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The Politics of Invasive Weed Management: Gender, Race, and Risk Perception in Rural California*

Kari Marie Norgaard
Department of Sociology and Environmental Studies
Whitman College

ABSTRACT ''Biological invasions'' are now recognized as the cause of significant ecological and economic damage. They also raise a series of less visible social issues. Management of invasive species is often a political process raising questions such as who decides which organisms are to be managed, and who benefits or is affected by different management techniques. In a rural region of northern California, the proposed use of herbicides on spotted knapweed sparked an intense social controversy. This research uses participant observation, interviews, and archival material to understand how members of the Karuk Tribe of California, the non-Indian community, and the U.S. Forest Service developed different perceptions of safety and risk regarding herbicide use. I describe interconnected factors that frame the interpretation of risk: institutional trust, proximity to exposure, gender, and race. Gender and race, in turn, form the basis of anti-herbicide mobilization. The larger sociological question highlighted is, who pays the price for species invasions? Use of herbicides on invasive species is increasing. Many people who face increased exposure to herbicides are members of racial minority groups. When the poor or racial minorities face disproportionate exposure, differences in risk perception become matters of environmental justice. This paper discusses the broader social implications of differences in risk perception among communities and land managers.

''Biological invasions'' are now recognized as the cause of significant ecological and economic damage: zebra mussels clog plumbing in the Great Lakes region, and tamarisk overtakes native willows all over the Colorado Plateau (Bright 2001; Pimentel et al 2000; Pimentel, Zuinga, and Morrison 2005; Schmidt and Simberloff 1997). Although humans have always moved organisms from one place to another as we travel, and participated in the shaping of so-called ''natural ecosystems,'' the rates of human travel and trade, and hence new species introductions, have increased rapidly with the advent of free trade—the latest phase of globalization. Living organisms are moving around the globe at an

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unprecedented rate through direct importation and also as ''hitch-hikers'' on freighters, packaging, and equipment. Some of these species take hold and spread rapidly in their new environment. When this occurs, native organisms, and ecosystem relationships may be quickly altered, as with the arrival of Dutch elm disease in the eastern United States, or the brown tree snake in Hawaii.

Biological invasions have been characterized as among the ''most dangerous and least visible forms of environmental decline'' (Bright 2001) and the second leading cause of biodiversity loss. Of all the impacts of these events, ecological and economic consequences have been the most readily identified and measured and are consequently the best understood, for example, Pimentel's oft-cited figure of $120 billion per year (Pimentel et al. 2000, 2005).

Contention over herbicides is one of the most common sources of social controversy regarding invasive species, and such controversy is increasing alongside the rising numbers of rural and urban acreage that are sprayed. Spraying of Malathion has provoked recent urban controversies in Southern California over the control of fruit flies and in Sacramento over the control of West Nile virus vectors. Similarly, in 2001 the possibility of spraying for the glassy-winged sharpshooter in rural Sonoma County, California, led to county-wide opposition and threats of direct action. One of the key issues this study highlights is the increased public concern over herbicide use and the bases for differences in the perception of risk regarding herbicide use. Agencies from the National Park Service to the U.S. Forest Service are mandated to control invasive organisms. Yet, management is often a political process: Who gets to decide which invasives are a priority for management? What methods are to be used? And who may benefit or be impacted by different management processes?

In 1997, spotted knapweed was found along the Clearwater River (this is a pseudonym) in a remote and rural region of northern California. Spotted knapweed is a serious concern of the California State Department of Agriculture due to its impacts on rangeland quality. The proposed use of herbicide treatment by the Forest Service sparked an immediate, intense, and ongoing controversy. Ninety percent of community members in the region oppose the Forest Service's plan to apply herbicides. The Karuk Tribe passed a resolution against the use of herbicides in their ancestral territory. Other community members threatened direct action. The Forest Service has received more comment letters on the current Noxious Weeds Environmental Impact Statement than any other recent action—including timber sales, which are usually considered the most

controversial of Forest Service activities. As of this writing, the weeds project has been placed on hold ''due to lack of funding.'' Forest Service employees have also alluded to community controversy as a factor.

What accounts for the different views of Tribal members, the general community, and the Forest Service on the safety or appropriateness of herbicides? To what extent do different risk perceptions reflect unequal patterns of exposure by race and gender? Despite agreement that spotted knapweed is a problem, members of the local community— the Karuk Tribe of California, the non-Indian community, and the U.S. Forest Service—are each affected differently by and have different notions of the best way to respond to the presence of spotted knapweed. This study provides a comparative analysis of how the three groups within the region have come to hold very different perceptions of invasive weed management. In so doing it highlights how race and gender inform risk, the relationship of risk perception to environmental justice and who pays the price for environmental degradation in the form of species invasions.

Perceptions of Environmental Risks

In the Clearwater River area, the proposed use of herbicides on invasive species led to immediate controversy. Public concern about potential health hazards of pesticides' use is widespread and crosses many demographic categories (Chimpan and Kendall 1995; van Tassell et al. 1999). There are also documented differences in perception of environmental risks by gender (e.g., Bord and O'Connor 1997) and among race and ethnic groups (Finucane et al. 2000; Flyn, Slovic, and Mertz 1994; Marshall 2004; Palmer, Carlstrom, and Woodward 2001). For many Native Americans in California, herbicides are strongly opposed and referred to as ''poison.'' Opposition to herbicide use was a central factor in the formation of the California Indian Basketweavers Association. This organization developed in 1992 to promote safe gathering conditions for Indian basketweavers, many of whom live in Northern California.

Overall, literature on gender, race, and risk perception describes what Flyn, Slovic, and Mertz (1994) call a ''white male effect,'' that is, that white men differ from members of all other groups in perceiving risks as smaller and more acceptable and in being more willing to impose environmental risks on others. Gender differences in environmental concern have been greatest with local problems and with issues that pose health and safety concerns (Davidson and Freudenburg 1996). Explanations for this gender gap have focused on social roles of

women as family nurturers and caregivers. Less research has been conducted on the basis of racial differences in risk perception. Social and economic conditions of racial minorities, including high poverty, low wages, and inadequate access to information and health care, contribute to greater risk of exposure, more significant consequences of exposure, and may also lead to perception of greater risk. Yet, aside from aspects of social class, what factors underlie racial differences in risk perception? Why are Native people in particular so strongly opposed to the use of herbicides? Are there racialized aspects of the life experiences of these individuals that lead them to different interpretations of safety and risk? In addition, many of the social factors discussed below, such as institutional trust, have specifically gendered and racialized dimensions. Voices from the Clearwater River provide insight into the understudied basis for racialized differences in risk perceptions.

Risk research over the past decade highlights the importance of social context in understanding the public's sense of risk. This may be due in part to gaps between theoretical explanations of risk and the realities of risks as they are experienced by people ''on the ground.'' Beamish notes that ''economic modeling of environmental trade-offs, contingency based probability assessments and psychological work on risk perception decontextualizes and oversimplifies the scenarios and experiences that inform lay-public interpretations'' (2001:11). Similarly, Clarke and Freudenburg observe that ''experts tend to concentrate on the details whereas the public focuses on the bigger picture'' (1993:71). Furthermore, much research outlines how perceptions of herbicides are intertwined with people's trust in institutions of government and industry (Freudenburg 1997; Murdock, Krannich and Leistritz 1999; Wulfhorst 2000). The notion of ''institutional trust'' is widely studied in risk literature. For example, Beamish (2001:6) describes how

> In the case of the Guadalupe dunes, the public's sense of risk emerged in part from perceptions of the threat posed by the immediate hazard, but more importantly from the sense of institutional failure on the part of both industry and government agencies.

He also notes that,

> When a complete breakdown in trust of this kind occurs, community members' perceptions of and reactions to risk can be seen as 'rational' but cannot be understood as merely

> calculative responses to the physical hazards associated only with the immediate, discrete event (p. 5).

Finally, in contrast to conventional risk evaluation models that tend to privilege the risk perceptions of experts over the public, sociological research indicates that even professionals may underestimate the crisis potential of the systems they operate (e.g., Perrow 1984; Schrader-Freschette 1991). Research by Slovic et al. (1995) found that occupational affiliation with chemicals lowers an individual's perceived risk of chemicals. Similarly, Hawkes and Stiles (1986) note that individuals with ''pesticide connections'' perceive the smallest amount of risk compared with scientists, government employees, the general public or elected leaders. From another angle, Dunlap and Buess' (1992) public opinion survey in the Pacific Northwest uncovered an interesting result: the belief that pesticides are necessary is one of the most important predictors of their acceptability. Research by Winston (1997) also found that the belief that pesticides are necessary is related to the beliefs that there are no alternative methods to remove pests, and that the benefits of pesticide use outweigh their risks. Institutional trust, proximity to exposure, gender, and race were each clearly visible dimensions of risk evaluation that in turn led to controversy in the Clearwater case.

Environmental Justice

When differences in risk result in part from relative chances of exposure, and when those who face exposure are members of poor or racial minorities, issues of risk perception fall into the broader issues of environmental justice. International, national, and regional trade is responsible for the transport of invasive weed species such as spotted knapweed across the nation or region. Yet, rather than instituting tighter regulations or fines on the movement of species, citizens and land managers combat these ecological and economic problems in specific locations on the ground. As a result, the use of herbicides for the management of invasive species is increasing across the United States. This increase is furthered by the intensification of weed invasions, the increased visibility of invasives as a social problem, and the direct marketing of herbicides for use in invasive management by chemical companies such as Monsanto.

Chronic exposure to low levels of pesticides or their residues on plants has been linked with serious human health problems including cancer, birth defects, and infertility (Baldi et al. 2001; Garry et al. 2002; Oliva, Spira, and Multigner 2001; Savitz et al. 1997; Zahm and Ward

1998; Zheng et al. 2001). Racial minorities experience disproportionate exposure to a variety of environmental problems in rural communities, including toxic waste (e.g., Bullard 2000; Pastor, Sadd, and Morello-Frosch 2004) and pesticides (Arcury and Quandt 1998). Furthermore, poorer people and members of racial minorities generally have less access to information and decision making options than whites. In their recent review of the effectiveness of the environmental justice Executive Order, Murphy-Green and Leip (2002) note the widespread lack of information on pesticides and pesticide laws among American farmers, about 90 percent of whom are Hispanic. The authors conclude that farm workers in the United States are ''one of the least statutorily and constitutionally protected occupational groups in America today … they are provided unequal protection under the law, which leads to environmental injustice'' (p. 685). Few investigations have been conducted into the experiences, herbicide exposure levels and access to information of other racial minorities in land management activities such as forestry, mushroom picking, tree planting, and highway maintenance. Even less is known about the experiences of Native Americans in particular. Most scholarly work on Native exposure to environmental problems has been in connection to energy use, mining activities, and radioactive disposal. Little has been done on exposure to herbicides resulting from cultural and subsistence ties to the land. This paper contributes to this understudied area of social experience.

Executive Order 12898, signed in 1994, requires that federal agencies identify and address adverse affects of their actions on human health or the environment of minorities and low-income populations, as well as the equity of the benefits and risks of their decisions across populations. Despite the Executive Order and minorities' increased risk of exposure, potential effects on the poor and racial minorities are rarely or never discussed in planning documents regarding species invasions. One of the broader sociological questions this paper highlights is the issue of who in society pays the price for environmental degradation.

Gender, Race, and Cultural Opportunity Structures

Whether protest is successful depends on a range of factors. In addition to work on resource mobilization and political opportunity structures, Johnston and Klandermans (1995:5) note that culture may function to channel or constrain the development and success of social movements. The notion of ''cultural opportunity structures'' refers to the kinds of actors and possibilities for action that exist based upon the distribution

of means within society. Taken-for-granted notions of who and what counts in society may serve as ''frames'' available to social actors (Snow et al. 1986; Swidler 1986). For example, since the 1960s, national-level cultural emphases on racial and gender equality have created a new cultural opportunity structure that elevates the voices of women and people of color in a variety of social movements. In the Clearwater case, gender and race led not only to different perceptions of risk, they also created opportunities for mobilization. These aspects of social experience formed the basis of ''cultural opportunity structures'' that were used in organizing opposition to spraying.

Data and Methods

The results presented here are part of a larger ongoing investigation into the social impacts of and responses to invasive weeds in a rural northern California community. Data for this paper were drawn from 15 months of ethnographic field work, including participant observation, interviews, and archival analysis. The Clearwater River community was selected because it appeared to provide an example of how a community could successfully mobilize and eradicate a serious invasive weed on the watershed level (this topic is the subject of another paper). In addition, the diverse racial and political make-up of the community lent itself to a comparative analysis of the various ways that invasive species may be viewed and the effects on different social groups. Finally, the regional presence and concerns of the three largest indigenous tribes in California suggested an important but understudied environmental justice issue. I began with broad research questions: How were people being affected by invasive weeds (if at all)? How did different groups within the community view invasive weeds? What compelled community members to spend so much energy on volunteer hand-removal tactics? And, in terms of the specific focus of this paper, what was the basis for the vastly different perspectives on whether herbicides were safe?

As a participant observer, I spent time in numerous community meetings, dug spotted knapweed, and attended regional and statewide meetings of land managers concerned with invasive weeds. In each of these settings I learned much about the perspectives, assumptions, concerns, and daily struggles of members of the Forest Service, Karuk Tribe, and non-Indian community. I also spent a great deal of time living ''as a community member'' in the Clearwater River watershed. This was necessary to develop trust and gather data in this remote area.

In addition to participant observation and extensive informal conversations with community members, I conducted in-depth interviews with 42 individuals: 5 members of the Forest Service (plus 3 other relevant land managers), 7 members of the Karuk Tribe (and 3 additional people connected to the California Indian Basketweavers Association who were not in the Karuk Tribe), 9 members of the Clearwater River Restoration Council, 8 general community members and 6 outside ''experts'' (including other professionals working with invasive species and a physician involved in the collection of herbicide exposure depositions). Informants were selected to cover the widest possible range of viewpoints in the community. Interviewees were also selected based on their ability to serve as key informants on specific issues. In-depth interviews were directed towards expanding understanding of current or past events and clarifying, confirming, or denying suspicions about social dynamics that I had developed from participant observation activities. All interviews were transcribed and coded.

Cultural and Political Diversity 'On The River:' Indians, Hippies, Loggers, Miners, and The Forest Service

The Clearwater River watershed is remote, pristine, and biologically significant. The watershed, which is largely free of invasive species, boasts exceptionally high water quality and is considered a key refugium for a number of fish at risk of extinction, including summer and winter runs of wild Klamath Mountains Province steelhead, spring and fall Chinook salmon, green sturgeon, Pacific lamprey, and Coho salmon. The human community along the Clearwater River is politically and culturally diverse. Residents of this relatively isolated watershed include the Karuk Tribe, loggers, ''back-to-the-land hippies,'' small scale farmers, miners and Forest Service employees. Poverty and unemployment are high among the approximately 250 residents.

The region is the ancestral territory of the Karuk Tribe of California. About one quarter of the community is Karuk, and the presence of the Tribe is a significant cultural and political feature of the region. The Karuk people have endured demographic and cultural decline since contact with white settlers as a result of systematic genocide, forced assimilation through boarding schools, and other aspects of legal discrimination (Bell 2002; Lowry 1999; Norton 1979). Since 1979, when they gained federal recognition, the Karuk Tribe has experienced a political, economic and ethnic renewal (Bell 2002; Nagel 1996). Members are actively recovering cultural traditions, including fishing

techniques, language use, ceremonial practices, and traditional basketweaving. The Karuk Tribe has a Department of Natural Resources and is involved in land management, although the Forest Service is the dominant land manager in the region (98.7% of the land area is managed by the Forest Service).

Non-Indian settlers entered the area as miners during the 1850s (Bell 2002), and some remained. Logging also brought non-Indians to the region in several waves. Timber has been a significant source of income for short periods in the watershed, especially in the 1970s and 80s when up to three quarters of the community were employed in forestry or related activities. A number of urban whites entered the river region during the 1960s as part of the ''back to the land'' movement, exerting their own cultural influence on the watershed (Salter 1981). Besides the Tribe, one of the important community organizations involved in land management is the Clearwater River Restoration Council (hereafter simply ''the Restoration Council'') formed in the early 1990s. The Restoration Council consists of a unique blend of miners, loggers, and environmentalists all working towards watershed health in the community. The Restoration Council employs a dozen or so community members and coordinates a much larger network of volunteers. This group of mostly non-Indians keeps track of community perspectives on land management and educates the community on upcoming management issues.

The local National Forest was established in 1905, and the U.S. Forest Service became the primary land managers along the Clearwater River by the 1930s. Forest Service management efforts over the last eighty years have followed notions of ecology and forest health derived from European models and have been shaped by national and regional mandates to provide timber (Davies and Frank 1992; Hirt 1994). Since the 1970s increased attention has been directed towards forest ecology. During the height of timber output from the region, the Forest Service had several offices located along the river and housed many employees in the region. More recently, the Forest Service has scaled back its activities and presence in the watershed, closing offices along the river. Most Forest Service employees now live and work in areas up to two hours drive from the River.

In this small community, Indians, non-Indians, and the Forest Service are not always distinct groups and sometimes overlap. Members of both the Tribe and the non-Indian community have worked for the Forest Service, and members of the Tribe are on the board of the Restoration Council. And the three groups have interacted differently at different times: all three have worked on cooperative projects, and all three have held conflicting perspectives.

"No Poisons in Our Watershed!" Controversies Over Weed Management and The Safety of Herbicides

While there was general agreement that invasive species such as spotted knapweed were not welcome in the watershed, the possibility of herbicide use as a strategy to control weeds was a topic of serious contention. Forest Service employees working on the issue considered herbicides to be either ''safe'' or a ''necessary risk that could be adequately managed.'' Community members in the Restoration Council and the Karuk Tribe, on the other hand, were almost universally opposed to the use of herbicides because of potential risks. Although both Indian and non-Indian community members were opposed to herbicide use, the basis for their opposition was somewhat different. How did each group develop such different perceptions of safety and risk? Here I will describe how social context, including the possibility of direct exposure, lack of institutional trust, gender, and race, shaped the differing views of those involved about the safety, meaning, and significance of herbicide use. Although both the Indian and the non-Indian community were opposed to the use of herbicides, there were differences between these groups that highlight significant racial dimensions to risk perception. The different bases for evaluation between groups led to different conclusions regarding herbicides as an appropriate management strategy. Gendered and racialized experiences in turn formed the basis of mobilization against herbicide use. I further describe how women and members of the Kaurk Tribe each used aspects of their experiences as the basis for generating opposition.

Local History and Institutional Mistrust

Sociological literature on risk perception describes the social bases of risk (Slovic 2000) and the significance of institutional trust (Beamish 2001; Freudenburg 1997)—two factors that are clearly relevant on the Clearwater. Probably the most significant defining event in the relationships of these groups was the aerial spraying of a mixture of 2,4-D and 2,4,5,-T on the forest and surrounding communities as part of the Forest Service's timber management practices in the 1970s and early 1980s. The spraying was part of what is known as a ''conifer-release program,'' in which herbicides were used on logged areas to prevent the growth of broadleaf trees and brush, species perceived to compete with newly planted conifer seedlings after clear cutting. This program was highly controversial in rural communities locally and throughout California and Oregon (Ortiz 1993; Van Strum 1983). Dioxin, the active ingredient of 2,4,5-T and Agent Orange, has been linked to hormonal

and endocrine disruptions in Vietnam veterans and their wives and children (Le and Johansson 2001). Incidents of water supply contamination, late-term miscarriages, and unusual cancers and birth defects were documented in the community. It was this event more than any other that galvanized and united this otherwise politically and culturally diverse community. Indians, non-Indians, miners, loggers, and hippies all joined efforts to stop the use of herbicides by the Forest Service. They did so successfully with a court injunction in the mid-1980s.

It is clear that current perceptions of herbicides and questions about the Forest Service's intentions are influenced by the earlier history of herbicide spraying. In addition to specific health problems such as cancers and birth defects, residents described experiences with the Forest Service that led to significant mistrust, including the spraying of a spring that was a family's water supply:

> [We had a tarp covering our spring]… And we had it tested. Our side had it tested and it was covered with whatever they sprayed and Atrazine … there was red dye still up in [our spring] and they [the Forest Service] had told us they were going to leave these buffers … But they hadn't.

This woman went on to say that, although they left their home for several days while the spraying occurred, when they returned she and her daughter became very ill with feverish flu-like symptoms that lasted several months and recurred for years afterwards. Another resident described the attitude of the Forest Service as disrespectful and generally mean:

> There were really a lot of people in the Forest Service that were nasty and mean. You couldn't really trust their motives or their interpretation of science, because they didn't really care… [T]o trust the government who was pretty freely using this stuff to be watching out for the welfare of people, it just wasn't happening. You have to watch out for your own welfare and health, because the Forest Service truly did not care.

And for some, distrust in the Forest Service in particular was linked to the growing general distrust of government and science in the 1980s and 1990s (Beck 1992). For example, one community resident described his successive experiences of being told that first DDT and then Agent Orange were ''safe,'' only to see both compounds classified as dangerous substances some years later. From his experience, it only made sense that many chemicals presently considered to be ''safe,''

given their minimal testing, would be recognized as dangerous in the future:

> What we keep hearing was that the herbicides are safe. Don't worry about it, we used bad chemicals, but they're safe now. My personal experience about that: I was sprayed with DDT heavily when I was a kid, and they felt it was safe. We used to ride behind the fog trucks and hide in the fog. We had also had this experience earlier in Clearwater River where Agent Orange was supposed to be totally safe, and that had been around for a while. Now these chemicals that are now told to be safe; there is just a lot of distrust, that in 5 or 10 years, these will be banned too, and then there will be a lot for residues. So, there is a nervousness about the herbicides.

In contrast, Forest Service ecologists and range scientists believed the use of herbicides for invasive plant control was very different from the aerial spraying of the past. People in the Forest Service emphasized that they had learned from past mistakes. Not only were herbicides safer now, but application techniques had improved:

> I knew the history, but wasn't directly involved with any of that, and the herbicides that were used in the seventies were aerial herbicides used for reforestation… I thought, ''Oh wait a minute, this is completely different context—we're talking about spot spraying'' And 20 acres was the maximum of the infestation. It's actually small little patches, you know, the size of this room.

Finally, not all experiences that generated mistrust were far back in history. Members of the Restoration Council described how, at a time when a cooperative hand-eradication program was in place, the Forest Service illegally sprayed knapweed infestations in a nearby area and failed to inform the community until much later (sprayed areas should be indicated with signs to minimize community exposure). One man described how this incident heightened his sense of mistrust:

> They didn't register that in the state, so it's illegal for them not to do that; they broke the law there… There's about seven places they broke the law. They violated the labels, sprayed closer to the creeks than they're supposed to. They used Tordon, which is not registered for use in California, so that wasn't good. There are all these things that they did that were really weird. So we really made an effort to document. After

> they had sprayed, I was quite upset and I didn't trust them and I wanted to make sure it was documented well.

While river residents seemed to agree that the application methods for proposed herbicides were not as extreme, and even that the chemicals were potentially ''safer'' than what had been used in the past, the risk remained above their thresholds. As mentioned in an earlier interview passage, concerns existed about human exposure and the exposure of Salmonid populations in creeks and rivers. This situation echoes Beamish's (2001:5) scenario, in which

> Perceptions of present and future risk associated with the massive contamination of Guadalupe Dunes grew more from impressions of the way corporate and government institutions in the area mishandled this and previous oil-related hazards than from fear of health risks associated with the discrete Guadalupe Dunes event.

Social Context of Risk Evaluation and Proximity to Exposure: Institutional versus Local, Abstract versus Direct

Another factor contributing to the conflict was that people's perceptions of the risk, significance, and meaning of herbicides were constructed within three very different social contexts. Indeed, the reactions of members of the Tribe, the general community, and Forest Service staff provide a window into the power dynamics of the local social structure. Forest Service employees were accountable to the agency at regional and national levels for funding, an organizational structure based outside the immediate area. The Forest Service made judgments and choices about strategies within an institutional framework that prioritized the importance of weed control at a national level and favored the use of herbicides to achieve this. Furthermore, Forest Service employees—most of whom did not live in proposed spray areas—viewed risk and safety in an abstract sense, referring to scientific literature and risk assessment studies. In contrast, the issues and concerns raised by community members in the Restoration Council and the Karuk Tribe derived from their attachment to place and residence in the community as well as long time observations of the area and the possibility of their direct exposure. Community members viewed weeds as a problem that should be managed, but also as an issue that could provide long term potential for employment to the region. And while Forest Service employees evaluated risks using scientific literature, community members' sense of risk was developed not only through the

use of science, but also within the context of local social, historical, and political forces.

Institutional vs. Local Risk Evaluation

Forest Service employees perceive herbicides to be the appropriate choice within a context of management direction (they receive mandates on the federal level) and existing resources (there is a set amount of funding for invasive weeds). Yet despite the overall institutional emphasis, Forest Service ecologists and weed managers are frustrated by too little funding to complete the task on the ground. The wildland area in the region of concern is extremely large, plant populations are located in remote areas, and staffing for the task is minimal. From the Forest Service perspective, herbicides are viewed as the primary strategy because they are seen as the most (and in some cases only) effective eradication tool and as the only cost-effective strategy to approach such a widespread problem. Additionally, the structure of funding itself favors the use of herbicides—funding is allotted on a per-acre basis, favoring the use of what community members see as the ''quick fix'' solution. As one Forest Service botanist explained:

> We get dollars relative to acres we treat. When you can't use herbicides, you can't treat that many acres, so Forests that were able and counties and areas that, Lassen, they do spraying, and all those kind of places, they tend to get a higher budget, because they can treat more acres. So there is a disadvantage of doing it manual, because you're never going to be able to compete with hundreds of acres when you're doing manual treatment.

Furthermore, although they may perceive themselves as neutral, Forest Service employees are also evaluating risks within social and institutional context. Forest Service employees, like other land managers working on invasives, receive information about available ''treatment options'' provided by chemical companies at trainings on invasive weed management at county and statewide events. For example, the California Invasive Plant Pest Council—the annual conference devoted to weeds in wildland areas of the state—receives major funding from Monsanto (producers of Round-Up, one of the more commonly used herbicides on weeds). At these meetings, agency staff is exposed to information that normalizes the use of these materials. Chemical companies use displays and brochures to promote the safety of their

merchandise and make presentations about their latest available products. Although some information about non-chemical approaches is present, the dominance of chemical options in these training settings creates the sense that chemicals are the primary effective strategy. Furthermore, one manager I spoke with at this meeting, whose research showed that Round-Up was less effective than mulching on a particular plant species, described instances of intimidation by chemical company representatives.

Whereas agency people almost universally lived and worked outside the watershed and evaluated management in the context of regional and national strategies, members of the Restoration Council and the Tribe evaluated appropriate management strategies from a localized context. Although they, too, used outside information sources; attachment to place for Indian and non-Indian residents led to questions about impacts on human health and fish and other species. Fish are an important species to both Indian and non-Indian river residents. People expressed concern that proposed herbicides have been reported as acutely toxic to anadromous Salmonids. Here one community member describes their concern about how herbicides might impact salmon:

> We're worried about the whole ecosystem really, but we tend to be fish-centric. So, noxious weeds are a potential problem to the water quality, as I said, fishery and watershed health. Anyways, we're really concerned about the impacts of spotted knapweed and the pesticide approach … It may impact spring Chinook … That set off the buzz because we have the only run of spring Chinook left.

Community members also expressed concern about human health effects and the possibility that chemicals could not or would not be used in accordance with guidelines. People asked questions about the likelihood of chemical spills in the river, as sprayers with backpacks inevitably slipped in the course of many necessary river crossings. In addition to concerns about the safety of the herbicides, residents also brought up the issue of what might go wrong in their application. When I asked one resident whether she believed that the present chemicals were safer than those in the past, she replied:

> No. No. I don't believe that for a minute. There is no way. And people are still people, and people still aren't perfect, so there's still going to be accidents, and there's still going to be mistakes, and they say they have training. But I've heard that

> training is a big fluke anyway. There is just no way. There is too much possibility for something going wrong and we don't know enough about it, and there's just—No.

Abstract vs. "Embodied" Risk Evaluation.

Most significantly, what underlies these differences in the social context of decision making is the issue of direct versus abstract evaluation of risks. One key issue that came up again and again was the notion of ''who pays the price.'' As one community member put it:

> My general feeling is that they are really isolated from the consequences of their decision. So, it's fine for them to say that it's safe, but it doesn't really matter if it's safe or not, because they don't live in this community, and they're not a part of the river the way that people who live around here are. It's easy for them to say that.

This difference between embodied or direct and abstract risk evaluation is evident in the narratives given by these groups about the issue of safety. For example, when the issue of safety came up in an interview, this Forest Service employee referred to the standards and scientific procedures of testing that were used to evaluate herbicide effects:

> The Forest Service contracted with this group: Syracuse Environmental Research Associates … And they have a full staff of, you know, toxicologists and biologists, etc. etc. that have done these risk assessments on how these herbicides impact human health, wildlife, soil, water, fish … How they do their risk assessment is they take the dose … the EPA gives a reference dose, which is the amount that it takes for any effect on a test population… The reference dose is the amount that you do—how much do you give until their No Observable Effect—well the reference dose is that cutoff where there is an effect. Some observable effect. And then that's divided by the dose that the application rate that we're proposing, and that comes up with a hazard quotient … So, you know, we have to disclose the effects and we have to be responsible with science. I believe that the science is valid.

Facing potential direct exposure, community members evaluated risks in a direct, embodied way, describing incidents of birth defects and cancers from personal histories or from people they knew and the

concerns these events raised for everyone in the community. One woman described how her own child's birth defect caused her to question the safety of herbicides used in her area at the time. In this personal testimony, this woman explains the different criteria for risk she uses when trying to understand the impacts on her child:

> Then I moved back to San Francisco some time in 1974 and gave birth to a baby, who was born with two holes in his heart … I felt particularly sensitive to the issue of human health hazard, and I felt as if, I had no way of knowing, but since I didn't know what caused my baby to be born with this life threatening problem, and I knew that herbicides had been used in a place where I lived, *I had no way to know that I wasn't—that my events weren't contributed to by that activity. I had no way to prove that it was and I had no way to know that it wasn't.* A few years later, my friend, Mary, as well as Edith, had a baby who also had a hole in his heart that wasn't as severe (emphasis added).

This woman's statement that, ''I had no way to prove that it was and I had no way to know that it wasn't'' illustrates the use of a precautionary principle. When it came to thinking about what had happened to her child, she used different criteria than Forest Service managers. Rather than looking for proof that there had been a connection, she wanted proof that there had not been one.

Gendered Exposure and Meanings of Herbicides

Along with the overarching mistrust of the Forest Service, questions about the process of science and differences in abstract versus direct risk evaluations, gender also shaped the experience of past herbicide exposure and the meaning of potential herbicide use in the future among both Indian and non-Indian community residents. Although nearly all community members were opposed to the use of herbicides, a number of women in the community held unique experiences of past herbicide exposure, in their bodies and through their social roles in the community as evidenced in the last quote. Gendered bodily impacts included late-term miscarriages, birth defects, and alteration of menstrual cycles. In 1976, one third of the pregnancies in the immediate area ended in miscarriages after the third month, one deformed child was born, and there were three molar pregnancies. Dramatic physical experiences such as miscarriages and menstrual-cycle disruption exemplify the difference between an abstract and embodied sense of risk. The local nurse described how the miscarriages were later in pregnancies than usual, and the fact that she was convinced they

were due to herbicide exposure: ''… later, after they sprayed around them, we had, the rest of the next two years, we had miscarriages, and they're always around the third month, where normal miscarriages usually are six weeks to eight weeks.'' Of course, not all women in the community had actually experienced such events, yet the stories of those who did made it clear to all women that very serious, personal consequences of herbicide exposure could affect them.

In addition to concerns regarding direct bodily exposure, both Indian and non-Indian women have particular worries about herbicide safety related to their social roles as both mothers and caregivers. Incidences of birth defects impact women as mothers of children, while cancers in adult people affect women as caregivers of the elderly. Karuk women in particular raised health issues facing children, such as exposure by teething on woven baby rattles and by food served in handmade bowls:

> For me, I worry about myself, but I like to make rattles, and the first thing you do is you give it to a baby and they're going to put it in their mouth. My kids teeth on their rattles, and I think that most kids do. So, it spends a lot of time in their mouth. Then, you also have your bowls that you eat out of. So, your food sits right in there.

The added risk of exposure, due to child's small body size, was also raised as a concern: ''After I had kids, I thought about it even more, because I make them rattles, or they eat the food, and I think about how little they are and how things affect them differently than they would your average person.'' Karuk women also expressed concern for seniors in the community, including elders who themselves held an important role in carrying on culture. ''Not that I shouldn't worry about me, too, it's just that I think about their little, fragile bodies, and the elders in health states where just little things like that can really affect them.'' Finally, there is the above mentioned potential of added exposure for weavers, who are predominantly women. Weavers in particular are exposed when cleaning materials in the field, when they put materials into their mouths, and are out in the woods visiting and tending gathering sites throughout the year:

> With willow and even hazel, when you go to clean them, I put the willow stick in my mouth and I peel off the bark. So that hasn't been soaked, it hasn't been washed. Nothing has happened to it; you clip it right off the plant, put it in your mouth, and strip off the bark. With stuff when you're making

> your basket, it's been soaked probably a couple times, but when you go to clean them, it's right there. I think most of all my concern is that you're out there. You're walking through everything even if they're not targeting the plant that you're gathering. You walk through whatever plant it was that they were targeting, to get to where you're, especially on the river sites.

Racialized Exposure and Meanings of Herbicides

While there exists an extensive literature on gender and risk perception, speculating, for example, on the relative importance of gender norms versus social roles of motherhood, little sociological work addresses the basis for observed racial differences in the perception of risk. Even less work examines the basis for widespread opposition to herbicides among Native Americans. For Karuk people, the meaning of herbicide exposure must be understood within at least three different contexts. First, traditional Karuk people have additional threats of exposure based on specific cultural practices, as for the basketweavers mentioned above. Second, control over land management is an issue of cultural sovereignty. And finally, the threat of poison in the watershed is viewed by at least some as one more event in a series of acts of genocide over the past 150 years.

Probably the aspect of the Clearwater story that makes herbicides most clearly an environmental justice issue is the fact that Native people would experience additional threats of exposure as a result of subsistence and cultural practices, including gathering, tending, weaving, and eating foods from the forest. In addition to the practices affecting weavers, Karuk people eat foods from the land, including plants and animals. There are numerous stories of deer killed for meat during earlier spraying whose livers and internal organs were deformed and abnormal. The fact that a common herbicide for use in forestry in the region is not registered for use on food shows the implicit cultural assumption that people do not get their food from the forest. This was explained to me by a staff member of the California Indian Basketweaver's Association:

> Garlon,[1] this is the most frequently used chemical in the county. It has pretty long persistence … What's interesting and shocking about this chemical is that it's not registered for use

[1] Note that in Garlon is not a proposed chemical in the current Weeds Environmental Impact Statement.

> on food crops at all … and there is no drinking water safety limit either. They're spraying about 100,000 pounds of this in the County every year, and there is no drinking water safety limit. It is just totally under the radar for the Safe Drinking Water Act. The issue about it not being registered for use on food crops, when there are people getting food plants out of the forest is pretty disturbing, too. That is just one way that the traditional lifestyles aren't being taken into account when they register these chemicals.

The assumption that food and water supplies do not come from the forest, and thus that forestry herbicides need not be tested for use on foods, puts traditional Native American people at greater risk. For the Forest Service and others, such problems may seem manageable. The species weavers use (e.g., willow, hazel) are not themselves targeted for spraying. The Forest Service has made efforts to accommodate weavers, yet for many these efforts are themselves intrusive, requiring basketweavers to identify their personal gathering areas.

This leads to a second racialized dimension of the decision-making process. Above and beyond the evaluations of hazards of individual chemicals, many Karuk viewed invasive weed management in the larger context of tribal sovereignty. The physical and cultural survival of Karuk people has depended upon their relationships with the land for tens of thousands of years. These relationships have been disrupted through different processes over the course of Indian–non-Indian relations during the last century and a half. The Karuk do not have a reservation, instead the Forest Service is the legitimate land manager of most of their ancestral territory. Part of sovereignty is not having to argue over details of spray areas or provide sensitive information to a non-Indian federal agency. That is to say, ''the bottom line is, we don't want herbicides in the watershed. End of discussion.'' Shortly after the Forest Service proposed spraying of spotted knapweed, the tribe passed a resolution against the use of herbicides. This document refers to both tribal sovereignty and ecological concerns:

> WHEREAS The Karuk Tribe of California is a historic sovereign aboriginal People, that have lived on their own land since long before the European influence of white men came to this continent; … and WHEREAS the Karuk Tribe is dedicated to the preservation and ecological integrity of the Clearwater River and WHEREAS the application of pesticides/herbicides greatly threatens the fragile ecosystem of the Clearwater River watershed, THEREFORE BE IT RESOLVED; that the Tribal Council opposes application of any type of pesticides/

> herbicides by the United States Forest Service or any other agency in the Clearwater River Basin (Karuk Tribe of California, 1999).

Thus to understand the significance of the herbicide issue, it is necessary to view it as many people did, in the context of 150 years of struggle over access to and control over resources and cultural survival.

Finally, as illustrated in this letter written by a Karuk community member to Forest Service in protest of herbicide spraying in 1981, at least some Indian people experienced past herbicide spraying and high rates of miscarriages as one more event in a series of acts of genocide.

> I guess it's easy for such a large organization to ignore such a small group of people. But it is not as easy for us to ignore the Forest Service when its actions cause such terrible damage to us. There are only 800 of us left. When we lose one baby, it is the same proportion as if you lost 275,000 babies. The herbicide spraying is clearly threatening our very survival as a people. Our cultural group is already endangered enough as it is.

Furthermore, cultural practices such as the act of weaving have been threatened through direct genocide and forced assimilation over the past 150 years. And the present moment is critical. Weaving, language, and other cultural traditions that were nearly lost are being actively recovered by new generations. One weaver in her forties described how her mother was discouraged from weaving. She herself did not learn to weave until she was older:

> When I was young … the elders didn't feel it was in the young one's best interest. They were pushing us more in the direction of basically leaving our culture behind, because they went through so many struggles, really severe struggles. Both my parents were forcibly removed from their home, their parents, and taken to what's talked about as Indian school ….

The perceived threat to weavers and the cultural practice of weaving carry a heavy weight of cumulative effects to physical and cultural survival. Thus, while Forest Service employees may be frustrated with the inability to ''get to the facts'' and discuss the details of particular chemicals, for the Karuk people, what is at stake is the ability to carry out traditional relationships with the land and, hence, ensure their cultural and physical survival without fear of exposure to herbicides, without having to ask permission from a foreign government to access

sites, and without having to depend upon the risk assessments and cultural frameworks of non-Indians to determine the safety of their activities. For Forest Service employees, the question at hand in determining appropriateness of herbicides as a management tool was the numerical values of No Observable Effect Levels calculated in laboratories. The proposed use of herbicides is understood by locals in a large context. For community members and native people in particular, the questions were about who makes decisions and how, and who experiences the consequences of such decisions.

Gender, Race and Cultural Opportunities for Mobilization

Despite the fact that spotted knapweed is a Class A pest in California, as of this writing no herbicides have been used on invasive weeds in the Clearwater area. Furthermore, this resource-poor community succeeded in stopping the widespread use of aerial herbicide spraying in the 1980s. How has this politically and culturally diverse community succeeded in achieving their vision of resource management in the face of a large federal agency like the Forest Service? To completely address this would be the subject of another paper. However, it is worth noting that gender and race, the same variables that led to differences in risk perception, were themselves used to mobilize against the use of herbicides.

Narratives about unequal exposure, particularly when voiced by women and Karuk tribal members, served as mobilization techniques because they provided frames which in turn resonated with dominant cultural beliefs about equality. These provided localized examples of ''cultural opportunity structure'' (see Jenkins and Klandermans 1995; McAdam, McCarthy, and Zald 1996) that work alongside ''political opportunity structures.'' More particularly, the sharing of testimony about racialized and gendered aspects of experience provided cultural elements of opportunity structures. For example, women in the community wrote comment letters and spoke at public meetings regarding their unique concerns. Social equality between women and men has also reduced the barrier between the public and the private spheres, which has probably helped to constitute a claims structure in which stories about care work and concern for the exposure of children in the home held greater potency. One of the women whose son was born with a hole in his heart describes her involvement: ''I organized a press conference for the first time, got the press to come, and got an article written in the San Francisco Chronicle. We made our presence known to the Forest

Service regional office in San Francisco.'' In the earlier struggle against aerial spraying, midwives and female medical practitioners played key roles in disseminating information:

> Because I was doing midwifery and I was spending time with pregnant women and babies, I was really concerned that people not be drinking contaminated water. We began educational stuff in our community. People talking to each other about the effects; for me it was learning some from the Native Americans who started to have miscarriages. We became aware of that, and then I started to hear about a lot of different possible effects down river where there had been a lot of spray use. People started passing that information word of mouth in a way in the beginning.

Similarly, although the material resources of Karuk Tribe are meager when measured alongside the U.S. Forest Service, the unique experiences of Karuk tribal members formed cultural opportunity structures that facilitated work against spraying. Karuk tribal members used their legitimacy as a sovereign nation as framing in their cause. The resolution against spraying in their territory and the organizing with other Native people across the state to form the California Indian Basketweavers Association—both of which were described earlier—are examples of these efforts. In addition, tribal members worked locally to educate land managers regarding specific uses that put Indian people at particular risk. Here, a basketweaver describes spending a day with people from the state highway department and a major user of herbicide to keep highways clear in order to show him the plants they used along roadsides.

> They were doing roadside spraying, and we invited CalTrans to come up and go on a field trip with us. We would stop along the way and there would be so many plants that—I think we met at nine in the morning, and it was one by the time we got just eight miles down the road. He was really astounded by how many plants we used.

The highway department stopped using herbicides in the county shortly after this visit.

Discussion and Conclusions: Herbicides—A New Environmental Justice Issue for Rural Communities?

As trade continues to increase and more and more species move around the globe, land managers, including the Forest Service, Bureau

of Land Management, Park Service, State Parks, and private groups will face increased weed invasions. For some groups, herbicides may be a useful and welcome tool. For others, herbicide use is problematic and even represents a threat unto itself. The most visible impact of biological invasions on the Clearwater community resulted from the proposed use of herbicides to manage unwanted weeds. While there was general agreement between members of the Karuk Tribe, non-Indian community, and the Forest Service that invasive species were not welcome in the region, there were different reactions to the issue of potential herbicide use. I have described how four interconnected factors led to different perceptions of the risk of herbicide use in response to spotted knapweed.

First, the history of Forest Service herbicide spraying was a significant factor in shaping the perceptions of both Indian and non-Indian community members. Moreover, in the Clearwater region, the generalized erosion of scientific and institutional credibility carries with it the rural anti-government flavor of many western communities and is accompanied by the revitalization of and support for tribal land management.

Second, a variety of other social context factors clearly differentiated the formation of risk by both the Indian and non-Indian community from that of the Forest Service. Whereas employees of the Forest Service made decisions within an institutional context that favored the use of herbicides, many of the concerns and perspectives of community members derived from their attachment to place, historical observations of the area, and the possibility of their direct exposure. A sizeable body of research points to the importance of social and historical factors in shaping the public's sense of risk. Less attention has been given to the development of risk perceptions among scientists and land managers who also develop their understandings of risk within social and historical contexts. The present study extends the limited research in this area, providing reflections on institutional organization that may have led Forest Service employees to view herbicides as more acceptable than did members of the other two groups. Winston's (1997) observation that the belief that pesticides are necessary is related to both the beliefs that there are no alterative methods to remove pests and that the benefits of pesticide use outweigh their risks is highly useful in understanding the different orientations of groups towards herbicides in the Clearwater River. In this case, both Indian and non-Indian community members viewed weeds as a problem that should be managed, but also as an issue that could provide long term employment for the region. Furthermore, given that community residents initiated

an intensive volunteer hand-eradication effort, they clearly did not see herbicides as the only way to defeat the knapweed invasion.

Third, gender differences in the risk evaluation of community members, many of which intersected with racial differences, concerned not only the documented importance of women's social roles, but also the less studied potential for direct bodily impacts such as miscarriages. Gender did not mark a divide between those who did and did not support herbicide use. Both women and men in the Indian and non-Indian community were opposed to the use of herbicides. And many women in the Forest Service were supportive of their use. Rather, in this case, gender provided an added dimension to the meaning and experience of herbicides for both tribal and non-tribal women.

Finally, voices from the Clearwater River give insight into the understudied basis for racialized differences in risk perceptions. Here the meaning and significance of herbicide exposure for members of the Karuk Tribe extended far beyond a simple calculation of probability of exposure risk. Social context features—including institutional mistrust, history of genocide, current land management struggles, and awareness of the unique Karuk uses of the forest, as well as missing scientific information regarding these uses—all contributed to the conclusion of tribal members I spoke with that herbicides were not ''safe.'' In summary, some meanings and perceptions of risk are a function of distinct cultural uses. Other meanings and perceptions are themselves an outgrowth of the process of racial formation. In particular, the desire for autonomy and institutional mistrust are outgrowths of historical experiences of colonialism.

This case study suggests that as herbicide use increases in rural areas, there may be new kinds of community concerns and new dimensions to ongoing struggles over land management. Furthermore, because: (1) forestry workers and others at the intersection of land and land management practices are often racial minorities, (2) people of color are both politically and economically disenfranchised and perceive greater environmental risk, and (3) Indians use the land for subsistence and cultural purposes, many of these new impacts may be on people of color. Pesticide exposure already makes agriculture one of the most hazardous industries in the United States (Arcury and Quandt 1998; Quintero-Somaini and Quiridongo 2004). Like farm workers, both forestry workers and Native American people are disenfranchised and medically underserved populations. Factors including economic dependence, lack of control over work and living environments, high poverty, low wages, inadequate health insurance, inadequate access to information, and cultural barriers to political participation all

contribute to increased risk of exposure and consequences for these groups.

Given the increasing prevalence of both invasive species and their management with herbicides, this paper reflects upon the broader social implications of differences in risk perception between communities and land managers. One of the larger sociological questions this paper highlights is who within society pays the price for species invasions. The use of herbicides for the management of invasive species is increasing across the United States. Many of those who face increased exposure to herbicides used for invasive species are members of racial minorities. When groups of citizens evaluate risk differently from land managers who have decision making authority, when differences in risk result in part from relative chances of exposure, and when those who face disproportionate exposure are members of poor or racial minorities, differences in risk perception become matters of environmental justice.

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