory Process

A large range of research communities have made a strong case for the importance of community participation in resource management, based on ideas of both sustainability and justice (Rocheleau et al. 1996, Acheson et al. 1998, Berkes et al. 2000, Howitt 2001, Reynolds et al. 2007). Although many governmental and non-governmental organizations are now incorporating community participation, some use it to strengthen their position, rather than for community empowerment. Risk planning recognizes two different kinds of participation—the expert-led technocratic and the democratic, the last of which incorporates community values (Fiorino 1990, Lane 2005). Rocheleau and Slocum (1995) explain that some agencies organize participatory projects without addressing stakeholder views contrary to the direction of the project, and label top-down projects as “participatory” in order to weaken those who might criticize the project. In other cases, locals are used as free labor to fill information gaps or to help in meeting objectives that were set by others (Rocheleau and Slocum 1995, Schroeder 2005). Such direction is not that intended by the CBNRM.

Several political ecologists claim that passing control of resources to communities can serve neoliberal projects decreasing the role of the state and giving power to markets, and may not meet community needs (McCarthy 2006, Holyfield 2007). In the case of fire management, it is certainly true that the federal government wants communities to take

more responsibility for protecting themselves from fire, in order to reduce government costs (Machlis 2002). That said, many communities are highly vulnerable to wildfires, and risk mainly comes from the structure of private property in the wildland-urban interface. It is still unclear whether the CWPP process focuses on reducing government workload or on producing policy that better serves communities, regardless of government effort. As such, paper 2 investigates the Galena CWPP process, both in terms of participatory style and community satisfaction.

Differences between Traditional and Western Knowledge

Traditional ecological knowledge (TEK) has been hailed as source of long-term ecological observation that can address issues of ecosystem complexity (Acheson et al. 1998, Berkes et al. 2000). Unfortunately, TEK cannot always be extracted from its context and inserted neatly into biological planning. Sometimes, TEK may draw on different epistemologies than Western science, and practitioners may have completely different values than resource managers (Berkes 1999, Cruikshank 2000, Watson and Huntington 2008, Clark and Slocumbe 2009). In other cases, conflicts between local and government or environmental agency knowledge have been explained by demonstrating the political nature of some agency positions (Escobar 1996, Hecht 2004, Neumann 2004). There have been a few cases of conflict, however, where further research, based on TEK, has led to improvements in resource management (for example, Huntingdon 2000). Community participation in management is much more likely to succeed if communities and agencies

can resolve knowledge conflicts over the resource in question. As such, the third paper investigates conflicts between indigenous residents and agency policy over the effects of wildfires, and lays the ground for policy and knowledge co-production.

The three dissertation papers that follow draw upon these themes and seek to evaluate how they inform the research questions posed.

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Chapter 2 Is there a “Community” Perspective on Wildfire Among the Koyukon? Using Q-Method to Investigate Shared Perspectives on Natural Resource Conflicts

Abstract

Researchers in sustainability science, political ecology, common property, and resilience and adaptation all argue that community inclusion in resource management produces more sustainable and just outcomes, but successful projects are elusive. One major problem is competing values between community members and government and conservation organizations and among groups within a community. This study uses a Q-sort to investigate the value and knowledge differences about wildfire ecology and policy present among community members and government resource managers in the Koyukon Athabascan villages of Galena and Huslia, Alaska. Publically, the conflict seemed defined by support for or opposition to wildfires, but Q-method results showed three groupings defined by deeper values: Caucasian residents and resource managers united around the idea of allowing natural processes to occur; older Koyukon residents concerned with the loss of local control, important places, and small animals; and younger to middle-aged Koyukon residents who felt that landscapes and subsistence activities were resilient to social-ecological change. The analysis produced two findings of note: a) age acted as the main axis of value differentiation among community members, and b) community members, while not homogenous in values, shared more preferences with each other than with outside resource managers and Caucasian residents. Additionally, the study concludes

that value differences can be successfully measured and that this is the first step in the co-production of mutually acceptable environmental goals.

On “Let Burn” policies: “Maybe far away from the town it’s okay. But let it burn right in front door, I don’t think that’s the way it should be. Portages that our ancestors and people used to use... to survive for the summer or a winter, you use in winter for dogs and springtime you pack canoes and hunt muskrat and beavers ...if they let it burn, all that trees is just knocked all over woods... and I don’t think too well of that. –Galena Resident 1

Communities and Natural Resource Management

Giving communities control over their local resources is a contentious proposition. Some common arguments for government resource management are that rural communities have neither the scientific knowledge nor the economic incentive to conserve resources (Hardin 1968, Brightman 1987, Hames 1987). On the other hand, scholars supporting community-based natural resource management (CBNRM) have documented communities with extensive observational knowledge of their environments, and informal institutions to sustainably manage them (Ciriacy-Wauntraup and Bishop 1975, Berkes 1987, Acheson et al. 1998, Berkes and Folke 1998, Ostrom 2005). Unfortunately, community environmental knowledge and practices do not always fulfill goals set by national governments or conservation organizations. Not surprisingly, many CBNRM projects have had poor outcomes, often due to competing environmental values both within

communities and between communities and outside organizations (Walters 1997, Kruse et al. 1998, Agrawal and Gibson 1999, Kellert et al. 2000, Robbins 2000, Schroeder 2005, Tallis et al. 2008, Clark and Slocumbe 2009). In addition to poor environmental outcomes, division within communities can further disempowerment women, poorer residents, or minorities, contrary to CBNRM's goals of empowerment and equality (Rocheleau et al. 1996, Howitt 2001, Tsing et al. 2005).

One response to poor outcomes is investigation of the conditions under which CBNRM succeeds (Ostrom 2005, Padgee et al. 2006, Kareiva et al. 2008). Another approach is deconstruction of government or conservation organization goals to show values and scientific errors (Blaikie 1985, Berkes 1987, Berkes and Folke 1998, Holling et al. 1998, Goldman 2004, Hecht 2004, Neumann 2004). Although both approaches recognize value differences, neither offer a methodological tool to identify and address competing interest groups in conservation. Agrawal and Gibson (2001) argue that simplistic assumptions of community based on group size, characteristics, or territory are problematic, and that the communities most likely to succeed in resource management are imagined communities: groups of people with shared norms and interests. Feminist post-modernists agree, recommending a focus on groups united by affinity rather than by physical characteristics of identity (Chang 1994, Rocheleau and Ross 1995). As such, identifying the key values held by competing groups, and the people united around them, is a logical first step towards environmental goals that diverse groups can support.

Q-method has successfully been used to determine shared perspectives among urban and suburban residents, who do not draw sustenance directly from their surroundings, but it has not been used extensively among indigenous people whose livelihoods are drawn from their immediate environments and who are the primary candidates for community-based natural resources management (Bawa and Gadgil 1997, Woolley and McGinness 2000, Webler et al. 2003, Burns and Cheng 2007). Robbins (2000) successfully used a Q-sort among forest-users in Rajasthan, India, but respondents sorted pictures of plants rather than statements. This study will test the applicability of a statement-focused Q-sort for determining value differences among a community of rural indigenous users and area federal and state resource managers.

Public Participation and Wildfire Management

A number of federal laws and policies, such as the National Environmental Policy Act, and the Department of Interior mandate, require that wildfire management consider public values (Machlis 2002). In addition, democratic principles require public input into government policies, and recognition of the values present in decision-making (Fiorino 1990, Lane 2005). In spite of legal and political support for public values in policy-making, those engaging communities in wildfire management focus on education and personal responsibility. This approach, known as the deficit model of participation, assumes that public values are misguided and can be aligned with science through improved education and communication (Kumagai et al. 2004, Rowe and Frewer 2004).

Currently, experts hope to re-educate the public away from a paradigm of wildfire suppression, and convince them that wildfires are a natural part of healthy ecosystems, suppression is unsustainable, and home safety is the responsibility of the homeowner (Dombeck et al. 2004, Kauffman 2004).

Although the deficit model may be appropriate for new communities in the wildland urban interface, where residents have little experience with forests and risks to homes is extreme, the situation is different in rural Alaska. Settlements are spatially compact compared to communities in the western contiguous United States, and the wildland-settlement interface is less extensive. In addition, Koyukon Athabascan (Koyukon) residents in these settlements have extensive ecological knowledge and depend directly on resources garnered from the adjacent boreal forest on federal public lands for food, income, and cultural continuity (Nelson 1983, Marcotte 1986, Osherenko 1988, Marcotte 1990, Chapin et al. 2008). Formerly Koyukon territory, these federal forests are an important cultural and economic dimension of everyday life and livelihoods, and are used for traditional subsistence activities, including hunting, fishing, and gathering (Nelson 1983, Alaska Region US Fish and Wildlife Service 2008). Wildfires in the boreal forest affect the availability, distribution, and access to wild resources, and as such, many Koyukon have strong views about wildfire policies and management practices. There is growing concern, especially given the increasing frequency of larger fires, apparently enhanced by climate change. In spite of Koyukon knowledge and experience, wildfire

managers in Alaska continue to address value conflicts with education, in the hopes of bringing community thinking in line with existing policies (Ray article 2).

Wildfire policy planners' failure to include community values is not surprising, considering that value differences have frequently hindered community participation in resource management. In this study, I use a Q-sort to investigate value and knowledge differences on wildfires in the boreal forest among resource managers and Koyukon residents in Galena and Huslia, Alaska. I argue that, while value differences may be inevitable, they are not insurmountable. Specifically, processes such as Q-sort that discover affinity groupings and their key values can be the first step in designing mutually acceptable environmental goals. Additionally, community members can have differing values while still having more in common with each other than with resource managers from outside areas.

Background

Galena and Huslia Alaska are communities located in the Koyukon homeland, a remote sub-arctic region dominated by vast lowlands, lakes, and boreal forest (Nelson 1983). Galena is a city of approximately 599 people located on the Yukon River about 270 miles west of Fairbanks. It is about two-thirds Koyukon. Huslia, Alaska is a village of 257 people located on the Koyukuk River 70 miles north of Galena. Its residents are predominantly Koyukon (Alaska Region US Fish and Wildlife Service 2008, U.S Census

Bureau 2009).

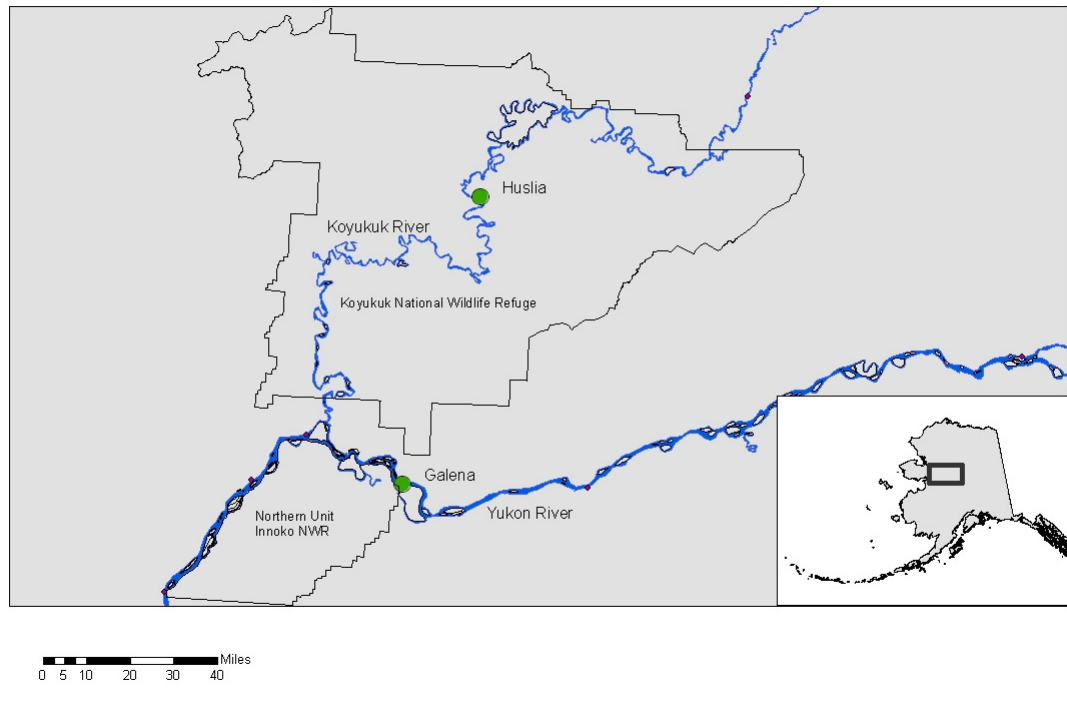


Figure 1 Map of Study Area

Both communities are located in the Yukon-Koyukuk Census area, a sparsely populated region of less than 6,000 people that constitutes almost 25% of Alaska's area (Alaska Region US Fish and Wildlife Service 2008). Neither community is accessible by road; residents can travel by boat in the summer, snowmachine in the winter, and airplane year round (Nelson 1983). The climate is extreme continental, and winter temperatures can fall as low as -64° Fahrenheit (Marcotte 1990). White spruce and hardwoods

predominate along rivers, black spruce, willow, and tamarack in low lying areas, and sedges, mosses and grasses in poorly drained treeless bogs (Marcotte 1990). The most common tree is the black spruce, which is highly flammable and tends to burn infrequently and at high intensity (Viereck 1973, Alaska Region US Fish and Wildlife Service 2008).

These forests are home to waterfowl, a variety of fish species, muskrat, beavers, wolves, mink, marten, and moose among other animals consumed by the Koyukon (Marcotte 1990). Local Koyukon historically moved several times a year in order to access seasonally abundant fauna and other resources. In the springtime, wetland areas were favored to harvest beavers, muskrats, and waterfowl. During summer, families set up camps along the major rivers to harvest salmon and whitefish, and in the fall they would move to stream outlets to trap whitefish and grayling, to snare small game, and to hunt large game. Winter villages were located along caribou migration routes and caribou fences were used to corral passing caribou (Nelson 1983, Marcotte 1990).

To this day, Koyukon residents of Galena and Huslia depend on traditionally used wild resources. People gather wood; hunt for moose, bear, waterfowl and small game; fish for salmon and non-salmon fish; and trap beaver, marten, mink, fox, and wolves. An Alaska Department of Fish and Game subsistence baseline study in 1985-1986 estimated that 787.1 edible pounds of wild foods per person per year were gathered in Galena (Marcotte 1990). A similar study done from 1981-1983 in Huslia estimated that 1082.1 pounds of wild food per person were gathered annually (Marcotte 1986). People in both

locations gather wild foods because of both cultural preferences and economic necessity. There is a lack of well paying jobs in both villages, and store food is very expensive because both places are located off of the road system, and all supplies must arrive by airplane or barge (Nelson 1983).

The land surrounding the two study communities came under the management of the US Fish and Wildlife Service, a federal agency, in 1980. The Alaska National Interest Lands Conservation Act (ANILCA) of 1980 created the Koyukuk and Innoko National Wildlife Refuges, and large areas traditionally used for Koyukon subsistence became subject to federal land management. The Koyukuk National Wildlife Refuge has an area of just over 1.8 million hectares, and surrounds the village of Huslia. The Northern Unit Innoko National Wildlife Refuge has an area of almost 304,000 hectares and is located just south of the community of Galena. The US Fish and Wildlife Service now has an office in Galena that manages these refuges (Alaska Region US Fish and Wildlife Service 2008). Under ANILCA, customary and traditional subsistence uses are protected on federal lands (Alaska Federation of Natives 1998).

Although subsistence uses continue and are legally protected, older Koyukon have, over the course of their lifetimes, experienced disruptive changes in their traditional lifestyles. *“Those days you had to go (to camp) with your parents. Today it’s against the law for kids (to go to seasonal camps), well, you know, on account of school.” –Galena Resident 4*

When young people were prohibited from spending time in seasonal camps with their families, there was a loss of traditional skills and the Koyukon Athabascan language.

“ I just lost my language after that. ... I understand the words... but I can't talk it. That's what happened when we went to grade school. Because we were determined to learn English and, so I kind of regretted that we didn't keep our language up. Now our kids, they never even hear it anymore, all the elders are dying off so very few of them talk their Native language here. And I'm 50 years old and I lost that language, and all down from there lost our language.”-Huslia Resident 6

In addition to a loss of language, laws began to regulate resource use, often in contrast to traditional patterns.

Well, now, they season the fishing. Whereas long ago all along the Yukon, up the Tanana River, everywhere you're goin'... I mean from one village to the other, you'll see fish rack all along the beach.” Galena Resident 7

“there's a good place up here, up the river a little ways there's a good (fish) camp up there.... But it's off limits, I mean you can't drift there”-Galena Resident 8

Older respondents described a strong sense of sorrow due to the loss of traditional skills, the Koyukon language, and local control over resource access.

Methods

Research for this study was conducted in Galena and Huslia, Alaska, between March and July, 2008.

This study used Q-method to group community members and resource managers according to their perspectives on wildfires. Q-method, developed in psychology, is a

quantitative method that investigates people's internal frames of reference by allowing respondents a high degree of control over the expression of their perspective (Robbins and Krueger 2000). Participants organize cards with a number of statements on them in a process called the Q sort. The collection of statements, known as the Q-sample, can be drawn from the respondents or people similar to the respondents, or can be created by the researcher in order to test a theory (McKeown and Thomas 1988). In this case, statements were drawn from local Koyukon knowledge experts, and area natural resource managers, in order to best reflect the local debate on wildfire effects.

In order to build the Q-sample, semi-structured interviews about perspectives on wildfires were conducted with a purposive sample of 42 Koyukon residents, 22 from Huslia and 20 from Galena. Interview participants were selected for the depth and breadth of their experience using the boreal forest, and topics covered observations of effects of wildfires on local resources and resource use, and perceptions of wildfire policy (Appendix B and Appendix C). From these interviews, a set of statements was collected representing the major positions area Koyukon residents took on the issue of wildfire and wildfire policy. Although many methods books recommend against using double-barreled statements (Bernard 2006), a number of double-barreled statements were used because they were an integral part of the Koyukon perspective. Statements representing agency perspectives were collected from informal interviews with employees of local resource management agencies about their position on wildfires in the area, and analysis of agency

policy documents and educational brochures about wildfire. There was some, but not total, overlap between participants in the interviews and participants in the Q-sort. Q-method is valid regardless of whether all (or any) respondents were interviewed for the Q-sample, which should adequately represent the issue of interest (McKeown and Thomas 1988). Participants commented that they felt the statements were a surprisingly good representation of the local debate on wildfires.

For the Q-sort, a purposive sample of 46 respondents was selected to represent a variety of perspectives (McKeown and Thomas 1988). Participants representing agencies included biologists and managers from the US Fish and Wildlife Service and the Alaska Department of Fish and Game, and fire specialists from the Alaska Fire Service (N=10). Caucasian residents of the area who did not work for an agency were also included (N=8). Finally, Koyukon residents of both Galena (N=14) and Huslia (N=15) of a variety of ages were selected to participate. People with a range of views on fire and with different experiences using the forest were deliberately chosen. All categories had both male (N=28) and female (N=18) participants.

The Q-sample, composed of 27 statements collected as described above, represented the spectrum of Koyukon and agency viewpoints (Table 3). Respondents were presented cards containing the statements and instructed to sort them onto a template with levels of agreement ranging from “Most Disagree” to “Most Agree”. While participants sorted the statements, their comments were recorded as notes. In addition, respondents

provided basic personal information including age, gender, and participation in outdoor activities.

Responses were analyzed using PQMethod software to perform a PCA analysis with Varimax rotation, which is considered the standard (Schmolck 2002). There is an important difference between Q-method and traditional use of factor analysis-the factors are used to explain the participants, or cases, and not the variables (McKeown and Thomas 1988). The software first creates a correlation matrix among participants depending on how they sorted the cards, factor analysis is performed on this matrix, and factors are rotated orthogonally to increase the number of respondents that have high factor loadings on specific factors. Factor loadings are similar to correlation coefficients and show how much of the variance in an individual's sort is explained by that factor. PQMethod then matches respondents to the factor that explains the most variance in their sort, if that factor explains more than half of the common variance and is significant at $p < .05$ ¹ (Schmolck 2002). A three factor solution was selected for simplicity of data analysis because a four factor solution resulted in fewer residents matching to more factors, thus making pattern identification more difficult². The three factor solution had 41 of 46 responses matched to

¹ Factor loading (a) is significant at $p < .05$ if $a > (1.96/\sqrt{\text{Nitems}})$, where Nitems = number of statements=27

² A four factor solution was tested in order to determine the robustness of findings. The first three factors were similar to the results of this analysis in terms of both demographics and values, but the fourth factor showed no clear demographic or value pattern.

factors, and these factors explained 49% of the total variance-24% for Factor 1, 12% for Factor 2, and 13% for Factor 3.

Unlike survey research, which compares responses across participants, a Q sort looks at the pattern of responses within each person. Respondents who matched to the same factor organized the entire set of statements in a similar manner, thus, each factor is interpreted as a “perspective.” Once respondents have been matched to factors, the program uses their responses to calculate idealized Q-sorts for each factor. For each statement, the responses of all matching respondents are weighted according to respondents’ factor loadings, averaged, normalized, and re-converted into the scale of the Q-sort. This allows the average or idealized responses for each factor to be compared. The researcher looks at the different factors, sees the statements that had high and low scores, and uses these to interpret the basic values of each perspective. Because agreement responses are scored from 1 to 3, and disagreement responses are scored from -1 to -3, respondents who match to the negative of a factor have views in opposition to that perspective (McKeown and Thomas 1988).

Q method does not require a large sample size in order to achieve statistical significance. The sample size is not related to the number of respondents, but instead to the number of cards sorted by each respondent (McKeown and Thomas 1988). In this study, respondents sorted 27 cards, which were sufficient to show clear differences in perspective.

Beyond Q sort, this study also draws on six months of ethnographic fieldwork in the Galena area, and several weeks in Huslia. The primary methods used included participant observation, recorded semi-structured interviews that included life history and seasonal-resource-use questions, and informal interviews about resource issues (Slocum et al. 1995, Bernard 2006). The interviews, with 42 Koyukon over the age of 45, were used to produce the Q-sample while still in the field. They were later transcribed, entered into ATLAS.ti, and coded according to both researcher-determined and emergent themes (Marshall and Rossman 1995). This was then used to inform the analysis.

Results

Residents matched to factors based upon ethnicity, age and employment (Tables 1 and 2).

Both Caucasian residents and resource managers³ had higher loadings on Factor 1 than Koyukon residents (Figure 2). Older Koyukon residents generally had higher loadings on Factor 2, and younger Koyukon residents had higher loadings on Factor 3, although there was some overlap (Figure 3). Average scores for each statement by factor were calculated using only the respondents who loaded significantly on each factor (Table 3).

³ Respondents who worked for resource management agencies in scientific, managerial, or educational positions were counted as agency, while respondents with maintenance employment were not

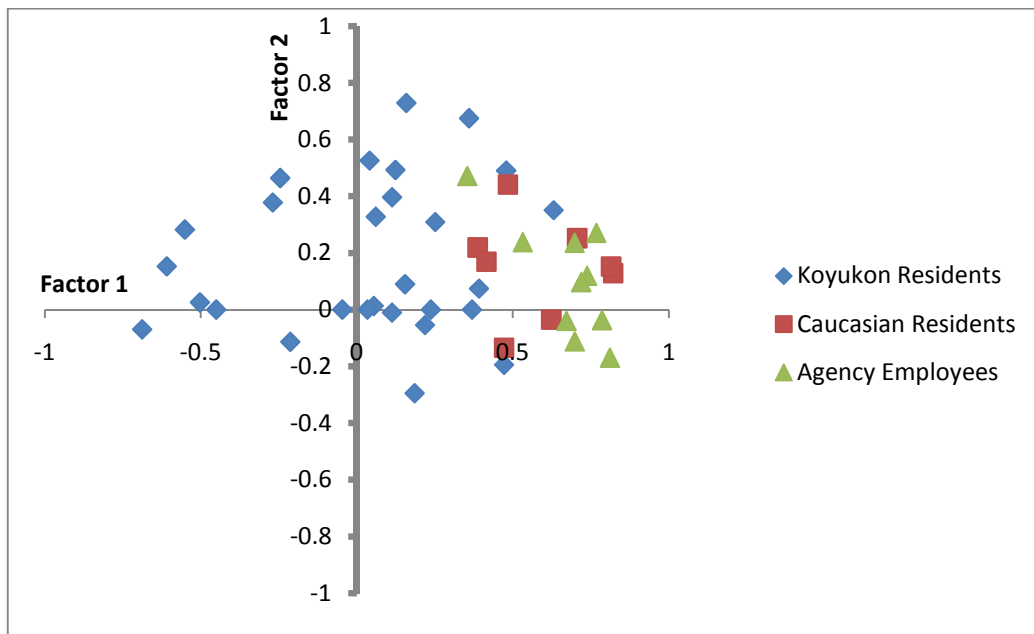


Figure 2 All respondents displayed by ethnicity and occupation

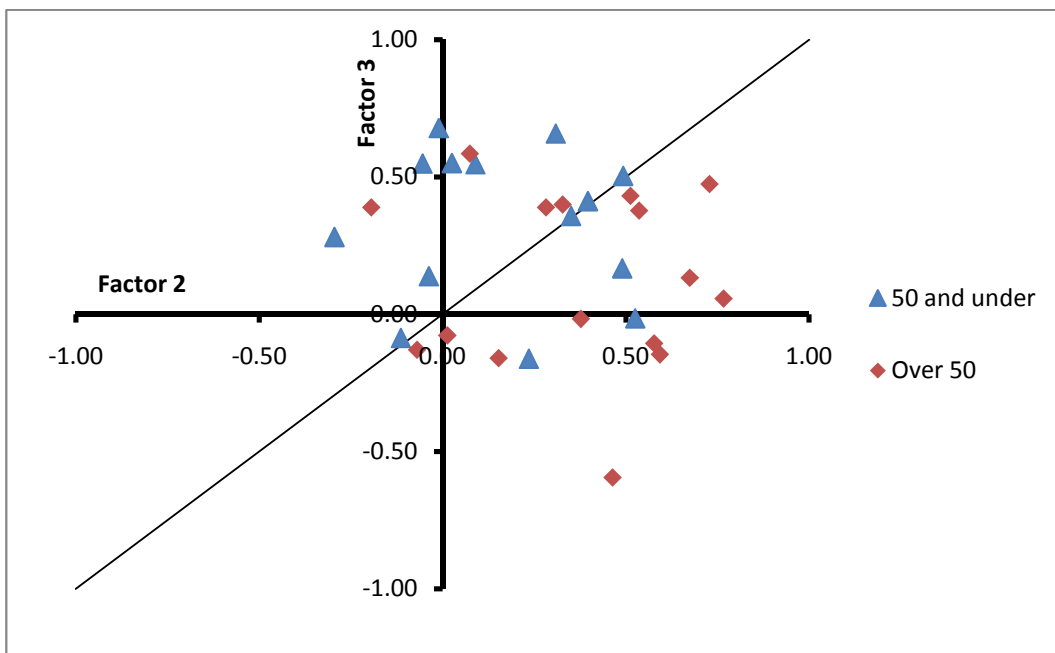


Figure 3 Koyukon respondents displayed by age

Factor	Caucasian	Koyukon	Koyukon Avg. Age	Traps	Extended stays on land
- 1 and -3	0%	100%	65	100%	100%
2	10%	90%	60	50%	70%
3	20%	80%	40	20%	30%
1	82%	18%	49	12%	24%

Table 1 Factor demographics, organized by declining resource use

Match	Gender	Ethnicity	Age	Agency	Town	Factor 1	Factor 2	Factor 3
Factor 1								
	Female	Caucasian	40	No	Galena	0.82	0.13	0.05
	Male	Caucasian	62	No	Galena	0.82	0.15	0.02
	Male	Caucasian	47	Yes	Galena	0.81	-0.17	0.34
	Female	Koyukon	29	Yes	Temporary	0.79	-0.04	0.14
	Male	Caucasian	32	Yes	Temporary	0.77	0.27	0.13
	Male	Caucasian	58	Yes	Galena	0.74	0.12	0.39
	Female	Caucasian	40	Yes	Galena	0.72	0.10	0.21
	Male	Caucasian	58	No	Huslia	0.71	0.25	0.22
	Female	Caucasian	37	Yes	Galena	0.70	-0.12	0.25
	Male	Koyukon	40	Yes	Galena	0.70	0.24	-0.16
	Male	Caucasian	41	Yes	Galena	0.67	-0.04	0.40
	Female	Koyukon	46	No	Galena	0.63	0.35	0.36
	Female	Caucasian	50	No	Galena	0.62	-0.04	0.36
	Male	Caucasian	52	Yes	Temporary	0.53	0.24	0.38
	Female	Caucasian	57	No	Galena	0.48	0.44	-0.14
	Female	Caucasian	52	No	Huslia	0.47	-0.13	0.39
	Male	Koyukon	62	No	Huslia	0.47	-0.19	0.39
Factor 2								
	Female	Koyukon	67	No	Galena	0.03	0.77	0.06
	Female	Koyukon	60	No	Huslia	0.16	0.73	0.47
	Male	Koyukon	62	No	Huslia	0.36	0.67	0.13
	Male	Koyukon	69	No	Galena	-0.45	0.59	-0.15
	Male	Koyukon	52	No	Galena	-0.05	0.58	-0.11

	Male	Koyukon	60	No	Galena	0.37	0.54	0.38
	Female	Koyukon	38	No	Huslia	0.04	0.53	-0.01
	Male	Koyukon	63	No	Galena	0.24	0.51	0.43
	Female	Caucasian	42	Yes	Temporary	0.35	0.47	0.30
	Female	Koyukon	67	No	Huslia	-0.27	0.38	-0.02
Factor 3								
	Male	Koyukon	32	No	Huslia	0.11	-0.01	0.68
	Female	Koyukon	26	No	Galena	0.25	0.31	0.66
	Male	Koyukon	52	No	Huslia	0.39	0.07	0.58
	Male	Koyukon	48	No	Huslia	-0.50	0.03	0.55
	Female	Koyukon	31	No	Huslia	0.22	-0.05	0.55
	Female	Koyukon	22	No	Galena	0.15	0.09	0.55
	Male	Caucasian	40	No	Galena	0.39	0.22	0.50
	Female	Caucasian	57	No	Galena	0.42	0.17	0.47
	Male	Koyukon	50	No	Galena	0.11	0.40	0.41
	Male	Koyukon	58	No	Galena	0.06	0.33	0.40
Negative Factor 1								
	Male	Koyukon	64	No	Galena	-0.55	0.28	0.39
	Male	Koyukon	69	No	Huslia	-0.69	-0.07	-0.13
	Female	Koyukon	56	No	Huslia	-0.61	0.15	-0.16
Negative Factor 3								
	Male	Koyukon	71	No	Galena	-0.25	0.46	-0.59
No Match								
	Male	Koyukon	21	No	Huslia	0.19	-0.29	0.28
	Female	Koyukon	70	No	Galena	0.05	0.01	-0.08
	Female	Koyukon	21	No	Huslia	-0.21	-0.11	-0.09
	Male	Koyukon	50	No	Huslia	0.48	0.49	0.17
	Male	Koyukon	46	No	Galena	0.12	0.49	0.50

Table 2 Rows represent study participants. Factor loadings are similar to correlation coefficients and show how much of the variance in an individual's sort is explained by that factor. Bold numbers indicate a factor match. Residents match to the factor that explains the most variance in their sort, if that factor explains more than half of the common variance and is significant at $p < .05$.

Statement	Factor 1	Factor 2	Factor 3
Some small animals can't escape from a wildfire. At certain times of the year, there may be nests with eggs, or baby marten in dens, and they will burn in a wildfire.	0	3	2
The experience of local users who have seen wildfires in this area is more important than scientific predictions and should be given more weight in decision making.	-2	3	0
It is important to have wildfires because they are a natural part of the Alaskan environment	3	2	3
Wildfires are an important tool that can improve habitat for moose.	3	2	1
Old portages, camping sites, and places where things happened in the past are an important part of the cultural history of the area. Wildfire destroys these places and cultural history is lost.	-1	2	-2
Climate change means more extreme fire weather and more intense wildfires. This could change how wildfires affect subsistence and the landscape. Wildfire management should take this into account.	1	1	1
It is cheaper to fight wildfires while they are small, even if they aren't threatening villages.	0	1	1
No areas are remote areas. Just because it isn't private property doesn't mean it's not our land. Wildfires there still affect us.	0	1	0
Spruce forests are very important to people in this area. After a wildfire spruce may not return within our lifetimes. Because of this it is bad to have too many large wildfires in an area.	-1	1	-1
Large wildfires can be harmful because they leave open areas where the permafrost will start to melt. It is bad to lose permafrost.	-1	1	-1
We need wildfires to keep the landscape from becoming overgrown. If we don't have wildfires, there won't be enough new growth for	2	0	0

moose to eat.			
The resource management agencies should teach people more about wildfires so that they can accept them	1	0	1
Most sites will survive a wildfire. Cultural sites are usually still recognizable, travel routes can be recut, forest will grow back, and animals will return.	0	0	3
Wildfires are good for trapping. A few years after a wildfire there are lots of marten because there are more mice and lemmings for them to eat.	0	0	2
There is always new growth in this area, even without wildfires. Ice movement, flooding, and human use keep areas from becoming overgrown and provide enough food for moose.	-1	0	1
Scientists cannot really predict how wildfires will affect the landscape.	-1	0	1
Heavy timber along drainages are important for moose because they provide shelter. If these areas burn, moose might move away or die off.	-2	0	1
It just isn't possible to fight all wildfires, especially if they are far from villages.	2	-1	-2
If all wildfires are suppressed, there may not be good subsistence in the future.	2	-1	-2
Wildfires are good because they convert spruce to willow and birch. It is better to have more stands of willow and birch because they keep the landscape diverse and make it less flammable	1	-1	2
If villages are made safer from wildfire, it will be easier to accept more fire away from villages.	1	-1	0
Resource management agencies should do controlled burns on public	0	-1	-1

lands in order to improve habitat for moose			
Wildfires are good because after a wildfire there is more unfrozen soil above the permafrost. This means that more things can grow.	0	-2	0
If someone's camp or trapline burns, it will be harder to pass knowledge on to their grandchildren.	-2	-2	-3
It isn't necessary to burn any area for any amount of food or resources.	-3	-2	0
Decisions about wildfire policy should be made using science	1	-3	0
After a wildfire God's creation is gone forever the beauty is gone.	-3	-3	-3

Table 3 Factor scores representing an idealized Q-sort for each factor, organized in descending order of preference for Factor 2 (Koyukon elders). Factor scores are a weighted and normalized average of the responses to each statement by the respondents matching to each factor. Factor scores have been re-converted into the scale of the Q-sort.

Factor 1: Natural and Necessary

Factor 1 is informally titled "Natural and Necessary". 17 people loaded significantly on this factor, including most of the resource managers and Caucasian residents, who comprised 88% of this group (Table 2). This group had a highly favorable opinion of wildfires because they were a natural part of the boreal forest ecosystem, and worried that a number of negative consequences would result from wildfire suppression (Table 3). This perspective felt that wildfire was an important tool to improve habitat for moose, and that wildfire suppression could lead to a shortage of new growth for moose to eat and cause damage to subsistence. Other statements supported by this group included that it isn't possible to fight all wildfires, and that decisions about wildfires should be made

using science. The group disagreed most with the statements “It isn’t necessary to burn any area for any amount of food or resources”, “If someone’s camp or trapline burns, it will be harder to pass knowledge on to their grandchildren”, “The experience of local users who have seen wildfires in this area is more important than scientific predictions and should be given more weight in decision making”, and “Heavy timber along drainages are important for moose because they provide shelter. If these areas burn, moose might move away or die off.” This group mostly supported statements drawn from resource management documents, and overall had an abstract, ecological approach to wildfires (Table 3).

Comments noted during the interviews revealed a more nuanced perspective. Several participants agreed that local knowledge and experience was important, but not more so than science. Two resource managers agreed that science could be political, and depended on the scientist, and one said local knowledge could be equally political. Several members of this group felt science and culture tempered each other, and agreed that science couldn’t account for the local hardships caused by fire. One respondent worried that locals could also make bad environmental decisions. Two resource managers agreed it was cheaper to fight wildfires while small, but one said he didn’t think it should be done, due to the biological benefits of wildfires. The other felt that management agencies were too cavalier about big wildfires, commenting that while fire management agencies were collecting paychecks, local people were getting their lives ruined. He had seen instances where local people were ignored and subsistence areas burned deliberately, and felt that

that kind of behavior could cost someone a career in a National Park in the lower 48, but got overlooked in “black spruce near Huslia.”

Conversations with resource managers in this revealed an enthusiasm for wildland fire. Managers strongly believed that wildfires would improve habitat for moose and increase moose populations, a view also held by various non-agency members of this group. Several participants explained that their biggest reason for supporting wildfire was their fear that moose populations were declining, and their desire to see them rebound. One manager explained that he knew wildfires killed small animals, but he did not think that was a bad thing, as overall he felt wildfires would help animal populations through habitat improvement. Wildfires were considered necessary to maintain a mosaic of successional stages on the landscape. In general, managers were supportive of local subsistence activities on the landscape, and felt that wildfires were a tool that could improve opportunities for subsistence. They were aware of local resistance to wildfire, but hoped that a combination of education and in-town risk reduction would change this.

Members of this group pursued a number of outdoor activities, with recreation (such as walking, biking or skiing), hunting, fishing, berry-picking, gathering plants, and firewood collecting being the most prevalent. Two members (12%) of this group trapped, one of them by airplane. Four members of this group (24%) agreed with the statement “I go out (on the land) for several weeks at a time in order to trap, fish, spend time in a cabin, or perform other subsistence activities.” Seven members of this group (41%) agreed with

the statement “I am out (on the land) most days doing some kind of work but come back at night.” No members of this group reported losing property to wildfire.

Factor 2: Valuing Local Knowledge and Places

Koyukon younger elders (average age 60) who draw on both traditional and Western knowledge and use the forest often made up 90% of this group, informally titled “Valuing Local Knowledge and Places”. Ten in number, this group shows a very strong concern for the well being of small animals, and worries they might be harmed in a wildfire. Respect for animals is an important part of Koyukon culture, and respondents explained that according to their beliefs success in subsistence activities depends upon respectful treatment of animals.

Members of this group feel that local knowledge and experience should inform decision making, and they tend to distrust decisions made in the name of “science”. They disagree with the statement “Wildfires are good because after a wildfire there is more unfrozen soil above the permafrost. This means that more things can grow.” As one respondent commented “The more we lose our permafrost, the more we lose our land.” This group also worries about fire impacts on important places, such as old portages and camping sites, and feel that wildfires could threaten cultural history. Overall, they are more likely to feel ownership of and connection with the landscape, and less likely to view it as wilderness. That said, to a certain extent they agree that wildfires were natural and could have some beneficial effects, and feel that even if people lose a camp or trapline they

could still teach their grandchildren subsistence. This group supports a mix of statements that included those drawn from interviews with elders and also from agency literature (table 3).

Members of this group explained that wildfires could have a number of negative effects on their subsistence. One of the major difficulties was access, as wildfires in the boreal forest often result in large numbers of trees falling across trails, and the lack of shelter and wind protection makes winter travel difficult. In addition, many older residents said that wildfires ruined the aesthetic of important places, as they become an impenetrable mess of black ash and fallen spruce trees. Finally, although many recognized that given enough time, subsistence would recover, they felt frustrated that they might not see this happen during their active years.

Members of this group reported a wide variety of subsistence activities, including hunting, fishing, berry picking, gathering wood for heat and smokehouses, and travelling around the country. While the only species Factor 1 respondents mentioned hunting was moose, Factor 2 respondents described hunting for moose, caribou, ducks, geese, bears, muskrats, grouse, and rabbits. Five members (50%) of this group reported trapping, and 7 members (70%) agreed with the statement “I go out (on the land) for several weeks at a time in order to trap, fish, spend time in a cabin, or perform other subsistence activities.” Four members (40%) agreed with the statement “I am out most days (on the land) doing

some kind of work but come back at night.” One member of this group, the only Caucasian, reported losing property in a wildfire.

Factor 3: Take it as it Comes

Factor 3 was informally titled “Take it as it Comes”. Ten people matched to this factor, and 80% of them were young to middle-aged Koyukon, with average age of 40. Two members of this group were Caucasian, and three of the Koyukon were in their fifties. In general, members of this group felt that wildfires were good for the landscape and had a number of ecological effects that could also benefit people. They felt that cultural sites were resilient and could survive a wildfire, but they did express some concern that small animals could not escape a wildfire. They disagreed strongly with the statements “If someone’s camp or trapline burns, it will be harder to pass knowledge on to their grandchildren”, “If all wildfires are suppressed, there may not be good subsistence in the future”, “It just isn’t possible to fight all wildfires, especially if they are far from villages.” and “Old portages, camping sites, and places where things happened in the past are an important part of the cultural history of the area. Wildfire destroys these places and cultural history is lost.” Overall, they felt that both subsistence and culture were resilient, in the face of both wildfires and the lack thereof. For the most part, this group agreed with statements that came from resource management agency literature on fire ecology, but they also supported a few statements made by local elders, such as those concerning the effects of wildfires on small animals (table 3).

Noted comments from members of this group included observations of new growth after wildfires, and one observation of burned small animals. Older Koyukon members of this group disagreed with some of the more managerial perspectives, with one commenting that the idea of using wildfires as a “tool” to improve habitat was culturally inappropriate. This respondent also felt that policy derived in the lower 48 was assumed sound without testing in Alaska, and worried that agency desires to burn the landscape would accelerate the landscape changes locally attributed to climate change. Another commented that if agency scientists “didn’t read about it, it isn’t true to them” and said he felt decisions about wildfires should not be left in the hands of one agency because there was no “challenge to power”. One of the Caucasian residents explained that both science and local values were important to her, and that while interchange was good, she disagreed with the paternalistic phrasing of the statement “The resource management agencies should teach people more about wildfires so that they can accept them.”

Participant observation with younger Koyukon revealed that many were active in subsistence activities, which were an important part of their identity. Unlike older Koyukon, most of these respondents did not speak their native language as children, nor did they spend time living in seasonal camps. Instead, most grew up attending schools in Galena or Huslia, but also participating in subsistence activities with their families. Often, these activities could be pursued in day trips by boat or snowmachine from town. Many had older relatives with cabins and camps on Native allotments and would spend some

time there. These residents strongly valued their culture, but did not express the same sense of loss or distrust of management that older Koyukon expressed.

Respondents in this group reported moose hunting, berry picking, dog racing, snowshoeing, gathering wood, travelling on the land, and picking berries. Three respondents (30%) agreed with the statement “I am out (on the land) for several weeks at a time in order to trap, fish, spend time in a cabin, or perform other subsistence activities.” Five respondents (50%) agreed with the statement “I am out (on the land) most days doing some kind of work but coming back at night.” One respondent reported losing a trapline trail in a wildfire and another reported losing personal gear in a fire while firefighting.

Negative of Factors 1 and 3

Four older Koyukon respondents, with an average age of 65, scored as either the negative of Factor 1 (3 respondents) or the negative of Factor 2 (1 respondent). Respondents who scored as the negative of Factor 1 (Natural and Necessary) defined their perspectives in opposition to the agency. They felt that wildfires had more negative effects than positive, and to trust local knowledge over science. One older resident matched as the negative of Factor 3. This was because he felt very strongly that wildfires threatened important cultural places, that the loss of a trapline made it harder to pass on knowledge to children or grandchildren, and that local knowledge was more important than science, all positions rejected by Factor 3. This resident had lost a trapline and a spring camp in wildfires, and commented that another place he frequented took 60 years to recover from a

wildfire. One respondent commented that, although wildfires might increase moose populations, he was afraid agencies were doing that to attract more outside hunters, and outside hunters were already a problem in the area. A common position among older Koyukon was that it would be better to increase moose populations by limiting outside hunters, rather than by burning areas important to local subsistence.

Semi-structured interviews and participant observation with older Koyukon revealed that most were strongly influenced by childhood experiences on the land, and had learned subsistence activities directly from their parents. They were also taught traditional rules dictating care and respect for animals; disrespecting animals could lead to a loss of luck in subsistence activities. These residents had spoken their native language as children, and moved with their families between the seasonal camps that dotted the landscape before the arrival of federal land management.

Many of these respondents expressed distrust of resource management agencies and outside decision-makers in general, due to negative experiences accumulated over their lifetimes. Some had been sent away to boarding school, and had been prohibited from speaking their native language, which was a traumatic experience. Many of these residents had stories of upsetting experiences with non-local regulators, and most felt that it was unjust for their traditional lands and activities to be managed by outsiders. In their childhoods they had made a living from the land through activities prohibited by current

regulations. These participants had experienced a great deal of loss over their lifetimes, and they feared policies that caused further loss of traditional livelihoods.

All four respondents (100%) agreed with the statement “I go out (on the land) for several weeks at a time in order to trap, fish, spend time in a cabin, or perform other subsistence activities” and three of the four (75%) agreed with the statement “I am out (on the land) most days doing some kind of work but come back at night.” All four respondents (100%) trap or have a spouse who traps. Two of the four respondents did not list their specific activities, but the other two listed hunting for bear and moose, fishing, travelling, and walking.

Differences between the groups

The important disagreement between “Natural and Necessary” and “Valuing Local Knowledge and Places” groups centered on the importance of local knowledge, the role of science in decision making, the necessity of wildfires for subsistence to continue, the feasibility of extensive wildfire suppression, the importance of historic places, and the deaths of small animals. Valuing Local Knowledge and Places strongly opposed the statement that decisions about wildfires should be made using science and ranked local knowledge as more important, felt that wildfire suppression would not damage subsistence, and disagreed with the idea that wildfire suppression was not always possible. In addition, they were bothered by the deaths of small animals and the loss of old portages or camping sites in wildfires.

The “Take it as it Comes” group differed from “Natural and Necessary” because its focus was less managerial. This group felt that wildfires had beneficial effects; they did not view the lack of wildfire as harmful to subsistence or wildfire as a tool to be used to improve the landscape. They also were more optimistic about the feasibility of wildfire suppression. This group differed from the “Valuing Local Knowledge and Place” group in not viewing wildfire as negatively affecting cultural and subsistence areas and in giving less weight to local knowledge relative to science. They also had a more favorable position on the conversion of spruce to birch and willow.

Discussion

The Groups

Numerous studies of rural, resource dependent communities have shown conflicts driven by class, caste, livelihood, gender, ethnicity, and power (Rocheleau et al. 1996, Kellert et al. 2000, Robbins 2000, Agrawal and Gibson 2001). The frequency of these findings led Kellert and colleagues (2000) to argue that conflicting interest groups should be expected in any community-based natural resource management project. In this study, within-community differences, while present, were not nearly as obvious as differences between Koyukon residents and resource managers/Caucasian residents (Figure 2). Although most Koyukon residents matched onto two different factors, many of them had moderate loadings on both factors (Figure 3 and Table 1). That the Q-sort showed a measurable gap between Koyukon and resource managers/Caucasians is not surprising,

considering that local Koyukon have grown up with different environmental experiences and world views. Traditional Koyukon beliefs focus on the powerful effects of human behavior on resource abundance and harvest success, and Koyukon resource management is based on a philosophy of respect for animals (Nelson 1983). As such, the death of small animals in a wildfire is deeply disturbing to many elders. In addition, resource use by Koyukon is different from that of Caucasian residents or resource managers. One study estimated that in Galena, households headed by Koyukon couples harvested an average of fourteen times as many pounds of wild resources as households headed by Caucasian couples (Marcotte 1990). Although households may participate in different resource harvesting activities, subsistence foods are generally shared widely. For example, in Huslia in 1983, 25% of the total Chinook salmon harvest was shared, mostly with households that did not fish for king salmon, and almost half of households reported receiving whitefish from other families (Marcotte 1986).

The results of the Q-sort, when considered with the ethnographic information above, imply that “community” can remain a useful construct when dealing with rural, resource-dependent communities whose resources are managed by people outside of the community. This is especially true in small, ethnically homogenous communities where residents are tied together by kinship relations, sharing networks, and a shared epistemology based on traditional resource use. Managers, rather than assuming homogeneity or conflict, would be advised to start projects with an investigation of value

differences. In this case the Q-sort method proved successful in eliciting perspectives and the people united around them.

The findings in this study also imply that age may be important and under-theorized facet of community differentiation. Differentiation by age was striking, with the oldest Koyukon respondents (average age 65) matching as the negative of Factors 1 and 3, with the next oldest group (average age 60) matching to Factor 2, and the youngest group (average age 40) matching to Factor 3 (Table 1). Education did not explain this trend, as several of the oldest respondents had associate's degrees (making them among the more educated participants) and still matched to the Factor 2. In addition, several of the respondents who matched to Factor 3 had college degrees, comparable to the resource managers and Caucasian residents who made up Factor 1.

Inglehart and Baker (2000) found that modernization led to value shifts in countries across the world, and differences between generations, as most values became set during people's formative years. Specifically, countries that experienced rapid growth and increasing life expectancies had the sharpest differences in values between young and old. This pattern was observed in Galena and Huslia and would imply that managers in places that have seen similar rapid modernization should consider age cohorts as potential interest groups. Value transitions around the world are path-dependent, with diverse cultures ending up in different places even after the value shifts associated with modernization (Inglehart and Baker 2000). In this study, younger Koyukon cohorts, rather than ending up

on the same factor as resource managers/Caucasian residents, defined a third factor. This shows that even after rapid modernization, cultural differences can persist, and challenges claims that the use of modern technology has erased Alaska Natives' rights to distinct perspectives.

The Issues

One of the major issues defining Factor 2 and the negative factor matches was the role of local, experience-based knowledge. Older Koyukon strongly felt that management should give local knowledge more consideration than science, and feared that managers educated elsewhere did not adequately understand local livelihoods or ecosystems. Thus, including local users in decision-making may improve local perceptions of resource management, regardless of outcome. Research has shown participation in policy creation can produce commitment to resource management, and exclusion from decision-making can lead to resentment and non-compliance (Jentoft et al. 1998, Ostrom 2005, Schroeder 2005). Although local communities may make mistakes, this is not a sufficient reason to exclude them from participation, as government resource management has had its own failures (Holling 1978, Jentoft et al. 1998, Pyne 2001). Democratic principles imply communities have a right to participate in decisions affecting their well-being, and good governance should include rural users and their values (Western and Wright 1994, Berkes and Fast 2005). As such, the desire of Koyukon to have a voice in local wildfire

management decisions is neither unreasonable nor unexpected and should be considered as a goal rather than the means to an externally set goal.

Another statement that separated older Koyukon from other groups was their attachment to cultural and historic places, which contrasted with agency desire for a landscape in a balanced mosaic of successional stages. The Koyukon sense of place is not an anomaly, as numerous scholars have shown how traditional cultures, including the Koyukon, value place, not just as a space that produces material goods, but as an important part of identity and culture (Thornton 1995, Basso 1996, Watson and Huntington 2008). In addition, Koyukon respondents explained that material use of resources does not occur in an abstract mosaic, but depends upon spatially heterogeneous resources and local informal institutions regulating access rights. This finding supports the claims of Roth (2004), who argued that traditional and state knowledge cannot be reconciled without consideration of the spatial dimensions of knowledge, use, and management practices at both the local and higher levels. As such, any serious attempt to include Koyukon residents in federal wildfire policy planning would start by considering spatial knowledge differences between the two groups.

Finally, both Koyukon groups believed that it was cheaper to suppress wildfire while small, rather than letting them burn and suppressing them once they had grown large and threatened villages. Two resource managers agreed that it was cheaper to fight wildfires while small. This suggests an interesting topic for future research-an

investigation of whether “let-burn” policies could actually be more expensive. It also suggests a new avenue for discussion between the two groups. Currently, agencies are using wildfire ecology education in hopes of convincing Koyukon residents to accept “let-burn” policies. As these residents suffer direct material losses from wildfires (Ray dissertation article 3), they are unlikely to completely change their perspective. It might be more effective to address issues of cost, as residents may be able to accept that there is simply not enough funding for total suppression.

Conclusion

Federal and state agencies assigned to wildfire policy and management face increasing pressure to include the local community into actual management plans and practices. This inclusion proves somewhat more complex in Alaska than elsewhere in the U.S. because so much of federal and state forest land has been taken from that historically used and claimed by indigenous Alaskans. These groups, such as the Koyukon communities examined here, not only reside within the forest lands but continue to use and value them in ways that are not typical in the remainder of the US. This study confirms through systematic Q sort assessment and participant observation undertaken in two Koyukon communities that [1] the “local” hold different values and visions about forest lands and wildfire threats to these lands than do the federal and state managers as well as local “Caucasian” occupants, but [2] that at least two distinctive value-vision sets were detected among the local, involving age cohorts. The distinction from the forest managers

resided in the cultural and subsistence meaning and value of forest lands and small animals to the Koyukon, and in a desire for more local control, suggesting that meaningful coproduced policies must address these issues. The distinction among older and younger Koyukon implies that age is an important factor to consider in future participatory projects.

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Chapter 3: Beyond the Technocratic/Democratic Dichotomy: Tailoring Participation in Wildfire Policy Planning to Local Knowledge and Experience

Abstract

Despite calls for a transition in risk planning from technocratic to democratic approaches, the former, predicted on expert control, prevails among most wildfire risk reduction in the United States. Advocates of the Community Wildfire Protection Plan (CWPP) process, which brings communities and agencies together to prioritize wildfire risk reduction projects in towns and in nearby forests, describe it in democratic terms, arguing it helps empower communities, and include local values in forest management. This study evaluates the CWPP process in the rural, predominantly Koyukon Athabascan community of Galena, Alaska through observation, surveys and interviews. It seeks to determine whether the process met democratic goals and led to community satisfaction with policies. Findings indicate that the process addressed only wildland-urban interface risk management, encouraging residents to accept agency goals through a technocratic, education-focused process. The resulting fire risk strategy was acceptable to both Caucasian and Koyukon residents, who had poorly formed opinions on wildfire risk in town, little knowledge of mitigation strategies, and moderate interest in planning activities. In contrast, Koyukon residents felt high frustration with wildfire policies, which affected local forests important for subsistence uses, but did not successfully incorporate local values. When dealing with wildfires, stakeholders perceive wildland-urban interface risk planning and forest management differently, especially in places where residents depend on forest for their livelihoods and have a history of traditional forest use and management. This study concludes that technocratic and democratic

planning philosophies are applicable to different planning processes depending upon local knowledge and interest.

Introduction

In the year 2000, catastrophic wildfires raged across the United States, displacing tens of thousands of people, leaving hundreds of families homeless, and burning millions of acres (Machlis 2002). This disaster inspired the National Fire Plan (NFP), a policy initiative to reduce wildfire risk through prevention rather than reaction, specifically by empowering communities to reduce their own risk (Steelman and Kunkel 2004, Steelman et al. 2004). Per the Healthy Forests Restoration Act of 2003, responsibilities are turned over to communities through the Community Wildfire Protection Plan (CWPP) process, where communities and agencies work together to prioritize risk reduction projects that address wildland-urban interface or forest safety (Machlis 2002, Steelman et al. 2004, California Fire Alliance 2009). Special federal funding is available for these co-produced projects, and the CWPP process has been lauded as “the first meaningful statutory incentive for the US Forest Service and the Bureau of Land Management to give consideration to the priorities of local communities...”(Communities Committee et al 2004, p 2). In Alaska, policy makers encourage community/agency CWPP collaboration in order to mitigate predicted damages from a climatically-induced increase in extreme fire weather (Adaptation Advisory Group of Governor's Sub-Committee on Climate Change 2009).

Initiatives that involve communities in policy-making are heralded as a transition from the technocratic model, where only experts are qualified to make decisions, to the democratic model, which recognizes implicit values in decision-making processes, controversy even among experts, and the value of public input into planning dilemmas (Fiorino 1990, Lane 2005). In spite of these directional narratives, many participatory projects are built on the technocratic assumption that public opposition to risk policies stems from a misunderstanding of science. This approach, known as the deficit model, focuses on improving risk communication and education, building trust, and convincing people it is in their best interest to take personal responsibility for risk prevention (Kumagai et al. 2004, Rowe and Frewer 2004). “Participation” has different meanings depending on context, and can range from technocratic approaches focused on information distribution, to democratic representation on policy-making bodies, to surveys, interviews and public meetings, which can support either style (Rowe and Frewer 2004).

Researchers have found evaluation of participatory processes difficult, and often use democratic principles as assessment criteria. Many programs have been criticized for not meeting democratic goals of treating participants as “partners” or giving them actual power over goals setting and outcomes (Arnstein 1969, Lane 2005). Most wildfire prevention projects would fail by these criteria, as they usually engage communities, not to design policy, but to learn why communities accept or reject agency goals (Steelman et al. 2004, Arvai et al. 2006, Brenkert Smith et al. 2006, Bright and Burtz 2006).

Assuming agency expertise over federal or state forests, project leaders may ignore the

large body of research on community forestry, which is especially pertinent in areas inhabited by indigenous residents.

The movement to include rural communities in forest management differs from risk planning largely because of a broader perspective that recognizes indigenous people's rights to land they have traditionally occupied and used (Howitt 2001, Schroeder 2005). In addition, while the general public has little specialized knowledge of risk planning, indigenous communities often have extensive environmental knowledge that comes from generations of use, and their participation in forest management may offer solutions to environmental unknowns (Acheson et al. 1998, Tsing et al. 2005). Researchers studying community-based natural resource management (CBNRM) have compiled numerous case studies on the successes and failures of these initiatives (Western and Wright 1994, Berkes et al. 2005, Brosius et al. 2005). These provide considerable insight into the factors a successful project must address, including recognition of value and knowledge differences within communities, and between communities and agencies (Escobar 1996, Rocheleau et al. 1996, Robbins 2000, Agrawal and Gibson 2001, Hecht 2004).

Movements to involve rural communities in forest management are a reaction to the frequent failures of technocratic policies that assume scientific knowledge is necessary for the sustainable and efficient use of natural resources. This assumption, used to justify the transfer of forests to private or government management, has sometimes led to both environmental degradation and local inequities (Agrawal 2002, Dietz et al. 2002). Forest communities, especially those labeled traditional, have long

regulated forest resource use through informal institutions, or unwritten rules used to organize resource access and prevent depletion (Posey 1985, Berkes 1987, Ostrom 1990). These locally-enforced rules create different categories of users, with privileges such as access to specific territories and rights to extract particular resources (Ostrom 1990). Areas that are not privately owned, but are regulated through local rules as described above, are known as common property and can often persist sustainably (Dietz et al. 2002). When government agencies create new rules and make enforcement of local rules illegal, environmental degradation may occur, as residents may be unable or unwilling to follow policies inconsistent with their traditional use patterns or the characteristics of the local resource, especially when government agencies are unable to provide enforcement. Additionally, local users lose the power to prevent access by non-local users. As such, areas that were sustainably managed through local institutions as common property may turn into situations of open access, where anyone may extract resources with low risk of consequences (Dietz et al. 2002).

Case studies have shown that common property regimes can persist sustainably when certain conditions are met, including national and state governance that does not prohibit local management, and a clearly defined group with common interests, member interdependence, and social capital (Agrawal 2002). Additionally, research indicates that state policies that are inconsistent with local institutions are unlikely to succeed and enforcement may generate resistance, mistrust, and resentment (Ostrom 2005, Berkes 2007). Sustainable resource use depends on trust, as residents will likely not follow regulation imposed by a body that they do not trust (Dolsak and Ostrom 2003). As such, wildfire risk reduction projects affecting forests used by indigenous people may not

succeed if they fail to build trust and to seek compatibility with local informal institutions.

Purpose of Study

Although the NFP's goal of empowering communities to improve both forest management and wildland-urban interface safety is important, it appears that many wildfire risk reductions projects fail to incorporate communities in policy-making or to consider the insights produced in the CBNRM literature on value differences or informal institutions. In this study, I evaluate the Community Wildfire Protection Plan in the rural Koyukon community of Galena, Alaska, in terms of both process and outcome.

Based on the results, I argue that the CWPP mixes two fundamentally different participatory processes—risk planning and forest management—that need to be approached with distinct strategies. Local residents feel that they lack of knowledge of risk prevention, and are enthusiastic about agency-led prevention education. As such, the deficit model is the appropriate method for increasing community participation in risk prevention, and surveys should be used to improve risk communication and align interventions with community values. Community members view forest management goals differently, as they have extensive environmental knowledge, institutions regulating forest use that have persisted in the face of federal land management, and livelihoods and traditions that are highly forest-dependent. As such, processes to include participation in forest management should seek compatibility with local informal institutions, address issues of trust, and have a formal mechanism for connecting participant input to policy-making.

Study Area

Galena, Alaska, is a pre-dominantly (63%) Koyukon Athabascan (Koyukon) community of almost 600 people, located along the middle Yukon River in interior Alaska (Fig. 1). The Yukon River, which is almost a mile wide at Galena, dominates the landscape, and its meanderings over time have created a vast system of lowlands, lakes and sloughs. As this remote area is disconnected from the road system, this large waterway provides the primary means of local transportation, by boat in the summer and snowmachine in the winter. In addition, the river has historically provided a stable salmon run, which is credited for the development of somewhat settled seasonal fish camps in the area in the past (Natcher et al. 2007).

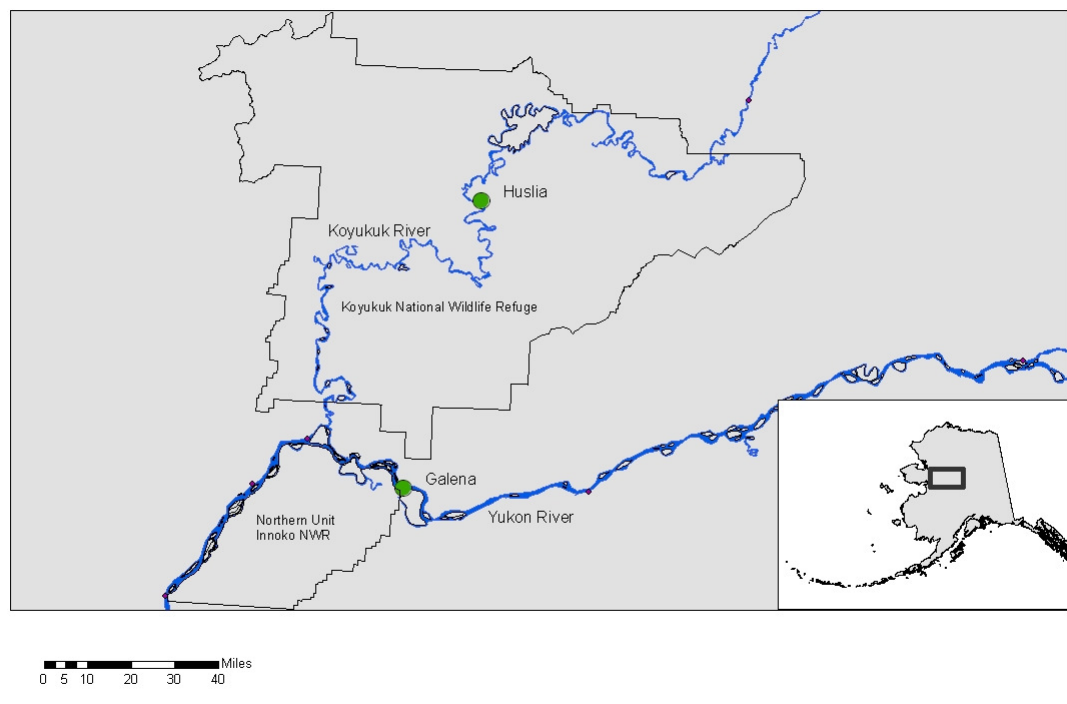


Figure 4 Study Area

Historically, Koyukon moved with the seasons in order to optimally exploit temporally and geographically variable resources. Spring camps were located in wetland areas to harvest beavers, pike, muskrats, and waterfowl, and in the summer families moved to camps along rivers to harvest salmon. In the fall families would snare small game, hunt large game, and trap whitefish and grayling at stream outlets. Winter villages historically were located along caribou migration routes (Nelson 1983, Marcotte 1990).

“We used to move around. Where ever the season is, like wintertime, we stayed in a cabin up there. And in the springtime we go out in the flats and my parents hunt muskrat. And they paddle on the canoe and they move wherever they’re hunting. And then that’s where they put up tent. And that’s, that’s how I was born where I was born. In summertime they move out to the river to fish, then fall time hunt, so they’re probably on the river too.”

Huslia Resident 1

Traditionally, certain sites such as bear dens, fish camps, and muskrat and beaver trapping areas, were treated as private property through local informal institutions (Natcher et al. 2007). Today, Koyukon live in towns and practice a mixed-cash subsistence economy, with families using money from wage employment to support subsistence activities on the landscape. Traditional foods continue to be important, both culturally and nutritionally, and the most recent study of wild food consumption showed that residents averaged 787 lbs per person annually (Marcotte 1990).

Although Koyukon have maintained subsistence traditions, it has been difficult due to laws that conflict with historic use patterns. One of the most disruptive laws

required children to attend school, which meant they could not spend time with their families in seasonal camps.

“We were always learning subsistence life. And then the school came. And then Grandma said we have to go to school because the school is here. Everybody gotta go to school. So, I’m starting school here in the village, while they’re out on trap line. That’s the way it was when I was growing up. ...they didn’t teach me how to trap.”-Huslia Resident 1

In addition to losing subsistence skills, children attending school also became unfamiliar with the Koyukon language.

It was only when we started going to school that we were introduced to the English language.... It was little tough because we were disciplined a lot by the nuns. Whenever we spoke our native language and after a while it (English) became our first language... we forgot our Athabascan language.” Galena Resident 6

Resource use was not only disrupted by children being separated from their traditional education, it was also disrupted as local land, which had been managed by Koyukon informal institutions, became subject to outside resource management.

“Nowadays we have to get logging permit, even with cabins now. Because the government want us buy their own lumber. Like money. ...Usually we just buy the gas, go upriver and float down logs, and build our own cabins. Now we got a logging permit, and there’s more land and more ownership seems like. Around the river where we used to get logs. Same for the firewood.” Huslia Resident 5

Since the Alaska National Interest Lands Conservation Act (ANILCA) of 1980, the traditional territory of the Galena-area Koyukon has been managed by the U.S. Fish and Wildlife service as the Koyukuk National Wildlife Refuge and the Northern Unit of the Innoko National Wildlife Refuge. Although ANILCA protects subsistence uses, they are regulated through federal decision-making processes and to a certain extent by Refuge planners. In 2008, 5 out of 13 employees were Koyukon from the local area, but the Refuge manager and assistant manager, lead biologist, and, most notably, the wildfire

manager, had all come from the Lower 48. Wildfire planning and response is one of the most active Refuge duties, as local forested areas are dominated by black spruce, which is highly flammable and burns at high intensity (Viereck 1973, Alaska Region US Fish and Wildlife Service 2008).

Methods

Fieldwork was conducted in Galena in May-June 2007 and March-July 2008, and document analysis of minutes of CWPP meetings outside of that time period. The case study, which sought to measure both the participatory nature of the process and resident satisfaction, used multiple sources of evidence in order establish construct validity (Yin 2003). These included participant observation of CWPP meetings and firefighting drills, analysis of policy documents, a survey of Galena residents (Appendix A), informal interviews with agency personnel, and semi-structured interviews with older Koyukon residents of Galena (Appendix B and Appendix C).

Participant observation was conducted over a period of 8 months, including May/June 2007 and March-July 2008, and included participation in CWPP activities, an internship at the Koyukuk National Wildlife Refuge, observation of subsistence hunting and fishing, and informal visits with members of the Galena community. Experiences in the community were used to inform the survey and interview instruments, both of which were tested on and modified according to the suggestions of community members and a local research assistant (Bernard 2006). In addition, participant observation and informal conversations were used to triangulate the results of the surveys and interviews, in order to determine their generalizability to the wider community.

A standardized survey designed around the Galena CWPP plan addressed wildfire risk, proposed methods of risk reduction, participation in planning, trust, and wildfire ecology. Most questions required respondents to score themselves on a 5 point Likert-type scale (Bernard 2006), which allowed for statistical analysis. The survey was conducted during the spring of 2008, using a sample of volunteers. Although random samples are considered the best method to eliminate selection bias, some statisticians consider that social survey data, regardless of sampling design, is always non-random, due to non-response bias (Smith 1983). In this case, a random sampling scheme would have likely resulted in a high non-response rate and biased the sample towards residents interested in wildfire policy and trusting of resource managers. As such, the sampling scheme was designed to build trust and to reach out to all types of Galena residents. As an incentive, residents who completed the survey were entered into a drawing for a drum of gasoline. This incentive was designed to motivate all types of residents to participate, regardless of their interest in wildfire policy or relationship with resource managers, as gasoline in Galena cost \$5.12/gallon at the time of the study. Because of the incentive, it was important to allow all residents the opportunity to participate, so as not to cause division or ill-will in the community.

In order to build trust, the Galena girls basketball team, trained by the researcher, surveyed community members in person. This also allowed older residents to participate, as team members could read the survey to them and record their responses. Additionally, paper surveys were also made available in public locations such as the store and post office, for residents to complete on their own time. The survey was advertised on the local radio station and announced at local events in order to ensure that most

residents were aware of it and had an opportunity to participate. The survey, limited to adults 18 and older, produced 144 submissions. The surveys were checked for measurement reliability by comparing responses to questions that should have similar or opposite answers (Vaske 2008). Measurement reliability was confirmed, but 13 surveys were excluded from the analysis because answers appeared random. 131 surveys were analyzed in SPSS, using descriptive statistics, independent and paired samples t-tests, and Spearman's rho (Vaske 2008). Although some statisticians recommend against parametric statistics for ranked ordinal data such as the Likert-type scale used in this study, statisticians and researchers have shown that t-tests are robust and perform well regardless of measurement scale used (Baker et al. 1996; Gardner 1975). Spearman's rho can be considered a special, non-parametric case of Pearson's r that is most appropriate for ranked ordinal data such as that used in this study (Vaske 2008).

The sample represented about 31% of the adult population of Galena (U.S Census Bureau 2009). The demographics of the sample were compared to those of Galena to test for response bias. The age distribution of respondents was similar to that of adult Galena residents, with a slightly higher proportion of middle-aged respondents. Additionally, survey respondents were 49% male and 51% female, and the Galena population is 55% male and 45% female, implying the survey had a slight bias towards female residents. Respondents were grouped into two groups-under 45 and 45 and older. Variables of interest were tested for significant differences using an independent samples t-test, and none were found. Male and female responses to variables of interest tested in the same manner, and only one difference was found, which is noted in the results. These tests imply that the slight demographic bias did not noticeably affect results. Of the

participants, 71 (54%) were Koyukon, 59 (45%) were non-Koyukon, and 1 was unknown. Since Galena is approximately 63% Koyukon, a higher percentage of non-Koyukon residents participated in the survey, and this bias was addressed by testing for significant differences between Koyukon and non-Koyukon respondents. Some differences were found and are reported in the results section.

Twenty in-depth, semi-structured interviews on Koyukon perspectives on wildfire and the forest were conducted in Galena in the spring and summer of 2008 by this researcher. Semi-structured interviews are considered an appropriate tool for working with Native Alaskan elders, as they allow respondents more control over the expression of their perspective (Huntingdon and the communities of Buckland; Elim; Koyuk; Point Lay; and Shaktoolik. 1999). As the specialized information sought in semi-structured interviews cannot be found by random sampling, a purpose sampling strategy was used to select older Koyukon residents known for their experience with the forest (Tashakkori and Teddlie 1998, Wengraf 2001). An interview guide, covering traditional use patterns, experiences with wildfires, effect of wildfires on forest use, suggestions for wildfire policy, and observations of forest change, was used to ensure consistency between interviews, but the order of questions followed the flow of the conversation (Bernard 2006). Interviews were recorded and transcribed, and coded in ATLAS.ti using both researcher-designed and emergent themes for codes (Marshall and Rossman 1995). Relevant coded data were analyzed and organized for this article.

Results

Community Wildfire Protection Plan Process

The CWPP is a policy document describing strategies for local wildfire risk reduction, and should address both fuel reduction in local forests, and structural ignitability in the wildland-urban interface. Communities have an incentive to create this document because projects outlined in an approved CWPP are prioritized for federal funding. The Healthy Forests Restoration Act of 2003, which created the CWPP, requires the document be collaboratively written by local and state agencies, approved by relevant federal and firefighting agencies, and inclusive of public input from any interested local parties. This study distinguishes between the CWPP, which is a policy document, and the CWPP process, which is the collaborative method used to create this document.

In Galena, the CWPP process was initiated in 2006 by the Wildfire Manager at the Galena USFWS office, which is responsible for the Koyukuk National Wildlife Refuge. The process was led by the USFWS, the major land management body outside of the town, and the Alaska Fire Service, the agency responsible for wildland firefighting in the area. Participants in the meetings included representatives from the Galena Volunteer Fire Department, the City of Galena, the Louden Tribal Council, Gana-A'Yoo Limited (the village Native corporation), and the Alaska Department of Fish and Game. Meetings were open to the public and advertised on the radio, but few members of the public attended.

The direct goals of the Galena CWPP process were to improve coordination between agencies so that they would be better prepared to respond in the case of a WUI fire, to evaluate wildfire risk in Galena, and to create and approve a town risk mitigation

plan. An indirect goal, which was mentioned in the final CWPP document and in at least one meeting, was to help the public transition away from a paradigm of complete wildfire suppression. Planners believed that if residents felt the town was safe they would accept “let-burn” policies in area forests. The CWPP planning process was conducted through a series of group meetings in which representatives agreed upon and delegated tasks, which were carried out by the relevant agencies, reported back to the group for input, and then incorporated into the final planning document. Some of the technical tasks conducted by various agency participants outside of the meetings included the creation of a base map of the town, a risk assessment of local houses, and the drafting of a mitigation plan. Tasks accomplished during meetings included the identification of high-risk areas in need of possible fuel reductions and the development of a protocol for joint response in the case of emergencies. The group also held several wildland-urban interface firefighting drills, in which members of the Alaska Fire Service, the US Fish and Wildlife Services, and the Galena Volunteer Fire Department worked together to simulate co-operation in the case of a wildfire spreading through town and igniting structures.

Although few members of the public attended the CWPP planning meetings, the core committee kept the process public through fliers and radio announcements, and there was no public opposition to any of the CWPP technical projects.

One of the major goals of the project was to undertake outreach and education in order to inspire community members to implement FIREWISE practices, which are a series of landscape modifications to make a home more defensible from wildfires. To achieve this end, pamphlets were sent out to local residents. One outreach idea was to

recruit elders to encourage community members, and on at least once occasion a well-respected elder was consulted. In general, there was significant support for outreach and a number of ideas were generated, but committee members spent less time on outreach than they did on technical aspects such as risk evaluation or plan writing.

The CWPP core committee met several times a year in 2006 and 2007, and a major risk assessment was conducted in summer 2006. By spring 2008, a mitigation strategy had been drafted, and one of the major goals of CWPP participants was to get community input and to tailor it to community needs. A survey on public acceptance of CWPP mitigation strategies, conducted in 2008 as part of this research project, was supported by the USFWS. The results of the survey were eventually incorporated into the final CWPP document, which was presented to the local Tribal Council, approved and finalized in 2009.

How does the community fit into risk prevention planning?

Although the CWPP process achieved important safety improvements in Galena, little community empowerment occurred. Instead, resource managers conducted most tasks. Survey results indicated community preference for this style of risk prevention, as respondents believed resource managers more qualified than the general citizenry. When asked who they trusted for information on wildfire, respondents reported trust in the BLM and the Galena Volunteer Fire Department that was significantly higher than their trust of the USFWS or their trust of family and friends (Fig. 2)⁴.

⁴The group of survey participants had a slightly higher percentage of women than the overall Galena population. When tested using an independent samples t-test, the only question where women and men

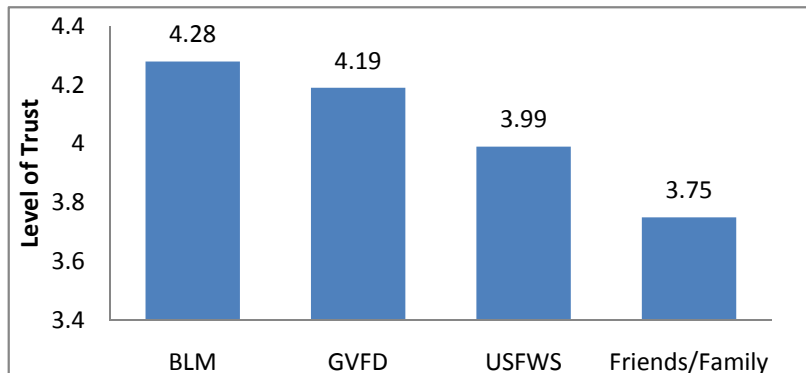


Figure 5 Trust for information about wildfire: 1=Don't Trust, 5=Trust Completely

In addition, when asked what would make Galena safer from wildfire, most responses indicated agency or local government projects. These included fire breaks; investments in infrastructure, equipment, or training; prevention and preparedness education; regulations on defensible space, burning, fireworks, and cigarette disposal; and planning. Other suggestions included increased personal responsibility, primarily in the form of clearing brush or trees around homes. No respondents suggested greater citizen involvement in planning, and most indicated an expectation of agency or local government leadership.

During the field period of this study, Galena residents often discussed resource management policies with intense frustration. Fire prevention planning, however, was never mentioned in the presence of the author and did not seem to inspire much concern or interest. This is likely because Galena residents had only a moderate level of worry

had a significant difference was over trust for the USFWS. Women had significantly higher levels of trust. Thus, the overall trust of the USFWS in Galena may be somewhat lower than the number reported here, due to response bias.

about wildfires affecting the town itself (average response 2.9 on a scale of 1-5 where 1=Not at all worried and 5=extremely worried), and fire prevention planning had not had negative effects on the Galena citizenry. Although the CWPP process encouraged FIREWISE modifications, they were not mandatory, and many residents were not even aware of the campaign. Only 29% of survey respondents reported receiving information about how to make their homes safer from wildfires, even after pamphlets had been sent out to all residents. The survey showed respondents found some modifications to be a good idea and others to be completely unacceptable due to inconvenience (Table 1). As none of these modifications were required, residents were free to ignore suggestions they found impractical.

Unacceptable	Acceptable	Very Acceptable
<ul style="list-style-type: none"> • Enclose Space Under House With Small Gauge Wire Screen (2.37) • Replace Spruce Trees with Aspen or Cottonwood (2.39) • Move Propane Tanks, Fuel Barrels and Woodpiles 30 feet from house (2.77) 	<ul style="list-style-type: none"> • Limb-up Trees to 6 feet (3.71) • Move Flammables from Under House (3.75) 	<ul style="list-style-type: none"> • Clear Out Understory Vegetation Such as dry grass, leaves and debris(4.17) • Remove Dead Trees Within 100 ft of buildings (4.18) • Avoid Parking in the Street to Keep it Clear for Fire Vehicles (4.39)

Table 1 Community willingness to implement FIREWISE modifications 1=Will Not Do, 5=Will Do As Soon as Possible

Is participation necessary?

Although respondents indicated agencies were the experts and should take the lead, there was a moderate interest in participation, and a moderately negative reaction to the idea that participation was unnecessary or pointless (Table 2). Respondents showed highest levels of support for deficit model participation, such as demonstrations and mailed information, where agencies could educate residents (Fig. 3). Public meetings, the option the CWPP committee offered, was one of the less popular options, and was significantly less popular ($p < 0.01$) than the top four options.

Statement	Average Response
I would like to vote for someone from the community who can represent me in planning to make Galena safer from fire	3.61
I would like to participate in planning to make Galena safer from fire	3.34
I trust the agencies to represent me so I don't need to participate in planning to make Galena safer from fire	2.94
I don't want to be included in fire safety planning	2.52
I don't think there is a point in participating in planning to make Galena safer from fire because it won't change anything	2.21

Table 2 Participatory preferences. Responses on a scale of 1 to 5 where 1=Really Disagree and 5=Really Agree

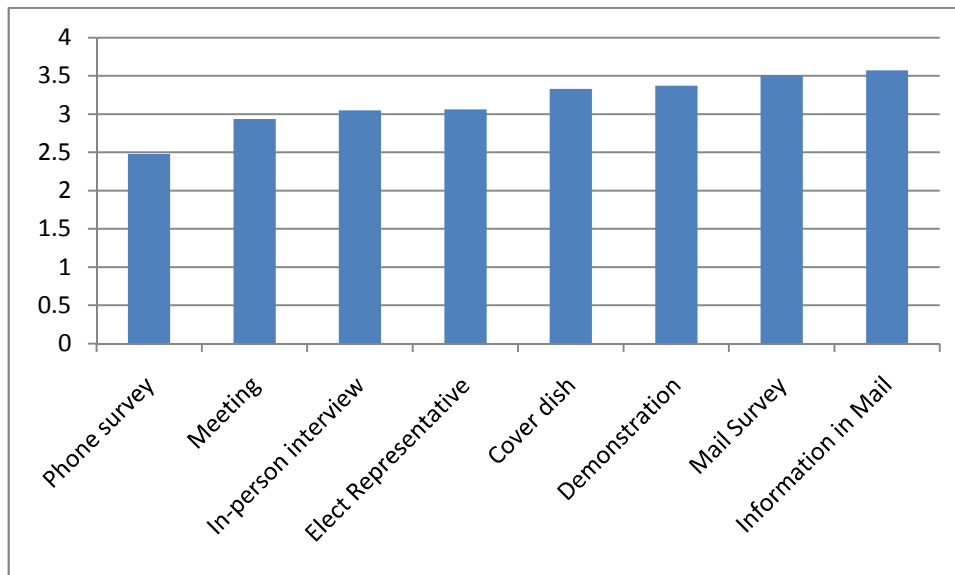


Figure 6 Preferred form of Participation. Scale of 1-5 where 1=Really Dislike and 5=Really Like

Interest in participating in wildfire protection planning (represented by response to the statement “I would like to participate in planning to make Galena safer from fire”) had a significant, low to medium correlation with worry about wildfires affecting Galena, and no significant correlation with worry about wildfires affecting subsistence (Table 3)⁵. Interest in participating in wildfire protection planning had significant, low to medium correlations with trust in the Bureau of Land Management (BLM), USFWS and the Galena Volunteer Fire Department (GVFD) (Table 4). Feeling that there was no point in participating had a significant, medium negative correlation with trust in Bureau of Land

⁵ Effect size of correlations measured according to social/behavioral science standards described in Vaske (2008) and Cohen (1988) where $r = .10$ is considered “small” or “minimal”, $r = .30$ is “medium” or “typical” and $r = .50$ is “large” or “substantial”

Management (BLM) and the GVFD, and a significant, average to high negative correlation with trust in the USFWS (table 4).

	Worry about wildfires affecting Galena	Worry about wildfires affecting subsistence
Interest in participating in wildfire protection Planning	Spearman's rho .252** Significance .005 N=122	Spearman's rho .023 Significance .803 N=120

Table 3 ** significant at $p < .01$

	Trust in BLM	Trust in USFWS	Trust in GVFD
Interest in participating	Spearman's rho .186* Significance .039 N=123	Spearman's rho .209* Significance .020 N=123	Spearman's rho .265** Significance .003 N=122
No point in participating	Spearman's rho -.310** Significance .001 N=122	Spearman's rho -.419** Significance .000 N=122	Spearman's rho -.319** Significance .000 N=122

Table 4 ** significant at $p < .01$; * significant at $p < .05$

Does Risk Perception Affect willingness to implement FIREWISE modifications?

Agencies involve the public in wildfire planning to promote risk awareness, with the assumption that increased risk perception causes residents to take safety measures such as FIREWISE modifications. Residents were asked separately about their willingness to implement eight different FIREWISE modifications, and this was averaged in order to calculate an overall FIREWISE score. Residents were asked separately about their worries of a wildfire burning Galena from outside or starting in town, and these responses were averaged to create an overall Galena Worry score. Spearman's rho was used to see if perception of wildfire risk and worry about wildfire affecting Galena were

correlated with willingness to implement FIREWISE modifications but neither was found to have a significant correlation at $p=0.05$ (Table 5).

	Perception of Wildfire Risk	Worry About a Wildfire Affecting Galena
Willingness to Implement FIREWISE modifications	Spearman's rho .081 Significance .373 N=124	Spearman's rho .081 Significance .375 N=123

Table 5 Risk perception and willingness to implement FIREWISE modifications

Has the CWPP process helped the public accept let-burn policies?

One CWPP goal was a public transition away from an expectation of wildfire suppression towards an acceptance of wildfires in surrounding forests. Planners hypothesized that the CWPP process could assist this transition because if people felt their town was safe from wildfire, they would be less threatened by wildfires in area forests. In order to test this theory, Spearman's rho was used to compare worry about wildfire affecting Galena with willingness to accept "let-burn" policies. If the prediction were true, a negative correlation would be expected. Instead, no significant correlation was found (Table 6).

	Worry About a Wildfire Affecting Galena
Acceptability of "Let-burn" Policies	Spearman's rho .090 Significance .314 N=127

Table 6 Worry about wildfires affecting Galena and acceptance of "let-burn" policies

Is Galena the main concern for wildfire damages?

Residents were also asked if they were worried about wildfires affecting areas they use for subsistence. A paired samples *t*-test was used to compare worry about wildfires affecting subsistence with worry about wildfires affecting Galena, and the difference between averages was not found to be significant (Table 7).

Group	Worry About Wildfires Affecting Subsistence	Worry About Wildfires Affecting Galena	(<i>t</i> -value)	Significance
All Respondents (n=126)	3.05	2.90	1.080	.282

Table 4 Worry about wildfire measured on a scale of 1 to 5 where 1=Not at all (Worried) and 5=Extremely Worried

Do Local Koyukon residents view wildfire protection planning differently from Non-Koyukon (or non-locals)?

An independent samples *t*-test was conducted on respondents who were separated into two groups: those who reported they were Gana'yoo share holders (n=55), and those who reported they were not (n=73) (Table 8). Gana'yoo is the local Native corporation, therefore shareholders are both Koyukon and from the immediate area. All variables were checked for significant differences, although the composite FIREWISE variable was used to represent the average of all FIREWISE modifications, and the composite worry variable was used to represent worry about wildfires starting inside or outside of Galena. Gana'yoo shareholders showed significantly less worry about wildfires affecting Galena, acceptance of "let-burn" policies, trust in the Galena Volunteer Fire Department and US Fish and Wildlife Service. They were significantly more likely to want to attend a

coverdish (potluck activity) as a form of participation in wildfire protection planning, and to feel that there is no point in participating in wildfire protection planning.

Group	Gana'yoo Shareholders	Non-Shareholders	(<i>t</i> -value)	Significance
Level of Worry About Wildfires Affecting Galena	2.6667	3.1096	-2.314	.022 (a)
Accept "Let-burn" policies	3.906	4.308	-2.013	.048 (b)
Trust GVFD	3.98	4.38	-2.299	.024 (b)
Trust USFWS	3.72	4.22	-2.409	.018 (b)
Participation-Coverdish	3.72	3.04	2.822	.006 (a)
Feel there is no point in participating	2.65	1.92	3.554	.001 (a)

Table 8 Koyukon and non-Koyukon Differences a=equal variances b=unequal variances

Interviews

Many elder Koyukon residents in the area had publically expressed opposition to wildfires, and managers had hoped that education and outreach, including the CWPP process, would help increase public acceptance of "let-burn" policies. Interviews were conducted with elder Koyukon residents during the spring of 2008, well into the CWPP process, to determine if they still opposed "let-burn" policies, and why.

Do all older Koyukon oppose wildfire?

Interviews showed that there was no one Koyukon response to wildfire (Table 9). Although there were more negative comments than positive or descriptive comments combined, many residents made comments falling into all three categories (Tables 10-12). Given the open-ended character of these interviews, quantitative analysis is not possible.

Type of Comment	Number of Comments
Negative	32
Descriptive	19
Positive	9

Table 9 Comments about wildfire made in semi-structured interviews

Negative Comments about Wildfires
<ul style="list-style-type: none"> • Hardship for travel due to downed trees, burned tussocks, stumps, or thick re-growth • Places do not always come back in the same way, and particular subsistence or cultural uses may not recover within an older person's lifetime • Trapping can become difficult due to burned trails, loss of cabins or sets, and disruption to furbearers • Small animals can be killed while nesting, and populations may not rebound in a burned area • Places can become aesthetically unappealing, unrecognizable, and burnt • Fires can be disruptive, causing smoke inhalation and evacuations • When moss/lichen is burned, caribou move out of the area • Old growth, which provides calving habitat for moose, and is valuable timber, is lost • Berries may not come back • Some places seem to have less moose after burning • It is drier now, and wildfires can burn more intensely, damaging soil and threatening larger areas

Table 10

Descriptive Comments About Wildfires

- Descriptions of past wildfires or old burns
- Factors affecting wildfires (weather, fuel load, fire history)
- Regrowth of berries or other trees and plants depends on the type of wildfire (intensity due to time of year or fuel load)
- Vegetation will come back, given enough time

Table 11

Positive Comments about Wildfires

- Young growth such as willows attracts moose
- Wildfire rejuvenates blueberries that are overgrown
- Wildfire clears out overgrowth
- After a few years marten trapping improves because there are more mice living in the new vegetation
- Downed trees provide habitat for birds and small animals

Table 12

Many comments in the descriptive category referred to the inherent complexity of wildfires. Respondents explained there was not one type of wildfire with predictable effects. Instead the physical results of wildfires depended on many factors, including the time of year, the weather, and the fuel type (see Ray dissertation article 3). Many residents were also concerned about the logistical effects of wildfires on subsistence, as these activities could not be conducted just anywhere. *“Alaska is a big place and there’s a lot of what you might call uninhabited land out there. But there’s only certain places*

that are good for camping. That are usable as far as hunting, gathering, and they've been used for countless generations” (Galena Resident 13).

In addition to certain types of subsistence areas being uncommon, people explained that only specific individuals or families have a right to use each area. Koyukon respondents in Galena described a system of common property institutions designed around respect for the traditional territory used by different individuals and families. Specifically, Koyukon residents would avoid conducting subsistence activities such as trapping or setting up seasonal camps in an area used by other families. Thus, even when areas were not formally “owned” in the eyes of the state, large tracts of public land effectively functioned as private property. As such, residents who had rights to specific areas would feel their loss in a wildfire as deeply as any landowner would feel the destruction of their private property, especially because some activities, such as trapping, were almost impossible to relocate.

“Another really big fire....Most of (Galena resident's) trap line area is gone. So who knows when it's gonna to come back. Might be 20 years, he's gonna be gone by then, you know! And so that 20 years, it would hurt someone like him, especially, couldn't bring his grandkids out there. He can't trap in this side 'cause (another Galena resident)'s right there, somebody from Fish and Wildlife is trapping toward the river from where his cabin was, the other side might be somebody from Koyukuk.... So...you're limited.” –Galena Resident 13

Although some respondents had a strong opposition to or support for any kind of wildfire, most opposed certain kinds of wildfires, in specific places, at particular times,

because of perceived threats to subsistence or culture. As such, generalized “let-burn” policies, created and implemented by federal agencies, were stressful and frustrating for many older Koyukon, who felt that resource managers did not understand the complexities of their subsistence lifestyle and local boreal forest environment (Table 13).

Respondent Reactions to “Let-Burn” Policies

Oppose because

- It will ruin the country
- Burns small animals and bird eggs
- Unnecessary under any condition, contributes to climate change (permafrost melting and conversion to deciduous forests)
- Dangerous because dry landscape can't stop fires from spreading
- No land is unused and a burn can affect residents anywhere
- Burning can be very disruptive to subsistence
- Desire to protect the land
- Unnecessary endangerment of villages, smoke inhalation, ash falling on town
- Fire suppression better option than welfare! Let burn eliminates jobs for villagers
- Disagree with controlled burns for habitat because animals are not a “crop”

Support Because

- Good for moose
- New growth favorable to a number of animals
- Good away from villages because areas are going to burn at some point anyway, and will burn more if too much time passes
- Places grow back
- Good for opening up brushy areas and replacing dried vegetation with new growth
- Possibly could help combat bark beetle
- Belief that people and culture should be resilient and not depend on management to fight fires.

Conditional Support

- Acceptable in jack spruce area but not in larger growth along streams
- Maybe far away but not right near town like the Bonanza Creek
- Smoke can be a problem but good for habitat
- Good because it clears out overgrown, bushy areas but question of controlling it to certain areas
- Natural and brings new growth, but dangerous too close to villages
- Sometimes acceptable because it can improve moose habitat in overgrown areas, sometimes bad because if an area has a lot of young animals it can kill them
- Depends on animals living there, and subsistence uses
- Acceptable far away but close to village or important camp areas should be protected
- Some management of smoke necessary because it is hard on elders but let burn is natural
- Habitat enhancement is good but it is bad to endanger people's property

Table 13

Residents had a number of suggestions for tailoring policy to protect subsistence lifestyles (Table 14), and many residents were generally frustrated that their experience was not valued in management decisions.

“Just bureaucrats and they sit in these offices and they come up with all these fanatical ideas of this is good and this is bad, and they have no experience what they’re talking about...And if they go out there and live and walk that country like I do, and make a living off of it, they’ll know that I’d much rather see it the way it is and me make a living off of it than let them burn it all up and then I’ll go there and there’ll be nothing for me.” Galena Resident 6

Many respondents expressed a sense of loss, explaining that when they grew up they were able to move freely around the landscape using resources as needed to survive, and regulating use through their own traditions and taboos. As one resident explained, local Koyukon had always been careful of their resource use: *“they never try to kill off the country”* (Galena Resident 1). For them, it was difficult to accept that resource use must now follow rules devised by managers who had lived most of their lives in other places. Many felt insulted by the implication that locals would overexploit resources if they were not overseen by agencies. Contention over wildfire policies in the forest were as much about lack of local input as they were about the hardships wildfires often caused for subsistence users.

Resident Suggestions for Places that Need Protection from Wildfires

- Old growth
- Flats not hills
- Nesting areas/times
- Within certain distance of town
- Cultural or historic sites
- Cemeteries
- Protect important campsites
- Allotments
- Villages
- Shelter Cabin
- Spruce along creeks
- People's land, cabins and camps
- Streams and creeks (potential for erosion into river)-especially if they come out at good fishing site
- Productive berry patches
- Important fishing areas
- Large spruce used for house logs
- Important camping areas. Spring, summer and winter camps.
- Historic places
- Trap lines
- Unregistered cabins
- Subsistence areas
- Fish camps
- Areas near villages

Table 14

Discussion

The respective merits of two competing visions for planning—the expert-based technocratic model and the public-focused democratic model—are well addressed in the literature and at times implying that the latter is more effective and socially just than the former (Arnstein 1969, Fiorino 1990, Rowe and Frewer 2000). This study suggests that these two models may be viewed as complementary rather than mutually exclusive, and application should depend upon planning topic, affected stakeholder demographics, and

local context. Most Galena residents, both Koyukon and Caucasian, preferred an expert-led process of wildfire risk prevention in the wildland-urban interface, as they had little information and poorly formed opinions. In contrast, Koyukon residents, who depend upon the forest for livelihoods and cultural identity, believed that decisions affecting forests, including wildfire policies, should include local knowledge and values. Planners, rather than designing a process to around a particular model, should investigate community knowledge on the subject.

Even when communities prefer the deficit model, incorrect assumptions can cripple projects. The Galena CWPP process, for example, did not meet its goal of increased public support for “let-burn” policies, as lowered risk perception in the wildland-urban interface was not, as had been assumed, correlated with acceptance of wildfire away from town, and residents were as concerned about wildfires affecting subsistence as they were about wildfires affecting their town. In addition, most residents did not realize that FIREWISE information had been sent to them. A survey, therefore, can correct expert misconceptions, and connect interventions to desired outcomes. Galena residents indicated that interactive risk education, including demonstrations of FIREWISE improvements and social activities such as potluck dinners, would attract public involvement. In addition, the survey indicated that trust is an essential component of community involvement in risk prevention, a finding echoed by other researchers (Kasperson et al. 1992, Kumagai et al. 2004). Thus, even deficit-style outreach may be most successful when agencies build trust in the community.

Wildfire risk prevention in the United States primarily uses deficit-model public involvement, and research focuses on citizens' responses to agency goals (Arvai et al. 2006, Brenkert Smith et al. 2006, Paveglio et al. 2009). This study showed that, while appropriate for wildland-urban interface risk reduction, it may be wholly inappropriate for forest management when residents depend on the forest. Findings in Galena support the claim that resource management cannot succeed if it works against local informal institutions (Alcorn 2005, Ostrom 2005, Berkes 2007). Koyukon residents expressed frustration with policies that ignored their traditional use practices and were less likely to trust land management agencies or to feel there was a point in participating in risk prevention planning. As wildfire policies cause drastic changes in forests, local users want to influence decision-making processes. Research showed residents had extensive knowledge of local forests, observing the effects of climate change and the variability of wildfire effects in detail unmentioned in agency policy documents (Ray dissertation article 3). As such, incorporating local users would not only serve democratic purposes, but could improve decision-making by increasing available information.

Conclusion

The CWPP process, which is based on the deficit model of community involvement and conducted mostly by resource managers, is appropriate for addressing risk prevention in the wildland-urban interface, as residents do not have extensive knowledge of risk mitigation strategies and feel it is the job of agencies to lead and educate. Surveys are a more successful method than public meetings for investigating assumptions and designing a successful outreach program. The CWPP process is not sufficient for

including local values into forest management in places such as Galena, where Koyukon residents have a history of occupancy, use and resource regulation, and mistrust outside management. A more involved participatory process is needed to successfully incorporate local values and practices into decision-making, and to build community/agency trust.

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Chapter 4

Wildfire Policy: Stuck in a Panacea Trap?

Sustainability science questions panaceas, or general solutions posited to apply in any situation, for environmental problems. Numerous case studies indicate that complex environmental problems resist generic solutions. This article address a panacea applied to wildfire management: that fire suppression changes forest structure and increases wildfire risk, and thus mechanical thinning or “let-burn” policies can restore all forests to their “natural” state, reduce wildfire risk, and improve ecological functioning. This belief causes conflict in Alaska, as managers tell indigenous users whose livelihoods are challenged by wildfires that their support of fire suppression comes from a misunderstanding of fire ecology. This study uses document analysis, participant observation, and semi-structured interviews to address both agency fire policy and indigenous knowledge of wildfires in the rural Koyukon Athabascan communities of Galena and Huslia, Alaska. The study concludes that the physical difficulties wildfires inflict on indigenous subsistence, the variability of wildfire effects, and unprecedented landscape flammability caused by climate change, all of which were apparent to community members and ignored in official policy, are important factors that should be considered by wildfire managers. Local observations imply that let-burn policies may not always be socially or ecologically optimal. The incorporation of local users and traditional knowledge into both the definition of problems and the search for solutions is necessary in order to develop wildfire policies that accurately reflect local environments and respect local livelihoods.

Introduction

According to Ostrom and colleagues (2007), a panacea is a popular solution prescribed for a diversity of environmental problems, with disaster predicted in any situation where the panacea is not applied. They argue that panaceas are doomed to fail because they explain environmental systems with overly simplistic models and assume homogeneity in human resource use preferences and behaviors (Ostrom et al. 2007). Diverse research supports these claims. Resource management studies caution against universal solutions, as diverse environments require different management strategies, and resilience studies recognize that general approaches often fail to address the complexities of real ecosystems (Holling 1978, Quigley and Bigler Cole 1997, Berkes and Folke 1998). Sustainability science in general calls for place-based assessments precisely because the complexity of coupled human-environment systems gives rise to such different outcomes by locale (Kates et al. 2001). Concomitantly, anthropologists and geographers have shown how many rural users developed viable systems to sustainably manage local resources (Posey 1985, Berkes 1987, Ostrom 1990). Political ecologists have demonstrated that conflicts between local knowledge and government policies often emerges from the political or overly general nature of those policies (Blaikie 1985, Goldman 2004, Hecht 2004). Indeed, science and technology studies make a compelling case that scientific knowledge is inseparable from culture and values (Jasanoff 2006). These findings point to the need to incorporate local knowledge and preferences into resource management in order to find solutions that are both ecologically sustainable and locally feasible (Osherenko 1988, Rocheleau et al. 1996, Acheson et al. 1998, Holling et al. 1998, Kofinas 2002, Tsing et al. 2005, Berkes 2007, Reynolds et al. 2007).

In spite of considerable research support for including the role of coupled system complexity and local knowledge in management practice, both of which imply variance in management practice by place, panaceas are alive and well in the practice of wildfire management. In the year 2000, catastrophic wildfires caused extensive damages, inspiring national prescriptions for reducing wildfire risk (Machlis 2002). New policies such as the Healthy Forests Initiative of 2002 and the Healthy Forests Restoration Act of 2003 assume that wildfire suppression changed forest structures nationwide, making all forests susceptible to extreme wildfires. These policies encourage managers across the country to restore forest structure in order to reduce wildfire risk (White House 2002). The Healthy Forests policy initiative is supported by a number of biologists and historians who believe that fire suppression anywhere has moved forest structure out of its historic range, increased wildfire risk, and decreased ecological function (Pyne 2001, Todd and Jewkes 2006). There is a common belief among managers and some ecologists that forests need to be restored to a pre-1850 structure, which purportedly supported infrequent, low intensity fires due low fuel loading. According to this narrative, fire suppression has caused fuel buildup, which is responsible for the unprecedented size and intensity of wildfires (Brown et al. 2004).

Although the national narrative that prior suppression increased current wildfire damages has gained momentum, numerous geographers and ecologists have shown it does not apply to all forests. Infrequent, high intensity wildfires occur naturally in many ecosystems, and fuel reductions or “let-burn” policies will not change this (Brown et al. 2004, Schoennagel et al. 2004, Platt et al. 2006). In addition, studies have shown that in some forests high-intensity wildfires are driven by climate and not fuel loading, and that

in some ecosystems there is no real connection between fire suppression and changes in fire regime or fuel abundance (McKenzie et al. 2004, Schoennagel et al. 2004). In spite of these challenges, there have been few attempts to question the applicability of national fire policies, let alone incorporate local knowledge of ecosystems into wildfire management (Shindler and Toman 2003).

In Alaska, the issue of wildfire risk is especially pertinent given climatically-induced, drastic increases in the annual area burned since 1990, and predictions that current levels of suppression will no longer be possible due to the increase in extreme fire weather (Hayasakaa 2006, Chapin et al. 2008). Alaskan boreal forests differ from forests of the Western contiguous United States where much of the research on forest fuel load increases has been administered. In addition, fire management policies have significant consequences for local livelihoods, as indigenous residents pursuing traditional subsistence pursuits depend heavily on the boreal forest (Nelson 1983, Marcotte 1986, 1990). Subsistence, in Alaska, is defined as the harvest of wild foods for noncommercial customary and traditional use and is protected by the State of Alaska Constitution (Alaska Federation of Natives 1998). In spite of clear ecological differences from other places, and particularly sensitive local livelihoods, many agencies in Alaska hire wildfire managers who got their education, training, and job experience in other parts of the United States. This situation is compounded by the fact that fewer studies have been done in remote, high-latitude regions than in more densely populated and accessible areas, and where data exists, they are often temporally limited. As such, it is more difficult for managers to gather the information they need to make informed decisions.

Recent efforts have explored the extensive environmental knowledge that Northern indigenous groups have accumulated through oral history and traditional resource use, and have postulated that it could be used to fill knowledge gaps and supplement the ecological information used by resource managers for decision making (Acheson et al. 1998, Kofinas 2002, Krupnik and Jolly 2002). In practice, however, it has been difficult to integrate traditional ecological knowledge with conventional resource management, for a variety of reasons. Indigenous knowledge rarely fits neatly into scientific models, as resource managers and Native peoples often perceive environmental issues in fundamentally different ways (Cruikshank 2000, Huntingdon 2000). In addition, indigenous users and managers commonly have very different environmental values and preferences (Berkes 1987).

In Alaska, traditional ecological knowledge is frequently not aligned with agency policy. Wildfire policy, for example, has been a consistent source of disagreement. Managers argue that “let-burn” policies are helpful to subsistence livelihoods, while rural indigenous residents state that wildfires have many harmful effects for subsistence. Disagreements between traditional ecological knowledge and management have the potential to lead to new insight into difficult management questions. For example, whalers from Alaska Eskimo Whaling Commission claimed that bowhead whale census numbers were too low because the visual counting method did not account for whales passing under the ice or far from shore. Once acoustic methods were incorporated biologists discovered that bowhead whales did indeed swim under the ice, and aerial surveys showed bowhead whales further away from shore than predicted (Huntingdon 2000). In most cases, however, disagreements between traditional ecological knowledge

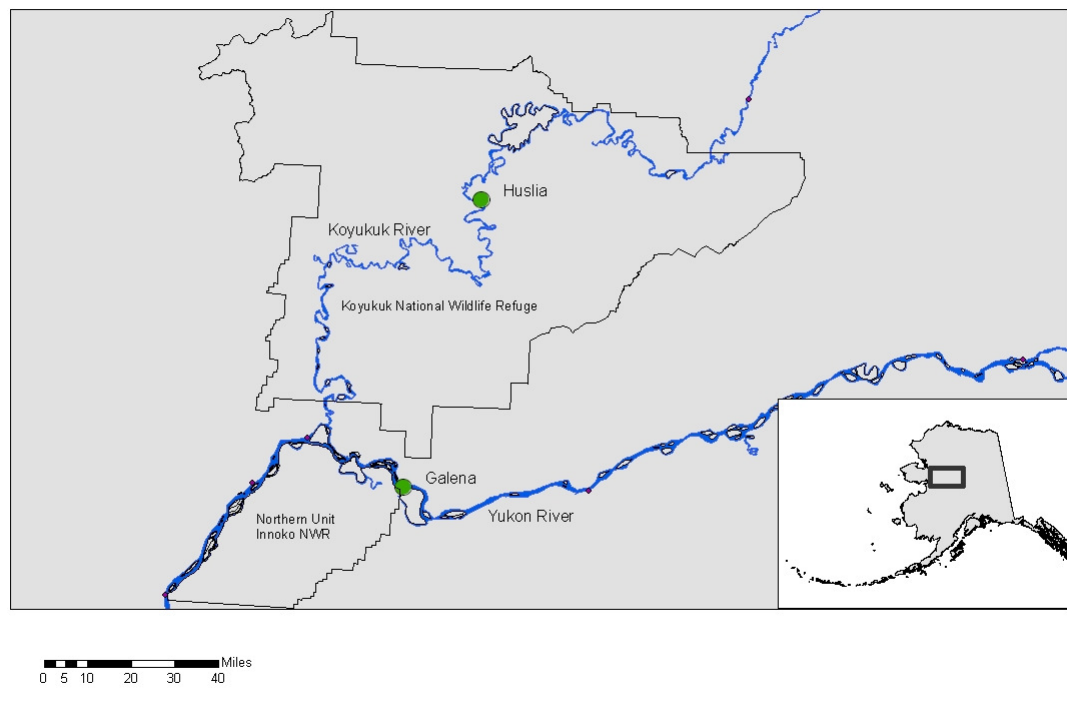
and agency science remain unresolved. One reason for this difficulty is that traditional knowledge is usually documented using social science research methods, and many biologists are often uncomfortable or unfamiliar with these methods (Huntingdon 2000). Another reason may be that agency scientists are often conditioned, both through their formal education and through the legal requirements of their work, to defend their methods rather than to question them. The result is that agency policy for engaging communities generally focuses on educating them to agree with national or state policies, rather than incorporating their knowledge and experience into more locally appropriate policies.

This study investigates the conflict over wildfire policy in Galena and Huslia, Alaska. Document analysis is used to investigate the basic assumptions and goals of agency wildfire policy, and semi-structured interviews are used to document local knowledge of and experience with wildfires. The evidence generated is addressed in terms of wildfire policy approaches, local input, local knowledge, subsistence implications, landscape flammability, climate change, landscape productivity, and human impact on forests. The study concludes that agency wildfire policy, which views wildfires as a positive force for resource improvement and a tool for maintaining a natural, balanced forest, is stuck in a panacea trap. This approach is overly simplistic because it ignores the complex and often unpredictable effects of real wildfires, the local value and use differences that lead to disagreement over whether these effects are positive, and the fact that climate change is permanently altering landscapes and fire regimes.

Study Area

Galena and Huslia are both located in a remote, roadless, and sparsely populated part of Western Interior Alaska that is dominated by the Yukon and Koyukuk rivers (Nelson 1983). Much of the land in the area is managed by the U.S. Fish and Wildlife Service, which oversees the 1.8 million hectare Koyukuk National Wildlife Refuge and the 304,000 hectare Northern Unit Innoko National Wildlife Refuge (Fig 1).

Figure 7 Study Area



The study area, dominated by the floodplains of the two major rivers, is a shifting landscape driven by water. This results in continuous plant succession, providing food for game such as moose, bear, and hare (Nelson 1983). According to the U.S. Fish and Wildlife Service, the Koyukuk area was designated as a refuge in order to protect its extensive wetlands and the area stands out for its diverse wildlife habitats. Agency sources explain that the mosaic of habitats is maintained by flooding and ice scour in the lowlands and wildfires in the uplands (Alaska Region US Fish and Wildlife Service 2008).

The boreal forest receives only $\frac{1}{4}$ the solar energy of tropical regions, and winter temperatures can be lower than -50 F, resulting in widespread permafrost. The interior of Alaska does not get much precipitation, perhaps only 6-15 inches a year, yet poor drainage resulting from this permafrost allows the Refuge area to be dominated by water and lakes. Landscape features are determined by elevation, aspect, local climate, soil type, drainage, permafrost, and fire history. Low areas, depending on drainage, range from bogs and shrub thickets, to muskeg to closed forest. Hills and mountains have forests and thickets at lower elevations, then moist tundra, and, at the higher elevations, alpine tundra (Nelson 1983).

Near the rivers, willows and alder thickets usually grow at water level and cottonwood and white spruce grow on the banks. Area wetlands are home to a variety of aquatic plants, and are recharged by snow melt, rain, and river flooding. Low, wet areas include treeless bogs dominated by low-growing shrubs such as dwarf birch, bog blueberry, and Labrador tea. About 27% of the Koyukuk Refuge is composed of poorly

drained peatlands with dwarf shrubs and mosses, and about 14% of the total refuge area is made up of tussocks and mixed tall and dwarf shrubs (Alaska Region US Fish and Wildlife Service 2008).

According to the Refuge Draft Comprehensive Conservation Plan (CCP), the Koyukuk Refuge and the Northern Unit of the Innoko Refuge together are about 44% forested. Muskegs, which are found in poorly drained areas and consist of sparse black spruce trees in a ground cover of shrubs and mosses, are the predominate forest type, and compose 26% of the Koyukuk and Northern Unit Innoko Refuges. Area forests range from open forest dominated by black spruce that are usually found in boggy areas over permafrost or on north facing slopes (7%), to deciduous forests that are usually found on hills in well drained areas (3%). Mixed forests of white spruce and deciduous trees can be found in well-drained areas along rivers or on south-facing slopes on hillsides (6%). Closed conifer forests of large white spruce are also found along rivers (2%)(Alaska Region US Fish and Wildlife Service 2008).

Black spruce areas in the Refuge are prone to large, frequent wildfires because spruce is very flammable, the local climate is very dry and hot in summer, and there is vertical continuity of fuels that allows wildfires to spread from the ground into the crowns of spruce. Wildfires can spread along the ground due to the presence of organic material, but large wildfires are usually patchy and leave some unburned areas. The shrubby and tundra areas burn differently, as the ground in those areas is often too wet to burn. Instead, in dry weather, a wildfire may burn quickly through the shrubs and

bushes, while leaving their roots intact (Alaska Region US Fish and Wildlife Service 2008).

Galena and Huslia are both in Koyukon Athabascan (Koyukon) territory, which is located along the Koyukuk and middle Yukon rivers in Northwest interior Alaska. Koyukon territory is associated with the boreal forest, and the culture has developed around the use of the boreal environment. Residents of the area traditionally moved with the seasons to take advantage of different boreal resources as they became available. Historically, in the springtime, families moved to spring camps located along lakes, in order to hunt waterfowl and to trap muskrat. In the early summer, families fished for pike and whitefish along tributaries of the major rivers. In summer, families lived in fish camps along the Yukon River in order to fish for salmon. Fall was a time to hunt for large and small game and to fish for fall chum and for non-salmon fish. In the winter, families moved out to remote trapping camps in the forest in order to pursue furbearers such as mink, marten, fox, lynx, wolverine, otter, and wolf. Wood from the boreal forest is used to build cabins and burned to provide heat (Nelson 1983).

Methods

Semi-structured interviews about knowledge and experience with wildfires were conducted with 45 Koyukon residents, both men (n=26) and women (n=19), from Galena (n=20) and Huslia (n=25). These were conducted by this researcher in English. Semi-structured interviews about traditional knowledge take considerable time, and the information sought is not met by random sampling methods (Tashakkori and Teddlie 1998, Wengraf 2001). As such, a purposive sampling strategy was employed, and

participants who were known in the community for their knowledge and experience of the boreal forest were selected. Both men and women over the age of 45 were interviewed. Most participants were in their 60s and 70s, spoke their native language as children, and had moved between seasonal camps with their families. They were assumed to be the most likely to articulate a traditional Koyukon perspective on wildfire and to have the longest observations of wildfire history.

An interview guide was used in order to ensure consistency (Appendix B and Appendix C), but the order of questions flowed according to the respondent (Bernard 2006). Topics covered included resource-use life histories, seasonal activities, lifetime observations of forest change, experiences with wildfires, and effects of wildfires on forest use, and the guide was developed using local feedback and input (Slocum et al. 1995). The semi-structured interviews were digitally recorded, transcribed, and coded in ATLAS.ti for both researcher-designed and emerging themes (Marshall and Rossman 1995).

In addition, participant observation, which included participating in subsistence activities with local Koyukon residents and engaging in many informal conversations about local experiences with wildfires and subsistence, was conducted over a period of six months (Bernard 2006).

Document analysis was conducted on local policy documents including the Koyukuk National Wildlife Refuge wildfire management plan, the Koyukuk National Wildlife Refuge comprehensive plan, and the Galena Community Wildfire Protection Plan. Analysis focused primarily on themes pre-determined by the analyst: stated

wildfire policies, reasons for these policies, explanations of wildfire ecology, and approach to local knowledge (Marshall and Rossman 1995). In addition, informal interviews and conversations were conducted with refuge scientists. Finally, participant observation was conducted which included observing agency meetings and helping with a wildfire mapping project (Bernard 2006).

Results and Discussion

Understanding the multifaceted evidence is facilitated by coupling the results and discussion by topics addressed. Table 1 provides a summary of the main points covered in this section. For each topic, the agency and Athabascan community views are described and discussed. Special emphasis is placed the evidence from the science community that is consistent with the Athabascan views. This approach is utilized not to undermine the science behind the agency views, but rather to demonstrate that some local interpretations are, in fact, consistent with results stemming from parts of the science establishment.

Agency	Community
Wildfires are beneficial for landscape	Wildfires effects vary according to vegetation and weather
Wildfires are an important tool for resource management	Wildfires are complex and the effects are too unpredictable to use as a tool
Wildfires are good for subsistence	Wildfires create logistical hardships for subsistence
Wildfires decrease landscape flammability	Flammability is not clearly related to fire history
Wildfires maintain the balance of landscape	The landscape is out of balance due to climate change and wildfires accelerate landscape change
Wildfires increase productivity	Landscape is valued for a diversity of functions, including some ranked low productivity
Wildfire suppression is unnatural	Humans always influence their environment

Table 1 Summary of community/agency differences in belief over wildfire effects

Agency policy approach to wildfires

Goal: “Maintain fire-related ecological processes to the maximum extent feasible.”

(Koyukuk and Northern Unit Innoko National Wildlife Refuge Fire Management Plan, p 21)

Analysis of the Koyukuk and Northern Unit Innoko National Wildlife Refuge Fire Management Plan (FMP), the Galena Community Wildfire Protection Plan (CWPP), and

the Refuge draft Comprehensive Conservation Plan (CCP) revealed a consistently favorable approach to wildfires, based on the idea that they are natural and that boreal forest ecosystems are fire-adapted (Table 2).

Agency Reasons for Supporting Wildfire

- Wildfire is natural and part of balance of nature
- Plants and animals are “fire-adapted” and wildfire is necessary for spruce reproduction
- Wildfire naturally regulates permafrost levels
- A return to historic levels of burning is preferred
- Organic matter decomposes slowly and needs wildfire to speed up process
- Wildfire reduces hazardous fuels and prevents build-up
- Wildfire increases early successional vegetation, a resource management objective
- Wildfire is a tool to accomplish resource management objectives such as an increase in the moose population

Table 2

Agency attitude toward local concerns

“The primary local attitude towards fire is that they are undesirable (from a timber loss standpoint) and should be extinguished. The early fire fighting concepts of putting out all the fires and fires are undesirable have influenced the local view of the role of wildland fire....It will take some time to educate the local public about the benefits of wildland and prescribed fire.” FMP page 5

Although Refuge employees were aware of local resistance to wildfires, officials attributed this to prior anti-fire outreach, such as Smokey the Bear, and the official policy reaction was to promote education so that residents would accept “let-burn” policies. Education strategies included making fire ecology brochures available in the refuge

office, teaching fire ecology in an annual science camp, and planned outreach to the city and school district.

Local Koyukon users' observations

Interview respondents reported drastic and rapid changes in landscapes as a result of wildfires. These effects varied according to the area that burned, and the effect on subsistence depended on both physical effects and cultural use patterns. They are captured diagrammatically in Figures 2-4.

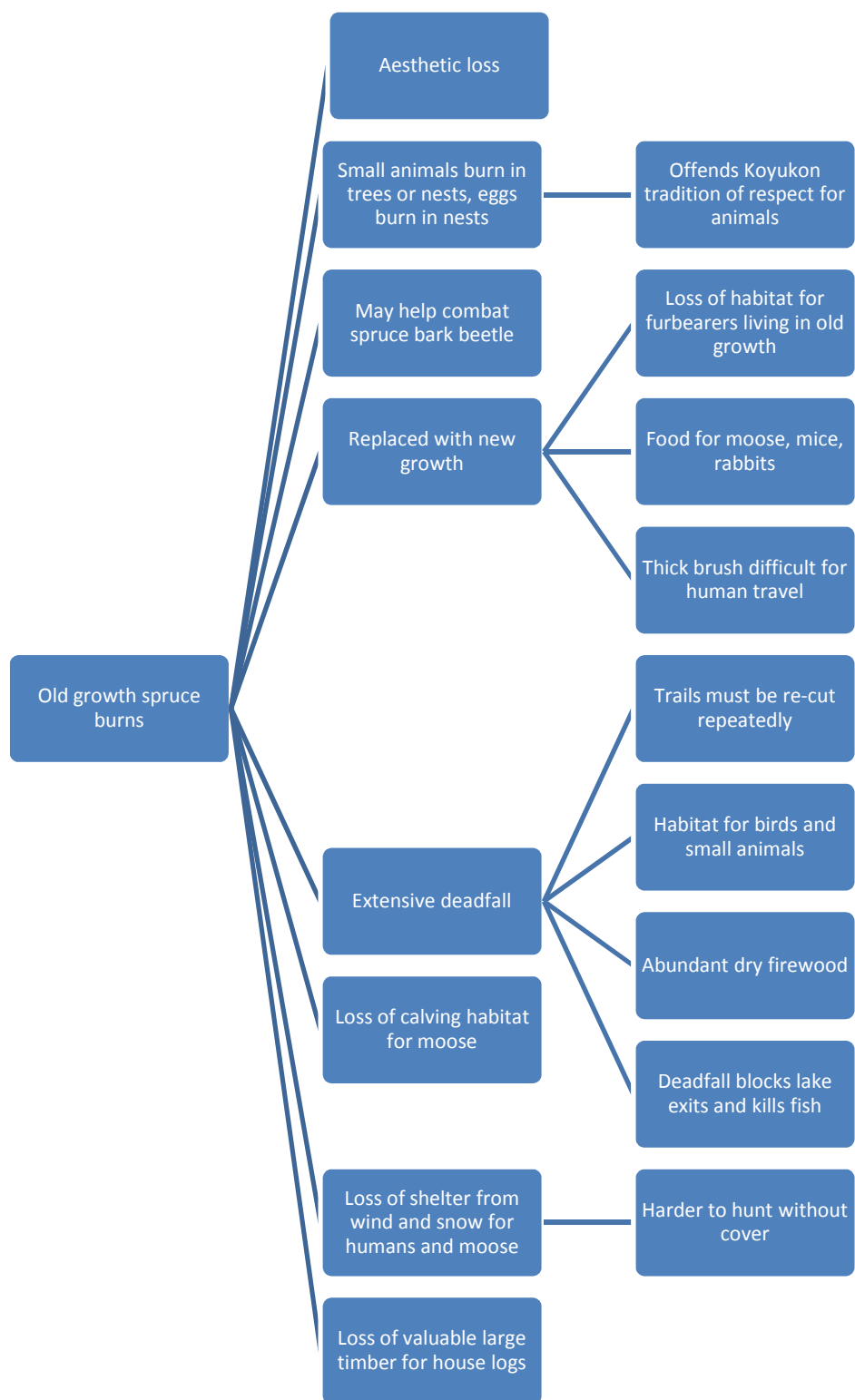


Figure 8. Fire effects as reported by Koyukon. First Column represents type of burn, second column represents primary effects, third column represents secondary effects.



Figure 9 Fire Effects as reported by Koyukon. First Column represents type of burn, second column represents primary effects, third column represents secondary effects.

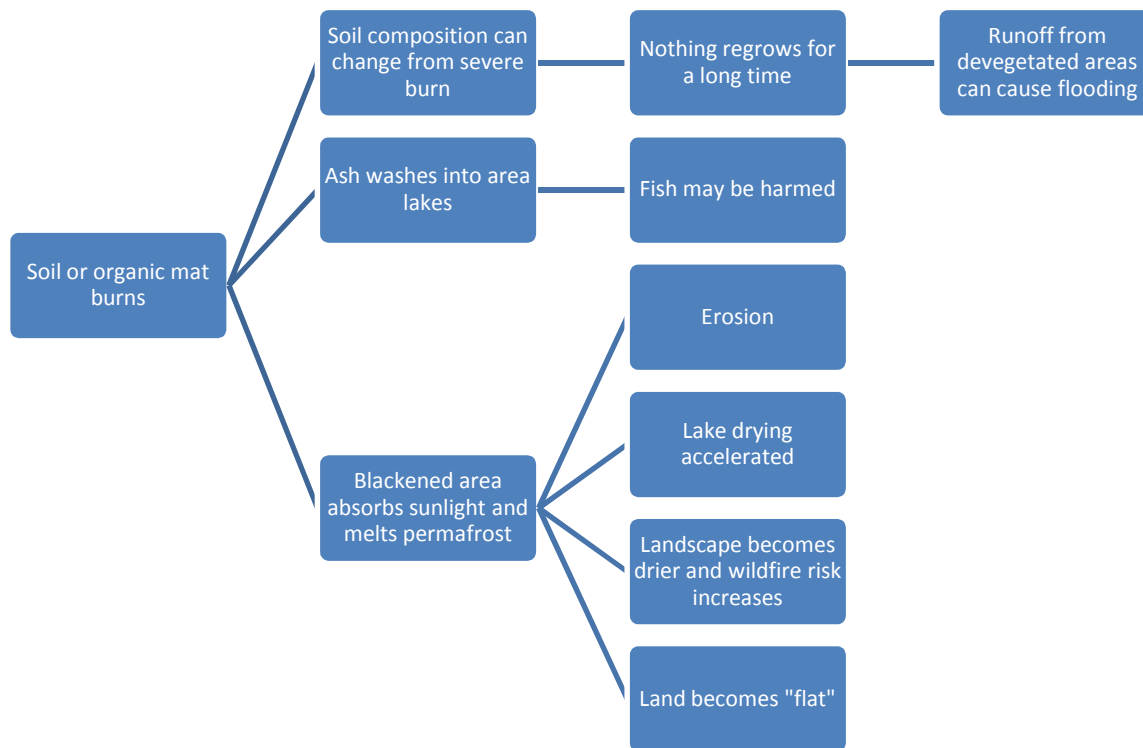


Figure 10 Fire effects as reported by Koyukon. First Column represents type of burn, second column represents primary effects, third column represents secondary effects, fourth column represents tertiary effects.

Wildfire as a Tool to Achieve Resource Management Objectives

Agency

On multiple occasions, agency documents emphasize the role of wildfire in maintaining both landscape and species diversity. Wildland fire is described as a tool that can be used to accomplish agency resource management objectives (Table 3). Given wildfires' purported positive effect on habitat, policies state that wildfires should be allowed to burn if they do not threaten life or property. In addition, prescribed fire is described as

another tool for both habitat management and risk reduction purposes. Although wildfires are mostly described as having positive effects on resources, the policy documents explain that large wildfires that do not leave unburned patches can hurt furbearer populations and complicate trapline access, causing hardship for trappers.

Predicted Resource Management Outcomes of Wildfires

- Improved moose browse
- Increased depth of active layer
- Increased ecosystem productivity
- Reduction of hazardous fuels
- Maintenance of fire dependent ecosystems
- Maintenance of habitat diversity
- Maintenance of species diversity
- Wildlife habitat improvement
- Increase in early successional habitats
- Healthy wetlands

Table 3

Community

“And what fire does, a lot of times it depends on how hot it is, or what kind of fuel is there....” Galena Resident 12

Many community members refused to produce generalizations about the effects of wildfires. Instead, they emphasized that the effects of wildfires depended on the vegetation burning, the condition of the vegetation, the temperature, wind conditions, and the resulting severity of the wildfire (Figure 5).

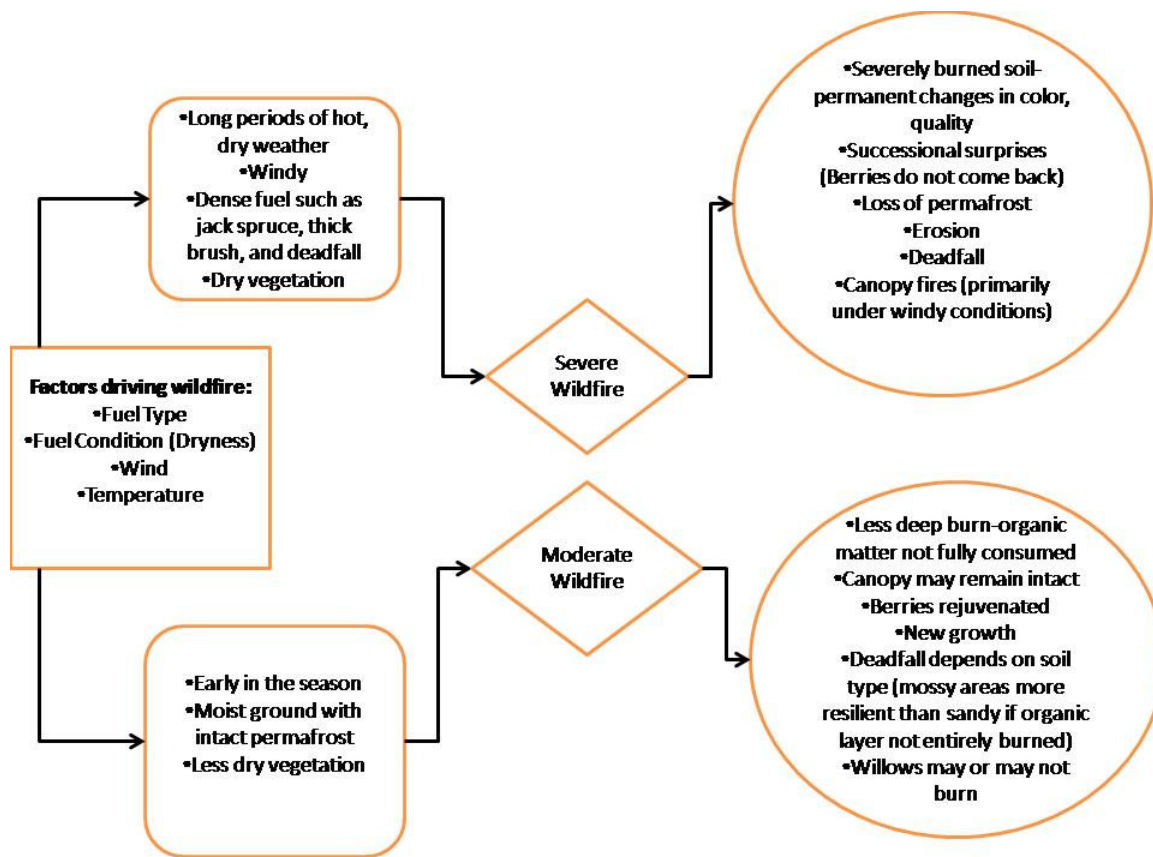


Figure 11 Koyukon descriptions of factors influencing wildfire effects on the landscape

As community members frequented different traditional use areas with distinct wildfire histories, they observed dissimilar effects of wildfires, most likely due to differing levels of burn severity. As such, some trappers experienced improved furbearer populations after a wildfire, while others experienced furbearer scarcity. Some hunters observed burns and did not see increases in moose populations, whereas residents using other areas felt that more moose were present after a wildfire. Other residents indicated that it was difficult to establish causality for changes that seemed to coincide with

wildfires, for example muskrats became scarce after a summer of intensive wildfires and one elder wondered if there was a connection.

A number of respondents questioned the claim that wildfires are needed in order to maintain habitat diversity. They explained that in the Galena/Huslia area, which is dominated by rivers, floodplains, and wetlands, there is always new growth. This growth can be attributed to ice scour when the river breaks up, wetlands entering succession, and the action of beavers. In addition, some felt that the spruce areas that were most likely to burn would not necessarily evolve into birch, or be frequented by moose.

Community members described wildfire effects that varied considerably depending on the topography of the area burning, weather conditions, fuel loading, and vegetation type. In contrast, the Refuge Fire Management Plan described all of these conditions as affecting fire behavior, in order to predict the kinds of potential firefighting situations that could arise, but did not address the effects of fire behavior or location on wildfire effects. Numerous studies have shown that factors including burn severity and pre-fire vegetative conditions can influence post-fire ecosystem response in the boreal forest (Dyrness and Norum 1983, Johnstone and Chapin 2006, Lecomte et al. 2006, Johnstone et al. 2009). In addition, researchers have demonstrated that fire behavior is sufficiently complex to resist simple predictions of change in ecosystem function as a result of burn severity or other measures (Keeley 2009). This would suggest that community members' observations are valid, and could help fill a managerial information gap. It would also caution against simplistic interpretations of wildfire effects when developing guidelines to meet resource management objectives.

One of the primary agency reasons for promoting wildfires on the landscape was the fear that wildfire suppression could result in a loss of species and habitat diversity. It is well documented that wildfires are the primary disturbance in the boreal forest ecosystem, and result in a diversity of successional stages (Chapin et al. 2008, Nelson et al. 2008). Some Koyukon respondents have questioned agency claims that wildfires are necessary for the maintenance of diverse habitats, explaining that everything from break-up to beaver activity contributes to landscape diversity. Taiga vegetation is driven by elevation, drainage, slope, aspect, and permafrost, resulting in a natural mosaic even in the absence of disturbance (Van Cleve and Dyrness 1983). In addition, Koyukon territory is dominated by meandering rivers that have a constant supply of early successional habitat due to annual ice scour and flooding, as such, many species such as moose primarily are associated with riparian corridors (Nelson 1983, Jandt 1992). Finally, Koyukon territory has a lower lightning strike density than other parts of interior Alaska, and no cultural history of landscape burning (Natcher et al. 2007). Although there is no clear consensus on whether wildfires are essential to the maintenance of species and habitat diversity in Koyukon territory, there is enough contrary evidence that this assertion should be supported with evidence before using it to make management decisions.

Effects of Wildfires on Subsistence

Agency

Management documents explained that, although agency policies required the provision of subsistence opportunities for local residents, they also mandated fish, wildlife, and habitat conservation “*for the benefit of present and future generations of*

Americans.” (FMP p 15) Resource managers felt that wildfires were doubly effective-- keeping the refuge in a natural state in accordance with national goals, while improving subsistence through habitat enhancement.

Community

Local residents had mixed feeling about the effects of wildfires on subsistence, primarily due to logistical problems resulting after large burns. Figures 6 and 7 show how respondents classified changes as positive or negative in relation to their customary and traditional uses. Only four categories of positive fire effects received five or more comments, compared to twelve categories of negative fire effects. The effects most commonly reported as positive were new growth and the rejuvenation of furbearers, moose, and berries, and these effects mirrored the predictions of agency policy documents. The effects of wildfire most commonly reported as negative were difficulties with travel, places not coming back to what they were, hardships for trapping, and the death of small animals. A number of complaints about negative effects dealt with direct physical hardship from fires, which were not mentioned in agency policy documents. These included smoke inhalation, the loss of an important shelter cabin, and the loss of traps, sets, cabins, and trails.

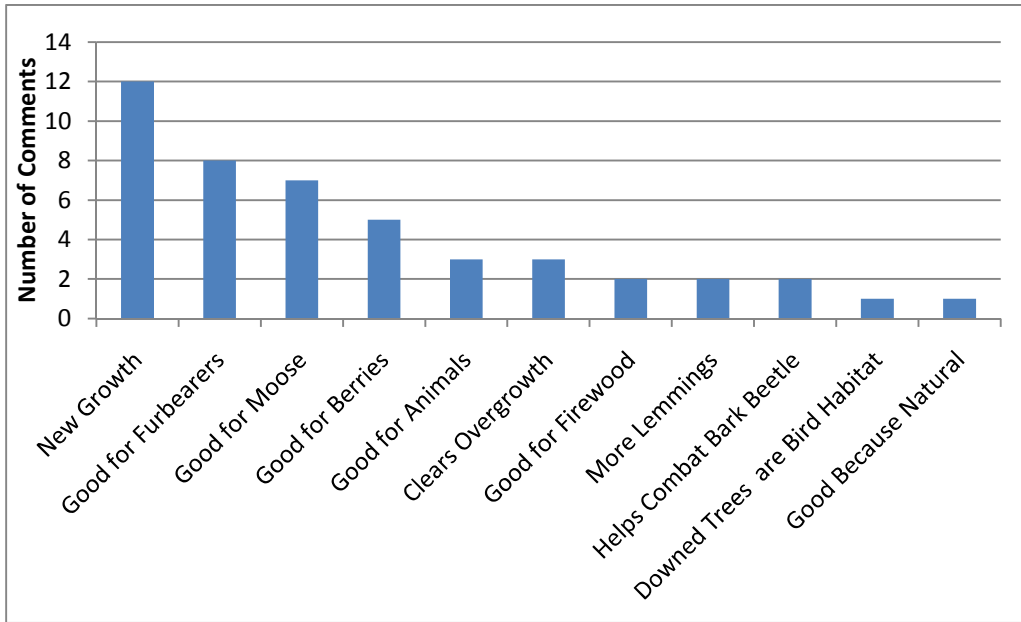


Figure 12 Koyukon positive Comments on Wildfire Effects

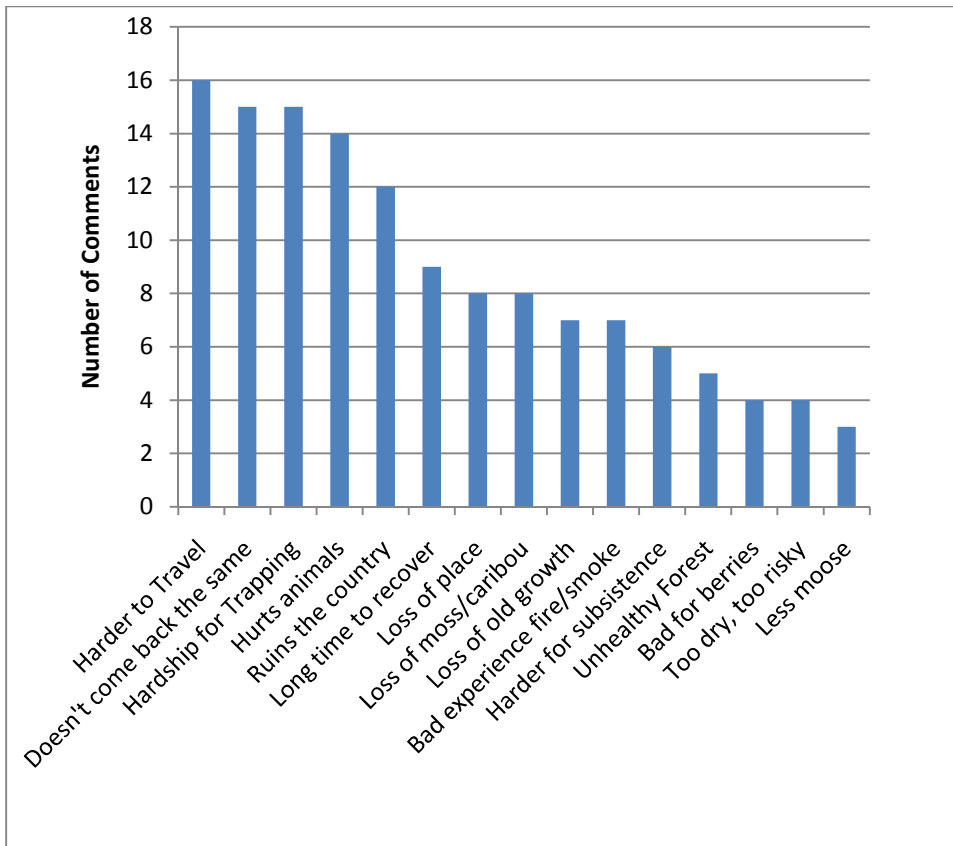


Figure 13 Koyukon negative Comments on Wildfire Effects

Respondent comments on wildfires differed from agency policy documents in a number of ways. First, while agency predictions addressed wildfire effects generally, focusing on new growth and habitat diversity, local respondents frequently addressed specific logistical issues associated with landscape change, such as the effects of post-burn vegetation on access and travel. As one resident commented, *“when something burns it washes out, rain just washes everything out. We had to pretty much cut out a whole new trail through that mountain after it burned. Not just one time, every year. New trees are falling over that trail.” Huslia Resident 12*

In addition, agency policies devoted a disproportionate attention to the predicted positive effects of wildfires on moose, which are the species involved in the most public management conflicts. In contrast, respondents approached subsistence from a multi-species perspective, considering the effects of wildfires on non-salmon fish, small game, furbearers, moose, and caribou. Many commented that the conversion of spruce to birch or willow might help some species, such as moose or rabbits, at the expense of other species, such as caribou, marten, or mink. As one resident explained, *“martens don’t deal well in birch trees. Mink don’t deal well in birch trees. Linx might, because they get rabbits. But all the other fur-bearin’ animals will go where the spruce trees are.” (Galena Resident 6)* Another commented that *“the (caribou) herd moved because of the fires up around in this area. They would probably think nothing of going another 150 miles and going on to an area that they know had food in it.” –Galena Resident 15*

While agency policy documents generally estimated effects on animal populations through habitat predictions, local respondents focused on individual animals, in keeping

with cultural mandates to treat animals with respect. Many elder respondents were uncomfortable with small animals, such as rabbits and marten, dying in wildfires, and with bird eggs burning in nests. They felt this was a disturbing loss of animals. *“Young was born in May, and they can’t help themselves these small marten. They’re born in the den, and they burn right up. Nothing you can do, even the mother burn too, no place for her to run.”* –Galena Resident 14. Respondents recognized that small game go through natural population cycles, and worried that fire-induced losses of individual animals could lengthen and exacerbate the low parts of the cycles. Others worried that individuals that survive a wildfire might simply move to areas that had not burned as recently, or that large wildfire further away would kill too many small animals, resulting in less that would be able to move into the local area.

Wildfire Suppression and Landscape Flammability

Agency

The Koyukuk Refuge Fire Management Plan claims that due to slow sub-Arctic decomposition rates, fire suppression can lead to a build-up of organic matter and increase wildfire risk. Wildfires are purported to reduce these hazardous fuels, and the FMP states that fire suppression will cause forests to shift from Condition Class I, which is a forest with natural vegetation structure and fire regimes to Condition Class II, which is a forest where vegetation structures and fire regimes have departed moderately from their natural condition. While the FMP states that annual acreage burned in Alaska since 1950 has decreased drastically, from an average of 2.5 million acres to 1 million acres, it also explains that is not clear in the immediate refuge area if the “natural” fire

cycle has been disrupted. A graph of acres burned per decade in the Koyukuk Refuge shows much higher annual burning in the 1950s, with drastic decreases each decade through the 1980s, a slight rise in the 1990s, and no data provided after the 1990s. It is implied, but not stated directly that wildfire suppression has drastically reduced the acreage burned in the area, with possible implications for forest structure and wildfire risk.

Community

The majority of respondents did not report a clear relationship between landscape flammability and time since last burn. As explained in Figure 5, residents felt landscape flammability was strongly driven by weather conditions. Even without considering the weather, there was no consensus between residents on the relationship between flammability and fire history. Although some residents felt that many places would burn eventually, and might become more flammable over time due to the accumulation of brush or dead wood, other residents explained that areas that had burned recently often re-burned because of the large amounts of dead wood and thick re-growth present.

Numerous respondents explained that the most flammable areas were “jack spruce” areas: dense forests of small spruce often found on hills or in the tundra. Other areas classified as highly flammable were places with thick brush and numerous dead trees. These two flammable areas were reported to occur both in areas that had not burned lately, and in areas that had burned recently. Some areas might always be jack spruce because of environmental constraints preventing the development of larger, more evenly spaced old-growth spruce forests, and other areas develop jack spruce as a temporary

post-fire successional stage. Areas that were typically brushy could have brush and dead trees building up over time, and flammability might decrease after a wildfire because of reduced fuel loading. Areas of mature forest might be converted into deadfall after a wildfire, and then overgrown with thick brush, thus increasing flammability. As such, the most flammable areas would under some environmental conditions be the result of recent wildfires, and in other environmental conditions be the result of long gaps between wildfires.

Johnson and colleagues (2001) argue that models developed in ponderosa pine forests, which do become more flammable over time, have been inappropriately applied in other environments, including the boreal forest. They explain that boreal forest flammability is driven by climate and not forest age, and that shifts in fire regimes have come from changes in climate patterns. In addition, they argue that, although vegetation has a smaller effect than weather on fire spread, the effect that vegetation does have is driven by fine or medium sized fuels, which remain constant within two decades after a wildfire. Thus, they conclude that wildfire suppression in the boreal forest does not lead to changes in forest structure or wildfire regime (Johnson et al. 2001).

Wildfire, the Landscape's Natural Balance, and Climate Change

Agency

Agency policy documents reflected national narratives promoting wildfire's role in the natural balance of landscapes. Fire management policy stated that wildfire suppression could result in detrimental changes to landscapes and a divergence from

historic structures. Balance is a major theme in Refuge policy documents, which imply that humans are in danger of disturbing the balance of organic matter, permafrost, forest structure, and vegetation succession through activities such as wildfire suppression. In particular, wildfires are described as important for maintaining early successional stages on the landscape, and early successional stages are listed as one of the special values needing protection in the refuge. Wildfires are needed in order to regulate natural processes and to keep them in balance and to maintain forest “health and vigor” (FMP p2).

Community

Interviews with local residents revealed perceptions that the landscape, rather than being in balance, was directionally changing as a result of a warming climate⁶. These landscape changes resulted in more extensive wildfires, a longer wildfire season and wildfires burning in places that did not historically burn (Table 4).

Older respondents commented that the land had dried out drastically over their lifetimes, and lakes that had once been used for fishing, beaver trapping, boat travel or swimming were now almost gone. This affected resident’s sense of security in the face of wildfires. *“Right now is worse because all the lakes dry out! If there’s fire around here on these flats, there’s nothing can hold it back ‘cause the lakes are all dry!”* (Huslia

⁶ Results drew on responses that reflected direct, local observations of climate change, such as descriptions of a lake previously used for fishing that disappeared. A few responses reflected national information on climate change, such as global sea level rise, but were not considered for this analysis. Residents may have shown concern over climate change due to their participation in previous projects documenting traditional knowledge and observations of climate change.

Resident 2) One elder commented that lightening had been rare when she was young, and now that lightning was common wildfires started more frequently. Other participants commented that the climate was getting hotter and drier, and that wildfires started earlier and burned longer. In addition, one respondent commented that melting permafrost had left some areas more vulnerable to wildfires. Elders explained that historically the wetland and river areas that residents inhabited in spring and summer time did not tend to burn. Some respondents commented that when they were young there were less wildfires or that wildfires tended to occur further away from people. Elders did have stories about experiencing wildfires during their youth, and a few reported having to flee or experiencing damage to winter trapping camps. That said, the general consensus among elders was that in the past lakes and sloughs gave greater protection, there was less lightening, and cooler, wetter summers, which meant that wildfires were more limited in both location and frequency.

Change	Resulting Change	Factors increasing wildfire damages
Warmer winters	Melting permafrost	Drier landscape
Melting permafrost	Loss of lakes	Less barriers to wildfire spread
Drying lakes	Dry grass and shrubs in place of water	Fast spread for wildfires, fires in places that did not traditionally burn
Hotter Summers		Drier vegetation, more extreme fire weather, longer fire season
More lightening		More fire starts
Less rain	Drier vegetation	Fires in places that did not burn in past
Late summer rainy season less rainy		Longer wildfire season
Thinner ice causes milder break-ups	Loss of flooding in lakes and sloughs connected to rivers	Drier landscape and loss of fire barriers

Table 4 Koyukon observations of climate change affecting the wildfire regime

While Koyukon residents showed concern over the effects of climate change, the Refuge Fire Management Plan (FMP) had only one sentence mentioning climate change, explaining that it “*may alter some of these fire relationships*” (3) with no explanation given. Instead, the FMP described fire as a central component of a naturally balanced landscape. Scholars have challenged the idea of a “natural balance”, arguing that

landscapes can exist in multiple equilibrium (or non-equilibrium) states, and that management cannot be successful unless it takes this into consideration (Holling 1973, Botkin 1992, Reynolds et al. 2007). The Alaskan boreal forest is currently not in balance, as climate change is causing directional changes in landscapes and wildfire regimes, which have been documented by physical scientists as well as indigenous residents (Krupnik and Jolly 2002, Hayasakaa 2006, Chapin et al. 2008). Evidence would suggest that management could be improved by incorporating residents' observations of and concern about climate change, as this is an area currently neglected in wildfire policy⁷. As there is no detailed ecological or fire history of the Koyukuk Refuge area, residents' recollections of historic landscape structure and wildfire patterns, and their observations of current changes, could offer valuable insight into wildfire management.

Productivity

Agency

Refuge policy documents lauded wildfires' ability to increase ecosystem productivity, as demonstrated in the following excerpt.

“Without fire, organic matter accumulates, the permafrost table rises and the ecosystem productivity declines. Vegetation communities become less diverse and productivity of wildlife habitat decreases. Fire rejuvenates these ecosystems. It removes some of the insulating organic matter and elicits a warming of the soil and an increased active layer depth. Nutrients are added as a result of combustion and by increased decomposition rates.” Koyukuk and Northern Unit Innoko National Wildlife Refuge Fire Management Plan p 11

⁷ The Refuge Comprehensive Conservation Plan does mention residents' observations of climate change and its potential to affect subsistence

Policy documents imply that a deepening of the active layer and a conversion of spruce to deciduous vegetation are beneficial to wildlife. In general, spruce, moss, and permafrost are described as lower productivity, and less useful to wildlife, than grasses, deciduous vegetation, and well-drained areas.

Community

Respondents did not measure vegetation or landscape by any standardized measure. Instead, they showed appreciation for a diversity of functions. Old growth, which is considered to have low productivity, is valued for a variety of functions, including the shelter it can provide to both people and animals, its function as timber, its ability to regulate young growth and provide open areas for travel, the habitat it provides to furbearers, and its inherent beauty.

“it used to have nice heavy timber along both sides of Bear Creek. Used to be good for moose.... moose would have their calf and they like that shade.... After it burnt up they don’t have any more shade, and ...the snow gets deep in the winter, always inside the spruce tree line the snow was not so bad. They (moose) can walk around good in there.” Galena Resident 9

Moss and lichen are also valued by residents, moss due to its aesthetic value and association with permafrost, and lichen due to its importance as caribou food. Residents recalled digging through moss to the permafrost and creating cold storage for food when there was no electricity for refrigeration. Several respondents also explained that the forest floor was an important part of the food chain *“the bugs that go under the moss and then the animals eat that.”* (Huslia Resident 7) *“Lot of thick moss and that’s where the mice stay. And that’s marten’s main food.”* (Galena Resident 16) Finally, a number of

residents explained that several different kinds of berries were associated with mossy areas. Overall, residents explained that moss and lichen are slow-growing and take time to accumulate, but provide many important ecosystem services. Numerous studies have confirmed the long-term harmful effects of burns on caribou due to the slow regeneration of lichen, and studies on furbearers and their prey have shown mixed results, with some cases of wildfires appearing beneficial, and other cases harmful (Pearce and Venier 2005, Nelson et al. 2008).

While refuge documents refer to spruce areas as “poorly drained” due to permafrost, and lauded the ability of wildfires to lower permafrost levels, Koyukon residents felt that permafrost prevented excessive erosion and landscape drying, the latter phenomena confirmed by ecologists (Viereck 1973). Several mentioned that cold winters helped maintain a green and moist landscape, because they kept permafrost from melting. Residents valued a wet landscape, as many subsistence resources, from non-salmon fish, to beavers, muskrats, and waterfowl, depended upon wet habitats. Others, such as berries and moss, thrived in moist habitats, and moist vegetation provided an important decrease in landscape flammability.

Overall, respondents viewed landscape change as transformation of habitats rather than creation of new habitat, as the creation of new growth depended on the destruction of older vegetation. In addition, while agency documents depicted new growth as a value to be protected (Alaska Region US Fish and Wildlife Service 2008), many respondents argued that old growth was more in need of protection, due slow growth rates in sub-arctic landscapes. Old growth represented a considerable time investment and could not

be replaced in respondents' lifetimes. *"It'll take you another hundred years just to get a tree half the size of the one that burn up."* Galena Resident 6.

One of the reasons the agency promoted wildfire as beneficial was because of its purported ability to increase productivity and deepen the active layer. Productivity is generally defined as the ability of a forest to produce new growth through the conversion of sunlight and carbon dioxide, and is of special interest to foresters, who attempt to maximize a forests' productivity and to prevent losses to its productive capacity (Maclellan and Carleton 2003). Ecologists confirm that black spruce are the least productive and most nutrient-limited taiga forest, largely because of high permafrost tables and cold soil temperatures, which are maintained by the thick organic layer (Van Cleve and Dyrness 1983). In addition, productivity and soil temperature all decrease with time elapsed since a wildfire, as an organic layer accumulates on the forest floor and becomes a nutrient sink (Van Cleve and Dyrness 1983).

Resilience theorists explain that conventional resource management, which quantifies and attempts to maximize specific ecosystem features, can cause a loss of resilience, variability, and opportunity (Berkes et al. 2000, Carpenter and Gunderson 2001). Berkes (2000) contrasts this with the diversification of traditional resource use, which builds resilience through its use of a variety of areas and species and its sensitivity to changes in resource status. This is apparent in the Koyukuk National Wildlife Refuge, where attempts to maximize ecosystem productivity, active layer depth, or early successional species ignore a wide array of valuable functions and services provided by permafrost, older forests, moss, and low productivity spruce areas. In addition, many of the agency

documents seem to show a bias towards summer-use forests, with preferences for deciduous trees and unflattering descriptions of boggy areas. This may be because much biological fieldwork occurs during the summer growing season, when it is possible to measure vegetation. In contrast, Koyukon users, through their year-round subsistence, value different features as the seasons progress. Boggy spruce forests become particularly valuable in the winter, when the frozen land opens up for travel, and spruce trees provide valuable shelter from snow and winds, and habitat for winter harvested animals. In addition, Koyukon users are adapted to the sub-Arctic environment, which has many low-density, and slow-growing resources, and as such they value older resources such as moss and older spruce, and recognize the importance of individual animals.

Role of Humans

Agency

Much of agency wildfire policy is based around the idea that wildfires are natural, and that intervention would disrupt the “wild character” of the Refuge. A goal of the fire management plan is to “*maintaining the pristine nature and wilderness values of the refuge*” (FMP 17). Although agency policy documents recognize Koyukon habitation and use of the area, they focus on its value as a wild area. A large part of the Refuge (161, 874 hectares) is federally designated wilderness, which means that it should be managed to preserve opportunities for primitive recreation and solitude. Federal wilderness designations imply that an area is untouched by humans, and are considered worthy of preservation so that the greater US population knows that wilderness exists and

can have recreational access to it. As such, their management is dictated by national and not local values, and recreational rather than extractive use values.

Community

While refuge wildfire management policy reflects discomfort about interfering with “natural” wildfire regimes, respondents described cultural beliefs that human behavior influences the natural environment. As such, respondents explained that instead of trying not to influence their environment, they behaved with respect in order to exert a positive rather than negative effect on their environment. Although respectful behaviors focused primarily on the use of fish and game, one elder respondent witnessed her grandfather praying in hopes of redirecting a wildfire around a cemetery. Many elder respondents felt worried that encouraging wildfires was disrespectful to the small animals or birds eggs that burned.

Area residents have a long history of use in the entire refuge, including the wilderness area. When they travel within a landscape that may look wild to the uninitiated, they perceive a long history of human habitation. Even within the designated wilderness numerous place names reflect local use, for example Three Day Slough took three days to travel in a birch bark canoe. Interview respondents recounted historical trails passing through the wilderness area, which to this day continues to be used for subsistence. Respondents were keenly aware of signs of past and present human use in the Refuge, and could recognize historical places through place names, stories, and physical signs. One respondent knew that a place had been an old village because of its Native name, and because of a story he had been told. “*My grandma...was there in*

1860s, when she was a little kid. She was at that village, they had a carnival...where they gather. She said she watched a snowshoe race that time. ...the village is gone long time ago.” Huslia Resident 3

Residents recognized physical signs of occupation and use including birch trees where people had cut strips to test the quality of the wood for making snowshoes or dogsleds, or had taken bark to make baskets. Hunters could not only recognize where people had cut wood, but could tell the time of year because taller stumps indicated people had been working in snow. Residents knew the location of old villages on the landscape, and one man dated a village as more than 300 years old because he could not recognize any signs of woodcutting in the surrounding forest. As such, they did not perceive the Refuge area, including the designated wilderness, to be wild or untouched. As Koyukon respondents felt that they influenced nature both voluntarily and involuntarily, they did not feel that fire suppression was a threat to the “wild” character of the Refuge area.

Human-environment geographers have shown that the Americas were populated by indigenous people who actively modified landscapes well before the arrival of Europeans (Posey 1985, Whitmore and Turner 1992, Denevan 1992., Mann 2005). Critical geographers have demonstrated how the idea of wilderness has been used to discredit indigenous resource use and to justify turning traditional territories into federal lands such as National Parks (Escobar 1996, Hecht 2004, Neumann 2004). Sustainability scientists, ecologists, and resilience scholars alike have recognized that sustainable management must recognize the role of humans as a part of environments (Botkin 1992,

Berkes et al. 2000, Reynolds et al. 2007). In the Koyukon territory, federal management of “wilderness” area obscures area indigenous history, and a greater inclusion of residents into management, including of wildfires, may help address this problem.

Basic Differences in Agency/Community Approaches to Wildfires

The fundamental difference between community and agency approaches to wildfires is that community members primarily used place-based observations and direct experience, and agency policy documents focused on predictive generalizations. These differences are not unique to the study area, other work has documented how traditional knowledge is typically rooted in particular contexts and places, in contrast with the universalizing and quantifying tendencies of Western science or resource management (Berkes et al. 2000, Watson and Huntington 2008, Clark and Slocumbe 2009). Berkes and colleagues (2000) argue that the qualitative approach of traditional knowledge-based usage can increase the resilience of ecosystems, as users are more likely to notice changes in resource status and to respond flexibly, whereas quantitative resource management strategies that assume equilibrium conditions and manage for maximum yield may result in losses in variability and resilience. In this case, community members observed climate-induced transitions in the landscape that had gone unnoticed by managers, and described the effects of wildfires as complex enough to defy simple predictions, thus challenging the general predictions of resource managers who hoped that wildfires could induce particular improvements in resource yield while maintaining a natural balance. Finally, community members described specific logistical problems created by wildfires that defied simple predictions of positive effects on subsistence

lifestyles, supporting Ostrom and colleagues' (2007) assertion that assumption of human homogeneity could also derail resource management strategies.

Broader Implications

The results of this study support arguments for greater community participation in resource management. Resident resource use produced detailed observations of change and landscape heterogeneity that could not be matched by generalized resource management documents, but were supported by the broader ecological literature. Koyukon challenges to the predictive capacities of resource managers, assumptions of ecosystem balance, and models that separate humans from their environment all support tenets of resilience theory (Holling 1973, Botkin 1992, Berkes et al. 2003). This case, however, also presents a challenge to theorists. Wildfire suppression has been portrayed as a threat to the resilience of ecosystems, with the potential to cause unexpected changes in fundamental ecosystem structure (Folke et al. 2003). Indigenous burning is recognized as a strategy that increased ecosystem services and resilience, and ecologists have demonstrated the beneficial effects of wildfires (Lewis and Ferguson 1988, Starfield and Chapin 1996, Turner 1999, Pyne 2001). Managers in the Koyukon area support "let-burn" policies and prescribed burns because they want to promote healthy natural ecosystems through the use of scientifically defensible management. Yet, Koyukon observations of local negative consequences of wildfires are also scientifically defensible. Koyukon residents make a strong case that let-burn policies may not be socially or ecologically beneficial, and, as shown in the results, many of their arguments are supported by the broader social-ecological literature.

The Koyukon recognition that wildfires are accelerating directional landscape change challenges conventional narratives of the role of wildfires in ecosystem resilience. It also exposes the depth of modern discomfort with certain kinds of human intervention, such as wildfire suppression. Most managers felt that wildfire suppression was risky because it interfered with “nature”, although prescribed burning, even in areas or times that would not normally burn, was considered appropriate. As Koyukon observers pointed out, wildfire, like any natural phenomena, is sufficiently complex to defy simplistic predictions. As such, it may not be a successful tool to maintain desirable ecosystem features, and in some cases may accelerate an ecosystem’s shift into a different, and possibly less desirable, state. If it is possible for humans to light wildfires that would not have burned naturally, in order to increase an ecosystem’s resilience, can it also be possible to suppress wildfires in order to maintain desirable ecosystem features? As indigenous groups in other parts of Alaska have stories of deliberate burning, some Koyukon residents have stories of deliberate suppression, where they banded together and put out wildfires, without help from agencies. If humans really are a part of ecosystems, and can manipulate landscapes through extractive use or prescribed burns, why is wildfire suppression considered universally damaging? Koyukon perspectives suggest managers and scholars should avoid broad narratives, such as the universal need for burning to increase resilience, in favor of locally appropriate solutions, informed by observational knowledge and the imperatives of local livelihoods.

Conclusion

This study of the conflict between local Koyukon knowledge of wildfires and the policies of the local federal wildlife refuges, rather than indicating a need for local education, indicates an opportunity to improve agency policies through the inclusion of traditional knowledge. Local residents maintain an in-depth understanding of the complex effects of wildfires on the local environment and of the effects of climate change on the wildfire regime, both of which had gone undocumented in plans and policy documents of the federal agency due to its focus on national, generalized narratives of wildfire effects, resulting in the panacea that various expert communities warn against. In addition, federal policies were based on a number of subjective values, including ideas of untouched wilderness, and a habitat-based, rather than logistical, approach to subsistence. Local participation in wildfire management would allow residents not only to share their detailed understanding of wildfires, but also to incorporate their values and the logistical considerations of subsistence. This may help federal agencies escape from the panacea trap that occurs when managers apply solutions designed for one environment in vastly different ecosystems.

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Chapter 5: Concluding Observations and Comments

This dissertation brings recent research on community-based natural resource management (CBNRM) to bear on wildfire planning in Galena and Huslia, Alaska, two remote settlements in the boreal forests of Alaska occupied by primarily by Koyukon Athabascans. Three research papers together addressed several major issues that can derail participatory projects: value differences within communities and between communities and agencies; participation that is not democratic; and conflicts between traditional knowledge and agency science. Drawing on works in community-based natural resource management, common property, political ecology, resilience and adaptation, wildfire ecology, and risk planning, the papers investigated each of these problems in the context of conceptual themes and practical solutions that resource managers can apply.

The concept of community as a homogenous entity has proven to be problematic, so much so that some researchers have suggested that the concept is questionable, and that community/state is not a useful dichotomy (Kellert et al. 2000, Robbins 2000). The first paper addressed this issue by way of a Q-sort that investigates community and agency perspectives on wildfires and tests for competing value groups. Results indicate that distinctive value-sets separate most agency and Caucasian residents from Koyukon residents, but that the Koyukon themselves hold at least two distinctive value sets that are driven by age. These results suggest that community as a shared-value term is relative to the issue being addressed and the divisions of the population in question. As such, in some cases it is valuable to CBNRM practitioners, especially when the state or external parties are juxtaposed to in situ ones.

This research makes an important applied contribution: it showed the potential for Q-method to be used by practitioners of CBNRM to investigate value differences. Not only did residents participate easily in the process, the results offered important insights into the local resource conflict. Residents and resource managers, rather than separated by statements on wildfire ecology, were mainly divided over the *method* of policy-making. Specifically, older residents strongly felt that local knowledge should be given more power, and local attachment to place and respect for animals should be considered during policy-making. This indicated potential for greater community involvement to reduce the conflict.

The results also make an important contribution to both CBNRM and resilience theory. While the literature on CBNRM has devoted considerable attention to resource value differences centered on gender, livelihood, or class, age appears to be an understudied axis of differentiation (Rocheleau et al. 1996, Kellert et al. 2000, Robbins 2000, Agrawal and Gibson 2001, Brosius et al. 2005). These results indicate that practitioners should consider the potential for different age groups to have divergent perspectives and to ensure that varying ages are represented in decision-making processes. This work supports sociologists' claims that most values are cemented by young adulthood, and persist throughout the lifetime (Inglehart and Baker 2000). The implication for resilience scholars, who seek to build stability of desirable characteristics in social-ecological systems, is that mechanisms connecting older users to resource policy-making may provide an important source of continuity and resilience.

The risk planning literature divides participation into two classes: technocratic, where experts involve community members in order to educate them, and democratic, where community members have real decision-making power (Fiorino 1990, Lane 2005). The CBNRM literature largely describes successful participation as democratic, and technocratic participatory strategies are usually described as participation in name only (Slocum et al. 1995, Schroeder 2005). Evaluators of risk planning participation largely espouse the democratic model of participation, but most wildfire risk prevention is done in a technocratic manner (Arnstein 1969, Dombeck et al. 2004, Kauffman 2004). The second paper addressed this theme through a case study of the Community Wildfire Protection Plan (CWPP). It showed that Galena residents, both Koyukon and Caucasian, felt that the technocratic style of the CWPP process was appropriate because it did not deal with area forests, but rather with risk reduction. Residents had little knowledge of or interest in wildland-urban interface (WUI) **wildfire risk reduction** and preferred to let experts lead. This outcome contrasted sharply with Koyukon frustration with **wildfire policy and forest management**, which conflicted with their livelihoods and informal institutions. For policies affecting area forests, residents felt local knowledge should play a larger role.

This research makes a contribution to risk planning evaluation by showing that technocratic participation may be appropriate in cases where residents have little knowledge or experience with the subject of a planning process. As such, technocratic approaches per se should not be rejected, but considered as a viable option after it has been established that a community does not have a history or interest in the proposed activity. *Projects should not be evaluated solely by participatory style, but by community*

satisfaction with process and outcome. This study also supports claims made by CBNRM and common property researchers that management that goes against local informal institutions is unlikely to succeed. In this case, Koyukon residents of Galena, who had informal institutions regulating forest access, frequently opposed wildfire policies that did not consider their use patterns. Wildfire managers, who frequently use technocratic methods of community involvement, should recognize that, while likely appropriate in WUI situations, they are not sufficient for policies affecting forests in areas with a history of resident forest use.

Although studies in political ecology, common property, sustainability science and resilience all affirm the importance of local co-production of knowledge and policy, implementation has proved difficult, often because local or traditional knowledge does not line up with official knowledge. Resilience researchers study traditional ecological knowledge (TEK) to provide insight into complex ecosystems, with the hopes of improving managements' capacity to sustain desirable ecosystem features (Acheson et al. 1998). Researchers trained in natural sciences may use positivistic methods that compare TEK with larger environmental narratives, which can result in analytical dead-ends when TEK leads to different conclusions (Huntingdon 2000). In contrast, political ecologists frequently challenge dominant environmental narratives as socially constructed, and work to determine the underlying causes of environmental change (such as (Blaikie 1985, Hecht 2004)). They have an interest in communities for the sake of justice, and often use in-depth fieldwork to understand community perspectives on environmental issues. This approach has led some biologists to argue that political ecologists neglect ecology (Peterson 2000).

Paper three addressed these themes, drawing on the assumption of verifiable and usable, but complex, ecological information typical of resilience, which has its roots in ecology, and political ecology's assumption that dominant narratives can be political, and in-depth, ethnographic approach to local knowledge. Intensive fieldwork was used to document traditional ecological knowledge (TEK) on wildfires, which was then analyzed with an understanding of ethnographic context and the spatiality of use patterns. The TEK was systematically organized and compared to selections from the broader wildfire ecology literature. Document analysis was used to investigate the assumptions of agency policy documents and their connection to broader environmental narratives. This approach resulted in several discoveries, including local observations of climate change and the variability of wildfire effects, which had been neglected by agency policy documents due to a focus on national narratives.

This study makes an important contribution to CBNRM and to resource managers in Alaska, because it shows that resilience and political ecology together are powerful tools for resolving conflicts between traditional knowledge and agency science and for producing usable information for resource management. It also shows that misalignments between traditional knowledge and national narratives offer a valuable opportunity to improve policies through the incorporation of local observational knowledge and affirms the need to avoid resource management panaceas. In addition, it offers locally specific observational knowledge that can be used by Alaskan wildfire managers to improve wildfire policy outcomes for Koyukon and other rural users.

One important result arising in all three papers was the role of history in determining Koyukon relationships with management. The research showed that Koyukon felt frustration with and distrust of government managers. Such views were due to a traumatic recent history, including forced boarding school attendance and the prohibition of their native language, Koyukon Athabascan. It also came from a lifetime of changing resource management rules and policies, as managers came and went every five to ten years, bringing new regulations and approaches. Many elders felt frustrated because there were so many regulations on resource use in areas where they had moved and used resources freely as children and young adults. They expressed discontent that decisions could be made by people who had no real stake in the consequences. As one man explained “*Cause you know, I’ll grow old and die here, and Fish and Wildlife is gonna come and go, doesn’t really mean anything to them*” (Galena resident 13). This shows that any effort to resolve management conflicts must make a genuine attempt to build trust and to respect local knowledge and livelihoods, an important finding for Alaskan resource managers.

In conclusion, the research undertaken in this dissertation comprises a thorough investigation of the conflict between federal land managers and Koyukon resource users over wildfire policy. It shows how resource managers can improve outcomes through the incorporation of community participation while avoiding or resolving common difficulties such as knowledge or value conflicts. Community participation not only builds community/agency trust while protecting local livelihoods, it also contributes local ecological knowledge that is vital to sustainable management. Perhaps this dissertation,

or the published papers to follow, will stimulate further research directly applicable to CBNRM and wildfire as practiced in the United States.

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Appendix A: Wildfire Risk Survey Instrument

Risk

What is the level of wildfire risk in Galena?

None

Very High

1

2

3

4

5

Are you worried about a wildfire burning into Galena from the surrounding country?

Not at all

Extremely worried

1

2

3

4

5

Are you worried about a wildfire starting in Galena and spreading through town?

Not at all

Extremely worried

1

2

3

4

5

What would make Galena safer from wildfire?

Are you worried about wildfire affecting areas that you use for subsistence?

Not at all

Extremely worried

1

2

3

4

5

Have you ever had your home or other property such as a cabin threatened by a wildfire?

Have you ever lost property such as a cabin, trapline, or camp in a wildfire?

Wildland Urban Interface

What are your favorite things about your house and yard?

How do you feel about open space around your house?

Really dislike

Really like

1

2

3

4

5

How do you feel about having trees close to your house?

Really dislike

Really like

1

2

3

4

5

How do you use the land and resources right around Galena, up to 5 miles out? (gathering firewood, running dogs, skiing, snow shoeing, snow machining, trapping, hunting, fishing)

When was the last time you tested your smoke detector?

In Galena, there is a high risk of wildfires that start and spread within town. The Volunteer Fire Department is worried about the high risk in some parts of Galena, as firefighters are often unable to save houses that have too much flammable vegetation around them. Homeowners can do several things that make their house much more likely to survive a town wildfire that starts in and spreads through Galena.

Have you received information on how to make your house safer from in-town wildfires?

Yes

No

Don't Know

Please describe anything you have done to make your house safer from in-town wildfires.

Which reasons have kept you from making your house safer from wildfires

lack of time

don't know what to do

too expensive

physically unable

not worried about wildfire

Other:

The following questions will ask about specific things you can do in advance to make your home safer in from wildfires that start and spread through town. Please explain if you would be willing to do these things.

(If score is 3 or less, ask why. Suggest: unable, too expensive, not enough time, would look bad, inconvenient, impossible)

Enclose the space beneath your home with small gauge wire screen to keep out firebrands?

Will not do

Will do as soon as possible

1

2

3

4

5

Why:

Clean out under-story vegetation on your property such as dry grass, leaves, and debris?

Will not do

Will do as soon as possible

1

2

3

4

5

Why:

Limb-up spruce trees to 6 feet?

Will not do

Will do as soon as possible

1

2

3

4

5

Why:

Remove any dead trees within 100 feet of your house, cache or other buildings?

Will not do

Will do as soon as possible

1

2

3

4

5

Why:

Replace spruce near your house with less flammable species like aspen or cottonwood?

Will not do

Will do as soon as possible

1

2

3

4

5

Why:

Move propane tanks, fuel barrels, and woodpiles 30 feet away from your house?

Will not do

Will do as soon as possible

1

2

3

4

5

Why:

Move anything flammable out from under your home?

Will not do

Will do as soon as possible

1

2

3

4

5

Why:

Avoid parking in the street in order to keep it clear for fire vehicles

Will not do

Will do

1

2

3

4

5

Why:

Is there a source of water near your house that could be pumped and used to defend your house?

If there were a grant to do fuel reduction around homes, would you be willing to have brush cleared around your house?

Fire Breaks

There may be a possibility of making fire breaks in different places outside of Galena in order to break up stands of black spruce.

Do you think having fire breaks outside of town would make you safer?

No safer

Much safer

1

2

3

4

5

How would a fire break outside of town affect your subsistence?

Hurt it a lot

Help it a lot

1

2

3

4

5

If there were new trails leading out to a firebreak, would you use them to get firewood?

Definitely not

Absolutely

1

2

3

4

5

If wood from fuel reduction projects could be used to generate electricity or heat, do you think it would be a good idea?

Definetely not

Absolutely

1

2

3

4

5

Participation in wildfire protection planning

I would like to participate in planning to make Galena safer from fire.

Really Disagree

Really Agree

1

2

3

4

5

I don't think there is a point in participating in planning to make Galena safer from fire because it won't change anything

Really Disagree

Really Agree

1

2

3

4

5

I would like to vote for someone from the community who can represent me in planning to make Galena safer from fire

Really Disagree

Really Agree

1

2

3

4

5

I trust the agencies to represent me so I don't need to participate in planning to make Galena safer from fire

Really Disagree

Really Agree

1

2

3

4

5

I don't want to be included in fire safety planning

Really Disagree

Really Agree

1

2

3

4

5

I am going to list some ways that your opinion can be included in fire planning. Please tell me how much you like the different options.

Attend a cover-dish and make public comments

Really Dislike

Really Like

1

2

3

4

5

Attend a demonstration or presentation

Really Dislike

Really Like

1

2

3

4

5

Participate in a meeting

Really Dislike

Really Like

1

2

3

4

5

Receive information in the mail

Really Dislike

Really Like

1

2

3

4

5

Have someone call me and ask me my opinion

Really Dislike

Really Like

1

2

3

4

5

Elect someone to represent me

Really Dislike

Really Like

1

2

3

4

5

Fill out mail survey

Really Dislike

Really Like

1

2

3

4

5

Be interviewed in person

Really Dislike

Really Like

1

2

3

4

5

Where do you get information about the effects of wildfire?

I am going to list some people who might tell you things about wildfire. I want you to tell me how much you trust them.

Alaska Fire Service/BLM

Don't trust

Trust completely

1

2

3

4

5

US Fish and Wildlife Service

Don't trust

Trust completely

1

2

3

4

5

Galena Volunteer Fire Department

Don't trust

Trust completely

1

2

3

4

5

Friends, Family and Neighbors

Don't trust

Trust completely

1

2

3

4

5

Wildfire and the forest

Research has shown that wildfire is a natural part of the Alaskan environment. It helps keep the forest diverse by creating areas of new growth. New growth can provide food for moose and other animals. Wildfire can warm soil and release nutrients.

How do you feel about this research?

I support controlled burns in order to improve moose habitat

Really Disagree

Really Agree

1

2

3

4

5

I can accept letting certain remote areas burn in order to help the forest

Really Disagree

Really Agree

1

2

3

4

5

I think this research doesn't always apply to all areas-every place is different

Really Disagree

Really Agree

1

2

3

4

5

I agree that wildfire has some good effects but it also has many harmful effects

Really Disagree

Really Agree

1

2

3

4

5

I have seen places get overgrown because of lack of wildfire

Really Disagree

Really Agree

1

2

3

4

5

I use areas that have burned.

Yes

No

Don't know

IF YES: what was the effect of the burn?

What places need most protection from fire?

Demographic Questions**Are you a homeowner?****Sex:****Age:****Are you a Ganayoo shareholder?****Are you a member of the Loudon tribe?****Have you been out firefighting?___ How many years?___****How many years have you lived in the middle Yukon or Koyukuk area?**

How much time do you spend out on the land?

 I go out for several weeks at a time in order to trap, fish, spend time in a cabin or perform other subsistence activities I am out most days doing some kind of work A couple days a week A couple days a month A few days a year

Appendix B: Semi-Structured Interview Guide for Active Users

Interview for people over the age of 45 who still get out on the land

Childhood

Where were you born?

What did your family do there?

Changes in the land

Did you go to spring camp? Have you been back to this place?

How has it changed?

Did you go to fish camp? Do you still go to fish camp in the same place?

How has it changed?

Did you go to a winter camp? Have you been back? How has it changed?

Did you go out trapping? Do you still go to the same places?

How have they changed?

How do you feel when you visit places that your have used for your whole life or that your parents used?

Compared to the past, is it harder or easier to find firewood? What about houselogs? Why?

Do you use any kind of specialty wood, such as birch for snowshoes or sleds, birch bark for baskets, or anything else?

If so, is it easier or harder to find them now, compared with in the past?

What plants did you eat as a child? Can you still find these plants? Is it easier or harder to find them?

What fish and animals did you eat as a child? Can you still find these? Is it easier or harder?

How has the whole Yukon/Koyukuk area changed since you were a child? Why?

In your opinion, what is a healthy forest?

Fire

Were there fires in any areas that you use for subsistence?

What were those places used for before the fire?

Can you still do those activities there?

How did those places change?

If the place you usually go to spring camp burns, what happens? Can you go to spring camp at another place?

If someone's trapline burns, can they trap somewhere else for a few years? Can they use someone else's trapline?

If someone's fish camp burns, what would happen?

If the place you usually camp while hunting burns, is it hard to find a new place?

If a berry patch burns, how do people find a new place to pick berries?

Are there stories associated with certain places? What happens if these places burn?

How do you know if people used to use a certain area a long time ago? Would you still know if it burned?

How do you feel when there are fires burning in the area?

Are there important places that should be protected from fire?

How do you feel about the policy of letting remote areas burn?

How do you feel about controlled burns?

Are you worried about a fire affecting the village of Huslia?

Are you worried about fires affecting areas you use for subsistence?

If you could teach people at the agencies something about wildfire, what would you say to them?

Learning about Subsistence

How do you learn about the land and animals?

Do you write things down about what you see each year? What kinds of things?

What would you like to tell agencies about local knowledge?

Resource Management and Participation

Have you been on any kind of council or board?

How were decisions made?

How did you like this?

Can you think of any local rules that were made by people here, not by troopers or agencies?
Any rules about where you can and can't go, or what you can or can't do?

Someone told me that he doesn't trap the same area every year in order to not trap out the animals. Have you done this or seen other people to do this?

Can you think of other ways that people are careful so that there will be enough animals?

Someone told me that when he used to go to spring camp every year, everyone would catch lots of pike, and there were always a lot of muskrats. He says now that people don't go to spring camp anymore, there are too many pike, and they eat the muskrats. Have you seen this happen? Are there other ways that people affect animals?

Someone told me that there was a problem in Galena with people using trails that other people cut to woodyards. He said people got together and decided that wasn't good, and after this people were better about respecting woodyard trails. Can you think of any times people solved problems like this without going to an agency or to law enforcement?

In your opinion, will people resolve resource issues amongst themselves if it is important to them?

Have you ever gone to a meeting held by an agency such as Fish and Wildlife? What happened? How did it make you feel?

Would you like to participate more in wildfire management? How would you like to participate?

Appendix C: Semi-Structured Interview Guide for Elders

Interview for Elders

Childhood

What is your name?

Where were you born?

What did your family do there?

Fire

Did you ever experience a wildfire?

What happened?

Did any places that you use burn?

What were those places like afterwards?

Are there stories associated with certain places? What happens if these places burn?

How do you know if people used to use a certain area a long time ago? Would you still know if it burned?

How do you feel when there are fires burning in the area?

Do you worry about the risk of fire inside of Huslia?

Do you worry about fire burning important places on the land?

What kind of places should be protected from fire?

A long time ago, if someone's spring camp burns, what did they do? Could they go to spring camp at another place?

A long time ago, if someone's trapline burned, what did they do?

If a hunting camp burned, what did people do?

If a berry patch burned, how did people find a new place to pick berries?

How do you feel about the policy of letting remote areas burn?

How do you feel about controlled burns?

Resource Management

When was the first time you met someone from an agency such as Fish and Wildlife or Fish and Game? What happened? How did you feel?

What is something you liked that an agency did? What is something you didn't like?

How do you feel when you talk to people from agencies?

If you could teach something to the people at the agencies, what would you teach them?

A long time ago, how did people make decisions about land and animals?

Ways of learning about the land and animals

What kinds of things did you learn from your parents?

How did they teach you? Showing? Explaining? Stories?

How did your parents teach you to show respect for the land and for animals?

Can you give an example of something your parents did to show respect for the land and the animals?

What kind of stories did your parents tell you?

What did you learn from these stories?

What did you learn about animals from these stories?

Did you get sent to school? Did they teach anything in school about the land and about animals?

How was it different from what your parents taught you?