Risk, Pollution and Sustainability in Rural Sichuan, China

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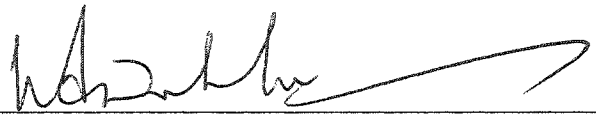

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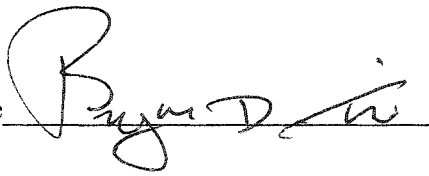
Signature 

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Abstract

Risk, Pollution and Sustainability in Rural Sichuan, China

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In this dissertation, I illustrate how people's perceptions of risk from industrial pollution in southwest China are shaped by political, social and economic factors at work within and beyond the study community. Futian Township, located in the Panzhihua municipality in southern Sichuan province, is used as a case study for exploring this topic. It is a mixed ethnic township consisting primarily of Shuitian Yi and Han residents. In contrast to previous work on the psychological dimensions of risk perception, I use a political ecology framework to analyze how the environmental risks associated with industrial pollution were produced through political and economic processes, and how community members understand and cope with the pollution problem. The dissertation is based primarily on data gathered during fieldwork in 2002-2003. I used a variety of research methods, including ethnographic participant-observation, in-depth interviews, quantitative survey questionnaires, and scientific air quality monitoring.

The results indicate that, although community members are all exposed to levels of air pollution (PM_{10}) that far exceed standards set by the Chinese government, their perceptions of the local pollution problem are varied. In general, most community members perceive a significant threat to their health and livelihoods from industrial pollution, and this finding stands in contrast to the inherited wisdom in risk studies that poor individuals and communities tend to worry less about environmental risk. In addition, individual perceptions of local pollution are linked to one's position within the local political economy. This is in part because of structural and economic reforms in China's rural industrial sector that encourage privatization of local factories, and also because of the particularly deleterious consequences of industrial pollution for the community's agricultural households.

The dissertation also documents the forced closure of local factories by officials from the State Environmental Protection Agency for failure to comply with emissions standards. This event, and its economic consequences, illustrates how state actors at different levels of the government bureaucracy understand and act upon key concepts such as "pollution" and "sustainable development."

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GLOSSARY OF CHINESE TERMS

Bai Zu	白族	(n.) The Bai minority nationality
Caizhengju	财政局	(n.) Bureau of Finance
Changjiang	长江	(n.) Yangtze River
Changshou	长寿	(n., v.) Longevity; to live a long life
Chifan Caizheng	吃饭彩证	(n.) "Meal ticket"; colloquial expression for something that provides sustenance or brings in income
Cun	村	(n.) Village
Cunban	村办	(adj.) Operated by village (eg. a factory operated by a village)
Dai Zu	傣族	(n.) The Dai minority nationality
Dangdiren	当地人	(n.) A person who hails from a certain locality; a local
Danwei	单位	(n.) Work unit
Daoli	道理	(n.) Rationality; reason
Datong	大同	(n.) A period of "great equality" among people as described in the *Book of Rites*
Daxing	大兴（乡）	(n.) Daxing Township
Di	地	(n.) Land; especially dry land as compared to irrigated rice paddy.
Dongbei Fangyan	东北方言	(n.) The dialect of Mandarin spoken in the northeastern region of China
Dukou	渡口（市）	(n.) The place name for Panzhihua prior to 1987
Ertan Shuidianzhan	二滩水电站	(n.) Ertan Hydroelectric Dam; Prior to the

		completion of the Three Gorges Dam, the largest dam in China at 240 meters tall
Eryang Hualiu	二氧化硫	(n.) Sulfur dioxide (SO_2)
Fantai Zhige	钒钛之歌	(n.) "The Song of Vanadium and Titanium"
Fazhan	发展	(n./v.) Development; to develop
Futian	福田（镇）	(n.) Futian Township
Futian Yangshi	福田样式	(n.) The Futian model of development, which uses minority nationality township status to attract outside investment
Gaige Kaifang	改革开放	(n.) Great Reform and Opening; a series of economic policies begun under Deng Xiaoping
Geti	个体	(n./adj.) Entrepreneur; entrepreneurial
Guanli Fei	管理费	(n.) Management fee
Guantian Cun	官田村	(n.) Guantian Village; one of four villages in Futian Township
Guanxi	关系	(n.) Social network; connections; a network of reciprocal relationships
Hanhua	汉化	(v.) To become assimilated into Han cultural practices and identity; to become "Hanified"
Hongdi	红地	(n.) Red earth
Huangshan	黄山	(n.) Arid hillsides unsuitable for cultivation
Huanjing Baohu (Huanbao)	环境保护（环保）	(n.) Environmental protection
Huaping	华平（县）	(n.) Huaping county
Hukou Zhidu	户口制度	(n.) Household registration system

Jiaotanchang	焦炭厂	(n.) Coking plant
Jiefang	解放	(n./v.) Liberation; to liberate
Jinchang Bujin Cheng	进厂不进城	"Enter the factory, not the city" (colloquial expression)
Jingui Cun	金鬼 村	(n.) Jingui Village; one of four villages in Futian Township
Jinjiang	金江	(n.) A town located within Panzhihua municipality
Jinsha Jiang	金沙江	(n.) Name for the Yangtze River between Batang and Yibin
Jinwan Shifen	今晚十分	(n.) "Ten Minutes Tonight" television program on Sichuan Provincial Television
Jinxin Chang	进锌厂	(n.) Primary Zinc smelter
Kaifa Qu	开发区	(n.) "Open district"; a designated geographical area promoting industrial development through private investment
Kaohe Zhibiao	考核指标	(n.) Cadre performance evaluation
Kechixu Fazhan	可持续发展	(n.) Sustainable development
Kexiru Keliwu	可吸入科理物	(n.) Inhalable particulate matter (PM_{10})
Laobaixing	老百姓	(n.) The common people; literally "old hundred names"
Lianhe	联合	(n./adj.) Cooperative; joint (e.g. a joint enterprise between governmental and private interests)
Liji	礼记	(n.) The *Book of Rites*
Litu Buli Xiang	离土不离乡	"Leave the land, not the countryside" (colloquial expression)
Luohou	落后	(adj.) Backward; under-developed
Luohou Qiye	落后企业	(n.) A backward factory; a factory lacking

		advanced technology
Meitan	煤炭	(n.) Coal
Miao Zu	苗族	(n.) The Miao minority nationality
Minwei (Minzu Shiwu Weiyuanhui)	民委（民族事务委员会）	(n.) Nationalities Affairs Commission
Minzu	民族	(n./adj.) Ethnicity; ethnic minority nationality
Minzu Shibie	民族识别	(n.) The ethnic identification project undertaken by the Chinese government in the 1950s to catalog all minority nationalities within China's borders.
Minzu Wenti	民族问题	(n.) The minority nationalities question; the problem of promoting development in areas with large minority populations
Minzu Xiang	民族乡	(n.) Minority nationality township
Mu	亩	(n.) Unit for measuring land area; equal to about 0.066 hectares or 0.165 acres.
Naxi Zu	纳西族	(n.) The Naxi minority nationality
Nisu Zu	傈僳族	(n.) The Nisu minority nationality
Panzhihua	攀枝花（市）	(n.) The city of Panzhihua
Panzhihua Gangtie (Pangang)	攀枝花钢铁（攀钢）	(n.) Panzhihua Iron and Steel Company, a state-owned enterprise
Pinkun	贫困	(adj.) Poor; impoverished
Qianxian	前线	(n.) The frontline (e.g. of a war)
Qingnian Dui	青年队	(n.) Youth corps
Qiye	企业	(n.) Enterprise; industry
Qu	区	(n.) District; an administrative unit of government equivalent to a county

Renhe Qu	仁和区	(n.) Renhe District, a sub-unit of Panzhihua Municipality
Renmin Daibiao Dahui	人民代表大会	(n.) People's Congress
Renminbi	人民币	(n.) Monetary unit in the People's Republic of China
Renti	人体	(n.) The human body
Shaoshu Minzu	少数民族	(n.) Minority nationality; ethnic minority
Shengchan Dui	生产队	(n.) Production team
Shengtai Huanjing	生态环境	(n.) Ecological environment; the biophysical environment
Shi	市	(n.) Municipality
Shilongba	石龙坝（乡）	(n.) Shilongba Township
Shuitian	水田	(n.) The Shuitian ethnicity; the largest minority ethnic group in Futian, officially classified as a branch of the Yi minority nationality.
Sichuanhua	四川话	(n.) The Sichuan dialect of Mandarin Chinese
Tangba Cun	塘坝村	(n.) Tangba Village; one of four villages in Futian Township
Tian	田	(n.) Rice paddy; irrigated fields
Waidiren	外地人	(n.) Outsider
Weirenmin Fuwu	为人民服务	"Serve the people" (slogan coined by Mao Zedong)
Weirenminbi Fuwu	为人民币服务	"Serve the people's money" (colloquial expression)
Wenbao	温饱	(n.) The basic needs of food and shelter; literally "warmth and fullness"

Wenhua Suzhi	文化素质	(n.) Cultural quality; educational level
Wuzitian Cun	务子田村	(n.) Wuzitian Village; one of four villages in Futian Township
Xiang	乡	(n.) Rural township
Xiangban	乡办	(adj.) Township-operated (e.g. a factory operated by a township)
Xiangzhen Qiye / Xiangcun Qiye	乡镇企业 / 乡村企业	(n.) Township and village enterprise
Xiaokang	小康	(n.) "Small comfort"; a standard of living, defined in the *Book of Rites* in contrast to "Great Equality," in which basic needs are met and small luxuries are attainable.
Ximeichang	洗煤厂	(n.) Coal washing plant
Yanbian	盐边(县)	(n.) Yanbian county; one of three administrative units in Panzhihua Municipality
Yeman	野蛮	(n.) Barbarian
Yi	彝族	(n.) The Yi minority nationality; an ethnic group comprised of various Tibeto-Burman speaking groups in Southwest China.
Yiliang weigang	一粮为刚	(n.) "Taking grain as the key link"; a national policy of promoting agricultural yields to mitigate the effects of famine after the Great Leap Forward in the 1960s
Yimin Cheng	移民城	(n.) Immigration city; a city comprised of resident immigrants
Yingxiang	影响	(n./v.) Influence; to effect, influence
You Hai	有害	(adj.) Harmful
Yuan	元	(n.) Monetary unit in the People's Republic of China

Zhanlüe	战略	(n.) Strategy
Zhen	镇	(n.) Urban township
Zhuang Zu	壮族	(n.) The Zhuang minority nationality

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I would first like to acknowledge the members of my faculty supervisory committee, whose inspiration, advice and critique made this dissertation better than it could otherwise be. Professor Stevan Harrell, in particular, read draft after draft with the kind of boundless energy for which he is known. In addition, his reputation among scholars and government officials in Sichuan opened many of the doors that made the research for this project possible. Professor Bettina Shell-Duncan, in addition to serving as a reader of this dissertation, provided valuable advice in formulating the research proposal, crafting survey questionnaires, and conducting statistical analyses. Professor K. Sivaramakrishnan lent a critical eye to the theoretical argument I make in this dissertation, suggesting additional readings and avenues for exploration. Professor Susan Whiting brought to this project her broad understanding of the political and economic role played by rural industry in the Chinese system. Professor Clark Sorensen provided support and mentorship early in my graduate studies and served as a sounding board as my ideas and research interests became focused. Finally, Professor Lee-Jane Sally Liu taught an anthropologist how to conduct air quality monitoring, lending me enough scientific equipment and laboratory analysis to virtually double the budget of my research grant. David Hardie and Tim Gould, both research scientists in Professor Liu's laboratory, also provided sound advice on monitoring techniques and conducted much of the analysis of the air quality data.

I would also like to acknowledge the financial support that made this dissertation possible. Funding for an early pilot research project, which I conducted in 2001 in the Chinese provinces of Heilongjiang and Sichuan, was provided by the Department of Anthropology at the University of Washington. A National Science Foundation Dissertation Improvement Grant (NSF-DIG 0210178), jointly funded by the Division of Cultural Anthropology and the International Division, supported the field research upon which this dissertation is largely based. Much of the time spent writing and doing archival research for this dissertation was supported by a Foreign Language Area Studies fellowship from the East Asia Center at the University of Washington.

My work has also benefited tremendously from the intellectual synergism created by the strong institutional relationship between the University of Washington and Sichuan University. Philip Chi, Harvard Wang, Marie Tsiang and Luc Uyen Nguyen, all undergraduate students from the University of Washington who participated in an exchange program with Sichuan University in 2002-2003, came to Futian for a brief period in the spring of 2003 to help administer a quantitative survey questionnaire to local residents. Their presence meant that I could cover far more ground than I could as a single researcher, and their hard work and tenacity was truly commendable. In addition, Thomas Worker-Braddock, who also participated in the undergraduate exchange program, and Jenna Tilt lent their knowledge of Geographic Information Systems to the creation of the maps used in this dissertation.

In addition to the financial support for my research, I could not have completed this project without the personal support of friends and family. I owe the deepest debt of gratitude to my wife, Jenna Tilt, who traveled to China twice with me to conduct

fieldwork and who bore, for extended periods of time, living conditions that were nothing short of trying. I also acknowledge the constant support of my parents and of my German-born grandfather, H.A. Seiter, whose dictum "stay in school and learn all you can" undoubtedly inspired me to undertake graduate school in the first place.

Any serious research project is by necessity a collaborative effort; in China, where foreign researchers are confronted with myriad bureaucratic obstacles, this is doubly true. I owe a particular debt of gratitude to the many Chinese scholars, colleagues, government officials and friends who saw the value in this project and helped me see it to fruition. Professor Li Xingxing of the Sichuan Provincial Institute for Ethnic Minority Studies accompanied me in 2001 on my first visit to Futian, the site that became the focus of my dissertation research. Possessed of a keen knowledge of the diverse ethnic minorities of southwest China, he served simultaneously as a skillful ethnographer, translator and liaison with local government officials. While I conducted extended fieldwork in 2002-2003, my visa was sponsored by the Office of Foreign Affairs at Sichuan University in Chengdu. Professors Yan Shijing and Chen Bing helped smooth the way for me not only to come to Sichuan as a visiting scholar but also to reside locally in Futian and conduct proper anthropological fieldwork, an endeavor they thought somewhat strange. Professor Zhu Fangming and Mr. Xiao Peichu of the Economics Department at Sichuan University lent their expert knowledge of rural industry to the project. Mr. Xiao Peichu also spent some time in Futian with me during fieldwork, building in-roads with local government officials and helping to translate my survey questionnaire into Chinese. A major part of the burden of translation was borne by Mrs. Ren Ying of the English Literature Department at Sichuan University, whose expertise helped me to create a survey that was both sophisticated and understandable to the local population in Futian.

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DEDICATION

For Jenna

INTRODUCTION

The goal of this dissertation is to examine the perception of risk from industrial pollution in rural China's township and village enterprise sector by looking in depth at Futian Township, located in southern Sichuan province. There are two things that need to be explained at the outset. The first is the incredible transformation that has taken place in rural China during the past two decades of economic reform. Although rural industrialization occurred in many areas as early as the 1950s in what were then called commune and brigade factories, true growth in this sector began in earnest with the economic liberalization policies of the 1980s. Economic planners, faced with a surplus of agricultural labor as well as insufficient urban resources, encouraged peasants in the 1980s to "leave the land but not the countryside." In other words, peasants were encouraged to remain in rural areas but to put down their tills and work instead for township and village enterprises (*xiangzhen qiye*, or TVEs), and a set of structural incentives were put in place to help TVEs grow and flourish. This represented a qualitative change in the economic structure of the Chinese countryside in which many agrarian areas were remade into mixed agricultural and industrial spaces.

Township and village enterprises have been both highly profitable and heavily polluting. Most TVEs are owned either by rural governments or by private investors; in remote locations, both of these entities tend to lack the capital necessary to invest in environmental mitigation technologies. Coal is almost universally the fuel of choice for most TVEs, which leads to high levels of particulate matter, sulfur dioxide, nitrogen dioxide and other pollutants. In addition, because of their vast numbers (currently some

20 million) and their geographic dispersal throughout the Chinese countryside, township and village enterprises are notoriously difficult to monitor. Although the Chinese government, through the State Environmental Protection Administration (SEPA), maintains an active program of monitoring emissions from TVEs, the sheer scale of the problem makes any real monitoring and enforcement impractical. Finally, rural governments often benefit tremendously from local industrial activity; as a result, local cadres are often tempted to look the other way when it comes to policing local pollution.

As a result of the rapid development of township and village enterprises, air and water quality in many rural areas in China is poor. Residents of rural industrial communities are faced with a dichotomy. On the one hand, rural incomes and standards of living have risen dramatically in recent years, and much of this rise can be attributed to the growth of rural industry. On the other hand, industrial pollution undermines agricultural systems and threatens the health of rural residents; respiratory ailments such as bronchitis and emphysema are now the second leading cause of death in both urban and rural China.

The second thing that requires some explanation is what exactly I mean when I say the goal of this study was to examine the perception of risk from industrial pollution. The study of risk perception began in the 1970s when researchers realized that people's assessment of various risky activities, behaviors and events—such as nuclear power, smoking, and pollution—often differed sharply from both expert assessment and actuarial data about these activities, behaviors and events. The question was: Why? Over the years, scholars studying risk perception, many of whom had backgrounds in psychology, have viewed the field as a window into human cognition. Their goal was to use the perception

of risk to study the universal patterns behind human perception and to understand how the characteristics of risk events themselves shaped these perceptions.

As I outline more thoroughly in subsequent chapters of this dissertation, I became interested in risk perception not as indicative of cognition but as a marker of the kinds of social, economic and political changes that people experience in their lives. The approach I take here in studying risk perception is one that seeks to understand the phenomenon not as the bounded, internal product of cognition but as something that tells us about social relations. It is an approach that has been fundamentally shaped by earlier anthropological work on risk, which, as Mary Douglas has noted, dismisses the idea that risk is the simple product of individual cognition in favor of the more nuanced, if messier, view that risk is communal property shaped by politics, economics and culture:

> Though they [risk analysts and academics] recognize that the grime and heat of politics are involved in the subject of risk, they sedulously bracket them off. Their professional objective is to get at the real essence of risk perception before it is polluted by interests and ideology. . . The risk analysts have a good reason for seeking objectivity. Like all professionals, rightly and properly, they do not wish to be politically biased: this is important for their clientele. To avoid the charge of bias, they exclude the whole subject of politics and morals. To see them studying risk-taking and risk-aversion in some imaginary pure state is disappointing to anyone who has been attracted to the dirty side of the subject. (Douglas 1992: 11)

The political nature of risks cannot be ignored, for two reasons. First, the fact that risks are brought into being through particular kinds of social and economic organization in human life means that ignoring this political process avoids a serious treatment of the creation of risks themselves and that any plan to mitigate the effects of environmental risks is likely to fail. The risks engendered by polluting smokestacks and nuclear power

stations did not come into being by themselves; they were built by people to serve specific economic and social functions.

Second, ignoring the political nature of risks leaves a gaping hole in the understanding of how risks are perceived by the public. Because risks are ontologically created through social, political and economic processes, the epistemological perception of risk is also contingent upon these same processes. In order to examine these processes and their effect upon risk perception, I bring the analytical tool of political ecology to bear on this dissertation. In particular, I borrow from political ecology the insistence that environmental problems are grounded in social relations; that environmental conflicts are in part struggles about meaning and the power to define; and that environmental issues played out at the local level must also include an analysis of higher levels of government implicated in the creation of policy and the dissemination of discourse.

I chose to study the perception of risk in Futian, a small township in southern Sichuan province under the jurisdiction of Panzhihua Municipality (see Figure 1). When I expressed interest in studying the economic and environmental effects of township and village enterprises, Futian was recommended to me as an ideal site by several people. The first was Stevan Harrell, who had conducted fieldwork in the nearby township of Zhuangshang in 1988 and 1994, and who felt that the area's Shuitian Yi minority identity, which had served to attract government investment in TVEs, would prove an interesting angle of research. The second was Li Xingxing, an anthropologist at the Sichuan Provincial Institute for Ethnic Minority Studies, who had visited Futian numerous times during the past twenty years while conducting research on the ethnic minority populations of southwest China. It was with Li that I first visited Futian, in

2001, to conduct a pilot study project on the role of township and village enterprises in local development. When I returned, in the fall of 2002, to conduct the more extensive fieldwork on which this dissertation is primarily based, it was under the auspices of Sichuan University's Department of Economics.

Futian is located at the Western edge of Panzhihua Municipality, an area of southern Sichuan province annexed as a Third Front industrial site in 1965 (see Figures 2 and 3). This region of Sichuan borders the Qinghai-Tibet Plateau, and has a semi-arid climate with summer monsoons. Many of the great rivers of China have their headwaters in these highlands; Futian is situated along a small stream which feeds into the Jinsha River, one of the primary tributaries of the Yangtze. The terraced river valleys support rice, winter wheat, and an abundance of other crops, but the surrounding steep hillsides are dry, covered in chaparral, Yunnan pine and eucalyptus. Most of Futian's 3,500 residents, some 53.2%, are of the Shuitian Yi ethnicity, a group of people who traditionally spoke the Western dialect of the Yi language, part of the Tibeto-Burman sub-family of languages.

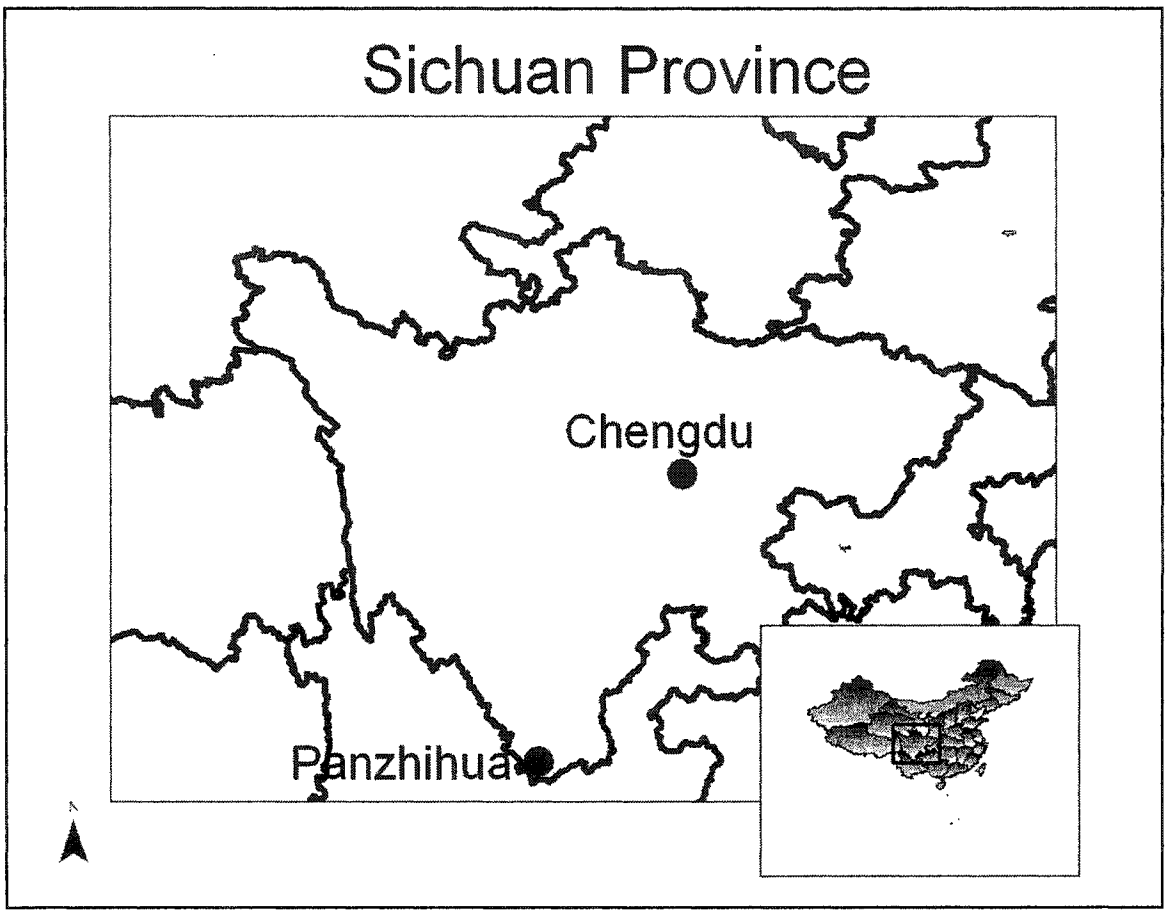

Figure 1. Map of Sichuan Province

Figure 2. Map of Panzhihua Municipality

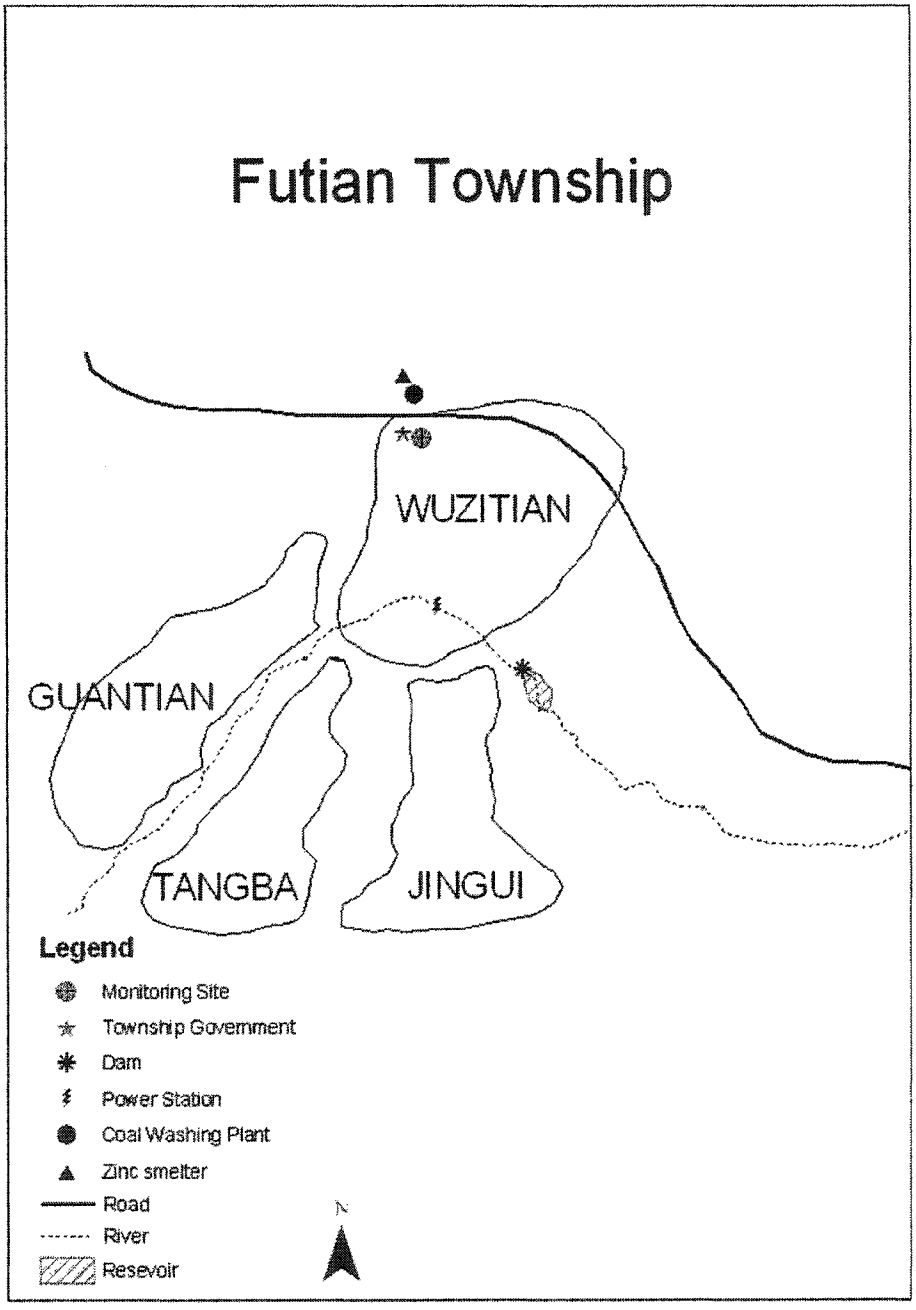

Figure 3. Map of Futian Township

Futian township and, for that matter, Sichuan province, are by no means renowned for their rural industries. To be sure, there are coastal provinces such as Jiangsu whose township and village enterprises have been highly successful, not to mention thoroughly scrutinized by academicians. But Futian is an intriguing place to test the hypotheses of environmental risk perception, given its role in the regional economy, the ownership structure and history of its industries, the marked contrast between long-term residents and newly arrived investors and workers, and the dynamics of its ethnic relations.

The nature of its TVE ownership structure, which is marked by a sharp division between long-term residents and newly arrived investors and industrial laborers, makes Futian an interesting case study. Over the past several years, all of the township's industries have been privatized, resulting in a scenario in which the benefits of industrialization are garnered by a few privileged outsiders and the pollution is shared by all. As will be shown in later chapters of this dissertation, villagers are forced to cope with the privatization of industry and the funneling of industrial profits away from the local community. At the same time, the health effects of local industrial pollution, the allocation of scarce water for hydroelectric power to fuel the factories, the damaging of crops and stock animals—all of these costs are encountered every day by most villagers.

The configuration of ethnic relations in Futian adds another interesting dimension to the study. It is here, on the ethnic peripheries of China, that the problems of development are most acute and the importance of industrial success most clear. Futian has been heralded as a paragon of the ethnic minority development paradigm, using its status as an ethnic minority township to leverage government investment in industry and

using industrial profits for community development (Li Xing Xing 1995: 237-266). The development imperative is as strong here as anywhere in China, and for the past two decades Futian has been reaping the benefits of industrial development in the form of government revenues, road construction, and improved schools and community facilities. the negative consequences of unfettered development are becoming acute.

Finally, there were practical considerations at work in the selection of Futian Township as a study site. The community has been fairly well visited by anthropologists from China (Li Xingxing and Li Shaoming of the Sichuan Provincial Institute for Ethnic Minority Studies), and from the United States (Stevan Harrell from the University of Washington). Relations are well established between these institutions and the Panzhihua Bureau of Ethnic Minority Affairs, whose approval was required to conduct this study. When I conducted a pilot study in 2001 on the economic and environmental impacts of township and village enterprises, comparing Futian to possible field sites in the northeast province of Heilongjiang, Futian seemed to hold the most promise for the completion of the study with minimal bureaucratic interference.

Methodological Approach

Chapter Five contains a detailed explanation of the specific methodological approach I took in the study of risk perception from industrial pollution in Futian. I will discuss here in brief, however, some of the practical and theoretical questions that drove my choice of research methods. The central problem I encountered during the course of this study was the methodological disconnect between the two theoretical bodies I sought

to link: political ecology and risk perception. The hallmark of political ecological research is an actor-oriented approach that takes into account the views of local stakeholders, an approach that entails intensive fieldwork. It is by nature an approach well suited to anthropologists trained in the ethnographic method. By contrast, the risk perception literature is replete with survey questionnaires and other forms of standardized quantitative analyses. It was my task to combine the two approaches in a cogent manner, and I have found them both well suited to understanding risk. Nevertheless, a combined methodological approach has its drawbacks. I was constantly being accused, mostly by fellow anthropologists skeptical of quantitative methods, of being decidedly unanthropological in my approach to this research project. My reliance on the ethnographic method in constructing a locally relevant definition of environmental risk, meanwhile, may seem unorthodox to those in the field of risk assessment.

The most fundamental research method I employed in the field was, in the words of Clifford Geertz, "being there"—participating in the daily lives of the people of Futian. No matter what else an anthropologist does (and this study entailed a variety of methods), ethnography and participant observation are still the cornerstones of anthropological research. This is vital for every stage of the research process, from gaining entrance to the research community, to collecting data, to interpreting the results of a completed research project.

After a brief period of pilot field research in 2001, I returned to reside in Futian along with my wife, Jenna, from November of 2002 to May of 2003. I found it extremely valuable to be present in the community and to live side by side with the people I sought to study; no other single methodological tool was more useful in gaining entrance to the

politically sensitive world of local industrial pollution. As H. Russell Bernard has reflected, the act of participant observation serves as a way of gaining visibility and trust in the study community:

> Participant observation involves establishing rapport in a new community; learning to act so that people go about their business as usual when you show up; and removing yourself every day from cultural immersion so you can intellectualize what you've learned, put it into perspective, and write about it convincingly (Bernard 1995: 137).

Furthermore, using the ethnographic method dictates what kind of data to which one will have access. As Emerson et al. (Emerson, et al. 1995: 11) rightly point out, "substance cannot be considered independently of method"—that is, the position of the researcher is a fundamental part of the data collected. This was particularly true for me as I tried to understand and interpret local events in the lives of Futian's residents, all within a cultural and linguistic context that stretched my abilities as a researcher. Whether I liked it or not, I was the research instrument; any data that went into my fieldnotes, or even into the in-depth interviews or quantitative survey questionnaire, was only as valid as my ability to understand and interpret it within the local context.

Finally, the ethnographic method provided a way for me to constantly test and improve the validity of the other types of data I collected (Bernard 1995: 136-164). The questions I used in interviews and survey questionnaires were formulated based on ethnographic observations, and participants' responses were later interpreted in light of what I had learned by being a participant observer. I view this as a major contribution of this dissertation to the study of risk perception, and it is a contribution unique to the methodological approach of ethnography. As Chapter Five describes in detail, risk

perception studies most often consist of quantitative measurements of the magnitude of perceived risk from a given event or activity. A major theme in the literature on risk assessment is known as "risk characterization." This is the process whereby scientific experts, after assessing the magnitude or probability of a given risk, convey, or "characterize," that information to the general public with a view toward minimizing public exposure to the risk at hand:

> The aim of risk characterization, and therefore of the analytic-deliberative process on which it is based is to describe a potentially hazardous situation in as accurate, thorough, and decision-relevant a manner as possible . . . and to make this information understandable and accessible to public officials and to the parties (Stern and Fineberg 1996).

The methodological approach I have taken in this dissertation is essentially the opposite. I set out with the assumption, drawn from political ecology, that intra-community differences in resource access and other social factors would influence individuals' perceptions of risk. My goal was to understand these risk perceptions *on their own terms*.

As an anthropologist I was troubled by how many studies of risk perception lacked a clear understanding of the local cultural context. I made an effort to allow ethnography to inform the standardized survey questionnaire by letting the study participants define risk rather than drawing upon set definitions from the literature. I did this by using an open-ended ethnographic interview format that was standardized but flexible (see Appendix A). The interview was designed to collect basic demographic information such as age, sex, family structure, and so forth, as well as to prompt participants to define key concepts such as "quality of life," "pollution," and

"development" that would later be used in a quantitative survey questionnaire designed to assess risk perception related to local industrial pollution. More than 50 people participated in the ethnographic interview process. Each informant was asked, for example, "What does the term 'environmental pollution' mean to you?" A follow-up question asked participants whether environmental pollution was harmful, and if so, how.

For each question involving the definition of key terms, the informant typically had a list of three or four items that he or she considered important elements of "pollution," or some other term. I then asked the participant to rank these elements in terms of importance or, in the case of pollution, severity. I ended up with a huge list of what constituted risk from industrial pollution for the local residents of Futian. These were later distilled into categories and used to create ranked questions for a standardized survey questionnaire.

The survey questionnaire I used consisted of 50 questions on basic demographics and household structure, work schedule, consumption patterns, quality of life, and risk perception pertaining to local industrial pollution (see Appendix B). The goal was to obtain a statistical measure of individual perceptions of risk from local industrial pollution and to determine through statistical analysis whether this perception was related to the social, economic and political factors outlined in my hypotheses, which are explained in detail later in this chapter. Of some 700 households in Futian, my research assistants and I administered the survey to 122 individuals, each representing a different household. I personally administered the survey to 76 individuals; the other 46 were administered by undergraduate research assistants from the University of Washington, under my supervision. Most informants read and completed the questionnaire themselves.

On occasion, when circumstances warranted (many older residents in Futian are either illiterate or lacked the proficiency necessary to fill out the questionnaire), I read the questions to informants and filled in the questionnaire form myself.

The section on risk perception consisted of a "risk perception index" (RPI) of seven questions, the content of which was culled from in-depth interviews by selecting the seven "risk themes" that appeared with the highest frequencies. As I describe later in the dissertation, this method of creating an ethnographically informed measure of risk perception has several advantages. First, because the constructs underlying risk were allowed to emerge during ethnographic interviews, I could be more certain that I captured as complete a picture as possible of what exactly constituted risk from industrial pollution for people in the community, rather than introducing my own biases regarding how risk should be defined. Second, the ethnographic interviews provided a rich qualitative context within which these definitions could be interpreted. Finally, the ethnographically informed "risk perception index" had very high reliability in statistical tests.

A Note on Language, Trust and Positionality

Although it has gotten easier for foreign researchers to work in the People's Republic of China as economic reforms have progressed and as China's ties with the international community have deepened, it is still by no means a simple task. One of the main barriers to conducting research in China is language. I was not charged with learning any of the Shuitian Yi dialect, since very few people speak it anymore, although a few of the older residents taught me some basic expressions. My main problem was

with the Sichuan dialect of Mandarin, what locals call *Sichuanhua.* Speakers of *Sichuanhua* frequently use a lexicon not offered in the standard Mandarin textbook and impossible to learn by any other means than immersion. Furthermore, even though the grammar of *Sichuanhua* is not appreciably different from standard Mandarin, consonants often morph spontaneously during conversation and vowels often change into diphthongs. (A speaker of *Sichuanhua*, for example, when waiting for a car, is waiting not for a *che*, as in standard Mandarin, but for a *chei*.) Although I speak Mandarin Chinese with a modicum of fluency, the Sichuan dialect was something that required constant effort, and this problem certainly impeded at times my efforts to understand and be understood.[1]

One's position as a researcher in the local community is perhaps an even thornier problem. To plop oneself down in rural China, a foreigner to boot, and begin asking questions about the pollution of township and village enterprises, is an audacious thing to do. Rural communities can be quite closed-lipped, even on the most benign of subjects. When the topic of research is one that could potentially threaten their livelihoods, they can be positively icy. Hammersley and Atkinson (1995: 72) are among the many

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[1] I'm reminded of my first visit to Futian, in 2001, when I interviewed local residents using a standardized interview protocol. Local residents, most of whom were familiar with listening to standard Mandarin on the radio and on television, could relatively easily understand my speech, which was freshly minted from an intensive language program in the northeastern city of Harbin. But I could understand precious little of their responses; I had to turn, with a shrug, to my companion, the anthropologist Li Xingxing, who handily translated *Sichuanhua* into standard Mandarin for me. It was only after many months in Futian that I became comfortable speaking and understanding the local dialect.

researchers who have noted the delicate balance between total honesty with research subjects and the danger of biasing research results or being denied access to certain types of data:

> What is at issue here . . . is not just whether permission to carry out the research is requested, and from whom, but also what those concerned are told about it. Some commentators recommend that an explicit research bargain, spelling out in full the purposes of the research and the procedures to be employed, be made with all those involved, right from the start. Often, though, this is neither possible nor desirable.

Simply put, does one acknowledge upfront an interest in the pollution from local factories and thereby run the risk of encouraging study participants to tell you what you want to hear, or does one take a route of less than full disclosure? I found that the ethnographic method of research provided a *de facto* way of getting around this question. By sheer presence in the community, one begins to gain access to a cultural system that might otherwise be impenetrable. In my case, this was true both of the local residents, who were my research "subjects," and of the cadres in the local government, who, I suspect, simply got tired of seeing me around, decided I was harmless, and allowed me to do almost whatever I wanted.

I did not take that kind of trust lightly, however. I did not record any of the identities of the people who participated in interviews or survey questionnaires. For one thing, I had committed to the University of Washington's Institutional Review Board that I would not do so, and, for another, I found that it loosened the tongues of the people who participated in the study to know that their responses were anonymous. In addition, I allowed local government officials to review (and in a few cases change) my interview

and survey questionnaire protocols prior to recruiting any research participants. Although this compromised at times my ability to direct the research in the way that I wanted, it established a relationship of trust with local government officials that was crucial to completing this project.

Another issue that I found particularly troublesome was that local residents often pegged me as someone aligned either with local industry or with the Environmental Protection Bureau. On any given day, I might be interviewing environmental monitoring officials from the Renhe District Environmental Protection Bureau in the morning and meeting with industrial laborers and managers in the afternoon. As a result, community residents in Futian were constantly trying to figure out what my motivations were, and to write me off as either an advocate for environmental protection, on the one hand, or as a supporter of local industry on the other. On one unlucky occasion, I even had to refuse a ride to Futian's industrial complex in the Environmental Protection Bureau's jeep, opting instead for a three-kilometer hike, in order not to be seen arriving at the local factories in the company of regulatory officials.

Dissertation Overview

This dissertation is divided into eight chapters. Chapter One provides an analytical framework for the dissertation by outlining key theories in risk perception research. I describe current trends in the study of risk perception, focusing primarily upon work on the perception of risk from pollution. In addition, I outline some of the contemporary scholarship in the inter-disciplinary field of political ecology and discuss

how it has influenced the approach I have taken in this dissertation. By viewing the problem of risk perception through the lens of political ecology, I am able to analyze the ways in which political and economic factors within and beyond the study community have produced the current problem of industrial pollution. I conclude Chapter One with a discussion of how integrating political ecology theory into the field of risk perception studies may serve as a powerful tool for analyzing the particular sociopolitical mechanisms that shape risk perception.

In Chapter Two, I describe the structural factors that led to the rise of China's rural industrial sector, highlighting both the Maoist and reform periods. Some 20 million township and village enterprises currently employ in excess of 130 million people throughout rural China, contributing to a remaking of the countryside as an industrial space. Reform-era ideology holds up the rural industrial sector as an example of "development from below," pointing to the rather spontaneous increase in TVEs during the 1980s. But key state policies—including migration controls, tax incentives, and cadre evaluation systems—also played a role in promoting and sustaining rural industry. I also describe in this chapter the pollution problems associated with rural industry, and some of the structural, financial and bureaucratic impediments to pollution control within the rural industrial sector.

Chapter Three describes Futian as a study site, giving particular attention to the growth of the township's factories and the role they have played in the township's development trajectory. Futian was annexed by Panzhihua municipality in the 1960s, and its rural factories have grown up in the shadow of the Panzhihua Iron and Steel Company, China's third-largest state-owned smelter. Futian itself is home to a predominantly

Shuitian Yi population, one of China's 55 official minority nationality groups, and the strategic use of ethnic identity has figured prominently in the township's development practices. I also describe in this chapter the three factories that were in operation during my period of field research, including a zinc smelter, a coking plant, and a coal washing plant—all of which burn raw coal as a primary energy source and employ minimal environmental mitigation technologies. To one degree or another, each of these factories, all of which had their start under the collective ownership of the township government, has undergone the process of privatization common throughout China's rural industrial sector during the reform era. The process of privatization, along with other sociopolitical factors, is an important part of way local residents frame the issue of risk from industrial pollution.

Chapter Four presents the results of a scientific assessment of ambient particulate matter in Futian conducted as part of my fieldwork. In keeping with my assertion that risk is both materially real and epistemologically constructed, I use air quality measurements to provide a baseline for understanding the kinds of risks to human health and ecosystem integrity posed by local factories. While detailed emissions data is available for most large cities in China, rural areas undergo very little systematic air quality monitoring, despite the fact that rural industry now produces some 60% of nation-wide pollutants such as sulfur dioxide. By monitoring the ambient concentrations of particulate matter, sulfur dioxide and nitrogen dioxide, and correlating these with factory activity, I assess from a scientific standpoint some of the ecological and health risks faced by local residents.

The perception of risk, however, is not reducible to the material dangers presented by air and water pollution. Chapter Five presents the results of a survey questionnaire conducted in Futian regarding local residents' perceptions of industrial pollution from local factories. The questionnaire was developed after extensive fieldwork during which informants were asked to describe and characterize the particular risks related to industrial pollution *as they saw them*. The result is a locally relevant variable called the "risk perception index" and a statistical model which measures intra-community differences in risk perception based on the index. The model is designed to test several hypotheses about the perception of risk from industrial pollution in Futian:

1) Poor communities, despite the need for economic development, nevertheless perceive risk associated with industrial development;
2) Economic stake in TVE success is a predictor of individuals' perceptions of environmental risk; that is, community members who stand to gain more from the economic success of the TVEs will perceive a lower degree of environmental risk;
3) Other factors such as health status, ethnicity, education, and length of tenure in the local community serve as mediators that affect risk perception. I make the following predictions:

    a. Community members with poor health status will perceive a higher degree of risk from pollution.
    b. Han Chinese residents will perceive a lower degree of environmental risk than Yi minority community residents.
    c. Community members with higher education will perceive a higher degree of risk from pollution.
    d. Long-term residents will perceive a higher degree of risk from pollution.

Using step-wise multiple regression, the model tests the effects of social, economic and health variables on risk perception. I interpret the results in light of the analytical framework outlined in Chapter One.

Chapter Six is an ethnographic description of the sociopolitical processes at work in Futian that shape local risk perceptions as observed in the statistical model. I argue that the privatization of local industry and the economic marginalization of many of Futian's citizens are both important processes involved in shaping the perception of risk from pollution. Similarly, industrial investors and laborers downplay the risks they face from pollution in a process I call "strategic risk repression." These processes are indicative of the way risk perception is embedded in local politics and economics.

In Chapter Seven I describe a key event in local industrial development in Futian: the closure of local factories by the Renhe District Environmental Protection Bureau. Authorities within this agency, after determining that Futian's factories were in violation of air pollution emissions standards, ordered the closure of the factories, setting off a debate with both ecological and political consequences. I discuss this event in light of two contradictory facts: the emergence of a discourse of "sustainable development" in China, and the continued insistence on the part of scholars that the Chinese Communist Party is not serious about enacting or enforcing the laws and policies of sustainable development as they relate to industry. I assert that it might be productive to think about multiple states in China, each with its own model of sustainability, and that such contestations occur in the field of meaning.

Chapter Eight provides a discussion of my findings and an overview of the practical and theoretical implications of this dissertation. In brief, the findings indicate

that the perception of risk from industrial pollution is indicative of more than the cognitive processes of the people who perceive risk, as much of the literature in risk studies suggests. Rather, the perception of risk is bound up with the same sociopolitical and economic processes that serve to create risk in the first place. Poor communities and individuals, contrary to the accepted wisdom in risk studies, are acutely aware of the health and ecological risks posed by local factories. I suggest that this is because they are both inordinately impacted by industrial pollution and systematically excluded from the benefits of industrial development. Finally, I discuss some of the ways in which anthropologists can contribute to the ongoing debates in the field of risk studies.

CHAPTER 1—AN ANALYTICAL FRAMEWORK

> "[Metaphors of landscape portray] not objectively given relations which look the same from every angle of vision, but rather . . . deeply perspectival constructs, inflected very much by the historical, linguistic and political situatedness of different sorts of actors." (Appadurai 1990: 7)

> "Nature is society and society is also nature." (Beck 1992: 81)

The study of risk and risk perception is germane to an anthropology engaged with environmental issues precisely because it occurs at the interface of society, technology and environment. The creation and distribution of risks tell us something about people's capacity for interacting with and managing the biophysical and social environments. Risks can be thought of as expressions of the "complex interactions of physical, biological, and sociocultural systems" (Oliver-Smith 2002b: 5).

The creation of environmental risk is both an inevitable result of the modernization process itself, what the sociologist Ulrich Beck has called "the threatening force of modernization" (Beck 1992), and something that increasingly threatens to undermine the capacity for modernization. Humans have, of course, encountered and managed risks throughout history; in fact, the capacity to overcome risk through ingenuity is perhaps one of the salient markers of being human. But the environmental risks that are the current byproducts of industrialization are qualitatively different from those of the past because of their far-reaching scope and because of the irreversibility of their consequences. The nuclear question, the contamination of air and water by chemical

compounds whose half-lives are longer than human history, and the proliferation of weapons with the capacity to destroy large tracts of humanity—all are symptomatic of risks brought on by modernity and marked by the "incalculability of their consequences" (ibid.: 22).

This dissertation focuses in particular upon what might be called technological and environmental risks; these are risks that occur in the biophysical environment as the products (or byproducts) of human action.[2] Technological and environmental risks are increasing more rapidly in the non-Euro-American context, where anthropologists have traditionally worked (Oliver-Smith 1996: 303). This is in part because the pace of economic development is particularly rapid in certain areas of Asia, Latin America and Africa, and also because many of these societies lack the monetary and technological means necessary to control and manage risk. This brings the problem of technical and environmental risk squarely within the purview of anthropology.

A central concern for anthropologists studying environmental risk revolves around the related questions of how people are differentially affected by the costs and benefits of risks, how they perceive and understand these risks, and what means they use to manage or mitigate the undesired consequences associated with risks. I have alluded in the introduction to the nature of the environmental risks faced by community members in

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[2] There is no small degree of semantic confusion in risk studies focused on disentangling the related terms of "risk," "hazard," and "disaster." In this dissertation I primarily use "risks" to refer to forces or conditions that carry the potential for individual, social, or environmental harm. In contradistinction to "disasters," "environmental risks," as I refer to them here, are caused at least in part by human-induced changes in the environment.

Futian, where this study takes place. Rural industrialization in the region, spurred by central government policy and increasingly under the management of private investors who hold the means of production, has radically altered the biophysical environment in southern Sichuan province and throughout much of rural China. The social and economic processes behind this industrial transformation constitute one story line of this dissertation. My focus, however, is how industrial pollution from rural factories has altered the local environment and how the people of Futian understand and cope with this change.

I do this by focusing on community members' *perceptions* of environmental risk. Because I chose to study risk perception, my work parallels psychological research in its practical methodological approach; among the many tools I employ are standardized survey questionnaires which ask informants to rate the magnitude of threat they perceive from a set of risks associated with rural industrial pollution. To this extent, I engage the psychological literature on risk perception insofar as my unit of analysis is the individual and my goal is to understand perceptions of risk. But my focus differs in one key respect. As I will discuss in this chapter, the study of risk perception emerged in psychology with the goal of understanding the patterns of human cognition behind risk and assessing how the characteristics of particular risks themselves influenced how people viewed them. Important related work has, of late, begun to focus on what might be thought of as the "sociological" influences on risk perception, including the political, economic and discursive forces that shape the way individuals evaluate environmental risk. This represents a clear movement toward a more holistic approach to the study of risk perception, and one that holds attraction for me as an anthropologist seeking to

understand how risk perception is situated within the social, economic and political lives of the people being studied.

Much of the recent work on the social determinants of risk perception, however, lacks a clear analytical framework. My aim in this chapter is to fashion such a framework by applying the lens of political ecology to the problem of risk perception. To the degree that the interdisciplinary field of political ecology has helped to delineate the ways in which social and natural systems are connected—through policy, through behavior, through discourse, and through social and cultural constructions of environmental problems—it has proven a useful analytical tool. At its core, political ecology is concerned with understanding the underlying social causes of environmental degradation, and with demonstrating how differential access to resources and other social formations participate in the production of specific environmental problems.

In constructing the analytical framework for this dissertation, I begin by outlining the field of risk perception from its emergence in psychology. I proceed to a discussion of recent research on pollution and risk perception, a body of work that, despite its lack of a theoretical center, has productively linked individual risk perception with social and economic variables. I then discuss how viewing risk perception through the lens of political ecology helps us understand the ways in which social processes are implicated in producing risk from industrial pollution in Futian Township, as well as the ways that local residents understand and cope with the pollution problem. In doing so, I draw primarily from two strengths of political-ecological research: a delineation of how environmental systems (and, I suggest, environmental risks) are socially constructed

through material practices and discourse; and a methodological approach that analyzes environmental issues at multiple temporal and spatial scales.

The Study of Risk Perception

Until fairly recently, environmental risks were defined largely from the scientific perspective even though it has been understood for some time that risks are perceived and understood differently by different segments of society. "Risk analysts," as professionals in the field were called, used relative frequencies of risk events over time and space to calculate the probability of a given risk event and the magnitude of its consequences. It was a field largely concerned with predicting and mitigating environmental and other threats to human health, such as pollution exposure and nuclear disaster. This actuarial approach also suggested that the "acceptability" of risk from any new activity or event is proportional to the level of safety associated with ongoing activities having similar costs and benefits (Starr 1969).

But this approach had several key flaws. First, because of its reliance on relative frequencies the actuarial approach examined data at aggregate levels, often failing to account for individual differences in exposure to risk. Second, it defined risk rather narrowly, confining it to physical harm to humans or the ecosystem and ignoring social or political costs that are more difficult to quantify. And finally, the actuarial approach assumed that individual perception of risk mirrored the "reality" of the data and therefore overlooked the psychological and social questions regarding how experience, cognition and discourse shape the perception of risk.

True progress toward understanding the human aspects of risk began in the 1970s when researchers found that the perception of risk by lay people often differed significantly from expert assessments and from the actuarial data itself (Fischhoff, et al. 1978). The question was, What accounted for the observed differences? Psychological research on risk perception has been one of the most productive aspects in the field dedicated to answering this question. Broadly speaking, psychological studies of risk perception (a body of research commonly referred to as the "psychometric paradigm") are dedicated to developing a taxonomy for hazards that can be used to understand how people respond at a cognitive level to the risks around them (Fischhoff, et al. 1978; Slovic, et al. 1984). In classic article entitled "How Safe is Safe Enough," Fischhoff et al. (1978) took the first serious steps toward understanding the psychological dimensions of risk perception. Respondents from the general public and from a sub-sample of experts with experience in the field of risk assessment were asked to consider a list of 30 hazard items from alcoholic beverages to X-rays and to rate, according to their perceptions, the risk of dying as a consequence of each hazard. Next, respondents were asked to order the items from least- to most risky and then to assign numerical risk values to each item by giving a rating of "10" to the least risky and assigning higher numbers to items that, in their perception, posed higher risk. Participants were also asked to rate each activity on nine different seven-point scales, each of which represented a cognitive "dimension" that the authors, following earlier work (Lowrance 1976), hypothesized to be connected to risk perception.[3] Fischhoff et al. found that these nine dimensions were highly inter-

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[3] The nine dimensions were: voluntary/involuntary, immediate/delayed, known precisely/not known,

correlated, suggesting that there might be a few basic dimensions of risk that explained people's cognitive perceptions. To investigate further, the authors conducted factor analyses, and found that two factors accounted for a majority of the observed variation between individuals' risk perception in their sample: "technological risk" and "severity."

Several interesting findings on the human dimension of risk resulted from this work. First, it was found that experts' judgments of risk differed markedly from the judgments of laypeople, and that the experts' judgments tended to be more in line with actuarial data on the "real" risks posed by each hazard item. This suggested that experts viewed the risk associated with each hazard item as synonymous with its annual rate of fatality, and, more importantly, that laypeople's perceptions of risk were driven by something else. Second, laypeople's estimates of annual fatalities from a given hazard item did not necessarily coincide with their ratings of "riskiness" for that item. Nuclear power, for example, had the lowest fatality estimate among laypeople but was associated with the highest perceived risk. Thus it was clear that something other than the probability of fatality or other physical consequences underlay the perception of risk by laypeople. Finally, and most importantly, the authors produced a two-dimensional cognitive map in which variation in individual risk perception was shown to be the product of two factors: technological risk, and severity. Risk items with high loadings on the technological risk factor were new, involuntary, largely unknown items perceived to be the products of technological innovation. Risk items with high loadings on the severity factor were associated with events whose consequences are certain to be fatal.

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uncontrollable/controllable, new/old, chronic/catastrophic, common/dread, and not fatal/fatal.

This two-factor explanation of risk perception based on "mental models" has become the hallmark of the psychometric paradigm and has been tested and affirmed in studies involving research subjects from all over the world, including France and the United States (Flynn, et al. 1994), Japan (Kleinhesselink and Rosa 1991), Hong Kong (Keown 1989), Norway (Teigen, et al. 1988) and Poland (Goszczynska, et al. 1991). At the core of this research is the idea that studying risk perception tells us about the "character" of certain risks and about the processes of cognition underlying risk perception.

From the perspective of social science, the chief accomplishment of the psychometric approach was to bring risk into the human dimension. By problematizing the notion that risk existed "out there" and could be understood by simply reviewing actuarial data on occurrence of risk events, the psychometric approach insisted upon viewing risk as a phenomenon filtered through human understanding and judgment. This represents a significant step forward in the study of risk. However, despite its clear superiority over early treatments of risk perception based on actuarial data, I find the psychometric paradigm unsuitable to an anthropological study of risk perception, primarily because of its use of what the anthropologist Mary Douglas has called "methodological individualism" (1992: 11). The psychometric approach atomizes the perceiver, ignoring the nuances of the social milieu within which risks are situated. It imagines a world without interactive effects, assuming that individual cognitive understandings of risk are bounded and closed. There are exceptions, of course—the work on "social amplification" of risk by Roger Kasperson (Kasperson 1988; Kasperson and Kasperson 1996) and others contains the seeds of a productive new synthesis of

psychometric and social research—but as a rule this approach is designed more to understand the character of risks and the cognition of risk perceivers than to understand the social processes behind risk.

Pollution and the Social Aspects of Risk Perception

It is within the relatively narrow field of studies on the perception of risk from pollution that a social framework for understanding risk perception is most fully realized. This is perhaps because pollution exposure is often a communal, rather than an individual, experience since pollution tends to cross political and social boundaries (Cole, et al. 1999; Moffatt, et al. 1999). A central problem for researchers is to determine what means and information sources people use to recognize the pollution they encounter (a body of scholarship often referred to as "public understandings of pollution"). Factors such as the observable effects of air pollution on the environment (Moffatt, et al. 1999), vision and other forms of sensory awareness (Moffatt, et al. 1999; Wakefield, et al. 2001) have an influence on the perception of risk from pollution. Sensorial perceptions—in particular, seeing or smelling pollution sources and activities—is perhaps the most salient way of identifying risk (Moffatt, et al. 1999; Bickerstaff and Walker 2001).

It is now generally acknowledged that public perceptions of pollution are filtered through access to financial resources, neighborhood characteristics, income, race and ethnicity. These have become subjects of scrutiny for researchers examining the social (extra-individual) determinants of risk perception. Furthermore, because individuals within communities are differentially affected by the costs and benefits of particular

risks, intra-community variation in risk perception can have implications for coping with and managing risks.

These studies, the major contributions of which I outline only in brief, represent a starting point for examining the role of social, economic and political factors in creating and distributing environmental risk and in shaping people's perceptions of risk. Spatiality, for example, has proven to be an important factor in determining individual perceptions of, and responses to risk. Howel et al. (2002), using interview and survey questionnaire data from England, suggest that, in addition to income, neighborhood characteristics such as proximity to industry have a strong influence on how people view industrial air pollution. Specifically, those who lived closer to pollution sources were more likely to perceive health threats related to pollution, despite a lack of scientific monitoring at the neighborhood level verifying this effect.

Other studies confirm the importance of spatiality but offer somewhat different conclusions. Bickerstaff and Walker's (2001) study, for example, finds that individuals identify strongly with their immediate neighborhoods as places of relative safety, health, and well-being. They point to the presence of a "halo effect" in which, despite the existence of scientific evidence, places closest to home are perceived as less risky. Individuals draw upon a sense of place in order to manage and cope with degraded environments.

One productive area within this vein of scholarship focuses on workplace communities. Mertz et al. (1998), for example, demonstrated that the health risks of certain industrial chemicals were perceived differently by different stakeholders within a company and within different groups outside the company. Attention must be given to

the costs and benefits associated with risk-producing activities in order to fully understand individual perceptions.

Other salient social characteristics such as gender, ethnicity, and nationality have been linked with risk perception. In what has been dubbed the "white male effect," Flynn et al. (1994) demonstrated that, within the United States, gender and race were powerful predictors of the perception of environmental and health risks. In their nationwide sample, White males were shown to have a lower perception of risk than White females and Blacks, even after controlling for the effects of income and education. A later study by Burby and Strong (1997) provides a qualitative explanation of why this might be so. The study suggests that, not only are Blacks more likely to be exposed to higher levels of pollution because of the systematic locating of polluting factories in minority-concentrated areas, but Blacks were also more likely to link perceptions of industrial pollution with narratives describing the general deterioration of their neighborhoods and their quality of life.

All of these studies on the social determinants of risk perception suggest that human understandings of risk are shaped and constrained by social factors outside of the individual. Currently, however, there is no cogent theoretical framework to explain how these factors lead to the creation of particular risks and how social factors shape human understandings and perceptions of risks. In the following sections I describe how applying some aspects of political ecology to the problem of risk perception helps to build such a framework.

Political Ecology

Broadly construed, political ecology is a theoretical framework that "combines the concerns of ecology and a broadly defined political economy" (Blaikie and Brookfield 1987). It is less a unified theory than a patchwork of related scholarship that shares common underlying principles. Responding to policy decisions that used cultural ecology and related fields in order to depict environmental degradation as the result of irrational, ignorant and destructive resource use patterns by people faced with poverty, political ecologists have chosen to focus on the complex structural, economic and political processes underlying environmental problems (Blaikie and Brookfield 1987; Grossman 1993; Peet and Watts 1996).[4] During the past twenty years, political ecology has been usefully applied in the fields of anthropology, geography, political science and related disciplines.

Blaikie and Brookfield's seminal book, *Land Degradation and Society* (1987) is widely held to be the cornerstone of political ecology.[5] The work of these researchers was

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[4] Perhaps the most explicit portrayal of environmental problems as extensions of poverty, and one with far-reaching consequences, is the Brundtland Commission's report, *Our Common Future* (World Commission on Environment and Development 1987). This influential report explicitly asserts that poverty and ignorance regarding resource management are root causes of environmental degradation.

[5] Peet and Watts (1996) point out that the anthropologist Eric Wolf and others saw the necessity of situating local analyses of environmental change within broader, macro-level studies of political economy as early as the 1970s. While they were by no means the only researchers working in this vein, it was Blaikie and Brookfield's unique contribution to cogently outline the goals of political ecological research and to coin the phrase "regional political ecology" itself.

focused on showing that land degradation was inextricably linked with economic marginality, that particular forms of social organization placed excessive demands on the local environment, and that the reality of environmental degradation is always filtered through the subjective perceptions of local stakeholders. Moreover, in insisting on an approach that considered factors beyond the community to be implicated in local environmental degradation (hence the authors' coining of the phrase "regional political ecology"), Blaikie and Brookfield sought to assess the complex relationships between multiple geographical scales, socioeconomic formations, and particular environmental problems. As Paulson et al. (2003: 206) point out in a recent review of literature in political ecology, the novelty in this unique interdisciplinary approach lay in the robustness with which it explains diverse environmental problems:

> Efforts to link social and physical sciences through an explicitly theoretical approach to ecological crises that was capable of accommodating general principles and detailed local studies of problems as diverse as water pollution in Delhi, soil erosion in Nepal, and deforestation in Para.

Inspired by poststructural theory and a focus on how discourse and power are implicated in environmental problems, political ecology now encompasses a range of related scholarship including: analyses of the role of multi-level politics in creating and mitigating specific environmental ills (Ferguson 1994; Moore 1996); examinations of the role of civil society and social movements in mediating these ills (Moore 1996; Escobar 1997); and discursive approaches to understanding the symbolic and cultural contestations behind environmental problems (Moore 1996; Escobar 1999).

Because of its effectiveness in analyzing environmental problems as societal issues, political ecology is capable of shedding light on the question of environmental risk perception, although these bodies of scholarship have not been explicitly linked. I discuss here how two strengths of political-ecological research—its treatment of the social construction of environments, and its use of multiple analytical scales—both suggest questions for inquiry and provide an analytical framework for interpreting the findings of this dissertation.

Social Constructivism and Risk

One place of common ground for virtually all studies on the human aspect of risk is the idea that risks, like other environmental phenomena, are at least in part socially constructed, mediated by human processes such as culture and politics. They are, to be sure, real and material events with consequences in the real world; but they are also perceived and dealt with by people within the subjective fields of meaning and culture. Anthropological treatments of risk seem to be most attuned to this perspective. As Anthony Oliver-Smith writes,

> Risk perception and assessment are grounded in the *cultural* norms and values that both govern and are embedded in the relationships that human communities have with their physical and social environments. In that sense, risk perception studies address both problems of immediate concern to specific communities but also theoretical questions about *cultural and social constructions of reality*. Risk perception engages cultural theory directly in its focus on ideologies and constructions of social, physical, and cosmological environments. (1996: 320, italics added)

The idea that risks are social constructions has found perhaps the most traction in the debates surrounding the assessments of particular risks by experts and laypeople. There is a fundamental disconnect between scientific "risk assessment" and lay "risk perception," and this disconnect is bound up with issues of power regarding whose characterization of risk will prevail. Expert and lay assessments of risk are at odds in many cases because they stem from wholly different epistemological approaches. In the case of air pollution assessment, for example, where experts are concerned with an accurate and objective measurement of a given pollutant, establishing clear exposure pathways, and determining the epidemiologic effects of exposure, laypeople may be concerned with the effects of pollution on the health of themselves and their families, as well as economic and other direct impacts on their lives.

Differences in the ways risk is constructed are never politically neutral. No matter how risk is socially constructed by the lay stakeholders involved, their judgment often must defer to the "experts" in risk assessment. As the sociologist Ulrich Beck has noted, laypeople, those who are most deeply affected by risk, are often considered "incompetent in matters of their own affliction" (1992: 53). This fact is reflected in the language used within risk assessment literature, where scientists "determine" risk and laypeople "perceive" it. In extreme cases, the debate may devolve into a situation in which experts claim for themselves the unique right to determine what risks are "real":

> Traditionally the purview of engineers, health physicists, statisticians and epidemiologists, risk is defined probabalistically according to "real risk," determined scientifically and objectively, vs. "perceived risk" by the public, assumed to be uninformed, false, illusory, or irrational. (Oliver-Smith 1996: 319)

Mary Douglas' articulation of this clash between rationality claims over the construction of risk is well crafted, if somewhat sardonic:

> The . . . division between the reality of the external world and the gropings of the human psyche have allocated real knowledge to the physical sciences and illusions and mistakes to the field of psychology. Causality in the external world is generally treated as radically distinct from the results of individual perception. According to this approach, risk is a straightforward consequence of the dangers inherent in the physical situation, while attitudes toward risk depend on individual personalities[6]. When particular risks are objectively ascertainable, it follows that the gap between the expert and the lay public ought to be closed in only one direction—toward the opinion of experts: the lay public must be taught the facts. (1982: 193)

But to say that risk is a social construction (or that, as some say, it is *merely* a construction, thereby diminishing its importance) is not the same as describing *how* risk is socially constructed, and here the debates over the "construction of nature" in political ecology are instructive. The theoretical grounding for what might be termed poststructural political ecology is a recognition by researchers that, while the relationship between people and the environment may be understood as material relations of production, the materiality of these relations are also (in fact, primarily) intertwined with symbolic questions, questions of meaning (Escobar 1996; Peet and Watts 1996; Escobar 1999). In this view, discourse—"an area of language use expressing a particular standpoint and related to a certain set of institutions" (Peet and Watts 1996: 14)—is seen as reflective of, and indeed constitutive of, social reality. Discourse shapes not only the ways in which people think and speak about development and environmental issues, but

constrains their actions and reactions, and delimits the social space in which these issues are dealt with. Mary Douglas, whose research was initially concerned with ritual pollution from sexual contact and with food taboos, took a similarly radical stance on social constructivism by suggesting that ideas about pollution exist quite apart from the physical dangers involved. For Douglas, culture itself, that "middle area of shared beliefs and values," plays a central role in mediating perceptions of risk (ibid.: 194).

But this radical constructivist stance (Ingold 1992; Escobar 1999), which puts social and cultural conceptions of nature above any sort of material nature, when transplanted into the field of risk studies, runs the risk of trivializing the experiences of people who are forced to live with environmental degradation. As Hacking (Hacking 1982: 41) points out "every once in a while the reader has to cry out that some pollution is real." The radical constructivist stance, which sees all environmental ills as the products of cultural and social discourse, runs the risk of denying the obvious claim that some phenomena exist quite independent of cultural and social construction. Insisting that problems like desertification, over-grazing, soil erosion, or industrial pollution are mere products of particular types of social organization does not, in short, validate the concerns of the people who have to live through these problems and cope with their very real consequences.

The approach I take in understanding the social construction of risk and risk perception is a synthetic one. I side with productive new research, sometimes referred to as the "bio-cultural synthesis" (Goodman and Leatherman 1998) or the "new materialism" (Biersack 1999) that recognizes both human effects on the natural world and nature's effects on human society. Such an approach to the study of risk

acknowledges that changes in the biophysical environment are at least in part shaped by human judgment and perception, but does not assume those judgments and perceptions constitute the entire picture. Anthony Oliver-Smith summarizes this synthetic approach and outlines its potential contribution to the study of risk (and the related field of disaster research) as follows:

> Disasters exist as complex material events and, at the same time, as a multiplicity of interwoven, often conflicting, social constructions. Both materially and socially constructed effects of disasters are channeled and situated variously within the society according to political, social, and economic practices and institutions. (2002a: 24)

I suggest here that environmental risks are socially constructed through several related processes. The first is through material practices, which are the products of particular social, economic and political processes. Material practices—industrialization, proletarianization, the extraction of raw materials and the emission of byproducts and pollution—transform the biophysical environment. Thus "we construct our own disasters insofar as disasters occur in the environments that we produce" (Oliver-Smith 2002a: 43). The transformation of the Chinese countryside into a mixed agrarian and industrial space, a story that I tell in detail in this dissertation, has been one of the most dramatic changes in the life experiences of the people who live there. This shift has also had a profound effect on the specific rural environments in which people live. I present air quality monitoring data from Futian in Chapter Four in order to understand, from a scientific standpoint, the nature and severity of the environmental risks faced by residents of Futian. The stance I take in this dissertation is thus not a purely constructivist one; I recognize the salience of material risk and its consequences for the people of Futian.

The second way in which risk is socially constructed is related to the ways in which particular social processes have created what Oliver-Smith (Oliver-Smith 2002a) has called "conditions of vulnerability" in the community. Vulnerability is the uneven exposure of an individual or group to a particular risk, and the capacity of that individual or group to cope with and recover from the impact of the risk (Wisner 2004: 11).

It is important to emphasize that, in most cases, vulnerability to environmental risk is not distributed evenly among members of society; rather, certain individuals and groups, because of economic inequality, differential access to resources and political processes within and beyond the community, are more vulnerable than others to some environmental risks. Indeed, the rise of "risk positions" in which some individuals are affected more deeply than others by a given risk, is a hallmark of modernity (Beck 1992). Just as wealth is distributed by the market in uneven and inequitable ways, so are the impacts of environmental risk unevenly distributed. Risk positions may be strongly linked to the political, economic, and class orders already in existence in society; it is often the case that wealth accumulates at the top and risk pools at the bottom.

Mary Douglas' treatment of risk from an anthropological perspective underscores this fact (Douglas and Wildavsky 1982; Douglas 1985; Douglas 1992). As she rightly points out, economically and socially marginalized segments of the population are least equipped to voice concern or to cope with a given risk. To this extent, for Douglas, "the dialogue is political" in that it is bound up with questions of equity, control, and power (Douglas and Wildavsky 1982: 174). Because of its historical focus upon the role of marginalization in the creation and distribution of environmental ills, political ecology acknowledges how risk events may unevenly affect the poor or those otherwise

unequipped to deal with environmental disturbance. Indeed, "while a disaster may affect an entire community, it is typically the poor who are most exposed to its effects and least able to bear the associated costs in terms of disrupted livelihoods" (Bryant 1998 84)

As Wisner et al. (2004: 11, original italics) have noted, what is necessary is an approach that explains "how one gets from very *widespread conditions* such as 'poverty' to very *particular vulnerabilities* that link the political economy to the actual hazards that people face." This dissertation is an attempt to bring such an approach to the study of risk in Futian. The development logic of the reform-era in the PRC, grounded in notions of industrial progress and bolstered by a changing economic landscape of privatization, has created rural communities for whom the extraction and processing of resources and the ensuring pollution are the central tenets of economic life. At the same time, these social and economic processes have assured that the benefits of industrialization are unevenly distributed within the community, while the costs—air and water pollution, compromised health, lowered crop yields—are borne by all, with the most vulnerable being the most affected. This story is at the core of this dissertation.

Finally, risk is socially constructed at the level of perception. The fundamental problem with the psychometric literature, and reason why its applicability to an anthropological study on risk is called into question, is its focus upon the individual as the unit of analysis and its consequent failure to account for the social and political factors influencing risk perception. Mary Douglas reminds us of the recurrence of this omission in much of the psychometric literature on risk perception:

> Though they [risk analysts and academics] recognize that the grime and heat of politics are involved in the subject of risk, they sedulously bracket

> them off. Their professional objective is to get at the real essence of risk perception before it is polluted by interests and ideology. (1992: 11)

But the political nature of risks cannot be ignored, for two reasons. First, the political nature of risks, the fact that they are brought into being through particular kinds of social and economic organization in human life rather than through their own accord, means that ignoring this political process avoids a serious treatment of the creation of risks themselves. The risks engendered by polluting smokestacks and nuclear power stations did not come into being by themselves; they were built by people to serve specific economic and social functions.

Second, ignoring the political nature of risks leaves a gaping hole in the understanding of how risks are perceived by the public. The perceived magnitude of risk from exposure to industrial pollution in Futian is contingent upon social factors such as tenure in the community, access to industrial profits, ethnic relations, and economic marginalization. People in the community do not make risk judgments about pollution in a social vacuum. Rather, they constantly situate their understandings of the pollution problem in the context of their economic and social lives. Because my focus in this dissertation is on the social determinants of risk perception, I account for processes of privatization and marginalization that influence risk perception. Political and economic marginality are not getting in the way of a proper understanding of risk perception. They are, rather, implicated in shaping the ways in which people perceive risk. Environmental risk occurs in politicized environments, and social and economic inequities are an integral part of the process of politicization.

Multiple Scales of Analysis

The second contribution of political ecology I draw upon in creating an analytical framework through which to view the problem of risk from industrial pollution is political ecology's growing tendency to analyze environmental politics at multiple temporal, spatial and political scales. Despite its early links to cultural ecology research which examined the environment-society nexus at the local scale, political ecology is now increasingly giving attention to causal factors at the regional, national and transnational scales and examining the ways in which actors at these levels are implicated in environmental change at the local level (Ghai and Vivian 1995; Peet and Watts 1996; Bryant 1998).

If one of the fundamental contributions of political-ecological research is that it places particular environmental problems—soil erosion, forest depletion, and so forth—within the context of political processes, a second and equally important contribution has been to demonstrate how politics beyond the local level effects local environmental change. By examining broad "chains of explanation" (Blaikie and Brookfield 1987) in human-environment interactions, political ecology is by necessity an approach that operates on multiple temporal and spatial scales (Bryant 1998). Such an approach is valuable because it more aptly captures the nuances of social action than simply focusing on either the micro- or macro levels. This analytical advantage has been aptly described by Rebecca McLain using a film metaphor:

> Instead of being limited to the two fields of view made possible by interchanging a regular and a telephoto lens, the chain of explanation provides greater flexibility by functioning as a zoom lens. With this lens one can focus in on the details of an individual and then gradually widen

> the field of view to provide a sense of where that individual is situated relative to other social actors and the biophysical environment. (2000: 44)

There are many examples of contemporary political ecological research with a multi-scale approach. James Ferguson's work (Ferguson 1994; 1999), for example, has shown how international development policies and practices shape patterns of resource use, employment, and migration in sub-Saharan Africa. Similarly, Muldavin (Muldavin 1997), working in China's northeastern province of Heilongjiang, demonstrated how local land degradation was "structurally embedded" in management practices and policies that transcended the local level. The resource struggles portrayed by Donald Moore (1996) in Zimbabwe cut across multiple terrains: they are struggles of identity and livelihood at the local level and, simultaneously, struggles against the totalizing force of the state.

An analytical approach that simultaneously examines multiple scales is sorely needed in the field of risk studies, as Kasperson and Kasperson (1996: 96) point out:

> Risk analysis, then, requires an approach that is capable of illuminating risk in its full complexity, is sensitive to the social settings in which risk occurs, and also recognizes that social interactions may either amplify or attenuate the signals to society about the risk.

Work on risk perception, in particular, too often produces a view of the individual risk perceiver as a singular, closed entity, as I have already noted. It became clear early in my fieldwork that, while risk perception was something that had to be measured at the individual level, there were political, economic, and discursive forces at work in the community and beyond that had a profound effect on shaping the pollution problem and on shaping local understandings and perceptions of industrial pollution. This recognition

in turn led me toward a theoretical approach capable of appreciating risk perception as an issue that cuts across multiple scales.

Pollution is by nature something that crosses boundaries; it is, as Mary Douglas (1968) has rightly observed, "matter out of place." At the same time that environmental risks are felt unevenly by segments of society, their consequences may, paradoxically, also have an equalizing effect. Although risks are differentially distributed according to class, ethnicity, access to political power, and so forth, they also contain an element of uncontrollability and are therefore universal in their effects. As Beck notes, "the risk climate of modernity is thus unsettling for everyone; no one escapes" (1992: 124). The effects of air and water pollution, to one degree or another, are shared by all precisely because their distribution is controlled more by the wind and gravity than by human intervention. Understanding the effects of pollution on individuals, communities and ecosystems is therefore a task requiring analysis at multiple scales (Cole et al. 1999).

The political and economic forces responsible for creating many environmental risks originate beyond the local community. In China, the impetus for rural industrialization and the growth of the township and village enterprise sector came from the central government. State policies governing industrial development in China have encouraged the rapid growth of inefficient, highly polluting rural industries, exposing hundreds of millions of people to industrial pollution over the past two decades. In addition, the adoption and enforcement of environmental protection laws are shaped, as I illustrate in Chapter Seven of this dissertation, by a new discourse of sustainable development adopted from international discourse by the central government and circulated within the environmental bureaucracy in China all the way down to the county

and district levels. This discourse, bolstered by a growing corpus of environmental law and bureaucracy in China, has the potential to bring far-reaching consequences, including closure, for heavily polluting rural industries. But the actual practice of environmental protection is a complex subject that crosses multiple political scales, often pitting different levels of the government bureaucracy against one another. Thus any research agenda that examines individual risk perception in the local community without taking into account the historical forces, across bureaucratic levels that create environmental risk is incomplete.

Toward a Political Ecology of Risk Perception

In sum, to one degree or another, studies in both political ecology and risk perception recognize the primacy of social factors in the creation of environmental problems. The two theoretical frameworks are couched in rather different terms, however. Political ecology highlights the role of social, economic, and political structures in the creation of specific environmental ills, with the goal of showing how power and marginalization are involved. The risk perception literature is, for the most part, concerned with how those specific environmental ills are understood, mediated, and in some cases mitigated by local actors. Both bodies of literature, however, are still somewhat amorphous and evolving.

Using political ecology as a lens through which to view environmental risk allows me to theorize about how risk is socially constructed in Futian. I take a synthetic approach to the social construction of risk, seeing risk and its consequences as both

materially real and produced through the distribution of vulnerability and the subjectivity of perception. Furthermore, I draw upon political ecology's use of multiple analytical scales in understanding how risks are produced.

What do we gain by applying political ecology to the study of risk perception? The analytical framework I outlined in this chapter has the potential to stretch the boundaries of both political ecology and the study of environmental risk perception, contributing to both by filling key gaps in both. In the case of political ecology, researchers have on occasion privileged politics at the expense of other factors in explaining environmental change. By "progressively contextualizing" from events to causes, Vayda and Walters (1999), for example, suggest that the task for political ecology should be to understand chains of events linked to environmental impacts and not to assume that political factors are necessarily the best explanation. At the root of this critique is the danger that a radical constructivist stance in political ecology will deny the salience and importance of any kind of biophysical environment, suggesting instead that real problems like industrial pollution are mere social constructions. I aim to steer clear of this position. The environmental risks faced by individuals and communities force us to accept the materiality of nature precisely because their consequences are real.

Another way that political ecology stands to benefit from the framework I create here for studying environmental risk is to widen its scope to include research in industrial settings. The body of political-ecological research as it currently exists suffers from extreme "land-centrism," and, as Bryant (1998: 89) points out, unequal power relations are as likely to be "inscribed" in the air or the water as they are to be "embedded" in the land. Political ecologists have produced no shortage of scholarship that sheds light on

environmental problems within agrarian, forestry, and pastoral environments; theorization has not, however, been extended in any significant way to include industrial systems. One notable exception is Brimblecombe's (1987) treatment of Industrial Revolution-era air pollution in England. Another is Anderson's (1995) study of air pollution in colonial Calcutta. But these are both explicitly historical in their approach and make only cursory use of other political ecology studies. My work is an explicit attempt to employ the political ecology framework in an industrialized landscape, thereby stretching its boundaries and increasing its explanatory power.

The environmental risk perception literature also stands to gain from the application of political ecology as an analytical tool. Currently, work on risk perception focuses almost exclusively on Western industrial society. Because most scholars tend to see environmental and technological risks as the unique products of post-industrial development (Beck 1992), and because the methodology employed in most studies is oriented toward psychology, the field has been slow to expand into other geographical areas.[7] The orientation of political ecology, by contrast, has been heavily toward the non-Western "Third World" (Bryant 1992), and building an analytical framework that applies political ecology to the problem of risk perception contains promise for addressing this gap.

Within the risk perception literature, most studies take as their point of departure the assumption that risk is at least partially a social construction. However, a well

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[7] Notable exceptions include recent work on risk perception in urban China (Zhang 1994; Lai and Tao 2003).

articulated argument about exactly how social and cultural forces shape risk perception is largely lacking.[8] The analytical framework I fashioned in this chapter is an attempt to address this lack. In addition to its theoretical import, the recognition that risk is socially constructed carries with it some very pragmatic promises. As experts in the field of risk communication have struggled with how best to present the facts and numbers of professional risk analysts to a public often deemed incapable of understanding complexity, there has been a gradual dawning of the idea that public opinions shape and constrain responses to risk and that the public should actively participate in risk assessment (Fischhoff 1995). All of this suggests that definitions of risk demand greater nuance than that accorded to them by scientific or technocratic treatments.

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[8] Mary Douglas, in publishing a second book on risk, conceded that a clear treatment of the social aspects of risk perception was still needed: "Originally this [book] was intended as a review of the literature on social influences on risk perception. However . . . in this case . . . the central core of interest in social influences on risk perception is missing" (1985: 1).

CHAPTER 2—RURAL DEVELOPMENT AND THE RISE OF RURAL INDUSTRY

> "All Chinese people support the Communist party, and socialism, and participate in the establishment and reform of the socialist system. This is because the Communist party, and socialism, can bring them a higher level of riches and continually improve their material and cultural living standards. During World War II, people said, 'Thirty mu of land, a cow, and warmth for my wife and children—this is Communism.' After liberation, people said, 'A two-story house, electric lights, and a telephone—this is Communism.' After collectivization, people said, 'Eating rice without paying for it—this is Communism.'"
>
> (Lin Ling, et al. 2002)

> "Development is the indisputable truth" (*Fazhan cai shi ying daoli*).
>
> (Deng Xiaoping)

Arturo Escobar, in his tour de force of critical development studies, *Encountering Development*, suggests that, within the Third World, reality was "colonized by the development discourse" (Escobar 1995). Rural development, in particular, entails a strategy of "modernization and monetarization" as well as a transition "from traditional isolation to integration with the national economy" (ibid. 205). Nowhere has this been more true than in rural China during the past quarter century of economic reforms, where rural livelihoods have been transformed and patterns of labor changed from agricultural to industrial.

In China, the most dynamic story of development is within the industrial sector and, in particular, in that sector peculiar to the Chinese economy: rural industry. Within

the space of two decades—from the late 1970s through the late 1990s—rural China underwent perhaps the most dramatic transformation in human history, and one in which more than 100 million peasants moved away from agriculture and into industry. This is a transformation that remade the countryside both literally and in an ideological sense. The countryside saw the sprouting of some 20 million small-scale industrial enterprises, along with a concomitant shift in labor, market linkages, and production outputs. In an ideological sense, China fulfilled—and is still fulfilling—a development imperative that has shaped the country for the better part of a century.

In this chapter, I outline both the ideological and economic factors that led to the rise of the rural industrial sector. Although township and village enterprises came to prominence during the reform era, important economic development strategies as well as ideological imperatives during the Maoist period provided the early impetus for rural industrialization. I then outline the particular development discourse of the reform era, with its emphasis on marketization, and the various factors that aided in the dramatic burgeoning of the rural industrial sector. Finally, I address some of the growing problems associated with township and village enterprises—particularly their role in China's intractable pollution problems—and why TVEs are a fertile subject for studying the political ecology of risk perception.

The Maoist Era: The Development Imperative and the Rise of Rural Industry

Barry Naughton (1992) notes that, at the beginning of reforms in 1978, more than 90% of the rurual labor force was in agriculture. By the late 1980s and early 1990s, more

than 50% of rural labor had moved from the agricultural sector to industry, and local governments depended on TVEs for upwards of 80% of their operating revenues. How did this happen? What forces led to what has been called "rural urbanization" (Guldin and Goldschmidt 1997), a situation in which the countryside was transformed with industrial labor and market connections broader than ever before seen?

China's rural industrial transformation was not solely the product of economic reforms under the Deng Xiaoping regime; it relied on historical forces with roots in the Maoist period. Despite the appearance that rural industry was the unique product of economic forces in the reform era, no segment of the modern Chinese economy has escaped the effects of the planned economy which preceded it. Equally important is the development imperative inherent in Maoism, dubbed "utopian urgency" by Judith Shapiro (Shapiro 2001), which created both the rationale for China's transformation and the means through which rural industrial development took hold.

It is easy to overlook the Maoist roots of rural industry. Government leaders, including Deng Xiaoping, architect of China's economic reforms, wanted to believe that the growth of rural industry constituted development from below, as evidenced by the following statement by Deng himself:

> Our greatest success—and it is one we had by no means anticipated—has been the emergence of a large number of enterprises run by villages and townships. . . They were like a new force that just came into being spontaneously. . . The Central Committee takes no credit from this.

The truth is perhaps a bit more complicated. Township and village enterprises relied on a set of institutional incentives that went back to the Maoist period. "However else one may wish to judge the Mao era," Maurice Meisner, the Chinese historian noted,

"it was the period of China's modern industrial revolution that established, however crudely, the basic foundation for China's modern economic development" (Meisner 1996). During the Great Leap Forward, which began with Mao's speech to the Second Session of the Eighth Congress in May of 1958, Mao insisted that every township and village (at that time commune and brigade) build so-called "backyard furnaces" for steel smelting (Meisner 1986). His goal was to outpace the steel production of Britain within fifteen years and thereby show the world the inherent superiority of both the Marxist paradigm and the Chinese people. Mao's production targets, based on a science that was subservient to ideology, would be accomplished at all costs. Mao figured that all that was necessary to accomplish the goal was to "lift the lid, break down superstition, and let the initiative and creativity of the laboring people explode" (Short 1999).

The small-scale steel furnaces scattered throughout rural areas were part of a policy of "walking on two legs"—that is, to simultaneously emphasize the development of both large-scale factories in the cities and small-scale factories in the countryside.[9] Coupled with agricultural development schemes that privileged ideology over science and common sense, the results of this policy were disastrous and well-documented: rural

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[9] An argument for rural industrialization was made as early as the 1930s by the imminent Chinese anthropologist and sociologist Fei Xiaotong, who thought that rural industry held the key to rising living standards in the countryside (Fei 1968: 114-126; Fei 1989).

areas produced steel of questionable quality, and an estimated 30 million excess deaths occurred around the country as fields lay fallow and grain production plummeted.[10]

The catastrophic effects of the overnight shift to rural industry were noted by some in Mao's government, including Liu Shaoqi, who initiated a policy of "taking grain as the key link" (*yiliang weigang*) in order to once again bolster agricultural output and stave off further famine. But the seeds of rural industry had been sown. Leftover from the Great Leap were the "five small industries," rural factories that produced the necessary inputs for agriculture, including iron and steel, chemical fertilizers, farm machinery, cement plants, and electric power.[11] These rural industries became administratively distanced from the central government, as demands were placed upon them to be self-sustaining in terms of tax revenue and production (Lin Qingsong and Byrd 1994) and in terms of producing employment opportunities and generating income for rural residents (Riskin 1987).

The Reform Era and the Acceleration of Rural Industry

The economic reforms, begun in the late 1970s and presided over by the regime of Deng Xiaoping, were predicated on the idea that "some must get rich first" in order that others may follow. Deng proclaimed that "to be rich is glorious," and this shift in the

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[10] In recent years, the actual death toll of the Great Leap Forward has become a polemical issue for many scholars. Judith Banister offers perhaps the most widely cited model of "excess deaths"(ie. famine-related deaths, plus famine-related fertility losses) during the Great Leap (Banister 1987).

[11] For a detailed treatment of the Maoist legacy of rural industry, see Perkins (1977).

development discourse of the Chinese government had a profound effect on the swift growth of rural industry.

A central part of the reform-era development discourse was focused on achieving "small comfort" (*xiaokang*) for China's citizenry. The concept of *xiaokang* first appeared in the "Record of Rites" (*liji*) from the Warring States Period (475-221 BC). This historical text describes an idyllic age of "great equality" (*datong*) in which heaven and man were in harmony and wealth was distributed evenly. But *datong*, according to the text, is an unattainable goal because of the tendency of humankind to acquire material wealth for personal gain. The alternative to equality is *xiaokang*, a state in which individuals seek their own pecuniary benefit.

Lest the historical context of *xiaokang* seem ambiguous and a bit esoteric, Deng Xiaoping proclaimed that the *xiaokang* lifestyle required a minimum per capita income of 800 US dollars.[12] He created, in short, a definition of development that was at once tied to the shared ideals of the national history and grounded in a decidedly modern economic context. The role of capitalist markets and the restructuring of the rural economy were to figure prominently in the Dengist regime's plans for actualizing development.

By the early reform period, surplus labor in the agricultural sector was a pressing problem throughout rural China. The implementation of long-term land leases to individual farmers and farm collectives—a bold move away from agricultural

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[12] Lu Hanlong (2000), a sociologist at the Shanghai Academy of Social Sciences does an excellent job of contextualizing the *xiaokang* of the reform era within the context of values passed down from Chinese historical sources.

collectivization that began, in some areas, as early as the Third Plenum in 1978—led to a rise in agricultural productivity and a restructuring of the rural economy. But change occurred slowly. Anhui Province, where Deng's political ally Wan Li was First Party Secretary, was the most widely known case where peasants experimented with decollectivization. In 1980, under Deng's leadership, the Party Central Committee pronounced the "production responsibility system," moving beyond the mandates passed by the Third Plenum. The production responsibility system allowed individual peasants and households, on a voluntary basis, to contract with the old production teams for the use of a portion of the former collective lands. Peasants were still required to meet basic procurement quotas and a state agricultural tax, but, in contrast to the Maoist era, after meeting the quota they were free to cultivate whatever crops they liked and to profit from their sale.[13]

The year 1984 was a watershed. In that year, Deng Xiaoping visited several of the brigades and communes in Anhui province that were known to be practicing the production responsibility system. In that year, Deng gave official sanction to this practice, and townships and villages replaced the communes and brigades of the Maoist era (Meisner 1986: 220-254). Peasants became subject to the new "household responsibility system," under which, after filling basic grain procurement quotas set by the state, they were free to grow whatever crops they pleased and to sell them on the

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[13] Throughout the reform era, land officially remained under the ownership of production teams and, ultimately, the state. Long-term leases have, however, had the same de facto effect as privatization, namely increased agricultural yields and efficiency (Ruf 1998: 129).

market for profit. Land leases were granted to peasants for 15-year terms, later extended, in 1992, to terms of up to 30 years (Selden 1998). This process, termed "rural embourgeoisement," by Szelenyi, represents a gradual movement toward small-scale family agriculture, auxillary production, and nonagricultural activity (See Kornai 1992).

More importantly for the purposes of this story, this shift also meant that the industrial enterprises of the Maoist period, though still held collectively, became the *de facto* property of the townships and villages. Township and village enterprises became a way of both increasing overall industrial output for the nation and sopping up surplus rural labor (Hsueh, et al. 1993). Thus the agricultural transformation away from collective production and toward *de facto* private production was fundamental to the development of rural industry. As Pei Xiaolin (Pei 1998b: 86) notes:

> The transformation started by the success of agricultural reform, immediately triggering the rapid development of township and village enterprises. Thus, the success of agricultural reform was actually the mother of the transformation. Had there been no successful agricultural reform, there would have been no rapid development of township and village enterprises.

Local governments throughout rural China responded swiftly to these new economic incentives. Numerical measures of all sorts tend toward inordinate size in China, but the growth in the TVE sector during the reform era is truly nothing short of incredible (see Figure 4). Between the years 1983 and 1984 alone, the number of TVEs increased more than five-fold. With an overall jump from 1.52 million in 1978, to a total of 20.85 million in 2000, TVEs have gone on to become arguably the most important part of China's economic reform story.

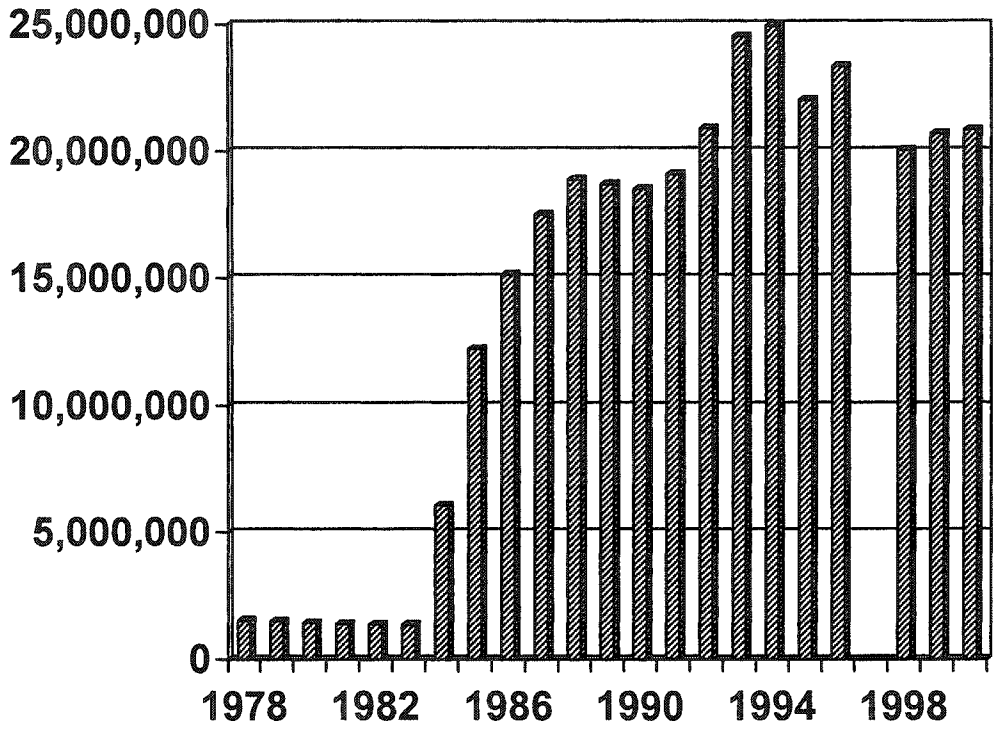

Figure 4. Increase in township and village enterprises, 1978-2000

Source: Compiled from the China Labor Statistical Yearbook [*Zhongguo Laodong Tongji Nianjian*] (Chinese Statistical Bureau 2001). Data for 1997 is unavailable.

The vertiginous growth of rural industry was the result of the central policy initiatives described above, but a set of disparate factors ensured the sustained success of TVEs. These included structural and policy advantages, the role of local cadres, and a rigid anti-migration policy that ensured that rural labor stayed in the countryside.

Central government policy toward TVEs in the early reform years was favorable—partly by design and party by oversight. Township and villages enterprises grew swiftly because they could get cheap industrial inputs at government-regulated

prices, and because they remitted, on average, only about six percent of their profit to central government taxes. By the late 1980s, government policy had begun to catch up, and TVEs remitted an average of 20 percent of profits to taxes. This was, however, still a much lower tax burden than state-owned enterprises, whose high debt and soft budget constraints led them to lose ground to the nascent, nimble rural industrial sector (Naughton 1992).

The flip side of this phenomenon was that, as TVEs remitted less tax revenue back to the central state, local governments became more and more dependent on this revenue. In addition, the relatively small size and nimble structures of rural enterprises were significant factors in their continued success throughout the reform era. Moreover, their location in rural areas meant that they were positioned to provide at low cost the necessary inputs to agriculture and the materials required to fuel the construction boom that took place throughout the reform.

At the local level, an abundance of scholarship has shown the high degree of articulation and inter-dependence between local governments and local industry. Selden (1998: 29) points out that the issue of just who controls the TVE is often ambiguous: "the evidence . . . is of a symbiotic relationship between the TVE and local government with power shifting to and fro between poles of autonomy and control over time." The profits from collectively held rural industries during the 1980s and 1990s accrued directly to their de facto owners—local governments—and were not remitted back to the central government. This is important because, as will be shown later, many township and village governments became highly dependent on the revenues generated by rural industry. As Whiting (2000: 72) notes:

> The fiscal system created a revenue imperative for local officials by requiring that local governments be largely self-financing, and since township governments were heavily dependent on industry to meet their revenue requirements, they had a strong incentive to promote local industrial development.

Whiting's case study found that up to 90% of local operating revenues in several townships in Jiangsu province came from local industry. Because local cadres served simultaneously as tax collectors and enterprise managers, budgetary shifting to avoid remitting taxes back to the central government was common. Futian, the site of this study, depended on rural industry for some 85% of its operating budget during the 1990s (Li Xing Xing 1995). As will be shown later, budgetary dependence on industry influences the decisions local cadres make about how to promote local factories, as well as whether or not to enforce environmental regulations that place financial burdens on local factories.

In short, township and village enterprises served as the "meal ticket" (*chifan caizheng*) for local governments throughout much of the reform era, and local governments in many cases have become an "activist state that selectively intervenes to guide and assist local industry to take maximum advantage of market opportunities" (Oi 1998: 95). Although the ownership and management structures of rural industries have changed through time, the rural industrial sector continues to be of vital importance to local governments. Rural industries provide the means through which local cadres seek to meet development targets, in turn creating tangible incentives to promote their growth.

In addition to responding to the budgetary incentives of TVEs, local cadres in many cases benefit personally and directly from TVE development. Hongyi Chen (2000)

argues that local cadre performance evaluations (*kaohe zhibiao*) are based heavily on local industrial performance, and that this creates a further incentive for officials to promote industrial development. When cadres' careers depend upon the efficient promotion of local industrial development, they are likely to pursue the goal with increased vigor. Moreover, it is precisely the local cadres who are in the best position to promote local industry. Because of their inside knowledge and connections to important sources of political power, they are the key to securing property rights, acquiring technology and human capital, absorbing financial risk, and assuring access to natural and political resources (Chen 2000; Pei and Liu 2001).

Ethnographic studies have provided further evidence on the intertwined nature of local rural governments and industry. Mayfair Yang (1994), in her study of reciprocal networks (*guanxi*), argues that these networks are a key element in the development of TVEs, since a rural enterprise must rely on the favor of local cadres. The demands of catering to local industry have rewritten the job description of these officials, who are increasingly expected to use their social connections for procuring the resources necessary for the success of local industry. The burgeoning of rural industry has led, according to Yang, to a displacement of the traditional socialist slogan of "serving the people" (*wei renmin fuwu*) in favor of a new slogan emblematic of the cadre's role in local development: "serving the people's currency" (*wei renminbi fuwu*) (ibid.: 161).

One final and important factor contributed to the rise of rural industry in China: the existence of strict laws governing rural-urban migration. The household registration, or *hukou* system, required all citizens to register with the central government. Rural and urban residents were subjected to wholly different state controls and were entitled to

different state benefits; urban household registration was closely linked with vital benefits and services, including housing, food rations, employment opportunities, health care, child care and retirement pensions.[14] To contain the strain on state resources such a system of entitlement implied, rural-urban migration was severely restricted, if not impossible. At the same time, government planners, faced with a surplus of agricultural labor and a scarcity of urban resources, encouraged peasants to "leave the land but not the countryside" (*litu bulixiang*), and to "enter the factory but not the city" (*jinchang bujincheng*). In other words, peasants were encouraged by a combination of policy and market directives to give up the agricultural livelihood while remaining in rural areas. Indeed, the capacity of rural industry to absorb surplus labor, thereby keeping peasants out of China's cities, was one of its most important accomplishments, and one that was lauded by the eminent Chinese anthropologist Fei Xiaotong, among others:

> It [rural industrialization] has avoided the occurrence of the social problems arising from overconcentration [sic] of the population as happened in the industrialization in the past. The development of industry in towns and rural areas and the speeding up of industrial enterprises have prevented the massive convergence of the population on big and medium sized cities. (1989: 238)

What has resulted is a total remaking of the countryside, a "rural urbanization" (Guldin and Goldschmidt 1997) marked by industrial development and articulation with outside markets—all while keeping production in the countryside and thus promoting industrialization without urbanization. This has had profound effects on the employment

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[14] For a discussion of the effects of the *hukou* system on migration and the development of rural industries, see Cheng and Selden (1994). Also see Hsueh, et al. (1993).

structure of the entire country during the reform era (see Table 1). As the rural labor force grew by more than 150 million, more and more workers moved from the agricultural sector to the industrial sector. At the same time, rural industrial output came to account for a staggering one-third of China's GDP.

Table 1. Contributions of rural industry to rural employment and industrial output

	EMPLOYMENT				OUTPUT
YEAR	**Total Rural Labor Force**	**% of Rural Labor in Agric.**	**% of Rural Labor in Industry**	**Total Rural Industrial Labor Force**	**% of National GDP Contributed by Rural Industry**
1980	318,359,000	93.6	6.4	20,275,000	N/A
1985	370,651,000	81.9	18.1	67,136,000	8.6
1990	420,095,000	79.4	20.6	86,731,000	13.5
1995	450,418,000	71.8	28.2	127,073,000	25.0
1999	468,985,000	70.2	29.8	139,847,000	30.3

Source: Compiled from the Chinese Ministry of Agriculture Report [*Zhongguo Nongye Baogao*] (Chinese Ministry of Agriculture 2002) and Li Chenggui (2000)

The real significance of Table 1 can only be seen in the context of China's *hukou* system, which kept laborers in the countryside. Between 1980 and 1999, roughly 120 million people found employment in the rural industrial sector, an average of more than six million per year. Li (2000) estimates that, if this growth had occurred in urban centers where industrial production might be sited in the absence of rural-urban migration controls, the influx of rural labor into China's cities would have been enough to raise the

national urban percentage by twenty points, to over 50%. Currently only 30% of China's population resides in urban areas. If all of China's industrial growth had taken place in cities during the reform era, it is easy to see the crippling effect this would have had on the system of uneven privileges upheld by the *hukou* system.[15]

Beginning in the mid-1980s, township and village enterprises, along with other sectors of the economy, began heading toward privatization. In many cases, privatization was a rational next step for rural industries that were increasingly under professional management and beginning to separate from local governments. Chen (2000) argues that the development of larger markets for goods produced by TVEs, the technical structure of the firm, and the economic setting in which the TVE was situated all had an impact on whether or not an individual factory became privately held. This she calls "induced privatization," since market forces provide tangible incentives to privatize.

At present, the TVE sector is actually made up of four types of enterprises: township enterprises (*xiangban qiye*), village enterprises (*cunban qiye*), enterprises owned by a cooperative of rural households (*lianhe qiye*), and, increasingly, enterprises owned by private entrepreneurs (*geti qiye*). There is no reliable data on exactly what

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[15] There is some disagreement about the precise link between migration and rural industrialization. Some authors argue that the role of rural industry in keeping labor in the countryside was negligible (Liang, et al. 2002). Their study did not find evidence that rural industrialization reduced migration during the years 1985-1990. Certainly, by the 1990s the gradual deterioration and sporadic enforcement of *hukou* policies, what has been called the "breakdown of the Great Wall," allowed for greater migration than previously known (Chan and Zhang 1999).

percentage of rural factories are privately held, and indeed ambiguous ownership is one of the hallmarks of the TVE sector. As a case in point, however, when I first conducted fieldwork in Futian during the summer of 2001, the township had nine TVEs, five of which were privately owned. By the time I returned for a second fieldwork period, in the autumn of 2002, the number of TVEs had been reduced to seven, and all of them were privately held.

The Pollution Problems of Rural Industry

Despite their recent dynamism, township and village enterprises face an uncertain future. A growing body of scholarship is concerned with the potential decline and ultimate demise of the rural industrial sector entirely. Williams (Williams 2001), for example, suggests that the swift privatization process in the face of poorly defined property rights has impeded TVE performance in recent years. A recent report published by China's Ministry of Agriculture on the state of rural industry reports that efficiency of production and quality control have been persistent problems (Xinhua 1997).

By far the most pressing problems confronting today's township and village enterprises, however, are ecological in nature. Both Chinese and international scholars acknowledge that, "at the same time that TVEs have developed very rapidly, they have also brought serious pollution problems" (Ren and Li 2002). Lang Meng, a Chinese environmental scientist, cites, in a hefty tome dealing with the overall state of the contemporary Chinese environment entitled *The Encyclopedia of Environmental*

Protection (Meng 1999), five major problems threatening the long-term survival of TVEs in China, four of which are directly related to the environment:

1. The rate of natural resource consumption associated with rural industry is unsustainably high;
2. The environmental degradation associated with rural industry is increasingly pressing;
3. Rural industrial pollution threatens the health and welfare of local residents;
4. Rural industrial pollution results in damage to industrial infrastructure itself, as well as to agricultural products; and
5. Unfettered growth in the rural industrial sector threatens the integrity of the socialist planned economy.

A number of factors contribute to the serious pollution problem of TVEs. Because TVEs are located in rural areas without access to large amounts of capital, they typically employ inferior, out of date technology. Coal, the most abundant energy source in China, is almost universally the fuel of choice for TVEs. Most coal is burned unwashed, and coal from the southern and southwestern regions is particularly high in sulfur content. Because rural industries typically lack significant sources of capital, investment in environmental mitigation technologies is impractical. In addition, some of the same structural problems discussed above—a high degree of interdependence between government and industry, the revenue demands placed upon rural industry, and the cadre evaluation system—contribute to the pollution problem by creating financial incentives to ignore the problem or to fail to enforce the environmental standards set at the national level (Ren Hongwei and Li Gong 2002). The responsibility of overseeing environmental

compliance rests with district and country governments, who receive a mandate (but precious little funding) from the State Environmental Protection Administration (SEPA). These governments often lack the proper technology and manpower to conduct thorough monitoring of rural industries and to enforce emissions standards.

Underpinning the practical limitations to an effective monitoring and enforcement regime, moreover, is a core socialist ideology that ignores the growing problem of pollution under the assumption that only the capitalist mode of production, with its profit imperative, is capable of reeking wide-spread environmental damage through the creation of externalities. In this view, environmental degradation linked to the socialist development process has become both an ideological impossibility and a growing reality.

It should be pointed out that, despite China's overall enthusiasm for rapid development, environmental protection is growing in importance. An originally small, nascent environmental protection bureaucracy, begun in the late 1970s, has grown into a ministry-level institution with a broad mandate to create and enforce environmental regulations.[16] The State Council, in 1984, passed the "Decision on Strengthening Environmental Management of Township and Neighborhood Enterprises," a set of regulations that would require factories to conduct environmental impact statements before construction, plan for pollution mitigating strategies, and pay fees and levies on

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[16] One way to track the progress of environmental protection in China is to measure the number of people employed in the environmental sectors of the government. This number in 2001 reached 380,000, including both national and local levels of government. A total of 140,000 enterprises of all sizes underwent environmental monitoring in 2001.

effluents. These regulations, and others like them, have not been competently enforced (Ho 2000). With its participation in the 1992 Summit on Environment and Development in Rio, moreover, the Chinese government signaled its willingness to address environmental ills and participate in the international discourse of sustainable development.

One of the central problems of doing research on rural industrial pollution is that, while pollution rates and their health effects in urban settings are comparatively well established, [17] almost no systematic monitoring takes place at the township or village level, primarily for the structural and economic reasons noted above. In addition, government reporting of and scholarly treatments on the subject of rural pollution are hopelessly vague. Samuel Ho (1995: 375), for example, asserts simply that "during the 1980s rural enterprises emitted ten to twenty times the amount of pollution of their urban counterparts." Ren and Li (2002) found that industrial waste water, volatile organic compounds, heavy metal emissions, and other pollutants all increased during the 1990s both in real terms and as a share of total pollution nationwide, but their estimates seem to be based on compilations of central government figures that are known to be unreliable.

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[17] Establishing an epidemiological link between pollution levels and health responses, even in cities, is, of course, no easy task. Two recent studies have provided the valuable beginnings of an understanding of the health effects of air pollution in China's cities. Xu et al. (2000), for example, show a link between particulate matter concentrations and daily mortality in the northeastern industrial city of Shenyang. Qian et al. (2000) show that air pollution in three urban areas has a correlation with health outcomes in children. It can only be hoped that other researchers will use similar methods to assess the health effects of pollution in rural areas.

Samuel Ho (2000) has provided data for solid, liquid and gas emissions for rural industries in Sichuan province and the municipal area of Chongqing, noting that, at the village level, less than 25% of wastewater is treated. But the problem of assessing air and water pollution emissions at the township- and village levels remains, mostly because data tend to be aggregated at higher levels of government. In Chapter Four I present the results of systematic monitoring of particulate matter in Futian, which I hope may serve as a baseline for understanding the exact nature of the material and health risks posed to the community by industrial pollution.

Why Study Township and Village Enterprises?

I chose to study township and village enterprises for both practical and theoretical reasons. When I first went to China, in 2001, to conduct a pilot research project, I got a glimpse at how ubiquitous TVEs are in contemporary China, and how vital to rural development. In the process of visiting several township and village enterprises in the northeastern province of Heilongjiang, and several more in Futian Township in southern Sichuan, I became aware that TVEs serve as a focal point for development aspirations in rural areas, boosting employment levels, attracting outside investment, and providing the revenue necessary to carry out development projects. As such, the rural industrial sector is of general importance to anyone concerned with the phenomenon of rural development in China.

But the changing nature of ownership patterns—Futian's TVEs were half collectively held and half private when I first visited in 2001; by 2003 they were all

private—has caused a shakeup in intra-community relations. As outside investors and migrant laborers have begun to reap the benefits of privatized industry, the pollution problem is shared and confronted by all members of the community. This presents an ideal setting for testing the assumptions of political ecology, which posits a link between resource access and environmental degradation. It also provides an opportunity to extend political ecology's theoretical framework by taking it out of its agrarian roots and situating it within an industrial setting.

CHAPTER 3—RURAL INDUSTRY CONTEXTUALIZED: THE CASE OF FUTIAN

> "I cannot sleep until we build the Panzhihua Iron and Steel Mill . . . If capital is lacking, I will donate the royalties from my own writing."
>
> Chairman Mao Zedong (quoted in Golden Panzhihua 1990: 3)

> "A few years ago, there were no factories in Futian, and none in Daxing, either. Now there are a lot more factories, and more opportunities for work. But there's also more pollution."
>
> (Futian resident)

Futian, located at the extreme western edge of the Panzhihua Municipality, is a township of 3,500 people (refer to maps in the Introduction). The area is situated on the eastern edge of the Qinghai-Tibetan Plateau. The township encompasses 52.3 square kilometers of land and the four villages (*cun*) of Tangba, Guantian, Jingui, and Wuzitian. Most of Futian's residents, some 53.2%, are Shuitian Yi, a group of people who traditionally spoke the Western dialect of the Yi language, part of the Tibeto-Burman sub-family of languages, although prolonged contact and intermarriage with Han people over the last century has led to a dramatic decline in the use of the indigenous language. The township is situated along a small stream which feeds into the Jinsha River, one of the primary tributaries of the Yangtze. The elevation ranges from 800 meters along the streamside, where the land is terraced for growing rice, to 1,400 meters where the ground is steep, dry and covered in chaparral, Yunnan pines and eucalyptus. Except for the wet season, which arrives during the summer months, Futian is dry and dusty, with red soils (*hongdi*).

The area is, in its way, quite beautiful. Reminiscent of the landscapes of the American southwest, it is marked by extremes in temperature (summers can reach nearly 40 degrees), altitude (surrounding peaks are as high as 3,000 meters), and aridity (annual precipitation is under 10 inches, most of which falls during the summer season).

Despite the adage, common throughout the southwest region, that one must "remove a wheelbarrow full of rocks just to grow a mouthful of rice," agricultural yields in Futian are sufficient to feed the local population and to sell excess grain, vegetables and meat as far away as Panzhihua City, although older residents recall that, prior to twenty years ago, poverty (*pinkun*) and hunger (*wenbao*) persisted. Irrigated rice is grown along terraced slopes, particularly in the valley bottoms near the stream. Most families have between one and five *mu* of land, typically consisting of some low-lying, irrigated land (*tian*) for rice production and some dry lands (*di*) higher along the more marginal areas for crops that either require no irrigation or that can be watered by carrying buckets of water from the stream.

At the northwestern edge of the township, situated along the main road between Panzhihua city to the east and Huaping, a county town across the Yunnan border to the west, is Futian's industrial complex. It is a patchwork of low-tech, rusted factories in various stages of operation or disrepair, and home to some 100 industrial laborers and their families, many of whom traveled hundreds of kilometers to relocate here for employment.[18] There are several zinc smelters, a coking plant, and a coal washing plant,

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[18] Futian's factories were in a constant state of flux throughout my fieldwork period. Many shut down their operations, and resumed again, during the space of a few months, due to both declining profitability and

all of which lack basic environmental mitigation technologies. On any given day, plumes of smoke can be seen rising above the industrial complex. The air has an acrid smell to it, and the water in the stream often runs black, depending on which factories are in operation.

In this chapter, I offer a detailed picture of Futian as a study site, paying particular attention to the state of rural industry as it existed during my fieldwork in 2002-2003. I show how Futian's TVEs have developed in the shadow of Panzhihua, a municipality founded in the 1960s for the sole purpose of constructing a state-owned steel production facility. In addition, I outline how the ethnic identity of Futian as a minority township (*minzu xiang)* has served variously as an asset to local development and as an explication of the reasons why development fails, and how, over the course of time, the local township government has grown dependent upon the revenue stream generated by local factories. Finally, I discuss how Futian serves as the setting for testing the hypotheses of political ecology and risk perception in this study.

The Myth of Arrival: Panzhihua and the Making of an Industrial City

The story of Futian Township's development is intimately tied to Panzhihua, a city whose history is both storied and short. In the early 1960s, after a diplomatic fallout with the Soviet Union, Mao Zedong and other Chinese leaders feared the destruction of their nascent industries at the hands of American or Russian bombers. During the Third

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increased enforcement of environmental regulations. This is a subject I discuss at some length in Chapter Seven.

Front Movement, scores of industries, large and small, were systematically dismantled and moved into the hinterlands for protection. Panzhihua, a region of southern Sichuan province known for its beautiful tree by the same name (Panzhihua means, literally, "climbing branch flower")[19], became the site of one of the most storied Third Front industrial complexes.

The only problem: no one lived there. The official history of Panzhihua, as reported in the *Panzhihua City Record* (Sichuan Province Panzhihua City Editorial Committee 1995), depicts the area prior to the Third Front Movement as barren, forbidding, and uninhabited, with only seven Han households making their homes along this winding portion of the Jinsha River. This is a story often repeated by the early Han settlers who came to the area at the request of the central government, and it is difficult to tell where official historiography ends and local oral history begins. The story seems designed partly to enjoin the reader or listener with a vision of just how forbidding and remote the region was prior to the Third Front settlement, and partly to illustrate in a tangible way the sense of isolation that the settlers felt, many of whom encountered a wholly different topography and climate than the ones they left.

In fact, the official story contradicts prior surveys of the area, which noted that, prior to 1964, the area of present-day Panzhihua probably had a population of around 300,000, some one-quarter of whom were ethnic minorities: Yi, Dai, Bai and Miao who lived for the most part in highland areas (Li 1995: 88).

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[19] The Panzhihua tree is a variety of the Kapok (*Ceiba pentandra*) and can grow to some 50 meters tall. Its flowers, which many local people lightly fry and eat, bloom yellow, orange or red in the early springtime.

Mr. Ma, a retired engineer at Panzhihua Steel whom I interviewed, recalled the summer of 1965, when he and his wife moved from Chengdu, some 700 kilometers to the north, to become part of that first contingent:

> I was part of the Young People's Corp (*qingnian dui*) back then. At first I couldn't bring my wife or family, who had to stay behind in Chengdu and wait until we had made some progress here. Of course, we were all poor back then, but the hardships we endured here were extraordinary. We didn't have anything, not even coal to cook with, and the hills were covered only in scrub and not good for burning. We used to put three stones together, light a fire underneath, and use the heated stones for cooking. The hills were full of nettles (*dajiancao*), and we would all be cut and scraped after a day's work. We wandered around with just one set of clothes, a wide-brimmed hat to keep the sun off us, and a canteen. As for transportation, we had nothing but our own two feet.

These physical hardships were, however, no impediment to Community Party ideology, which demanded the development of Panzhihua for reasons of national security. On March 4, 1965, Chairman Mao Zedong read a Ministry of Mining and Industry report recommending the construction of an iron and steel mill at Panzhihua, and that very day made the pronouncement of a "wise decision" to develop the region. Work units from Sichuan and Yunnan were mobilized immediately, and some 50,000 workers, some with their families, arrived in Panzhihua throughout the summer of 1965.

Geological surveys had confirmed in the late 1950s that the landscape in and around Panzhihua was endowed with rich mineral deposits, including iron ore (both hematite and titanium-bearing titano-magnetite), coal, gypsum, and other minerals. It was subsequently discovered through further exploration that Panzhihua is also home to 93% of China's total titanium reserves as well as substantial deposits of vanadium (Shapiro

2001). A prominent statue displayed in downtown Panzhihua still bears the title "Song of Titanium and Vanadium" (*Fantai Zhige*).

By any measure, the influx of new settlers to the area in the early years was astounding. The historian Judith Shapiro, who has reconstructed the migration history of Panzhihua, reports that in the first year alone, 41,047 migrants arrived. That same year, Panzhihua, then called simply "Dukou" after a ferry crossing on the Jinsha River, assimilated several large people's communes from Yunnan and Sichuan provinces, redrawing the local administrative boundaries and putting some 80,836 people under the administrative control of Panzhihua. This brought the total of Panzhihua's population in 1965 to 122,243 people.

Between 1965 and 1971, the city saw a steady influx of migrants, with a net gain of 22,691 people annually. After the initial dispatching of work units from nearby provinces, experts in iron and steel were needed to provide technical consulting for the smelter. In the late 1960s, thousands of workers and their families arrived from the northeast, in particular from the great steel city of Anshan, in Liaoning province. Workers from Wuhan city were also mobilized. This legacy is reflected in the contemporary composition of Panzhihua's residents; the city is known throughout the country as an "immigrant city" (*yimin cheng*), and residents joke that one can learn the northeastern dialect (*dongbei fangyan*) simply by spending time in Panzhihua.

The work of the early years was treacherous. Workers were charged simultaneously with building the iron and steel mill and with constructing the Chengdu-Kunming railroad line, which ran through an outlying neighborhood of Panzhihua called Jinjiang and which would transport the steel produced there to other production facilities.

Summer temperatures reach 100 degrees Fahrenheit. The death rate of the 1965 migrants was an astounding 13% (Shapiro 2001). But dedication and ideology drove the newly arrived workers toward their goal. Mr. Ma, retired engineer and early settler of Panzhihua, recalled the inspiring slogan of those early days: "Don't think of father, don't think of mother; until you produce iron, you can't go home" [*Bu xiang die, bu xiang ma; bu chu tie, bu hui jia*].

Panzhihua in the twenty-first century, though by no means as provincial as it had been, is still a company town, with some 100,000 local residents employed directly by the steel mill, the Panzhihua Iron and Steel Corporation (*Panzhihua Gangtie*, or simply *Pangang*). Pangang itself is located on the north bank of the Jinsha River and consists of a sprawling complex of industrial infrastructure, company-subsidized residences, shops, and restaurants; it is a self-contained city. When a working shift ends or begins at Pangang, the streets are clogged with hundreds of employees on their way either to the factory or back home, each wearing a hard hat and a denim jacket with the company logo—a bold "P" and "G" superimposed on one another, for *Pangang*—embroidered on the left breast.

Rural Industry Contextualized: The Case of Futian

Futian Township was one of the areas annexed by Panzhihua in 1965 when the city was established. It is situated at the far western edge of Renhe District, one of three administrative areas within the jurisdiction of Panzhihua Municipality (refer to maps in

Introduction).[20] There is a local saying here, in this narrow sliver of Sichuan surrounded by Yunnan, that says: "Go 5 kilometers in any direction and you can't understand the language." This is not as true in contemporary Futian as it was in the recent past. In the 1950s and 1960s, when Han people began moving to the region in earnest, they encountered a complex ethnic and linguistic landscape with many local variants of the Yi language, as well as small contingents of the Bai, Miao, Dai, Zhuang, and other nationalities.

Because of its recent annexation from Yunnan, Futian sits on a narrow spur of land in Sichuan province surrounded by Yunnan. If one comes by bus or car from Panzhihua, the road passes through several Yunnan towns, enters and exits Futian, continues over a mountain to the northwest, and passes back into Yunnan within a few kilometers, a strange amalgamation of border crossings that is summed up in a local saying: "Breakfast in Yunnan, work in Sichuan, lunch in Yunnan."

Most of Futian's township and village enterprises—which include several zinc smelters, a coking plant, and a coal washing plant—played a peripheral role in the operations of Pangang, providing cheap inputs to the industrial giant. In recent years, however, both the downstream markets and the ownership structure of Futian's industries have been in a state of flux, and government officials and rural residents alike are coping

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[20] The other two are Miyi County, to the northeast, and Yanbian County, to the northwest. Panzhihua Municipality is immense, with 7,149 square kilometers of land under its jurisdiction and a population, in 2001, of just over one million (Sichuan Province Statistical Yearbook 2002). Many official documents cite Panzhihua as the "longest city in China."

with an uncertain industrial future. The pollution problems associated with Futian's industries are, to the outside observer, acute. As will be shown in detail in Chapter Four, their reliance on coal as an energy source, and their absence of environmental mitigation technology, create both ecological and health problems for industrial laborers and the residents of the township.

The View from the Factories

The Zinc Smelter

On a crisp but sunny day, one of the investors in Futian's zinc smelter, a soft-spoken man in his early sixties, sits on a low stool inside his home, smoking Marlboro cigarettes. The house, a two-room brick squatter shack with a cement floor, is situated inside the industrial complex on the outskirts of Futian. There is a color television set and DVD player on a table in one corner, with a stack of Hollywood DVDs beside them.

The house doubles as the base of operations for the zinc smelter. The investor has been in Futian for four years, having migrated from the neighboring province of Guizhou with his wife and son. Together, they invested RMB 450,000 (roughly $55,000) in personal savings and bank loans in their family's zinc smelter. In this investor's case, the savings came from his retirement account, which he cashed out after serving as a high school teacher for some thirty years.

The factory is a secondary zinc smelter (*jinxinchang*). It produces 25-kilogram blocks of relatively pure zinc, most of which are shipped to Kunming for alloying with iron and steel. Zinc has been used for several hundred years, both in China and in the

West, as a galvanizing agent in ferrous metals to prevent corrosion (Cocks and Walters 1968). The metal plays a particularly important role in rural China, where the construction industry continues to boom and the need for galvanized roofing materials of corrugated iron is particularly high.

The local zinc-bearing ore, much of which comes from Huaping county, across the provincial border in Yunnan, is a zinc sulfide concentrate. Prior to 2001, the township government owned and operated a primary zinc smelter (*chuxinchang*), whose function was to remove the sulfur content from the zinc sulfide ore, providing the privately owned secondary zinc smelters, like this one, with a more pure form of ore for their smelting activities. This primary zinc smelter, whose now-defunct 50-meter smokestack is still the most visible landmark of the industrial complex, has since closed because the township government could no longer afford to operate it and was unable to find a private investor to take over operations. Futian's zinc smelter now acquires ore from Shilongba Township in nearby Huaping County, across the Yunnan border.

The smelter consists of six open furnaces that vent coal smoke into the air without a smokestack. Operations are steady, and the smelter produces 30-40 tons of pure zinc per month, which it sells to a company in Kunming, some 300 kilometers to the south. The investor initially came to Futian in hopes of developing his factory, selling it off within a few years, and making enough money to secure his family's financial future. When operations are steady, his net income amounts to RMB 10,000 per month, roughly twenty times the township average. With enough time and effort, he told me, he should be able to "pave a good way for my children" [*po yi tiao lu wei haize zou*]. His eldest son, who also holds a share of the zinc smelter, resides in Futian. His youngest son is getting

advanced training as an engineer in Guizhou, but the youngest son's wife, a slim woman in her late twenties, has the task of staying in Futian with the family to prepare meals, do the washing, and perform the other duties of a daughter-in-law.

The smelter employs some twenty people, all of them men. Most of them are migrant laborers who have either followed the investor from Guizhou province or who have prior experience working in similar industries nearby. Some of them have brought their families: the industrial complex is rimmed by a row of low squatter houses, many of them with bare dirt floors and filled with only the most basic of necessities: a few chairs, a bed covered by a mosquito net, and a small coal-burning stove for cooking and heating.

On this day, only four out of six furnaces are in operation. The men shovel piles of raw coal, most of which is brought from the neighboring county of Huaping, across the provincial border in Yunnan some two kilometers away, into the furnace chutes. Semi-refined zinc ore is placed in ceramic cylinders and hoisted into the furnaces with metal tongs. After a period lasting from hours to more than a day, depending on the quality of the ore, the men carefully remove the cylinders, pouring the molten zinc into rectangular molds. The entire factory complex, an area carved out of the dry and unproductive hillside (*huangshan*) above town, is littered with coal piles, empty ceramic cylinders, and unusable zinc slag.

The men work slowly and methodically. None of them wears a mask or eye protection, despite the thick, sulfurous smoke pouring out from the sides and the top of each furnace. The smelters consume coal at a fantastic rate: according to the investor, between 10 and 15 tons of raw coal are consumed for every ton of pure zinc produced. There is a tall smokestack in the center of the complex—an infrastructural improvement

that cost the smelter's investors RMB 40,000 (nearly $5,000)—that is tied to each furnace by a central ventilation system.

The Coking Plant

On a hot day in March, I rode alongside a coking plant employee from Yanbian County in northern Panzhihua, to a state-owned chemical fertilizer factory in Huaping County, Yunnan. He steered the six-ton blue dump truck, laden with a 12-ton load of coke, cautiously down the mountain roads into the wide, fertile valley, where farmers were beginning to level and clear their land with water buffalo for the rice season.

Upon arriving at the fertilizer factory, a huge structure that smells of chemicals and sulfurous smoke, the driver steers the truck into a weighing station and receives RMB 3,000 from an attendant, 250 yuan per ton of coke. According to the fertilizer factory's financial manager, a young, smartly dressed woman who could be seen bustling constantly from the main office to the loading station where coke was off-loaded, the factory produces 7,000 tons of chemical fertilizer each month, most of which is distributed to individuals and production teams in Sichuan.

The coking plant employee has been working at the plant for more than two years. His status as a skilled laborer (driving trucks is seen as a rather enviable occupation in the Sichuan countryside) affords him a good salary of RMB 2,000 per month. His wife and young daughter still live back in Yanbian, but he only has the chance to visit them once each month.

Prior to 1997, most of the coke produced in Futian went to fuel steel production at the Panzhihua Steel Plant (*Pangang*). Since that time, however, Pangang has increased its

reliance on nuclear and hydroelectric power sources, and Futian has been forced to find other markets for its coke, chief among these being the state-owned fertilizer factory in Huaping. (The Ertan dam and hydroelectric facility, currently the largest hydroelectric project in China pending the completion of the Three Gorges Dam, began operation in 1998. It is located some 60 kilometers outside of Panzhihua City and is the single most important power source in the region).

The coking plant has been in operation under various forms of ownership since 1989, when it was established in 1989 as a collective enterprise (*jiti qiye*) with a total investment of RMB 600,000. Of that sum, 230,000 yuan was invested by a collectivity of local citizens, 40,000 yuan was invested by the township government, 260,000 was secured by bank loans to the township government, and 70,000 yuan came from other investment sources. That year, the plant produced 100,000 yuan worth of coke and the township government netted 60,000 yuan in taxes and 50,000 yuan in profit. In 1992, the plant invested 55,000 yuan in environmental protection technologies in the form of a waste water management piping system.

In addition, the Panzhihua Environmental Protection Bureau contributed RMB 250,000 for environmental mitigation technologies (of which a now-defunct smokestack is the only remnant). Because of Futian's previous status as a minority township (*minzu xiang*), as will be discussed later in this chapter, the coking plant also benefited from a RMB 1 million investment from the Panzhihua Nationality Affairs Commission (*Minzu Shiwu Weiyuanhui,* or *Minwei*). Later, the township government also secured some capital from the Panzhihua Bureau of Finance (*Caizhengju*) in order to improve the coking plant's facilities.

Back at the coking plant, the driver rests while his co-workers, some 25 young men in soot-blackened clothes, unload more dump trucks filled with raw coal. They carry the coal in wheelbarrows and place it in one of 11 brick-lined ovens, each of which consists of a brick-lined trench some eight feet wide, ten feet deep and twenty feet long. Coke is a hard, porous carbon material used for high-heat industrial operations. It is most commonly used for steel production, where its role is to burn off the iron content in the blast furnace. Raw coal is converted to coke through a heating process in an oxygen-free environment. Futian's coking plant accomplishes this task in a low-tech fashion: the men tightly pack each oven with coal, igniting it from beneath and allowing it to smolder. In most cases, an oven full of coal will smolder for several days while the volatile compounds (including sulfur dioxide, tar, and oils) burn off. After this process is complete, the men pry away great chunks of porous, silver coke with crowbars, load it into the wheelbarrows, and fill the company dump truck for another run to the fertilizer factory. On any given day, there are four or five furnaces operating simultaneously; the others are either in a state of preparation or clean-up.

The volatile compounds that are burned off during coke-making are all vented locally. Although the coking plant has a brick smokestack, it has not been in use for at least the past year following an explosion. Sulfurous smoke wafts from each of the active furnaces, venting into the open air. When I first visited the coking plant, during the course of pilot research in 2001, I could hardly breathe in the presence of all the noxious gases. Throughout the extended field period, I had to keep a handkerchief with me to subtly cover my mouth and nose as I walked around—and sometimes on top of—the ovens.

The Coal Washing Plant

Futian's coal washing plant is located in the same industrial complex on the northern edge of the township. A wiry man in his fifties sits in front of a panel of levers which control the speed of the conveyor belts that usher a constant stream coal through the washing shack, a small building that houses the plant's machinery. He is from Yanbian County in the northwest of Panzhihua, and has been doing similar work all of his life. The day is hot, and the worker's station, covered by a roof and cooled by the constant flow of a watery coal slurry from a series of cement chutes, is the envy of the other workers, all of whom work outside under the glaring sun.

The coal reserves of China vary in quality and in "cleanliness"—that is, the percentage of pyretic sulfur that they contain. Coal from China's southern and southwest regions is notoriously high in sulfur content, and coal used in industrial boilers or domestic stoves is typically washed using a variety of methods to remove the sulfur.

Futian's coal washing plant was not in operation throughout most of my field research period. One morning in the spring I climbed up to the industrial complex on my way to an interview with one of the investors in the zinc smelter, and I heard a sound like the rumbling of a large truck. As I got higher on the hill, I realized it was the coal washing plant running. This particular plant has been in operation since the early 1990s, when the local government ran it under internal management. By 2001, when I first visited Futian, the plant had become unprofitable due to the depletion of the local coal supply and had been shut down. It was reopened during the spring of 2003 as a purely

private enterprise whose owner lives in Yanbian County. The plant employs ten men, most of whom are also from Yanbian, and turns out 20 tons of washed coal per month.

Raw coal from Huaping County is brought to the site by dump truck. The coal is particularly fine; I hardly saw a piece over one-half inch in diameter. The plant is situated on the natural slope of the hillside, and gravity does much of the work. A few workers stand at the top of the hill, where the coal has been sorted into piles by diameter using screens. They begin shoveling it onto a small conveyor belt, which ushers the coal into a small machine shack. The coal is flushed with water from a hose, and the machinery rotates vigorously until the coal is mixed into a slurry. The slurry travels further down the hill through a series of narrow cement canals, where it collects in a catch basin about twenty feet square, pooling to a depth of about two feet. It is left in the catch basin to dry for at least ten days, at which time it consists of a thick paste about the consistency of peanut butter. The paste is mostly used locally for household heating and cooking; villagers in the more developed portion of the township (generally Wuzitian village, the area closest to the main road) have indoor coal-fuelled boilers that run on small cylinders of coal (*meitan*) which have been formed from a mold. Other villagers further away from the center of the township simply receive the coal slurry in a bulk shipment, packing it by hand into little balls that will later be thrown into small coal heaters.

The View from the Ethnic Periphery

In Futian Township, as in other areas with predominantly minority populations, the question of rural development is intimately related to the perceived backwardness

(*luohou*) of the local people. Although the Shuitian Yi are not perceived in quite the same negative light as some of the highland Yi people elsewhere in Sichuan and Yunnan, it is typical for Han people to ascribe the backward state of Futian's economy to the low "cultural quality" (*wenhua suzhi*) of the Shuitian. This is in line with a historical tradition in China of viewing minority groups within and outside of the nation's borders as inferior to the Han. The following rhyming poem, recited to me by a local Shuitian Yi man and presented here in pinyin and English, illustrates how the Yi are often perceived as hopelessly naïve, juvenile, and generally unfamiliar with the trappings of modern civilization:

Old Brother Yi

Yijia gange jincheng lai

Mopi Yishang shuirong xie

Yangpi koudai li beiqi

Kuqiao baba kaichulai

Yijia gange jincheng lai

Yangpi dabiao jiaopixie

Cunkuan zheng'er suishendai

Qiche manzai yuliang lai.

Old brother Yi comes into town,

Plopping his burlap sandals down

Shouldering his goatskin pack,

He pulls out buckwheat cakes for a snack.ru

Old brother Yi comes into town,

Clothes and shoes of goatskin sown

He closely guards his bank receipt,

And trades for a carload of surplus wheat.

In southwest China, the task of rural development is connected to the "nationalities question" (*minzu wenti*). It was reiterated to me countless times by local residents and Han Chinese academics alike that Futian, and areas like it throughout the southwest, were poor because they were inhabited by ethnic minorities who were not only culturally inferior to the Han but who also lacked the will and ambition necessary to achieve successful development. The history of cultural contact between the Han and the minority peoples living within the borders of the Chinese state has been the story of a "civilizing project" (Harrell 1995a) in which the vast array of ethnic groups were systematically classified and, in most cases, acculturated to Han Chinese cultural practices and economic livelihoods.

The ethnic identification project (*minzu shibie*) of the 1950s is perhaps the most overt and widely cited example of the civilizing project. This project involved troops of dedicated, often scantily trained ethnologists who applied the Stalinist criteria of ethnic classification (common language, common territory, common economy, and common psychological nature) to the myriad peoples living in China's hinterlands. These criteria

were sometimes supplemented by self-identification of the people in question as well as the Han's folk understanding.[21] The goal was to catalog all of the ethnic groups within China's borders and, ostensibly, bring the benefits of socialism to all. By the end of the ethnic identification project, China had 56 officially recognized ethnicities, including the Han, who account for some 91% of the country's population, and 55 "minority nationalities" (*shaoshu minzu*).

Anthropologists will note the parallel with the cultural evolutionist leanings in their field during the early 20th century. Nationalities were placed on the same linear continuum, with the assumption that, though the groups may be in different relative positions, all are heading in the same direction by the same path. In the Chinese case, however, this continuum was overlaid with a sense of Marxist history that pointed to Communism as the "end of history." Thus ethnic minorities become an object of development, in need of state intervention if they were to attain even a modest level of development.[22]

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[21] More than a quarter of a century later, the famous sociologist and anthropologist Fei Xiaotong wrote a reflective account of the process of ethnic categorization that took place in the late 1950s (Fei 1989). For a detailed treatment of the "civilizing project," see Harrell (1995b).

[22] Of course, one's own ethnicity is often constructed in opposition to neighboring groups. My Shuitian landlady during fieldwork, who subsequently became a good friend and confidante, scolded her eight year-old son for his disgusting table manners by calling him "Yi jiao," which she says is a heathenized subset of the Yi people looked upon with contempt by both Han and Yi alike. With a little probing, she offered that the Yijiao live in high mountain areas. Their skin is darker than her people, the Shuitian Yi, and they have

It is my opinion that the civilizing project, while it has been conducted within China by the central government over the past half century, has also been bolstered by the work of international scholars looking for a link between ethnicity and underdevelopment. Some authors (Wang and Hu 1999), noting the tendency for minority populations to inhabit harsh and inhospitable topographies, go so far as to suggest that there is a direct correlation between mountainous terrain and poverty. Not surprisingly, it is precisely these areas that are most heavily populated by ethnic minorities:

> Geographically, the ethnic minorities are concentrated in the border areas and in mountainous areas. For this reason, none of the provinces in which more than ten percent of the population are ethnic minorities make it into either the high-income or middle-income category (ibid.: 86)[23].

Recent policy directives have arisen to address China's pattern of uneven development. One of these, the "Great Western Opening" policy, was outlined in several speeches delivered by Jiang Zemin during the summer of 1999, and has since grown into an important, if disjointed, strategy for development. The policy was designed to improve the living standards in Western regions, including the following provinces and administrative regions: Chongqing municipality, Sichuan province, Guizhou province, Yunnan province, Tibet Autonomous Region, Shanxi Province, Gansu province, Ningxia

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poor hygiene, refusing to bathe more than occasionally. They are "barbarians" (*yeman*), who have a taste for raw meat and who eat rice by holding the bowl close to their face and shoveling the grains in.

[23] Sichuan province provides an apt illustration of this. In 1992, for example, 43 Sichuan counties were below the national poverty line; of these, 21 were counties with high concentrations of minorities (Wang and Hu 1999).

Hui Autonomous Region, Qinghai province, Xinjiang Uigur Autonomous Region, Inner Mongolia Autonomous Region, and Guangxi Zhuang Autonomous Region (China Labor Statistical Yearbook 2001: 395).

The Great Western Opening policy was designed to encourage the influx of investment, both domestic and foreign, in the region and to increase national government expenditures in the region, in order to foster economic development. The development model laid out in the policy is one that takes advantage of the unique aspects of the western regions, including abundant natural resources and cultural heritage. Eco-tourism is part of the plan, as is the simultaneous emphasis on the development of agriculture and industry. The goal was to begin to close the gap between the West and the more advanced areas of China, and to accomplish this by emphasizing both social and ecological progress:

> By the middle of the twenty-first century, the Western region will become a new and strong region marked by sound economic development, social progress, welfare, ethnic unity, and with beautiful and clean mountains and streams. (China Labor Statistical Yearbook 2001: 12).

The thrust of the policy is to begin remedying the vast economic disparities across regions in China—disparities that were nurtured for two decades by government officials eager to promote development along China's east coast. It also contains an explicit treatment of ethnicity, insofar as ethnicity is seen as linked to underdevelopment, both because of the structurally embedded inequalities between the Han and minorities (access to education and Chinese fluency, for example) and because of the particular cultural

practices and ethnic consciousness of the minorities which impede acculturation and development (Lai 2002).

The Shuitian Yi

In addition to a sizeable Han population and a handful of other ethnic groups (Bai, Dai, and, according to officials, a single household of Miao), Futian is home to a predominantly Shuitian Yi population. The Yi people, of which there are some seven million throughout the southwestern region, are an amalgamation of dozens of related but separate groups classified as a single "minority nationality" during the ethnic categorization project (*minzu shibie*) of the 1950s. Their language—or, rather, group of languages, some of which are mutually unintelligible—belong to the Lolo-Burmese subgroup of the Tibeto-Burmese language family (Bradley 2001). By official Chinese government accounting, there are six major dialects of the Yi language (Chinese scholars use the term *fangyan,* despite the fact that these dialects are mutually unintelligible): the Southern Nisu, Southeastern Sani, Eastern Nasu, Northern Nuosu, Central Yi and Western Yi.

The Shuitian Yi of Futian Township, according to linguistic research, belong to the Western Branch of the Yi (*Laluo*). This is the branch most closely related to Lahu and Lisu than to the other Yi branches. There are currently some 500,000 people who belong to this branch, whose language historically had no known writing system (Bradley 2001: 205). According to Li Hong, Futian's vice-Mayor and a Shuitian from Tangba village, about 53.2% of Futian's 3,500 residents are Shuitian. The rest are predominantly Han,

although there are small populations of Dai, Naxi and Bai, as well as other groups of Yi (primarily Nuosu).

The ethnic history of Futian, it seems, has always been a story of coexistence between the Shuitian and the Han, who have resided in the area as long as Futian's oldest residents can remember. Harrell (2001: 288) reports that the local ethnic minorities (*minzu*), including the Shuitian, have interacted with the Han since at least the early part of the twentieth century:

> According to the older residents of Tangba, during the early part of the twentieth century this was a generally poor area, and the *minzu* . . . were uniformly poor, and many of them worked as tenants for either the He or the Lu, two Han landlord families.

Since at least the founding of the People's Republic, in 1949, the Shuitian have been acculturated to Han ways of doing things; local residents inevitably refer to this as being "Hanified" (*hanhuale*). In fact, many local residents could not understand why I, as an anthropologist, would possibly be interested in studying the Shuitian, since they had been so completely acculturated as to become ethnologically uninteresting. A Shuitian wedding, held in Tangba village during the course of my fieldwork, featured the usual Han customs of black-on-red calligraphy and giving money to the bride and groom. Perhaps the only vestige of Shuitian custom in this affair was a circle dance, which was held into the wee hours of the morning on the final day of the three-day celebration, and which featured about a dozen dances unique to the local Shuitian population.

Local standards of dress do not differ significantly between the Shuitian and the Han, and it is the rare Shuitian person who can speak a word of the traditional language.

A woman from the predominantly Shuitian village of Tangba with the surname Li, the aged mother of my landlady during fieldwork, was an exception. On rare occasions, she and her other elderly friends, all of whom were more than eighty years old, would sit around our coal stove and speak the Shuitian language together. Her husband, with whom she most often spoke Shuitian, had passed away several years previously, and it was rare for her to speak the language with anyone else outside the house. By contrast, her daughter, who was in her late thirties, could neither speak nor understand the Shuitian language.[24]

The View from the Local Government

One might conclude, from the disparities noted above between the Han and minority nationalities, that ethnic minority status is always framed locally as an impediment to development. But this is not necessarily the case. In fact, in the recent past the Shuitian identity has served as a way of attracting government funding and investment to the area, and the local township and village enterprises have served as a

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[24] It is clear to me that at least some awareness of traditional Shuitian culture has been retained in Futian. A relative of our landlady, also surnamed Li and also from the village of Tangba, is a local history buff. Despite having only a junior middle school education, he has written, with the collaboration of the anthropologist Li Xingxing, a book entitled *Ethnic Minorities of Renhe District (Renhequ Shaoshu Minzu)*. The book is full of ethnographic descriptions of the Shutian Yi, as well as pictures of traditional Shuitian dress, which, he says, is markedly different from the Central Yi groups in the Liangshan area. The differences included a pattern on the traditional headcloth (*toupa*) that was unique to the Shuitian.

vehicle for this transformation. The anthropologist Li Xingxing (1995) argues that Futian has successfully leveraged its status as a minority township (*minzu xiang)* to attract government and private investment to the area, and that Futian might therefore serve as a model to other minority areas. He describes the "Futian Model" (*Futian yangshi*) of development as one in which the local government, through the development of agriculture and the reinvestment of township and village enterprise revenue, increases local incomes and standards of living. By virtue of its status as a minority township (*minzu xiang)*, Futian was able to procure special funding from the district government to promote industrial development.

Harrell (2001) takes issue with Li's analysis. He points out that many of Futian's characteristics—high proficiency in the Chinese language, agriculturally suitable soils, and a relatively well developed track record in basic education—are assets that don't exist in many other minority areas and thus make Futian unsuitable as a paragon of minority development.

In any case, it is clear that ethnic identity has been a salient issue in Futian's development. I found it interesting to read these accounts of the Futian of the recent past, when ethnicity, however tenuously differentiated from the Han, was used strategically to promote local development. My experience was quite different. The Shuitian people I knew, as well as the Han who lived alongside them, were now coping with economic decline as the local township and village enterprises were slowly losing traction, a trend common throughout rural China (Williams 2001). In this environment, ethnicity was seen as a barrier to development and as a rationalization for continued underdevelopment and the faltering of local industry.

Mr. Hu, a young Shutian man with a round face and a flat-top haircut, is the local cadre in charge of enterprise development. His family is from Tangba village, a predominantly Shuitian area in the southwest of the township, where his clan is one of three in the village (the others are the Ni and the Li). His family is well known throughout the township: in the late 1980s and early 1990s, his father served as Mayor during what could be considered the golden age of the local TVEs.

From his desk, on the second floor of the government building, one can see the plumes of black smoke rising from Futian's factories on the hillside above town. Mr. Hu is concerned about the current state of affairs. The local investment climate has turned. In the 1990s, when Mr. Hu's father was serving as Mayor, there were some 17 TVEs, including four coal mines, four coal washing facilities, four coking plants, one construction company, one gas station, and three zinc smelters. Revenue from the factories, all of which were still collectively held by the township government to one degree or another, was pouring in. In the mid-1990s, the township constructed a six-story government office building, paved the main throughway, built two new schools for the poorest and most remote of Futian's four villages, and invested in new agricultural technology.

The productivity of Futian's industries has slowed due to economic pressures and to increased enforcement of environmental regulations, a subject that I will discuss at length in Chapter Seven. As a result, tax revenues from local industry have fallen, and the township government is beginning to feel the fiscal pinch. Futian's single operating zinc smelter, for example, is subject on a monthly basis to a management fee (*guanli fei*) of 400 yuan per furnace, and a straight tax of 150 yuan per furnace (the smelter contains six

furnaces). In addition, there is a land fee of 2,000 yuan per furnace calculated on a yearly basis.[25] Nevertheless, actual revenues taken in by the local government have declined rather precipitously over the years, from 1.1 million yuan in 1998 to approximately 500,000 yuan in 2001.

The text of a letter, written in late 2002 from the township government to the Renhe District Bureau of Finance (*Caizhengju*), illustrates the degree to which local government interests are intertwined with industrial success. According to the letter, which describes the financial difficulties encountered by Futian's coking plant in recent years, in 1994 a total of RMB 4.5 million was invested in the plant in order to both increase production and comply with environmental standards. Of this sum, 2.7 million yuan came from bank loans taken out by the township government, 650,000 came from the district and township governments' finance divisions, 250,000 came from the Panzhihua City Environmental Protection Bureau, and the remainder came from the township government.

By late 1996 obtaining raw materials in Futian became difficult due to the area's depleted coal reserves. The coking plant began obtaining raw coal from neighboring Huaping County, in Yunnan, after it was determined that the transport costs were too

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[25] One of the key questions of economic studies of township and village enterprises is how to resolve the issue of property rights. In particular, as Jenny Clegg (Clegg 1998) notes, what happens when an enterprise that sites on land held by the township or village collective is privatized? In Futian, the land fee (*tudi fei*) is used as a partial solution to this problem. While the fixed capital (infrastructure, equipment, etc.) have been bought outright by private investors, the township government still receives a royalty for the use of its land.

high to obtain the coal from elsewhere within Panzhihua municipality. Staggering under rising production costs and the pressures of the marketplace, the coking plant shut down its operations in 1997. By that time, the burden of debt was very high, totaling five million yuan. Most of this debt was carried by the township government in the form of bank loans; in addition, a small portion of the debt was owed to local collective investors who had loaned their savings to the enterprise. The coking plant also owed some 350,000 yuan in back taxes to the township government and 50,000 yuan in taxes to the district government in Renhe.

The private investor from Chengdu who currently owns a primary interest in the coking plant arrived on the scene in the late 1990s. The township government in Futian is allowing him to use the capital investments of the plant, including the coking furnaces and other structural improvements, all of which are still under the nominal ownership of the township. He is allowed to hire his own workforce consisting almost entirely of outside migrant laborers. He procures his own inputs of raw coal from Huaping county, and is taxed a flat rate on the amount of coke the plant produces, along with a land use fee. These monies go to the township government in order to try to offset some of their debts incurred over the past several years of industrial decline.

The current situation for the township government is dire. Given the heavy burden of debt that the township government is still carrying on an enterprise whose financial solubility is clearly in question, the letter is essentially a petition to absolve the Futian government of some RMB 555,000 owed to the district Bureau of Finance (*Caizhengju*). In a final plea at the end of the letter, Futian's officials make it clear that "there's no

guarantee the cadres will even have food to eat, let alone pay back the debt" to the district government.

This speaks to the high degree of articulation between industry and local government, and it speaks to the utter dependence of Futian on industry. The factories are literally a "meal ticket," as the letter from the township government makes clear. It is no surprise, then, that industrial development is the number one priority of the local government officials in Futian. Most recently, the district government in Renhe has been attracting outside investors to the area, enticing them with several glossy brochures that advertise the advantages of doing business here, including rich mineral deposits, favorable tax policies, and an abundance of labor[26].

A local government meeting may serve as an illustration of the way in which Futian is coping with these new challenges to development, and the role that ethnicity plays in them. Shortly after the beginning of the new year, the local government held its semi-annual People's Congress (*renmin daibiao dahui*), in which representatives from all four villages were present to discuss the year's progress and future development goals. A white banner, hung at the back of the conference room, featured Deng Xiaoping's famous saying, "Development is the indisputable truth" (*fazhan cai shi ying daoli*). Another banner, whose message was written by Mr. Wang, the township's Communist Party

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[26] The attractiveness of doing business in Futian has changed in recent years, as have the tactics used by local and regional governments for luring investors to the area. While mineral deposits were a primary means of attracting outside investors a decade ago, today the district government in Renhe relies primarily on tax breaks. Investors who set up rural factories here are offered a one-year tax holiday.

Secretary, read, "See clearly the true situation and the new responsibility to take steps to beckon commerce, attract investment, and push Futian toward new development" (*renqing xincai lieming juexin renwu nachu xinjucuo yi chao shang qi zi tuidong futian xin fazhan*).

The heart of the meeting was a discussion of Futian's recent failure to meet satisfactory development goals, particularly in terms of industrial output. Revenue from TVEs was down, and the district branch of the Environmental Protection Agency was in the process of shutting down some of the worse polluters, including several zinc smelters, for failure to meet emissions standards. During an impromptu speech by Party Secretary Wang, the highest-ranking Communist Party official in Futian, village representatives were encouraged to find a way to continue developing the township:

> Remember, we are in danger of falling behind our neighbors, Shilongba and Daxing [two townships across the Yunnan border]. This shows the need to work harder to attain a *xiaokang* society. We must overcome our backwardness . . . The industrial output of Sichuan as a whole is immense. You think it's not possible for us to attain this level of development? You think it's too hard, that we're too poor, too backward? Well, I say, we common people (*laobaixing*) have knowledge of our own. We have experience. If we think we can accomplish something, then we can. All you have to do is liberate your thinking! (*jiefang nimende sixiang*).

Mr. Zhang, a young Shuitian man in his thirties and Mayor of Futian, also underscored the need for continued development in the face of the current economic troubles:

> Look at the overall development situation of China. We have the seventh largest economy in the world. And you have to say that's not bad. But we need more development of the economy, more development of technology, more development of culture. . . Look at the economy of China's eastern regions—Guangdong, Shanghai. You have to say that there's a big difference between them and us in terms of development. We've only just solved the problem of hunger and poverty (*wenbao wenti*). We have a long way to go, and we have to depend on ourselves to

> solve our economic problems. We can't rely on the national government, or even the district government. It is only when our living conditions here in Futian are improved that we can begin to solve the really important problems, such as education, cultural quality, and economic development.

The problem of industrial development is seen by local government officials as being doubly difficult, given Futian's relatively poor, uneducated population of Shuitian Yi people. As Li Hong, Futian's vice-mayor, told me, the primary obstacle to sustained economic development in the area is the low cultural quality (*wenhua suzhi*) of the local population. As Ann Anagnost (1997) describes in her analysis of public discourse regarding migrant laborers in China, this is a concept with particular salience for most modern Chinese. Within the national imaginary, the low cultural quality of rural people in general is considered an impediment to the accomplishment of national goals and an affront to national pride. Futian's residents have the added burden of an ethnic identity that pegs them as less capable of keeping up with the demands of development and modernity. In addition, local residents have, on average, only an eighth-grade education, and have a difficult time adopting new technologies. Whether or not one chooses to see underdevelopment as a problem inherent to the "nationalities question" (ie. embedded in their cultural backwardness), or as the result of systemic political and economic failures, it is clear that ethnicity plays a role. Often it is the individuals themselves in Futian who cite their own lack of education and skills (and therefore cultural quality) as the reasons why development targets remain out of reach.

Using Futian as a Case Study

Futian township and, for that matter, Sichuan province, are by no means renowned for their rural industries. To be sure, there are coastal provinces such as Jiangsu whose township and village enterprises have been highly successful, not to mention thoroughly scrutinized by academicians. But the case of Futian is an intriguing place to test the hypotheses of political ecology and risk perception, given its role in the regional economy, the ownership structure and history of its industries, the marked contrast between long-term residents and newly arrived investors and workers, and the dynamics of its ethnic relations.

If, as Blaikie and Broofield (1987) have suggested, the political ecology approach entails delving into the complex relationships between geographical scales, social and economic organization, and environmental degradation, then this approach is inherently a regional one. Futian's peripheral role in the development of the Panzhihua industrial complex, and its continuing role in the regional economy, make it a suitable site for research.

In addition, the nature of its TVE ownership structure, which in recent years has been marked by a sharp division between insiders and outsiders as industries become privatized, makes Futian an interesting case study. Over the past few years, all of the township's industries have been privatized, resulting in a scenario in which the benefits of industrialization are garnered by a few privileged outsiders and the pollution is shared by all. As will be shown later, villagers are forced to cope with the privatization of industry and the funneling of industrial profits away from them. At the same time, the health effects of local industrial pollution, the allocation of scarce water for hydroelectric

power to fuel the factories, the damaging of crops and stock animals—all of these costs are encountered every day by most villagers.

The configuration of ethnic relations in Futian adds another dimension to the study. It is here, on the ethnic peripheries of China, that the problems of development are most acute and the importance of industrial success so clear. The development imperative is as strong here as anywhere in China, and the negative consequences of unfettered development are becoming acute. This provides the backdrop to test one of the axiomatic assumptions of risk perception studies: that poverty and economic marginalization result in a higher tolerance for industrial pollution insofar as industry represents jobs, income opportunities and a higher standard of living.

Finally, there were practical considerations at work in the selection of Futian Township as a study site. The community has been fairly well visited by anthropologists from China (Li Xingxing and Li Shaoming of the Sichuan Provincial Institute for Ethnic Minority Studies), and from the United States (Stevan Harrell from the University of Washington). Relations are well established between these institutions and the Panzhihua Bureau of Ethnic Minority Affairs, whose approval was required to conduct this study. When I conducted a pilot study in 2001 on the economic and environmental impacts of township and village enterprises, comparing Futian to possible field sites in the northeast province of Heilongjiang, Futian seemed to hold the most promise for the completion of the study with minimal bureaucratic interference.

CHAPTER 4—THE MATERIALITY OF RISK: AIR POLLUTION IN FUTIAN

Futian's township and village enterprises are typical of the rural industrial sector in their use of coal as a primary energy source. Smoke from coal combustion has become a daily part of life in Futian, and most residents recognize some degree of risk from exposure to it. In keeping with my assertion that environmental risks are both material problems and social constructions, I present in this chapter the results of inhalable particulate matter (PM_{10}) monitoring in Futian Township during a four-month period in 2002-2003. In doing so, I wish to provide a basic understanding of the material and health risks the community faces from PM emissions. I do not suggest that particulate matter data alone can stand in for the myriad risks to human health and ecosystem integrity posed by industrial pollution in the community; rather, I use it as one indicator of local environmental quality and as a baseline against which the community perceptions of environmental risk presented in later chapters of this dissertation may be measured. In the process, I ask several questions. How do particulate matter concentrations in Futian compare with standards set by the Chinese State Environmental Protection Administration (SEPA) and with U.S. EPA standards, both of which are designed to protect human health and welfare? Are particulate matter concentrations correlated with factory activity in Futian? What kinds of impacts might the observed levels of PM_{10} have on human health, on economic viability, and on ecosystem integrity?

First, I discuss some of the known effects of particulate matter on human health, economic viability, and economic integrity, using existing monitoring and

epidemiological studies. Next, I give an overview of criteria pollutant standards in China, along with the goals and guidelines of Chinese air pollution regulatory policy. Finally, I present the methods and results of ambient PM_{10} monitoring in Futian and discuss some of the implications for the effects outlined above.

Particulate Matter and its Effects

Particulate matter, especially inhalable particulates (PM_{10}), is a major byproduct of coal combustion and presents a growing problem in both urban and rural China. Particulate emissions take a toll on human health by inducing or exacerbating cardiovascular and pulmonary diseases. In addition, high levels of PM are associated with economic loss due to hospitalization and lost productivity of workers. At a more general level, PM has a significant, if poorly understood, impact on ecosystem health.

Particulate matter includes any substance other than water in the atmosphere with a size greater than molecular dimensions. Most often, PM is manifest as aggregates of various molecules and substances, including sulfate, organic carbon, nitrate, and elemental carbon (soot). The sizes of particles within PM may vary greatly, from 10^{-4} to 10^{4} micrometers. In China, where coal combustion fuels most industrial boilers, sulfates, aerosols converted from sulfur dioxide during condensation in the ambient atmosphere, are the most common airborne fine particles.

A number of epidemiological studies have shown a direct link between atmospheric inhalable particulate matter (PM_{10}) and respiratory diseases, pulmonary

damage, and mortality (Dockery, et al. 1993; Hoek, et al. 1997; Samet, et al. 2000).[27] One study in particular (Dockery et al. 1993) provides a good estimation of the health effects of PM_{10}, showing a 0.8 percent increased mortality rate for each 10 $\mu g/m^3$ annual increase in PM_{10} exposure. Of course, ambient particulate matter and other criteria pollutants (SO_2, NO_2) are generally correlated (Kan and Chen 2003), and these pollutants bring with them their own health outcomes. Isolating the effects of a single pollutant species within the ambient air matrix is extremely difficult.

Similar epidemiological research is just beginning in China. Several recent studies have begun to uncover the link between particulate matter and health problems in Chinese cities. Xu et al. (2000), for example, show an association between particulate matter concentrations and daily mortality in the northeastern industrial city of Shenyang. Qian et al. (2000) found a relationship between air pollution, including PM and sulfur dioxide, and childhood asthma and other respiratory diseases in three urban areas in China. Using time-series data on PM_{10}, SO_2 and NO_2, along with epidemiological data, Kan and Chen (2003) showed an association between these pollutants and total mortality

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[27] There is continued debate about the relative effects on health from fine (<2.5 micrometers, or $PM_{2.5}$) and ultra-fine (<1 micrometer, or PM_1) particles. Some epidemiological studies have found $PM_{2.5}$ to be more closely associated with health problems than PM_{10} (Dockery, et al. 1993; Schwartz, et al. 1996). I chose to monitor PM_{10} because data from the U.S. EPA calls into question the association between $PM_{2.5}$ and specific health outcomes, and because China's State Environmental Protection Administration (SEPA) has not set national standards for $PM_{2.5}$. Data on sulfur dioxide levels were also collected as part of this study, but are not reported here due to errors in the collection method.

in Shanghai. Peng et al. (2002) used dose-response functions to estimate the impact of PM on human health in the northern city of Shijiazhuang.

In addition to its toll on human health, particulate matter in the ambient atmosphere is associated with economic loss. Hospital visits due to the health impacts described above, coupled with lost worker productivity, are taking a mounting toll in China. Although the studies conducted thus far are in urban China, in many cases economic losses from ambient air pollution are estimated at 4-7% of the GDP of the area under study (Li, et al. 1998).

Perhaps the most difficult to quantify are the effects of particulate matter on vegetation and general ecosystem health. Vegetation is affected by particulates through various processes, including dry and wet deposition on the plant itself and effects on soil chemistry. These processes are, as yet, poorly understood, and determining the exact response of ecosystems and vegetation types to a given concentration of PM depends upon the particular size and chemical mix of the PM involved, as well as atmospheric conditions (Grantz, et al. 2003). Nevertheless, it is clear that PM may induce a phytotoxic response in vegetation, including crop plant varieties within agroecosystems. These acute effects are most pronounced when crops or other plants are grown in proximity to known industrial point sources, as is the case in Futian. As Grantz et al. (Grantz, et al. 2003: 224) write,

> Most documented direct effects of PM . . . have been in severely polluted areas surrounding industrial point sources, such as limestone quarries, cement kilns, and metal smelting facilities. These effects are dominated by course PM, as fine particles have wider distribution.

In these cases, reductions in yield, flowering and reproduction of plants from particulate deposition, including dust and trace metals, have been noted (Saunders and Godzik 1986).

In China, urban air pollution has received the overwhelming majority of scholarly attention (Qian 2000; Xu 2000; Peng, et al. 2002; Kan and Chen 2003). Air pollution, however, is not exclusive to urban areas in China. Township and village enterprises are notorious polluters, as I have already outlined in Chapter Two of this dissertation. Their sheer number (some 20 million), geographic dispersion throughout the countryside, and their almost exclusive use of raw coal as an energy source in the absence of mitigation technologies, make them serious polluters. It is estimated that TVEs are responsible for some 60% of China's sulfur dioxide emissions (World Bank 1997). Thus the risks associated with high ambient concentrations of various pollutants are as high in many rural areas as in urban centers.

Despite the role of rural industry in China's air pollution problem, very little systematic air quality monitoring takes place in rural areas. The data that exists, moreover, are aggregated at provincial and municipal levels. Sichuan province, for example, had a total of 1.3 million tons of particulate matter emissions in 2000, and Panzhihua municipality, where Futian is located, had 99,000 tons (Sichuan Province Statistical Yearbook 2002). Resolution below the provincial and municipal levels is generally lacking.

The three factories in operation in Futian during the period in which I conducted air quality monitoring included a zinc smelter, a coking plant, and a coal washing plant, as described in Chapter Three. All of the factories use raw coal as a primary energy

source, and have limited access to environmental mitigation technologies; particulate matter emissions, therefore, can be expected to be high. Because of pressure from the Renhe District Environmental Protection Bureau, which has jurisdiction over Futian, local factory operations were in a constant state of flux throughout the study, and this is reflected in the monitoring results presented here.

Overview of Criteria Pollutant Standards in China[28]

As the effects of PM_{10} and other pollutants on human health become clearer, more stringent regulation has followed. I present here a brief overview of Chinese standards for criteria pollutants, set by the State Environmental Protection Administration (SEPA), and contrast these with U.S. EPA standards. Both agencies set multiple standards of attainment. In the case of the U.S., the primary standard described in the National Ambient Air Quality Standards (NAAQS) is designed to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. The secondary standard is designed to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and structures. By contrast, China's State Environmental Protection Administration (SEPA) sets primary, secondary, and tertiary air quality standards for criteria pollutants based on geographic zoning[29].

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[28] "Criteria pollutants," each of which is associated with standards for ambient concentration, are used as indicators of general air quality.

[29] The U.S. government also sets pollutant concentration increments based on geographic zoning (see Boubel, et al. 1994)

Class I areas, with the most stringent emissions regulations, are tourist, historic, and conservation areas; Class II are residential urban and rural areas, including agricultural areas such as Futian; and Class III are industrial areas and heavy traffic areas (Wan Siji 1999). Each class corresponds to a criteria pollutant standard (*biaozhun*). Criteria pollutant ambient concentration standards for both the U.S. and China are shown in Table 2.

Table 2. Comparison of criteria pollutant standards of US EPA and Chinese SEPA

POLLUTANT*	U.S. EPA STANDARDS		CHINESE SEPA STANDARDS		
	Primary	**Secondary**	**Primary**	**Secondary**	**Tertiary**
Sulfur Dioxide (SO_2)	**Annual:** .03	—	.05	.15	.225
Units: ppm	**24-hour:** .14	—	.13	.4	.65
Nitrogen Dioxide (NO_2)	**Annual:** .053	.053	.075	.075	.15
Units: ppm	**24-hour:** —	—	.15	.15	.225
PM_{10}	**Annual:** 50	50	40	100	150
Units: $\mu g/m^3$	**24-hour:** 150	150	50	150	250
Ozone (O_3)	**1-hour:** .12	.12	.2	.3	.4
Units: ppm	**8-hour:** .08	.08	—	—	—
Carbon Monoxide (CO)	**24-hour:** —	—	3.5	3.5	5
Units: ppm	**8-hour:** 9	—			
	1-hour: 35	—	9	9	17
Lead (Pb)	**Annual:** —	—	1.0	1.0	1.0
Units: $\mu g/m^3$	**Quarterly:** 1.5	1.5	1.5	1.5	1.5

* Chinese standards for SO_2, NO_2, O_3 and CO were originally written as concentrations ($\mu g/m^3$). They have been converted here for ease of comparison with U.S. standards. PM_{10} and lead standards were originally written as concentrations. (Data from Boubel, et al. 1994; Wan Siji 1999)

China's State Environmental Protection Administration, formerly the National Environmental Protection Agency, took the first step toward controlling total national emissions of twelve major pollutants when it initiated the Total Emission Control Plan, in 1996. The plan allotted emissions quotas to each of the 31 provinces and autonomous regions (including provincial-level cities such as Beijing). Provincial-level

Environmental Protection Bureaus are then responsible for setting emissions targets for areas within their jurisdiction. Systematic monitoring in most rural areas, however, is sporadic and often entails dramatic political consequences, as will be shown in later chapters of this dissertation. Very little air quality monitoring had taken place in Futian prior to the monitoring project described here. The last recorded monitoring of total suspended particulates (TSP) and sulfur dioxide (SO_2) in Futian, a measure of point-source pollution from the zinc smelter, took place in 1999; the results presented here thus represent the only recent monitoring of general ambient levels of PM_{10} in the community. Representatives from the local Environmental Protection Bureau in Renhe District ordered the closure of Futian's factories during the study period, a process that I describe in some detail in Chapter Seven. It is important to note here, however, that the factory closures began a period of negotiation between factory managers and regulatory officials in which factory operations were in a state of flux. Ambient levels of PM_{10} reflect the on-again, off-again operations of Futian's factories during this period.

Methods

Particulate matter (PM_{10}) was measured at one stationary point located in the center of Wuzitian, the main village within Futian Township, approximately 500 meters south of the factory complex (refer to maps in Introduction). This location was chosen because it represents the hub of the township, where most stores, residences and human activities are centered; it is also the only place within the township with the reliable source of electricity necessary to operate the monitoring equipment. Thus the results

reported in this chapter are not meant to be a measure of point source particulate matter from specific factories, but rather a measure of general ambient levels of PM_{10} in the community at large.

Particulate matter was collected on 37 mm Teflon filters (polyetrafluroethylene with support ring, model 225-1709; SKC, Inc., Eighty Four PA) using a SKC 224-XR series personal monitoring pump equipped with a Marple Personal Environmental Monitor (PEM) impactor. Particles were captured using a flow rate of 4 liters/minute, over four separate sampling periods, from December 2002 to April 2003, each seven days (168 hours) in length.[30] The flow rate was checked and calibrated every 24 hours using a rotometer. It was necessary to sample for seven consecutive days in order to represent a longer-term ambient level. Because of high concentrations of particulate matter, it was necessary to change the Teflon filters, sometimes more than once, during each sampling period to avoid overloading the filter and pump and to maintain a constant flow rate. When determining seven-day concentration averages, therefore, each filter was weighted according to the amount of time it was exposed.

The concentration ($\mu g/m^3$) of PM_{10} was determined through gravimetric analysis, using a seven-place electronic ultra-microbalance (model UMT2; Mettler Toledo, Greifensee, Switzerland). All filter weights were measured in duplicate or triplicate, and the filters were equilibrated for at least 24 hours before weighing. Both equilibration and weighing were performed inside a controlled environmental chamber at the University of

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[30] The final sample period was only 86.1 hours in length.

Washington with constant temperature (22.4 +/- 1.9 degrees C) and relative humidity (34.7 +/- 2.5%).

Results

The average PM_{10} concentration across the four sampling periods was 205.9 $\mu g/m^3$, 2.1 times higher than the Chinese SEPA annual standard for Class II areas and 4.2 times higher than the U.S. EPA annual standard. However, PM_{10} concentrations varied widely from one sampling period to the next. Observed PM_{10} concentrations are shown in Table 3. A time-series chart of observed PM_{10} concentrations is shown in Figure 5.

Table 3. Observed concentrations of PM10 and factory activity in Futian

SAMPLE PERIOD	FILTER START DATE	PM_{10} ($\mu g/m^3$)	FACTORY ACTIVITY
Sample Period 1	Dec 22-24, 2002	236.6	Coking plant only
(Dec 22-29, 2002)	Dec 24-27, 2002	251.4	Coking plant only
	Dec 27-29, 2002	254.9	Coking plant only
	7-Day Period Average	247.6[a]	Coking plant only
Sample Period 2	Jan 15-18, 2003	351.0	None
(Jan 15-23, 2003)	Jan 18-20, 2003	408.5	None
	Jan 20-23, 2003	330.9	None
	7-Day Period Average	356.4	None
Sample Period 3	Mar 1-4, 2003	118.0	None
(Mar 1-8, 2003)	Mar 4-8, 2003	111.7	None
	7-Day Period Average	114.7	None
Sample Period 4	Apr 20-23, 2003	106.8	Zinc smelter only
(Apr 20-24, 2003)	April 23-24, 2003	99.4	Zinc smelter only
	7-DPeriod Average	104.7[a]	Zinc smelter only
Average of Sample Periods with Factory Activity		189.8	
Average of Sample Periods without Factory Activity		264.0	
Average of all Sample Periods		205.9	

[a] Difference between averages is significant, $p<.01$.

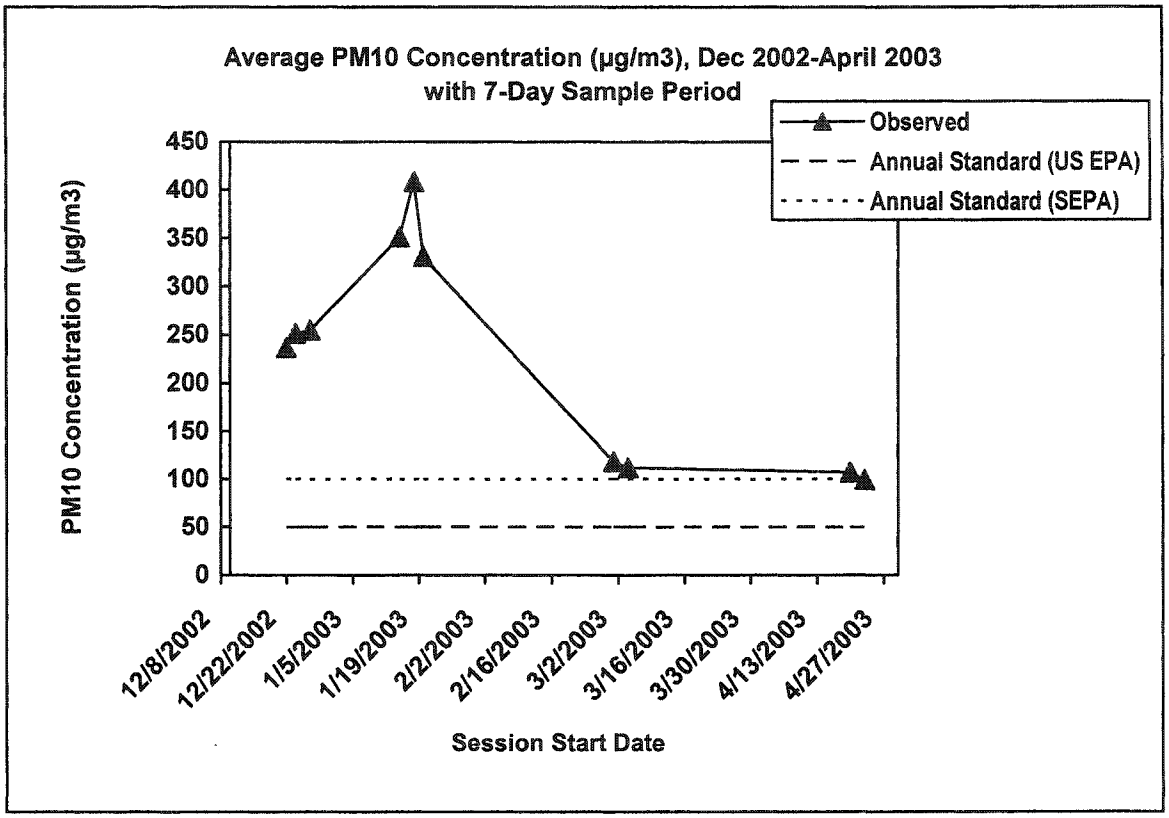

Figure 5. Average PM10 concentrations (µg/m3), Dec 2002-April 2003

Observed levels of PM_{10} were not related to factory activity in Futian. In fact, average concentrations during periods when local factories were not in operation (264 $\mu g/m^3$) were higher than concentrations during periods when the factories were in operation (189.8 $\mu g/m^3$). The highest concentrations of PM_{10} were recorded during the second sample period in January, 2003, when no local factories were in operation, and the second-highest concentrations were in December, 2002, when only the coking plant was in operation. This is likely due to the heavy use of coal for domestic heating during the winter months as well as the prevalence of wind carrying resuspended dust during winter. The two periods during which any factory activity took place differed markedly in

their ambient concentrations of PM_{10}. Sample Period 1, during which the coking plant was the only factory in operation, showed a concentration of 247.6 $\mu g/m^3$, while Sample Period 4, during which the zinc smelter was the only factory in operation, had a concentration level of only 104.7 $\mu g/m^3$. An independent-samples t-test revealed that the difference in concentration between these seven-day periods was statistically significant. This observed difference may also be attributable to the seasonal differences discussed above.

Discussion

The observed levels of ambient PM_{10} shown in this chapter were high, exceeding both U.S. EPA and SEPA annual standards. Accordingly, it can be expected that Futian's residents are susceptible to the kinds of health risks entailed by chronic exposure to PM_{10}, namely cardiovascular and pulmonary diseases, depending on the chemical composition of the PM_{10}. Using results from previous epidemiological studies (Dockery, et al. 1993) which have shown a 0.8% increase in mortality for every 10 $\mu g/m^3$ increase in annual PM_{10} exposure, residents in Futian might be expected to have a 12.8% higher risk of mortality relative to a baseline of annual concentrations under the standard of 50 $\mu g/m^3$. In addition, the observed levels of PM_{10} are likely to have a severe effect on vegetation, including crops, and on soil chemistry (Grantz, et al. 2003).

The lack of a clear correlation between local factory activity and ambient levels of PM_{10} is likely due to a combination of factors. This result reflects, first of all, the centrality of problems of scale in air quality monitoring. In particular, "transboundary

emissions" have a known confounding effect on local air quality measures (Peng, et al. 2002 2289), and Futian provides an apt illustration of this. The community is located within a nexus of rural industrial activity, with three other townships, each with coal-burning factories, located less than 10 kilometers away (refer to maps in the Introduction). Moreover, Panzhihua Iron and Steel Corporation, the third-largest state-owned steel smelter in China, is located just 60 kilometers to the east, and casts a shadow over the entire region's air quality. What this means is that air quality is a regional phenomenon; while local point sources may be the most obvious culprits, they are by no means solely responsible for local ambient levels of PM_{10}. This result underscores some of the political difficulties in monitoring pollution levels and in enforcing pollution standards at the local level. The Environmental Protection Bureau in Renhe District, which has jurisdiction over Futian's factories, forced these factories to close in order to protect the health and well-being of local residents. Meanwhile, neighboring factories within different jurisdictions continued polluting with impunity, reaping the financial benefits and degrading regional air quality.

The fact that a significant difference in PM_{10} concentrations was detected between the two sample periods with factory activity is somewhat telling. Sample Period 1, during which the coking plant was the only factory in operation, showed dramatically higher PM_{10} concentrations than Sample Period 4, during which the zinc smelter was the only factory in operation. Although it is impossible to determine the precise effect of any given factory on local ambient levels of PM_{10}, and although seasonal factors such as wind and domestic coal combustion complicate the analysis, this result may reflect differences in the use of environmental mitigation technologies. In 2000, after receiving pressure

from the Environmental Protection Bureau for violating emissions standards for TSP and SO_2, the owners of the zinc smelter invested RMB 40,000 in a new filtered smokestack to cut down emissions. The coking plant, on the other hand, uses no smokestack; its emissions are vented from open coke ovens directly into the air. These results may therefore reflect the efficacy of basic environmental mitigation technologies.

The results of this chapter contain, of course, many limitations that preclude broader interpretation. One pitfall with assessing health risks from air pollution by using PM data alone is that it is difficult to identify the independent effects of individual pollutants given the variability of air mixtures (Ito et al. 1993; Borja-Aburto et al. 1997). In short, without a detailed chemical analysis of PM_{10}, it is difficult to predict specific health outcomes (Brook, et al. 1997). In addition, ambient levels of PM_{10} do not necessary reflect individual exposure. An epidemiological study using personal monitoring methods would be necessary in order to determine differences in exposure between groups within the community (eg. industrial workers and farmers). In addition, a major road runs through the study community, and car exhaust is another confounding variable that makes it difficult to determine to what extent ambient air quality is influenced by point-source pollution from factories and to what extent other factors play a part.

Nevertheless, the levels of ambient PM_{10} observed here are far in excess of accepted standards and consistent with increased risk of mortality, respiratory and cardiopulmonary diseases, and harmful effects on ecosystem integrity, including damage to vegetation. Rural air pollution in China from industrial activity is a serious issue that deserves careful scrutiny.

The results of PM_{10} monitoring presented in this chapter should be viewed within the context of this dissertation. I do not suggest that PM_{10} concentrations can stand in for the entire list of pollution problems to which local residents may be exposed, a list that includes much more than just air pollution. Nor can PM_{10}, or any kind of air pollution for that matter, stand in for the complex concept of risk, a concept whose meaning within the local cultural, economic and political milieu forms the basis of this dissertation. Rather, the observed concentrations of PM_{10} presented here simply give us an empirical starting point for examining the way environmental risks from industrial pollution are understood and dealt with in the local context.

CHAPTER 5—MODELING RISK PERCEPTION

> Risk analysis, then, requires an approach that is capable of illuminating risk in its full complexity, is sensitive to the social settings in which risk occurs, and also recognizes that social interactions may either amplify or attenuate the signals to society about the risk. (Kasperson and Kasperson 1996: 96)

Introduction

Conventional wisdom in risk studies holds that poor countries and communities tend to be less concerned about environmental risks than their more well-off counterparts, preferring to sacrifice environmental quality for economic growth (Baumol and Oates 1979; Beck 1992). This logic is frequently applied to China, whose rural citizens in particular are often viewed as too poor, too uneducated, or too concerned with making a living to worry about environmental problems (Edmonds 1998 726; Wheeler, et al. 2003). This idea is beginning to be met with some challenges, as poorer areas recognize the threats to health and welfare presented by environmental degradation (Dunlap, et al. 1993), but it still a widely held axiom in development studies and studies of risk perception.

Previous studies have shown that the character of a given risk—whether it is voluntary or controllable, how pronounced are the magnitude of its consequences—explains in part how people perceive it. This "psychometric approach" (Fischhoff, et al. 1978; Slovic, et al. 1984), applied primarily in the United States and Western Europe, consistently shows that quantitative differences in the assessment of a variety of

environmental risks—from nuclear waste to smoking—can be explained by the qualities of the risks themselves (Slovic 1987) and that risk perception reflects an underlying and universal cognitive structure.[31] Scant attention, beyond early theoretical work by Mary Douglas (1982), has been paid to social models of risk perception and the ways that risks are situated within broader social, political, and economic contexts. The "actual" risk itself is only part of the equation of risk perception, which is bound up with questions of equity, control, and power. In particular, if we believe the anthropological take on risk perception, we are compelled to see risk perception as a product of social and cultural forces and to acknowledge, with Anthony Oliver-Smith, that risk perception is "grounded in the cultural norms and values that both govern and are embedded in the relationships that human communities have with their physical and social environments" (1996: 320). In other words, cultural, economic, and social factors play a mediating role between actual risk and perception of risk. As Mary Douglas has noted regarding her earlier work on ritual pollution from sexual contact, "cultural analysis shows us that ideas about pollution are not sufficiently explained by the physical dangers."

Exactly what factors shape risk perception is the subject of a growing body of literature which acknowledges the importance of such factors as knowledge and information about risk (Slovic, et al. 1990; Fischhoff 1995), proximity to industry (Howel, et al. 2002), community and neighborhood characteristics (Bickerstaff and

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[31] The seminal work of the psychometric paradigm (Fischhoff, et al. 1978) pointed to two factors—labeled *technological risk* and *severity*—that account for a large percentage of differences in risk perception. This two-factor structure has been tested and repeated in many cross-cultural studies of risk perception.

Walker 2001), past exposure to a given risk (Pollnac, et al. 1998), and demographic factors such as race and gender (Flynn, et al. 1994).

This chapter builds upon these related studies by examining risk perception through the lens of political ecology in order to explore the relationship between social, economic, and health variables and perception of risk from industrial pollution among rural community members in Futian Township. Does the threat of economic insecurity, what Ulrich Beck has called the "tangibility of need," come with a higher tolerance of risk in the case of Futian Township, where industrial jobs are sought after for their higher pay? Are all community members affected equally by the industrial pollution produced by Futian's factories, or is there a risk distribution hierarchy? What are the social, economic, and political factors that shape risk perception in Futian?

In particular, this chapter presents a statistical model that tests hypotheses drawn from the literature mentioned above and from prior field research:

1) Poor communities, despite the need for economic development, still perceive risk associated with industrial development;
2) Economic stake in TVE success is a predictor of individuals' perceptions of environmental risk; that is, community members who stand to gain more from the economic success of the TVEs will perceive a lower degree of environmental risk;
3) Other factors such as health status, ethnicity, education, and length of tenure in the local community serve as mediators that affect risk perception. I make the following predictions:

e. Community members with poor health status will perceive a higher degree of risk from pollution.
f. Han Chinese residents will perceive a lower degree of environmental risk than Yi minority community residents.
g. Community members with higher education will perceive a higher degree of risk from pollution.
h. Long-term residents will perceive a higher degree of risk from pollution.

This chapter makes several contributions toward an anthropological treatment of risk assessment. First, the application of risk assessment procedures within a Chinese cultural context is novel. Zhang (1994) produced a list of twenty environmental risks of concern in the People's Republic and asked respondents to rate these risks in terms of the overall threat they presented and in terms of some of the risk characterizations found in other studies with Western samples (Fischhoff, et al. 1978). Lai and Tao (2003), using a sample of Hong Kong Chinese, evaluated differences in risk perception among the risk characterizations noted in previous studies (Fischhoff et al. 1978) and used a list of 25 risks particular to the Hong Kong context. In both of these studies, the two factors underlying risk perception cited in previous research—"unknown risk" and "dread risk"—were not observed. Both authors point to cultural explanations as to why their subjects showed such differences in perception in comparison to Western samples. But the methodological approaches taken in these studies relied on either pre-set lists of hazards chosen from previous literature or created by the study authors. This leaves serious questions about whether the hazards chosen represent important and salient issues within the Chinese cultural context.

The second contribution made in this chapter toward an anthropological understanding of risk perception is an attempt to bring an ethnographic sensitivity to risk

assessment. I develop a tool for measuring risk perception in a way that is informed by anthropology's tradition of consideration of local phenomena on their own terms and within their own social, economic, political, and cultural contexts. Instead of drawing upon pre-selected risks, the risks used in this study were drawn from ethnographic interviews with informants who, because they live in the study community, are intimately familiar with the particular risks they face from Futian's industrial factories.

Finally, the model of risk perception presented in this chapter makes another contribution to anthropology and to risk perception studies by drawing hypotheses from anthropology and political ecology and explaining intra-community differences in risk perception not merely as a function of the risks themselves or of individual cognition, but as a result of social, political, and economic forces at work both within the local community and in rural China as a whole. In addition, political ecology is applied as an analytical tool in interpreting the relationships among the variables. Rather than examining the characteristics of risks themselves or the cognitive processes of research subjects as determining factors of risk perception, I choose instead to build a social model that views risk perception as embedded in social processes within and beyond the local community.

The focus on environmental risks in this study are indicative of trends within the PRC as a whole, whose policies, if not always backed by enforcement, are increasingly aimed at addressing some of the intractable pollution problems associated with rural industrialization. Within this framework, the current chapter's significance lies in its assessment of the perceptions of community members themselves. If, as Robert Weller (1999: 127) suggests, environmental problems in the PRC increasingly present a forum

for pushing the "boundaries of political possibility," then an assessment of community members' attitudes toward their own environmental problems goes a long way toward understanding how environmental and political issues are intertwined for rural Chinese residents.

Methods

Creating an Ethnographically Informed Measure of Risk

As noted above, most studies in risk perception ask study participants to rate the degree of threat they perceive from each of a pre-set list of environmental risks. These risks are then used as the basis for understanding "environmental risk perception" as a whole (Fischhoff, et al. 1978; Slovic, et al. 1979). Partly as a function of anthropological tradition, which stresses the need to understand cultural phenomena from the inside, and partly out of a lack of a set of risk questions relevant within the context of rural China, I created a set of risk questions based on ethnographic interviews with community members about the specific risks presented by local industrial pollution. Rather than relying upon set definitions of risk from the literature, I allowed the informants in this study to describe for themselves those risks presented by local industrial pollution. This is in line with current research that sees the community itself as a vital tool in understanding pollution and developing locally relevant indicators of environmental health (Cole, et al. 1999)

Because I anticipated that different stakeholder groups would hold different views on local pollution, I used a "site-based" sampling frame based on Arcury and Quandt's

(1999) study rather than a simple convenience sample. First, I identified the demographic characteristics that I considered most salient to the research project. Based on the hypotheses of the study, which posit a link between economic stake in local industry and risk perception, I used occupation as the primary sampling criterion, dividing the households of the community into the following groups: agriculture, industrial labor and management, commercial, and government and service.

After generating a list of sites where I might sample for each group and contacting key informants within each group, I recruited subjects by either approaching them directly or asking for help from the key informants in recruiting. For example, among industrial laborers, often the key informant was a factory manager or fellow laborer.[32] I recruited from all four villages (*Guantian, Wuzitian, Tangba* and *Jingui*) within Futian Township. This was important because all of the industrial factories are located in the main village of Wuzitian, where community members were perhaps most directly affected by pollution and where the economic benefits of rural industrialization were most apparent. Because important demographic and economic characteristics (e.g. ethnicity and income) varied at the household level, sampling took place at the household level; I identified households within each occupational group and then interviewed only one person from the household, randomizing as far as possible the informants I

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[32] This selection method contains an obvious bias in that key informants played an unusually important role in recruiting other informants. Nevertheless, in rural China, where the researcher is seldom given carte blanche control over the recruitment of subjects and where most aspects of life are determined in part by inter-personal relationships (*guanxi*), I found myself compromising on sampling procedures in order to get access to informants.

interviewed by gender and age. The composition of informants in the sample is shown in Table 4.

Table 4. Composition of informants: ethnographic interviews

VARIABLE	CATEGORIES	N	% OF SAMPLE
Occupation	Agriculture	12	33.3%
	Industrial Labor	8	22.2%
	Commercial	12	33.3%
	Government/Service	4	11.1%
Gender	Male	28	77.8%
	Female	8	22.2%
Ethnicity	Han	28	77.8%
	Yi *	5	13.9%
	Other **	3	8.3%
Total		36	100%

* Indicates Shuitian Yi, the largest ethnic minority nationality in Futian.
** Others included in the sample belonged to the Dai ethnicity.

A total of 36 informants participated in the interviews, and each interview lasted from one-half hour to more than two hours. A typical interview lasted one hour. For the ethnographic interviews, I used a format that was standardized but flexible (see Appendix A). One part of the interview was designed to collect basic demographic information such as age, sex, and family structure, and another part asked participants about their perceptions of pollution from local factories. Each informant was asked, for example, whether they perceived pollution from local factories as harmful, and if so, what specific threats they perceived from the pollution. I recorded their responses on the interview form. When my ability to write Chinese characters failed me, I enlisted the help of local assistants. The average number of specific threats listed by informants was 2.1.

During the analysis of these interviews, I ended up with a long list of the specific risks posed by industrial pollution to Futian's residents. I performed theme analysis on these various risks, distilling them into seven salient "risk themes" that describe how local informants characterize the various risks posed to them by industrial pollution. Many participants mentioned a particular theme more than once, sometimes rephrasing slightly. I have condensed these into one theme where appropriate. These seven risk themes, along with their frequencies of appearance within the theme analysis, are shown in Table 5. Examples of comments representative of each theme, taken directly from ethnographic interviews, are shown in Table 6.

Table 5. Characterizing risk from pollution: risk themes

THEME	INFORMANTS USING THEME (N)	INFORMANTS USING THEME (%)
Direct Health Effects	34	94.4%
Damage to Plants/Crops	23	63.9%
Damage to Visibility/Scenery	23	63.9%
Harm to Animals	14	38.9%
Economic Losses	8	22.2%
Indirect Health Effects	5	13.9%
Limits to Longevity	3	12%

Note: *Direct Health Effects* included concerns that pollution caused health problems for the informant, his/her family, or the community in general. *Damage to Plants* included concerns that pollution destroyed or compromised both agricultural crops and other plants. *Damage to Visibility and Scenery* included primarily concerns that air pollution, in particular, impaired a person's ability to see across the valley in which Futian is situated or otherwise damaged the aesthetic quality of the area. *Harm to Animals* included concerns that water pollution, in particular, contaminated drinking water for livestock. *Economic Losses*, mentioned primarily by farmers, included the concern that air and water pollution damaged crops, lowering yields and incomes for farming families. *Indirect Health Effects* included the concern that, by eating crops and animals affected by pollution, people were putting themselves at risk. Finally, *Limits to Longevity* included concerns that local people were less likely to experience a long life (*changshou*) as a result of exposure to pollution.

Table 6. Examples of informant comments related to risk themes

THEME	EXAMPLES OF COMMENTS RELATED TO THEME
Direct Health Effects	"The pollution makes me get sick easier and more often."
	"It makes people sick; it's bad for people's bodies."
Damage to Plants/Crops	"We've started seeing an impact on our crops over the past few years. The air pollution and ash build up on the crops and destroy them."
Damage to Visibility/Scenery	"The main thing is, you can see it. It looks bad."
	"Visibility is not good."
Harm to Animals	"It's bad for the livestock."
Economic Losses	"It's harmful to our plants and animals, and this hurts people economically."
Indirect Health Effects	"The animals drink polluted water and then we eat the animals. This is harmful to people's health."
	"It [pollution] gets into the plants and animals and then people eat them and it causes health problems."
Limits to Longevity	"It [pollution] may have an effect on longevity, but I'm not sure. There are a lot of long-lived people in Tangba."

Survey

Sampling procedures for the survey were identical to the site-based procedures described above for the ethnographic interviews used to define risk, with one exception. Because of the relatively small number of informants in the "industrial laborer" category in Futian, and because this category comprised an integral part of the study, 15 industrial

laborers were recruited from the neighboring township of Shilongba. Exploratory analyses revealed that these informants did not differ significantly from the Futian sample on any of the demographic variables germane to this study. An initial sample of 146 was recruited to participate in the survey; 24 informants either chose not to participate in the survey or only completed part of the survey, for an overall sample of 122 and a response rate of 83.6%. I personally administered the survey questionnaire to 76 of the study participants; the other 46 were administered by four undergraduate students from the University of Washington, under my supervision. The study sample size was chosen to achieve a level of precision required to detect a 10% difference (ie. 0.5 on the 5-point scale) in the relationship between the independent and dependent variables. The composition of informants in the survey is shown in table 7.

Table 7. Composition of informants: survey questionnaire

VARIABLE	CATEGORIES	SAMPLE SIZE (N)	% OF SAMPLE
Occupation	Agriculture	47	38.5%
	Industry	33	27.0%
	Commercial	27	22.1%
	Government/Service	14	11.5%
Sex	Male	77	63.1%
	Female	45	36.9%
Ethnicity	Han	67	54.9%
	Yi*	42	34.4%
	Other**	13	10.7%
Total Sample		**122**	**100%**

Note: N=122

* Indicates Shuitian Yi, the largest ethnic minority nationality in Futian.

** Other ethnicities represented in the sample included Dai, Naxi, Nisu, and Nuosu.

A survey questionnaire was devised that consisted of several sections including demographic and socioeconomic information, perceptions of industrial pollution from local factories, views on local quality of life, and self-assessed respiratory health. After the survey was translated into Chinese, it was pre-tested with a sample of 12 informants from across occupational, ethnic and gender groups. Based on the pre-test results, the final survey was shortened and some portions were reformatted for clarity.

Seven questions regarding perception of pollution, based on the seven risk themes described above, were phrased in the form of statements (for example, "pollution in my township damages people's health" was chosen as the question representing the *direct health effects* risk theme) and respondents were required to indicate their level of agreement with the statement on a five-point scale as follows: *1=strongly agree, 2=agree somewhat, 3=don't agree or disagree, 4=disagree somewhat, 5=strongly disagree.* During the analysis, responses were inverted so that "1" represented the lowest perception of risk and "5" represented the highest. A "risk perception index" (RPI) was created by taking the mean score of these seven questions for each respondent.

Before creating the "risk perception index" (RPI) using the seven risk themes, these themes were checked for inter-correlation and reliability. A correlation matrix of the seven risk themes was constructed, and the correlations between the seven variables were positive and statistically significant, most at the .01 level. The correlation matrix is shown in table 8.

Table 8. Correlation matrix for seven risk themes plus risk perception index (RPI)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	RPI
(1) Direct Health Effects		.764	.737	.741	.744	.676	.682	.871
(2) Longevity			.881	.711	.763	.761	.749	.918
(3) Harm to Animals				.737	.818	.760	.650	.910
(4) Indirect Health Effects					.806	.735	.667	.867
(5) Harm to Plants						.728	.728	.903
(6) Economic Losses							.661	.858
(7) Damage to Local Scenery								.833
Overall RPI Score								

Note: All correlations are significant, $p<.01$

In addition, principle components analysis was used to determine whether a single dimension or multiple dimensions underlay the seven risk themes used in the risk perception index. Based on an examination of both the eigenvalues and the scree-plot, a single factor that accounted for 78.4% of the variance of the seven variables was extracted. The loadings on the seven variables ranged from .83 to .92. This indicates that

there is a strong relationship among the variables and that a scaled variable that includes all of the variables (i.e. the risk perception index) is likely to be a consistent representation of risk perception. A measure of reliability for the risk perception index was calculated using Cronbach's alpha, with an alpha level of .95. This indicates that the scores from these seven variables are reliably measuring the same thing, namely the perception of risk from local industrial pollution.

I found that there are several benefits to using ethnographic data to construct a scaled variable for measuring overall risk perception. First, the researcher is less likely to omit important constructs underlying the concept being measured; because the constructs are allowed to emerge from the interview process, the researcher can be more certain that he has captured as accurate and complete a picture of risk as possible. Second, the scale itself is interpretable within a cultural context. Because responses on the scaled variable exist within the context of rich ethnographic data, they are more easily interpreted. Finally, a scale constructed in this way has high reliability when examined through statistical analysis.

Results

General

Overall, Futian residents in the current sample perceived a moderately high degree of risk from local industrial pollution. The mean score on the RPI was 3.90, and the standard deviation was 1.22. The distribution of scores on the RPI was left-skewed, indicating that the majority of informants perceived a moderately high degree of risk, and

only a comparatively small number of informants perceived little risk. Several transformations were performed on the RPI in order to achieve a more normal distribution. The logarithmic transformation, in particular, produced a slightly more normal distribution but made the interpretation of further analyses less clear. As a result, the original, untransformed RPI was used in all subsequent analyses reported here. Mean scores for each risk theme, along with the RPI index and a ranking by perceived severity of threat, are shown in Table 9.

Table 9. Ranking of risk themes according to perceived level of threat

RISK THEME	THREAT RANKING	MEAN	SD
Indirect Health Effects	1	4.18	1.22
Harm to Plants	2	4.08	1.34
Damage to Scenery	3	3.99	1.34
Harm to Animals	4	3.88	1.47
Economic Losses	5	3.80	1.33
Longevity	6	3.71	1.50
Direct Health Effects	7	3.66	1.50
Risk Perception Index (RPI)		**3.90**	**1.22**

Independent Variables and Risk Perception

To examine the relationships between the independent variables of interest (economic stake in industry, ethnicity, tenure, education, and respiratory health status) and the dependent variables (seven risk themes and overall RPI score), a series of independent-sample t-tests and Pearson correlations were conducted. To determine economic stake in local industry, informants reporting that at least one member of their

household worked in a factory were coded as "high"; informants without any family members in factory labor were coded as "low." For ethnicity, "Han" indicates that the informant self-identified as ethnic Chinese; "other" includes primarily Shuitian Yi, the largest minority nationality in Futian, as well as small numbers of various ethnic groups in the community including Dai, Naxi, and Nuosu. For pollution-related respiratory health status, a variable was created that incorporated several health-related questions while controlling for smoking, since most males in the community are smokers and this likely influences respiratory health. "Good" indicates that the informant did not experience a cough or difficulty breathing during the past month. "Poor" indicates that the informant had either a cough or difficulty breathing and was a non-smoker. Tenure is simply a measure of the number of years an informant has resided in the study community. Finally, education is the number of years of formal education completed.

The results of these analyses are shown in Table 10 and Table 11. Using the Bonferroni approach to control for Type-I error, a p-value of equal to or less than .005 (for t-tests) and .008 (for Pearson correlations) was required for significance.

Table 10. Mean scores and t-test results for risk themes by ethnicity, stake in industry and respiratory health status

RISK THEME	ETHNICITY			ECON. STAKE			RESP. HEALTH		
	Han	Other	T[a]	High	Low	T[a]	Good	Poor	T[a]
Direct Health Effects	3.41	3.94	1.91	3.07	3.97	3.18**	3.42	4.29	-2.82*
Longevity	3.38	4.09	2.62	3.31	3.92	2.14	3.55	4.16	-1.96
Harm to Animals	3.64	4.16	1.96	3.36	4.16	2.91*	3.77	4.19	-1.37
Indirect Health Effects	4.03	4.36	1.49	3.76	4.41	2.83*	4.08	4.48	-1.60
Harm to Plants	3.84	4.36	2.14	3.43	4.43	4.14**	4.00	432	-1.15
Economic Losses	3.55	4.07	2.13	3.49	3.96	1.81	3.74	3.97	-.82
Damage to Local Scenery	3.86	4.15	1.16	3.50	4.27	3.11**	3.88	4.32	-1.16
Overall RPI Score	3.67	4.16	-2.21	3.41	4.17	-3.34**	3.78	4.25	1.87

Note: N=119

[a] Type-I error controlled by using Bonferroni procedures.

* Indicates p-value equal to or smaller than .005.

** Indicates p-value equal to or smaller than .0025.

Table 11. Pearson correlation coefficients for risk themes by tenure and education

RISK THEME	TENURE (R^2)[a]	EDUCATION (R^2)[a]
Direct Health Effects	.237	.225
Longevity	.252*	.160
Harm to Animals	.309**	.105
Indirect Health Effects	.163	.185
Harm to Plants	.326**	.159
Economic Losses	.265*	-.032
Damage to Local Scenery	.214	.103
Overall RPI Score	.287**	.151

Note: N=120

[a] Type-I error controlled using Bonferroni procedures.

* Indicates p-value equal to or smaller than .008.

** Indicates p-value equal to or smaller than .004.

Economic Stake in Industry and Risk Perception: Initially, a Pearson correlation coefficient was calculated between the percentage of household income from factory labor and RPI score. There was a positive and statistically significant correlation, but a large number of informants (n=76) had no income from industry at all, and those who did (n=42) tended to rely on this income for the overwhelming portion (73.9%) of their total monthly household income. Ultimately, high economic stake in industry was defined as having a household member working in a factory and contributing any portion of the household income, and low economic stake in industry was defined as having no household members working in a factory.

There were significant differences in risk perception between high- and low-stake groups. The mean RPI score for the high stake group was 3.41, while the mean score for the low stake group was 4.17. The difference was statistically significant, $t(116)=3.34$, $p<.001$, indicating that, overall, informants with household members in industrial labor perceived a lower degree of risk from industrial pollution compared to informants without household members in industrial labor. In terms of the seven risk themes comprising the RPI, statistically significant differences in risk perception were detected between the high- and low-stake groups across five themes. Informants in the high stake group consistently perceived a lower degree of risk from pollution in terms of direct health effects ($t(113)=3.18$, $p<.0025$), indirect health effects ($t(116)=2.83$, $p<.005$), harm to animals ($t(116)=2.91$, $p<.005$), harm to plants ($t(116)=4.14$, $p<.0025$), and damage to local scenery ($t(117)=3.11$, $p<.0025$).

Ethnicity and Risk Perception: It was hypothesized that Han informants, having more access to the benefits of industrial development, would perceive a lower degree of risk than ethnic minority informants. Han informants did report lower RPI scores than their ethnic minority counterparts (3.67 compared to 4.16, respectively), but the difference was not statistically significant, $t(117)=-2.21$, $p=.029$. Han informants reported a markedly lower perception of risk to longevity from industrial pollution than non-Han informants (3.38 compared to 4.09, respectively), but the difference was not statistically significant under Bonferroni procedures used to control for Type-I error, $t(116)=2.62$, $p=.01$.

Pollution-Related Respiratory Health and Risk Perception: To represent pollution-related respiratory health status, a variable was computed for those who had experienced either a cough or difficulty breathing in the past month and were non-smokers. Informants who had experienced these symptoms and were non-smokers were categorized as having "poor" respiratory health status, while those without symptoms were categorized as having "good" respiratory health status. It was hypothesized that informants with "poor" respiratory health would perceive a higher degree of risk from industrial pollution than informants with "good" respiratory health status. The results of the t-tests show that respiratory health was partly related to overall risk perception, but that this relationship was driven by very specific concerns about the threats posed by industrial pollution to human health. For the *direct health effects* risk theme, the group reporting poor respiratory health had a markedly higher perception of risk than the group reporting good respiratory health (4.29 compared to 3.42, respectively), and this result

was statistically significant, t(114)=-2.82, p<.005. Mean scores on the overall RPI differed between "poor" and "good" groups (4.25 compared to 3.78, respectively), but the results of the t-test were not statistically significant, t(117)=1.87, p=.07.

Tenure and Risk Perception: Average tenure in the community was 23.4 years (with a minimum of 1 month, a maximum of 71 years and a standard deviation of 18.1 years). It was hypothesized that informants with a longer history of residence in the community would perceive a higher degree of risk from local industrial pollution. To test this hypothesis, Pearson correlation coefficients were computed between years of tenure, overall RPI score, and scores on each of the seven risk themes. The results showed a moderate, positive correlation between years of residence in the community and RPI score (R-square=.287, p<.004), indicating that longer-term residents in the community perceived a higher level of risk from local industrial pollution. In addition, tenure showed a moderate, positive correlation with four risk themes, including effects on longevity (R-square=.252, p<.008), harm to animals (R-square=.309, p<.004), harm to plants (R-square=.326, p<.004), and economic losses (R-square=.265, p<.008).

Education and Risk Perception: Average education in Futian was 8.9 years (with a minimum of zero years, a maximum of 16 years and a standard deviation of 3.2 years), but varied significantly across age groups. It was hypothesized that higher education would be correlated with higher perception of risk from local industrial pollution. To test this hypothesis, Pearson correlation coefficients were computed between years of education, overall RPI score, and scores on each of the seven risk themes. There was no

statistically significant correlation between education and RPI score (R-square=.151, p=.1). There is some evidence to suggest, however, that education, while not related to overall RPI score, is a factor in perceived risks to human health in particular. The two strongest correlations found were between education and direct health effects (R-square=.225) and between education and indirect health effects (R-square=.185), but neither of these relationships was statistically significant (p=.02 and p=.05, respectively).

Regression Analysis

The final step in the analysis was to determine, using stepwise multiple regression, how well combinations of the independent variables can predict scores for the risk perception index (RPI). Following the hypotheses and the results of the bivariate analyses above, it was hypothesized that economic stake in local industry was the primary predictor for risk perception scores, and this variable was used as the primary variable in the regression analysis. In addition, the other four variables of interest (ethnicity, pollution-related respiratory health status, tenure, and education) were also forced into the regression model. The model resulting from this analysis is shown in Table 12.

Table 12. Regression analysis

PREDICTOR VARIABLES	STANDARDIZED BETA COEFFICIENTS	SIGNIFICANCE (p-value)
Respiratory Health Status	.155	.079
Tenure	.298	.006
Ethnicity	-.040	.682
Education	.246	.009
Economic Stake in Industry	-.227	.013
R^2=.23, N=109, df=5, F=6.18, p=.000		

Note: "Good" respiratory health was coded as 0, "poor" as 1. For ethnicity, "non-Han" was coded as 0, "Han" as 1. For economic stake in industry, low stake was coded as 0, high stake as 1.

Three predictor variables—economic stake in industry, tenure, and education—had relatively high beta values and were statistically significant ($p<.01$). Tenure and economic stake in industry show similar predictive impacts upon the regression model. A stepwise removal of tenure produced an R-square change of .072, while a removal of economic stake in industry produced an R-square change of .059, and a removal of education produced an R-square change of .046 ($p<.001$). Thus a combination economic stake in local industry, tenure and education appears to produce the best-fit model for predicting risk perception related to industrial pollution.

Discussion

In sum, the methodological approach used here is unique in that it allowed informants to delineate the specific threats from local industrial pollution that were of particular concern to them. In addition, the goal was to assess risk perceptions specifically related to the local pollution problem rather than a wide-ranging list of

hazards as used in other studies (Fischhoff, et al. 1978; Flynn, et al. 1994; Lai and Tao 2003). As a result, we get a glimpse into a uniquely local risk situation, and the results of the study must also be interpreted within the context of local phenomena. Findings in this chapter suggest that the majority of community members in Futian, regardless of demographic characteristics, perceived a moderate level of risk from pollution from township and village enterprises. This is consistent with previous risk analysis research using Chinese samples (Zhang 1994; Lai and Tao 2003) By itself, this finding is interesting in that it overturns the common logic that economic development, that paramount goal in modern China, trumps concerns over ecological problems and human health (Edmonds 1998 726; Wheeler, et al. 2003). The results also call into question some of the inherited theoretical wisdom in risk studies, namely that "chemical factories with their imposing pipes and tanks are symbols of success" and that, where economic need is poignantly felt, risks remain "largely invisible" (Beck 1992: 41-42). In short, conventional wisdom would have us believe that economic necessity coincides with blindness to risk, and that poor countries and communities prefer to sacrifice environmental quality to achieve economic growth (Baumol and Oates 1979). On the contrary, as the results presented in this chapter suggest, Futian's residents, despite experiencing relative economic scarcity and a need for local industrial development, are keenly aware of and threatened by the environmental risks posed by their local factories, which are the very engines of local economic growth.

Risk perception differed quite dramatically between segments of the sample. Significant effects of selected demographic factors on risk perception have also been observed in this chapter. Economic stake in local industry, as noted above, resulted in

consistently lower perceptions of risk for Futian's residents. Of the five risk themes for which risk perception differed between high and low economic stake groups, two of them—harm to animals and harm to plants—are related to agricultural livelihood. Informants in the low stake group perceived a greater threat in these two themes, I would argue, because they make their livings from agriculture and are thus keenly aware of the effects of pollution on their crops and animals. One informant noted during an interview:

> Water pollution is the biggest problem. It comes from the coal-washing plant and sometimes it turns the whole river black for days or weeks at a time. The river water is what we use for irrigation and for the animals, so it's a big problem. We have no water to use when the pollution is bad.

Those whose economic livelihoods require a heightened sensitivity to ecological change are more apt to perceive a higher degree of risk to industrial pollution. Second, and perhaps more importantly, many farmers are acutely aware of the fact that the choicest industrial jobs—which provide incomes four or five times higher than agricultural labor—are beyond their reach for reasons that I will discuss shortly.

A correlation between tenure in the community and risk perception was also observed in this chapter. Longer-term residents tended to perceive a higher threat on the risk perception index and across four risk themes, including threats to longevity, harm to animals, harm to plants, and economic losses. To some extent, length of tenure may co-vary with age, and these results may be seen as similar to other studies in which older residents perceived a higher degree of risk from certain threats than younger residents (Zhang 1994; Lai and Tao 2003). But here we must also consider the larger socioeconomic changes taking place throughout rural China. Township and village

enterprises, as their name suggests, were once communally owned factories designed to absorb rural surplus labor and promote local development through the generation of tax revenues that, for the most part, stayed within the local community (Naughton 1992; Whiting 2000). In recent years, however, the privatization of these enterprises, coupled with the loosening of migration controls, has resulted in dramatic increases in rural-rural labor migration. Township and village enterprises, as the primary source of non-agricultural labor in the countryside, have been instrumental in this shift. In Futian, all of the factories currently operating were once communally held and are now privately owned and managed, most by investors from outside the community. These outside managers, known colloquially as *waidiren* (literally, "outsiders"), often either bring with them a trained labor force from their own community or hire primarily outside laborers, in part to disguise how many workers are actually on the payroll from local government officials. The result is a situation in which local community residents, who once garnered the benefits of industrial labor, are now denied these labor opportunities in their own community and are forced to bear the costs of industrial pollution. The resentment many residents feel is palpable. One informant noted that "We don't get any benefits from the township and village enterprises; all the factories are private, and they're all owned by outsiders." Another, a man in his fifties and a life-long resident of Futian, was openly contemptuous of the factory managers and workers who relocated to Futian from the neighboring province of Guizhou: "They come from outside our town, ruin our environment, make money, and then go home."

In this way, it is clear that risk perception, within the context of the statistical model presented in the current chapter, is more than a product of the nature of the risks

faced by informants, as the psychometric approach maintains (Fischhoff, et al. 1978; Slovic, et al. 1979). Instead, as the anthropologist Mary Douglas and the political scientist Aaron Wildavsky have noted, "the dialogue is political." (1982: 174). The creation of risks, along with the distribution of their consequences, is an issue inherently shaped by broader social, political and economic forces. I suggest that political ecology, which posits a link between specific kinds of social formations and environmental degradation, provides a useful analytical framework within which to understand the results presented in this chapter. As previous research on environmental problems in rural China has shown (Muldavin 1997), degradation is "structurally embedded" within the reform-era paradigm of rapid growth. What this chapter suggests is that both the creation of environmental risks and the perception of them are shaped in part by the broader political and economic structural changes taking place in the Chinese countryside. This position is outlined more fully in the following chapter.

The final question for consideration, of course, is why risk perception matters at all. Apart from its theoretical implications noted above, I suggest that intra-community differences in risk perception may be symptomatic of some form of political discontent. As reform policies change the nature of township and village enterprises, diminishing many of their benefits to local communities, and as industrial pollution in the countryside becomes an intractable problem, rural residents, if the results of this chapter may be believed, are becoming disenfranchised. Moreover, as Robert Weller (Weller 1999: 127) has suggested, environmental problems in modern China have become a forum for pushing the "boundaries of political possibility." Intra-community differences in risk

perception may be symptomatic of inequitable distribution of environmental risks, which may in turn compromise political stability.

Conclusions

Using a set of risks particular to rural industrial pollution in China, generated through ethnographic interviews, this chapter determined that community members in Futian overall perceived a moderate threat from local pollution. The nature and degree of the threat perceived was different across different demographic characteristics, in particular economic stake in local industry, tenure in the community, and education. As discussed above, these results may be due in part to recent changes in economic policy in rural China and the disenfranchisement that many local residents feel.

These findings, and the interpretation outlined above, are in line with recent studies of risk that attempt a nuanced approach to understanding risk perception that recognizes the importance of the "sociocultural context in which risks are framed and debated" (Lai and Tao 2003: 683). While the findings presented here, given the methodological approach, are particular to the study community, it is clear that risk perception is as much about social, political, and economic factors as it is about the actual risks faced by individuals and communities. I outline this position more fully in the following chapter, where I discuss some of the specific sociopolitical mechanisms responsible for the intra-community differences in risk perception observed here.

CHAPTER 6—KNOWING RISK, NO RISK: EXPLAINING DIFFERENCES IN RISK PERCEPTION

The previous chapter has shown the influence of inequality in access to the financial benefits of rural industry on shaping the perception of risk from industrial pollution in Futian. In particular, I have demonstrated that community members who had access to the financial benefits of industry were apt to perceive a lower degree of risk from industrial pollution than were farmers and other community members. I have interpreted this in light of political ecology, which, in contrast to some of the dominant views in risk studies, including the psychometric paradigm, emphasizes the need to understand risk perception within broader social, political, and economic frameworks. Where the psychometric paradigm points to underlying cognitive factors as the source of differential risk perception between individuals, my intent is to understand how "risks are defined, perceived, and managed according to principles that inhere in particular forms of social organization" (Rayner 2002: 84). Within this view, differential perception of risk is indicative of the uneven distribution of benefits from a given risk-producing activity, a phenomenon which is itself grounded in particular kinds of social organization. In short, the political ecology approach to risk that I employ here argues that "what one sees depends on where one stands" (Rayner 1992: 92)

In this chapter I sketch in some detail the kinds of sociopolitical mechanisms that influence community members' perceptions of risk in Futian. I do this by linking risk perception to the broad changes taking place in Futian's political economy, including the privatization of Futian's factories. I discuss how the differences in risk perception

measured in the statistical model of Chapter Five are indicative of community members' different positions within the local political economy. I do this by examining two competing narratives of risk. One narrative, what I call "knowing risk," represents agricultural and other non-industry community members' recognition of the problem of industrial pollution. It details the ways in which this group understands and copes with the consequences of pollution for their health, their livelihoods, and the integrity of the local ecosystem, and how the perception of risk is bound up with questions of equity and justice in the distribution of financial benefits from industrialization. The other narrative, what I call "no risk," is representative of factory laborers and investors themselves, who see local industry as the area's economic life-blood and for whom the concern about industrial pollution is secondary to concerns over economic vitality.

Knowing Risk: Farmers' Narratives of Industrial Pollution

How do individuals recognize and impose meaning upon the risks they face? Given that industrial pollution in Futian, a risk to which everyone in the community is exposed, gives rise to multiple and contested perceptions of it as demonstrated in the model presented in the previous chapter, another way of asking this question is: How is pollution transmuted into risk? A growing body of scholarship suggests that sensorial perceptions—in particular, seeing or smelling pollution sources and activities—is perhaps the most salient way of identifying risk (Moffatt, et al. 1999; Bickerstaff and Walker 2001). Vision operates as an effective means of identifying risk when the pollution comes from a proximate source. But pollution in general, and air pollution in particular, is by

nature something that transgresses boundaries; it is, as Mary Douglas (1966) has suggested, "matter out of place."

Information about pollution—its sources, its severity and its consequences—is shaped by social processes and discourse. Ideas about pollution are in the social domain and are mediated, amplified or attenuated through social discourse about risk (Kasperson and Kasperson 1996). In some cases, the media play an important role in shaping risk discourse (Greenberg, et al. 1989). Pollution is given meaning through such discourses, which constitute a kind of "local knowledge of pollution" (Moffatt, et al. 1999).

I suggest here that local knowledge about pollution in Futian is acquired most significantly through everyday experiential encounters with it. Instances of harm—including damage to crops and lost economic livelihood—are implicated in the uneven perception of risk. This approach is in line with recent research that suggests a link between direct, observable effects of pollution and community members' perceptions of it (Moffatt, et al. 1999; Bickerstaff and Walker 2001). In addition, access to the benefits of the risk-producing activity plays a key role in the perception of risk.

Experiencing Harm

One informant, a 48 year-old Shuitian farmer, lived with his wife and two children on a narrow plot of land consisting of only three *fen* (three-tenths of a *mu*, or less than one-twentieth of an acre). He grew primarily rice and sweet potatoes; the latter he cultivated on a sloped corner of his land without irrigation, carrying buckets of water from the river each day to sprinkle over his crop. The family's cash income amounted to

approximately RMB 200 per month, a sum that was consumed almost entirely by the eldest son's tuition fees at Panzhihua University. The farmer's total dependence on agriculture—which provided subsistence but a very marginal living—meant that he was particularly vulnerable to ecological changes wrought by industrial activity. His chief complaint was that water pollution emissions from a nearby coal washing plant threatened to undermine his economic viability:

> We've had a terrible experience with the coal washing plant in Daxing [the neighboring township in Huaping County, Yunnan]. The plant is upriver from here. Starting in about 1991 or 1992, at certain times of the year when the plant is running a lot, the whole river turns black. We don't want to irrigate our crops with it, and the animals can't drink from it.

His assessment of the pollution problem stemmed from direct experience of specific harms caused by industrial activity, and his position within the local social and economic milieu made him particularly vulnerable to industrial pollution. With such a narrow margin of economic viability, this farmer was acutely aware of the negative impact that air and water pollution had on his yield.

In 2000, he and another member of his production team in the valley of Wuzitian, a 33 year-old Han man who also feared for the viability of his crops in the face of local pollution, complained formally both to the Futian Township government, which reported the case to the Renhe District Environmental Protection Bureau, and directly to cadres in Daxing Township, where the offending coal washing plant was located. A compromise was reached whereby the township government of Daxing, which still held primary ownership over the coal washing plant as a township and village enterprise, would pay 50

yuan to each farming family downstream in Futian who had been affected by effluents from the plant.[33]

The sum could scarcely begin to cover the financial losses of many farmers, some of whom had lost a whole season's crop. Local farmers, given the pittance of the settlement, held this up as an example not of the triumph of local citizens organizing against pollution but as a case of bureaucratic snubbing of those without economic and political power. "Fifty yuan!" the man told me, rolling his eyes, "What are you going to do with 50 yuan? They ruin your crop and then they give you 50 yuan!" This sentiment was echoed by many other farming households who cultivated land along the river in Futian's lower valley.

In addition to experiencing directly the negative impacts of industrial pollution, local farming households were engaged in a constant struggle with the township government over its policies regarding economic development. The township government, they complained, constantly emphasized industrial development while downplaying the importance of agriculture, despite the fact that a majority of households in Futian depend solely upon agriculture for their livelihoods. Beginning in late 2002, the township government invested in the construction of a small hydroelectric power station below the main reservoir in Futian, primarily to replace government tax revenue normally supplied by the local factories. This was necessary for two reasons. First, a decreased

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[33] Under the process of Administrative Review in China, it is common for a local environmental protection bureau to investigate damages caused by pollution and either mediate between parties or impose a decision, which may include ordering the polluter to pay compensation to the damaged party (see Palmer 1998: 802).

market for coke at Panzhihua Iron and Steel Company, coupled with a gradual depletion of local coal reserves, meant that many of Futian's factories were on shaky financial ground. Secondly, officials from the Renhe District Environmental Protection Bureau (EPB) were discussing the possibility of shutting down Futian's factories for non-compliance with emissions standards, a decision that would have far-reaching economic impacts for the township government. Local cadres planned to generate power year-round at the hydroelectric station and sell the surplus electricity to the neighboring township of Shilongba, located across the provincial border in Yunnan. Subject to a separate environmental regulation regime and apparently more financially solvent than Futian's factories, Shilongba's factories were flourishing, demanding ever more power. This plan was laid out in township government documents and discussed at length in government meetings. Construction was underway throughout 2002-2003.

Local agricultural households, however, bore the unexpected burden of chronic water shortages as the river had to be diverted in places during the construction. Moreover, it became increasingly clear that, after the hydroelectric station was completed, irrigation water would be scarce in the village of Jingui as a major share of the river water would be permanently dedicated to power generation. "We don't have enough water for irrigation," a 38 year-old Shuitian farmer from Jingui told me. "They're constructing the power station along the river, and our water has been cut off."

Farming households throughout Jingui had similar stories. Land plots are comparatively large in the village, with many households cultivating up to five *mu* of irrigated rice paddy (*tian*) and ten *mu* of dry fields (*di*), but villagers hadn't been able to plant a winter wheat crop in 2002. By early spring of 2003, it became clear that the power

station would not be completed in time to supply the village with irrigation water, and villagers fulminated about the likelihood of losing their main summer rice crop.

Industrial development, in the eyes of farmers, was the culprit. By insisting upon promoting industry over agriculture, despite the fact that a majority of Futian's households depended primarily on agriculture for their livelihoods, the township government was sacrificing the well-being of a majority of its residents. Within this framework, agricultural households saw local factories as an affront to their livelihoods. As one informant said, "We don't get any benefits from the factories; we depend on our land." Because of the important role they played in the local economy, industrial laborers and investors wielded substantial influence over government officials and over the agenda of economic development in Futian, often at the direct expense of local farmers. Their powerful position within the local political economy, and their only cursory reliance on the local agrarian ecosystem assured laborers and managers that their economic needs would be met while the environmental risks of industry were externalized. As Susan Stonich (1999: 24) has written,

> Such power is manifest in the relative abilities of actors to control access to and use of environmental resources, to transfer environmental risk to other actors, and to affect certain policies and projects (often partly through the control of public discourse).

For all their animosity toward the outsiders (*waidiren*) who had exploited business and employment opportunities in Futian and profited from polluting activities, local residents in Futian also ultimately used narratives of risk from industrial pollution to level critiques against the development policy and practices of the government. These narratives revealed a deep-seated mistrust toward both local cadres and district

government officials, who were supposed to play, in the eyes of local residents, the dual roles of development promoter and public health protector. The power to control and disseminate information about the local pollution problem was a central concern for farming households. As one informant said, "the government is supposed to tell you when the pollution is bad [so you can take steps to avoid exposure]. But they don't care about the interests of common people (*laobaixing*). All they care about is more investment and more money."

Many farmers' narratives also revealed the belief that the government knowingly turned a blind eye to industrial pollution in Futian because of the township's relatively weak position within the regional political economy. As one informant noted, "The government allows these polluting industries to exist in rural areas because they know people need the development and won't object." In essence, these narratives reflected a complimentary relationship between what Ulrich Beck (1992) wealth distribution and risk distribution: economically marginalized communities were consistently exposed to environmental risks because they needed the financial benefits associated with them. Residents were aware of the environmental and health risks they faced from factory smoke and water effluents, but, faced with a local government bureaucracy that privileged industrial development, there was very little they could do to protect themselves.

Experiencing Reform, Privatization, and Marginalization

Narratives about "knowing risk" must be read alongside the broader political and economic changes taking place in Futian. During the boom years of the 1990s, when more than a dozen local factories operated in Futian and all were under collective ownership by the township government, industrial profits were funneled into community development programs. New schools were built or renovated in three of Futian's four villages (Wuzitian, Tangba, Jingui); a section of the winding, inter-village road was graded and paved; and a six-story township government office building with a fresh white-tiled façade was constructed. The benefits of industrialization, in short, accrued to the community as a whole, and even agricultural households without a direct financial connection to industry enjoyed a share in the fruits of development. After all, the strategic use of minority nationality status to attract higher-level government investment in industry, and the commitment of local government officials to community development was a hallmark of the "Futian Model" (Li 1995: 237-266). Successful here, the model could be applied anywhere in the southwest regions, where the problems of poverty and ethnic "backwardness" often are intertwined.

Beginning in the late 1990s, however, Futian's factories began the shift toward privatization that has characterized reform-era TVEs across the country (Pei 1998a).[34] Underlying this trend, of course, has been the systematic loosening of migration controls

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[34] During my first visit to Futian, for pilot research in 2001, several of the township's seven extant factories were still held collectively by the township government. By late 2002, as I began the extended field period, all factories in Futian were owned outright by outside investors.

that once bound peasants to their production teams. The three factories that operated consistently during 2002-2003—the zinc smelter, the coking plant, and the coal washing plant—had been bought by private investors, all of whom hailed from outside Futian. The township's collective assets, in short, had been systematically sold off to outsiders, a process that Jeffrey Muldavin (1996) has called the "dismantling of communal capital."

These outside investors brought with them their own labor forces or culled from the ubiquitous stocks of migrant labor throughout the countryside. Thus the privatization of local industry was compounded by the outsourcing of labor opportunities, leaving the local population of Futian dependent primarily upon subsistence and small-scale market agriculture. Where many households had at least one member who earned wages from local factories during the period of collective ownership, after the privatization of industry these households lost a valuable source of income. Local residents in Futian used the colloquial, mildly derogatory term *waidiren* ("outsiders") to refer to the migrant laborers and recently arrived investors, and the memory of communal benefits from industry gradually faded with the completion of the privatization process. As one farmer told me, "it [industrial development] has brought a lot of *waidiren* into the community to invest in industry, but we don't get any of the benefits from industrial development."

The primary benefit, of course, was higher income. According to my survey, households with at least one family member working in industry earned, on average, RMB 2,043 per month, while households without any income from industry earned just RMB 801. Purely agricultural households—households that relied solely upon farming for their livelihood—comprised the majority of households in the township and earned, on average, just RMB 433 per month, a sum that was supplemented with in-kind income

from farming. By contrast, the private investors in Futian's factories earned as much as RMB 10,000 per month, a fantastic sum by local standards. Industrial development in the recent reform-era in Futian, then, became the purview of a rather select group of investors and laborers from outside the community, while agricultural households received little benefit.

Futian's agriculture has scarcely operated beyond a subsistence level. Various attempts to create an agricultural economy of scale capable of producing cash crops—oranges in the 1980s; silkworms in the early 1990s—had all failed. Land availability varies greatly from one village to the next; farmers in Jingui and Tangba, for example, held, on average, three or four *mu* of irrigated rice paddy (*tian*) and up to 10 or more *mu* of dry fields (*di)* for cultivating other crops, while farmers in Wuzitian and Guantian typically held less than one mu of paddy and one or two mu of dry fields. To be sure, there were households whose yields amounted to a handy surplus that could be trucked into Panzhihua City for sale—in particular, some farmers were specializing in the breeding of pigs or the cultivation of several varieties of melons—but the vast majority of households ate what they produced and sold or traded small surpluses at the local morning market on Futian's main street or in the neighboring township of Daxing.

The agricultural system of Futian, although it comprised the bulk of employment and subsistence for the township's residents, was at constant risk of being undermined by local industrial activities. In the local imaginary, the agricultural livelihood is capable of raising living standards only so much, and many agricultural households in the community are aware of their tenuous position within the regional political economy. As one informant put it, "agriculture solves the problem of warmth and fullness, but it

doesn't make you well off." A cash income is what the farmers want most. Sending a child to the district town of Renhe to complete junior middle school requires RMB 200-300 per month in tuition and boarding fees, a sum that often takes every bit of a household's monthly cash income, while the family members who remain at home rely primarily on their own crops for food.

The people who are "well off," so far as those outside of industry can see, are those within the circle of industrial benefits: the managers, investors and laborers that have descended on Futian in the past few years to partake in the privatization of local industry. As Bickerstaff and Walker (2003: 54) write, "inequitable risks are imposed on those individuals and communities already marginalized by positions of economic, social, or political isolation." Risk is experienced by those outside the circle of industrial benefits both as harm from pollution and as marginalization within the local political economy.

No Risk: Investors' and Laborers' Narratives of Industrial Pollution

Strategic Risk Repression

Near the industrial complex, on the hillside of dry chaparral to the north of Futian's center, is a scatter of hastily built, one-room brick houses where the industrial laborers and their families live. I visited one of the migrant workers, a 28 year-old Han man, who lives there with his wife and small son. The family had moved to Futian from their ancestral home in Guizhou in order to find work in the zinc smelter where, in a good month, the young father could earn RMB 800. The family's house, which consisted of a

single room with a floor of packed earth, was less than a hundred meters from the zinc smelter, and the air was acrid with the smell of sulfurous smoke. There were shards from broken ceramic cylinders used in smelting the zinc ore, and the ground was covered with a thick layer of black soot. The trees surrounding their house, mostly eucalyptus and Yunnan pine planted within the last twenty years as part of a reforestation campaign, were dying from the deposition of particulate matter from the factories on their branches.

Nevertheless, on the subject of industrial pollution, both the worker and his wife were adamant that there was no harm to themselves or their young son. Their main concern was that inspectors from the Renhe District Environmental Protection Bureau were visiting Futian frequently, threatening to close local factories for non-compliance with air pollution emissions standards. In their view, environmental regulations themselves created risks in the form of job loss and economic stagnation. As the worker told me, "They [EPB officials] say there's pollution, but it's not bad. How can you develop without jobs?"[35]

The fact that a particular community faces potential environmental dangers does not necessarily mean that those dangers will be acknowledged. As Ulrich Beck has noted, "affliction by hazards need not result in awareness of the hazard . . . Dangers can always be interpreted away" (Beck 1992: 75). The differences in risk perception observed in the statistical model in Chapter Five showed that economic stake in industry had a strong effect on how community members viewed pollution. One side of this equation is that

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[35] The enforcement of environmental standards, and its impacts on local factories, is a subject which I take up in Chapter Seven.

farmers and other residents outside of industry were acutely aware of the effects of pollution on their crops and the consequences for their livelihoods, as I have just described in the previous section. The other side of the equation is the consistent downplaying of risk from pollution on the part of those within the circle of industrial benefits.

Industrial laborers, investors, and their families used various means to repress the risks they faced from industrial pollution. Many of the workers' narratives, in particular, made reference to their bodies as sites of risk, but their narratives were almost universally used to downplay the risks they faced. As one man who had migrated to Futian seven years previously to take advantage of labor opportunities in the local factories said, "The pollution from these factories has no effect on human health (*dui renti meiyou yingxiang*)." To prove his point, he added, "I've been doing this kind of work for years with no health problems."

Pollution as Other

One way of downplaying the risk posed by industrial pollution is to assert that there are places far worse than where one lives. Some of the narratives of factory laborers and managers used comparative language to "other" the pollution problem (Bush 2001), to insist that industrial pollution created health and environmental risks somewhere else, but not in Futian. One of the investors in the zinc smelter, a man from Guizhou province, suggested that local factories played only a small part in Futian's pollution problem, and that the real culprit was major industrial activity in Panzhihua:

> It's very bad in Panzhihua because of Pangang [Panzhihua Iron and Steel Company], but it's not bad here. We don't really notice the impact of these local factories (*dangdi xiaogongchangde yingxiang women mei ganjuedao*).

Another factory investor, a man in his late fifties from Guizhou, noted that "the pollution here is not nearly as bad as in Panzhihua. Pangang puts out a lot of air pollution, but small places like Futian don't really have a problem."

Industrial workers and investors were keen to the fact that the regulatory officials in Renhe were putting local factories under increased scrutiny. They were also aware that if the Renhe EPB decided to close Futian's factories for non-compliance, the consequences for their families and livelihoods could be disastrous. Many industrial workers and investors felt that the EPB was practicing selective enforcement of environmental standards, and that Futian's factories became the target of environmental enforcement because they were small enough to be closed without incurring a significant economic impact at the district level. Moreover, the factory's role in the regional political economy was increasingly marginal; state-owned enterprises like Pangang remained at once vital parts of the regional economy and symbols of national pride and development. Despite the fate of many state-owned enterprises throughout China, many of which are being closed or privatized, Pangang has increased its output in recent years and increasingly acquires raw materials from abroad. Small-scale enterprises carried no such

visibility or symbolic import; they could be regulated out of existence with virtually no deleterious effects outside of Futian.[36]

This kind of "othering" of the pollution problem speaks to the problem of scale inherent in nearly all pollution problems. Part of the perniciousness of air pollution lies in the ease with which it transgresses boundaries. With Panzhihua Iron and Steel Company, the nation's third-largest state-owned smelter, located just sixty kilometers away, Futian was certain to be affected by the regional dispersion of air pollutants from an operation of that scale. The community, moreover, is encircled by other industrial townships—Longdong, Daxing, and Shilongba—all of which emit air and water pollution from their own factories. Pollution is a regional problem that respects no spatial boundaries (Cole, et al. 1999).

But such narratives of risk repression also represent, I argue, a kind of calculus of the risks and benefits of rural industrialization on the part of workers and managers. Given the magnitude of health risks posed by emissions that exceed annual standards by a factor of five, as outlined in the air quality monitoring results in Chapter Four of this dissertation, and given the increased vigilance of district monitoring officials, who insist that emissions from Futian's factories are dangerously high, how are certain individuals able to systematically ignore the tangible risks they face?

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[36] There was a historical precedent in Futian for local factory closures due to non-compliance with emissions standards. In 1997, the Renhe EPB closed a small zinc smelter in Tangba, the primarily Shuitian village in Futian's lower valley. In fact, most factory workers and investors lived in constant fear of being shut down by the district government, and these fears were realized in the winter of 2003, as I will discuss in Chapter Seven.

These narratives of risk repression serve a function for the factory investors and laborers who subscribe to them. Anthropological work on risk (Rappaport 1988) has suggested that the denial of risk may constitute its own sort of active agency insofar as it allows individuals to participate in activities that are otherwise financially rewarding. The denial of risk is adaptive; it allows factory managers and workers to persist in producing industrial products and profits while compromising their own health and the environmental integrity of the community and the region at large.

I do not suggest that the industrial pollution itself goes unnoticed. Rather, investors' and laborers' narratives of risk repression reflected a two-fold logical argument: that the risks engendered by industrial pollution were minimal, and that these were outweighed by the benefits of industry to themselves and to the community. In essence, strategic risk repression points to a distinction between danger and risk, the former being something material and quantifiable, and the latter depending on perception and perspective. Strategic risk repression, then, involves the "stopping of the translation, or flow, of danger into risk" (Paine 2002: 68).

Paine has called this the "no risk thesis," and for him a person subscribes to the thesis if he "proceeds and persists with its enterprise despite its associated danger and does so without risk calculations . . . Shutting out of perceptions of the world." There are two elements to this formulation: the failure of perception and the failure to calculate. But industrial workers and investors in Futian had both of these faculties intact: even the young family whose livelihoods depended on wages from the zinc smelter freely admitted that their factory produced black, sulfurous smoke; to argue otherwise would be ignore an obvious material fact. Thus their perception of the material phenomenon of

pollution was intact. And it is disingenuous to suggest that these people and groups do not calculate. Paine seems to suggest that risk repression is irrational; I suggest the opposite. Risk repression in this case is rational precisely because people are making the calculation and deciding that livelihood is more important than the risk posed by industrial pollution. Thus danger is not translated into risk.

Regulation as Risk

In the process of articulating a cultural theory of risk, Mary Douglas has argued that, from the vast array of events and possibilities people can worry about, they will select for particular attention the risks that serve to reinforce their social organizations. In this view, individuals actively perceive and manage risks "according to principles that inhere in particular forms of social organization" (Rayner 1992: 84).

Part of the vast difference in risk narratives between farmers and industrial laborers and investors can be explained by the fact that these groups subscribed to wholly different definitions of risk. Industrial laborers and managers in Futian were focused not on the risk of pollution but on the risk of having their economic livelihoods undermined by the closure of factories designed to mitigate that pollution. Because of their concern about the continued economic viability of their families and their community amidst the possibility of factory closures, industrial managers and laborers used narratives of risk repression both to critique government regulatory policy and to put forward a vision of the kind of development they wanted to see. In their experience, the heightened regulatory climate in Futian was the risk of greatest concern. Many took the Renhe

District Environmental Monitoring Bureau to task for enforcing environmental standards and threatening their livelihoods:

> I know the Environmental Protection Bureau thinks that we pollute. But as far as I can see, there's no harm to people. If you go over to the Renhe District government offices, you tell them that we're dead over here [*women sile*]. People have lost their jobs.

Industrial managers and laborers saw it as the government's responsibility to promote local development in accordance with the promises of the central government. Often, the central government's own policies and rhetoric were used as a tool for leveling critiques against the government for enacting harsh environmental protection policies. One informant cited the "Great Western Opening" policy outlined by President Jiang Zemin in recent years, a policy designed to turn the western region into "a new and strong region marked by sound economic development, social progress, welfare, ethnic unity, and with beautiful and clean mountains and streams" (Quoted in China Labor Statistical Yearbook 2001: 12).

By this standard, Futian's development trajectory was, in the eyes of industrial investors and laborers, a dismal failure. More to the point, it represented a failure on the part of local government officials to enact key development policies passed down from higher levels of government. As one informant pointed out:

> The policy [Great Western Opening] is supposed to bring a lot of investment into places like this. There has been a lot of development; workers in these factories made better wages than all the farmers. But now [because of increased environmental regulation] all that's finished.

The Great Western Opening policy promised to bring development to the poorest areas of China's western provinces by "opening" to investment and industry. Within this rhetorical framework, the increased scrutiny of Futian's factories by Renhe EPB officials seemed incongruous. As one factory laborer pointed out, "This place is supposed to be an open district (*kaifaqu*). But how can you develop like this, with no jobs?"

For industrial managers and laborers, and their families, development is about job creation. It is about enjoying the benefits of the Reform and Opening policies of the last two decades which facilitate the creation of wealth. As such, as one factory owner from Guizhou put it, Futian has seen nothing but "bad development" in recent years as the financial complexities of operating township and village enterprises have become more difficult to navigate and as the environmental regulatory climate has become more suffocating.

Factory managers and laborers saw the decline of Futian's industries, and the job loss that such a decline entailed, not simply as benign events resulting from the economic troubles facing township and village enterprises all over the country; rather, they saw these events as a direct attack on their livelihoods by the district government. As one informant put it, "if they [the district government] keep shutting down factories, the air will be clean but no one will have jobs."

Discussion

I have argued in this chapter that intra-community differences in risk perception are systemic, stemming from the uneven distribution of benefits from rural

industrialization in the face of economic reform and privatization. Agricultural residents' perceptions of risk are heightened by their everyday experience of industrial pollution as it damages their health, threatens their crops, and undermines their livelihoods. Industrial laborers and investors, meanwhile, practice what I have called "strategic risk repression," ignoring or downplaying risks within the calculus of outsized remuneration from factory activities.

The perception of risk is never politically neutral, but is dependent upon the sociopolitical and economic structures within which it is produced. As Beck has written, "the same pollutants can have quite different meanings for different people, according to age, gender, eating habits, type of work, information, education and so on" (Beck 1992: 26). Both narratives I describe here raise questions about the meaning of key processes that have taken place in the local community, including liberal economic reforms and industry privatization, an influx of industrial laborers from outside the community, and an increased scrutiny of local factories by environmental regulators.

I suggest that one cannot separate the ontological creation of risk from the epistemological perception of it. Uneven access to the sociopolitical and economic benefits of industrialization contributed to the creation of particularly vulnerable segments of Futian's population. Farmers, who because of their marginal economic position were perhaps least prepared to cope with environmental degradation, bore the brunt of the ecological damage from industrial pollution. The development logic of the PRC, grounded in notions of industrial progress and bolstered by a changing economic landscape of privatization, has created rural communities for whom the extraction and processing of resources and the ensuing pollution are the central tenets of economic life.

Farmers' marginal position in this political economy is mirrored by their heightened perception of risk. Conversely, industrial activity created a privileged segment of "outsiders" for whom industry was functional and beneficial, and whose perception of risk from industrial pollution was consequently low.

Focusing only on the cognitive aspects of risk perception, as the psychometric paradigm does, ignores the fact that risks are created within particular social contexts and economic structures. What is needed is an approach to risk perception that addresses the multidimensionality of the problem. As Oliver-Smith has noted,

> Disasters exist as complex material events and, at the same time, as a multiplicity of interwoven, often conflicting, social constructions. Both materially and socially constructed effects of disasters are channeled and situated variously within the society according to political, social, and economic practices and institutions. (2002a: 24)

Such an approach cannot ignore the messiness of risk perception. Risk perception is a product of sociopolitical and economic systems precisely because risks themselves are products of the same systems.

CHAPTER 7—WENBAO WENTI, HUANBAO WENTI: COMPETING DEFINITIONS OF SUSTAINABILITY

Noting the poor state of environmental protection in China, recent scholarship sees the implementation of sustainable policy as a constant struggle between environmentalist citizens' groups, who seek to "green" China, and the state itself, which seeks to suppress environmental protection in order to both sustain the country's high rate of economic growth and to prevent the spilling over of environmentalist action into the arena of national politics, which could become a direct affront to state power (Dai and Vermeer 1999; Weller 1999; Lo and Leung 2000; Ho 2001). Nevertheless, recent speeches by high Communist Party officials, including former President Jiang Zemin, point to a shift toward a new discourse of sustainability on the part of the Chinese state. This discourse borrows heavily from the internationalist discourse of sustainability that gained momentum after the 1987 World Commission on Environment and Development, which popularized the phrase "sustainable development." This discursive shift, coupled with a growing framework of environmental law, signals the Party's willingness to acknowledge the importance of sustainability in its development goals.

In this chapter I discuss how the growing discourse of sustainability at the national level in China relates to the local problem of industrial pollution in Futian. In particular, I describe the environmental regulatory regime in Renhe District which resulted in the closure of Futian's factories for non-compliance with emissions standards. This somewhat drastic event has several significant implications worth considering. First, it forces us to rethink the notion that the Chinese government is not serious about

enacting sustainable environmental policies and practices. I demonstrate here that the new national discourse of sustainability filters down to the lower-level government entities responsible for enforcing compliance with emissions standards, and that officials within the district-level Environmental Protection Bureau see their enforcement duties as an extension of this national discourse. Second, the closure of Futian's factories by the district EPB forces us to move beyond thinking of the Chinese state as a singular entity with clearly definable interests; such a view runs the risk of creating what Donald Moore (1996: 126) has called a "misleadingly monolithic model of the state." I suggest that, within the realm of environmental politics, even a notoriously controlling single-party state such as China contains controversial positions within different levels of government. Finally, I suggest that, as is often the case within local environmental politics, such controversies ultimately revolve around the power to define. In particular, the closure of factories in Futian came to hinge on the contested meanings of sustainable development itself, with different levels of government advocating wholly different models of sustainability.

Toward a Discourse of Sustainability

In 1966, Chairman Mao Zedong declared that "if people living in nature want to be free, they will have to use natural sciences to understand nature, to overcome nature and to change nature; only then will they obtain freedom from nature" (Mao 1966: 44, quoted in Ho 2001: 895). This statement effectively summarizes much of the ideology regarding the environment during the Maoist period: human beings and nature are

fundamentally separate, and the goals of human beings, which supersede the needs of the biophysical environment, must be accomplished through a reliance on science and technology. Mao's rhetoric had already been preceded, of course, by more than a decade of policy geared toward radically altering the Chinese environment. During the campaigns to eradicate the "Four Pests," for example, citizens were encouraged to wage war against rats, flies, mosquitoes and sparrows. The excesses of the Great Leap Forward, during which wetlands were drained, dikes built and forests cut in order to recover arable land for farming, constitute another well documented case (Shapiro 2001).

The past decade, however, has seen a discursive shift on the part of central government authorities in regards to their attitudes toward the environment. The phrase "sustainable development," which became an international buzzword after the UN World Commission on Environment and Development in 1987, has been adopted and circulated within the Chinese government and within Chinese-language scholarship on the environment. In state-sponsored publications, "sustainable development" (translated as *kechixu fazhan*) is defined in accordance with the Brundtland Commission's (1987: 43) definition: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (*ji manzu dangdai rende xuyao, you bu dui houdai rende nengli goucheng weihaide fazhan*) (China Industrial Development Report 2000).

Former President Jiang Zemin has peppered many of his recent policy speeches with references to sustainable development. In a speech at the Fifteenth People's Congress, he cited the size of China's population and the inadequacy of the country's natural resources as key reasons why the country must put forward a cogent "strategy of

sustainability" (*kechixu fazhan zhanlüe*) that entails the dual responsibilities of economic development and environmental protection (Wang, et al. 2000: 23).

Similarly, in his speech before the 16th National People's Congress in 2002, President Jiang discussed the meaning of *xiaokang* (literally "small comfort," or being well off) within contemporary Chinese society. The concept, which first appeared in the "Record of Rites" (*liji*) from the Warring States Period (475-221 BC), has been variously defined over the course of the last half century by Mao Zedong and by his successor, Deng Xiaoping, who once famously proclaimed that "to get rich is glorious." The fact that President Jiang made this key term part of his address to the NPC is, therefore, barely worth noting, but his particular redefinition of the term is. Jiang laid out what he called "four main goals in establishing a *xiaokang* society" (*jianshe xiaokang shehui si da mubiao*), the last of which, despite its obtuse language, unmistakably underscores the national government's shift toward a discourse of sustainability:

> [China should] continuously strengthen the ability to attain sustainable development (*kechixu fazhan*), better the natural environment, improve efficiency in the use of natural resources, attain harmony between man and nature, push toward the development of the forces of production for all society, a rich life, and the road leading to the development of a better environment and civilized society. (China Township and Village Enterprises 2002: 4)

Scholarly attention to sustainability has also been forthcoming of late in the Chinese-language literature on environmental science and policy. Qu (2002), for example, argues in the new journal *Environmental Protection* [*Huanjing Baohu*], a publication sponsored by the State Environmental Protection Administration (SEPA), that the need for sustainable development is an urgent issue of national security. He advocates

a position that requires both the government and citizens to recognize that ecological systems must be managed holistically and with the long-term future in mind. Similarly, Guan (2002) urges a policy shift toward sustainability that would contain five key elements:

1) Working toward inter-generational equity by considering the resource needs of future generations;
2) Using the principles of environmental economics in order to achieve sound resource management;
3) Balancing the needs of humans and nature;
4) Emphasizing environmental education; and
5) Placing the goal of ecological security on equal footing with economic and national security

Because of their prominent role in the nation's air and water pollution problems, as I have outlined earlier in this dissertation, rural industries receive a great deal of attention in the scholarly literature on sustainable development. Noting the propensity for high rates of natural resource consumption and pollution among rural industries, a recent report by the Industrial Economics Research Center of the Chinese Academy of Social Sciences (China Industrial Development Report 2000: 108) recommends strict control of these industries and the elimination of so-called "backward industries" (*luohou qiye*), which lack any environmental mitigation technologies.

The discursive shift toward sustainability within government and scholarly circles in China coincides with a gradual burgeoning of laws and regulations regarding the

environment and of the government bureaucracy overseeing them. During the Ninth National People's Congress in 1998, amidst massive cuts in the national bureaucracy, the State Environmental Protection Administration (SEPA) not only survived, but was promoted to ministerial status (Jahiel 1998).[37] This originally small, nascent environmental protection bureaucracy, begun in the late 1970s with a few thousand employees nation-wide, has grown into a powerful institution with a broad mandate to enforce environmental regulations and employed, by 2001, some 380,000 people at all administrative levels.[38]

A substantial body of environmental law, reaching as far back as the 1950s and steadily growing since the late 1970s, forms the basis of environmental protection in China (Palmer 1998). This body of law includes provisions from the primary bodies of both civil and criminal law, including the General Principles of the Civil Law (Law Yearbook of China Law Yearbook of China 1987: 68-76) and the Criminal Law (Law Yearbook of China 1987: 142-151) provides for criminal punishment for environmental pollution. In regards to the particularly acute problems of rural industry, the State Council, in 1984, passed the "Decision on Strengthening Environmental Management of Township and Neighborhood Enterprises," a set of regulations that would require rural

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[37] Prior to its promotion to a ministry-level unit, the agency was known as the National Environmental Protection Agency (NEPA).

[38] For an excellent overview of the environmental bureaucracy in China, see the State Environmental Protection Administration General Report for 2001. Also see Jahiel (1998).

industries to conduct environmental impact statements before construction, plan for pollution mitigating strategies, and pay fees and levies on effluents (Ho 2000).

The Chinese State as Environmental Protector?

The discursive shift toward sustainability that I have just described, along with a broadly conceived legal commitment to the enactment of sustainable law and policy, does not necessarily coincide with state action. Indeed, the fact that industrial pollution in many places goes on unabated leads one to question the state's commitment to enforcing environmental protection laws and policies. Political scientists, sociologists, and anthropologists who study environmental politics in China have, by and large, been pessimistic about the possibility for consistent enforcement (Dai and Vermeer 1999; Weller 1999; Lo and Leung 2000; Ho 2001). Despite his recognition of the existence of environmental groups that promote a green agenda, Peter Ho, for example, sees these groups as, by necessity, clandestinely working toward their agenda beneath the radar of an overarching state, which invariably seeks to squelch them:

> Chinese environmentalism has developed in a gradual way, encompassing the same wide variety of green NGOs and organizations that can be observed elsewhere in the world . . . On the other hand, environmentalism in China also has a distinct feature that sets it apart from the West and the ex-socialist states in the Eastern bloc: it lacks both the opportunity and the immediate urgency to openly confront the central government. (Ho 2001: 897)

An analysis of the relationship between environmentalism and civil society by Robert Weller produces much the same conclusion, namely that "environmental and other social groups either work closely with the government or are repressed" (1999:

128). The prospects for a true flourishing of sustainable policy backed by enforcement in China, given the repressive nature of one-party politics, and that party's orientation away from environmental protection, are thus grim, as Lo and Leung (Lo and Leung 2000: 704) point out:

> The regime's lack of a democratic tradition imposes tremendous institutional constraints on the further pursuit of a popular approach to environmental governance . . . There is no independent non-government green group for organizing fragmented public opinion into a powerful political force.

These assessments of environmental consciousness in China all share one thing in common: their insistence that the Chinese Community Party is not serious about enacting any of its environmental policies, and that environmentalist citizens' groups must circumvent government bureaucracy in order for any progress to be made at all. Peter Ho's formulation makes this abundantly clear; in his view, there are only two viable options for enacting sustainable environmental policy—co-optation or resistance—and both imagine a Chinese state that lacks any actionable commitment to sustainability (Ho 2001: 913).

It is clear, however, that enforcement of environmental policy does occur on occasion. Steps taken in 2002-2003 by the Renhe District Environmental Protection Bureau, the government entity with jurisdiction over Futian's factories, have placed me in the ironic position of trying to understand the Chinese state as an environmental protector. Futian's industries became, during this period, the focus of increased scrutiny by media outlets and by district EPB officials, creating a political stir that ultimately ended with the closure of all three of the township's factories. In the following section, I

describe the emissions enforcement regime undertaken by this rural EPB in regards to Futian's factories, and some of its political and economic consequences.

Sustainability in Practice: Monitoring, Media, and Industry Closures

In an ironic turn of events, the galvanizing of community opinion in Futian over industrial development occurred when the community faced the loss of its factories. To be sure, economic trends both regionally and throughout rural China were at least partially to blame. A precipitous trend toward privatization in the face of poorly defined property rights (Williams 2001), poor capitalization, and sluggish efficiency records (Xinhua 1997) are all exogenous factors, common to many if not most rural enterprises, that threaten the survival of Futian's factories. Moreover, since at least 1997 coal and other raw materials have been scarce within the township boundaries, and the township government has been struggling beneath debts from bank loans and from the District Bureau of Public Finance. These factors have combined to produce an economic climate that stifles the growth of Futian's TVEs.

These systemic and economic factors, however, explain only part of the problem. Futian's industries became, during the period of my field research, the focus of increased attention for provincial media outlets and for district environmental monitoring officials,

both of whom had an apparent interest in seeing that China's environmental regulations were enforced.[39]

On the evening of December 21, 2002, an exposé program called "Ten Minutes Tonight" (*Jinwan Shifen*) aired on the Sichuan Television Station, a province-wide media outlet. The program focused exclusively on the local enterprises of Futian and the environmental pollution problems associated with them. At the beginning of the program, a reporter with a hidden camera interviewed the owner of Futian's zinc smelter, a Guizhou native whom I had interviewed some weeks earlier. I encountered the television program by happenstance while visiting with a family in a local shop on Futian's main street. I watched the television as the owner, in front of the hidden camera, explained how his enterprise, despite its obvious pollution problems, constituted a vital source of tax revenue for the local government and therefore was immune to regulation. The reporter wielding the hidden camera went on to interview several workers from the zinc smelter as well, and showed a cut-away shot of the factory belching black smoke into the sky and stacking its product—blocks of pure zinc—in a shanty warehouse.

Party Secretary Wang, Mayor Zhang, and the Renhe District Environmental Monitoring Bureau Chief all made appearances of their own on the television program,

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[39] It is impossible for me to know how much of the increased scrutiny of Futian's factories was due to my presence in the community. The presence of a foreign researcher looking into the politically charged topic of industrial pollution almost certainly prodded both the media and Environmental Protection Bureau officials to pay closer attention to Futian. Nevertheless, it became clear during the course of my fieldwork that Futian's factories had undergone forced closures in the recent past and that local industrial pollution was already a salient issue for community members, for the media, and for regulatory officials.

discussing the state of Futian's industrial development and its impact on the local environment and the health of the township's citizens. The increased media scrutiny of Futian's factories had immediate political consequences. Indeed, it didn't take long for officials from the Renhe District Environmental Monitoring Bureau, under the bright lights of a provincial-level media outlet, to take action. By the end of December 2002, every township and village enterprise in Futian had been shut down for non-compliance with emissions standards pending further notice. Later, when I asked Party Secretary Wang, a short, wiry man with polished shoes, what effect the factory closures would have on Futian, he said simply, "I guess we'll be a lot poorer."

The closure of local industries for failure to meet environmental standards has a historical precedent in Futian. In 1997, the district government shut down a small zinc smelter in Tangba, the primarily Shuitian village in Futian's lower valley, and the rusted shell of the factory can still be seen on a bluff above the village. Throughout my period of fieldwork, the local factories closed and reopened multiple times in response to pressure from regulatory agencies in Renhe, and the financial consequences for industry owners and workers, as well as for the local government, were devastating.

The story of one particular factory and its closure may serve as an illustration of the financial losses that were at stake. The owner of the local zinc smelter had relocated, along with his family, to Futian from Guizhou in 1997. He formed a partnership with his wife and brother-in-law, and the group invested their retirement savings and money from personal bank loans—some RMB 450,000, or $50,000 in total—in the enlargement and improvement of the smelter, which had been, since its construction in the early 1990s, under the ownership of the township government.

The smelter consists of six open furnaces that, taken together, produce 30-40 tons of pure zinc per month, which is sold to a company in Kunming, some 300 kilometers to the south. Approximately twenty men, most of them from Guizhou province, work in the smelter, and many of them have brought their wives and children with them. They live in a series of shoddily constructed brick houses near the industrial complex on the edge of town. The prospect of permanently closing the smelter was deeply troubling to the investors, who stood to lose most of their capital investment, and to the workers, who were laid off.

Because the investors in this particular smelter were vocal in their opposition to the factory closures, and because they had both the financial resources and the educational background to protest (the primary investor had been a high school teacher for some thirty years before retiring and moving to Futian), their factory became the site of some of the bitterest controversy surrounding the industry closures. On a sunny afternoon during the height of the factory closures, Mr. Zhang, a 34 year-old chemist and the head of the monitoring station at Renhe District's Environmental Protection Bureau agreed to come to Futian to meet with the investors and discuss the fate of their factories. He ascended, along with three bureaucrats from the agency, the scrub-covered hill leading to the factory complex in a jeep bearing the logo of the District EPB, parking in front of the row of residences just adjacent to the factory where the workers and investors live. Only two of the smelter's six furnaces were in operation, both producing steady black puffs of sulfurous smoke. Mr. Zhang sat down on a wooden bench just a few feet from one of the smelters, and one of the investors, the wife of the primary partner in the factory, brought out bottles of orange juice for the guests.

After some initial pleasantries, the business of negotiation began. The wife of the primary partner, old enough to be the mother of Mr. Zhang, and quite clearly aware of her matronly stature, did most of the negotiating, while Mr. Zhang himself listened, nodded, and stared off into space. The heart of their exchange revolved around whether the group of investors had heeded past EPB demands to shut down:

Investor: Did you get the report I sent to your office about our business practices and air pollution emissions.

Monitoring Station Chief: I got it. But I've told you before, there's nothing I can do. Your factory doesn't meet the emissions standards. The smoke is even worse than it was the last time I came up here. It's terribly dirty.

Investor: There's some smoke, but it's very clean. It's not harmful. Anyway, you have to give us more time. My husband and I are retired, and we've invested our savings in this [factory]. You have to just give us three more weeks to finish off the zinc ore we've purchased.

Monitoring Station Chief: I've given you enough time. We agreed last time I came here to monitor that you'd close the factory on April 5. That's nine days ago now.

Investor: [getting agitated] But we did close. We've only got two furnaces out of six running now. Look over here, and you tell me: are the other four furnaces hot or cold?

Monitoring Station Chief: Okay, okay. Calm down.

Investor: Feel them. Are they hot or cold?

Monitoring Station Chief: They're cold.

At the end of this exchange, during which Mr. Zhang tried his best not to be cowed, the investor presented a series of demands on behalf of herself and her partners. First, the investors requested that they be allowed to keep the factory open on a provisional basis for three more months in order to pay back as much of their loan as possible and use up the remaining raw coal that had already been purchased to fuel the smelter furnaces. Second, they requested that the Renhe District government recognize that they had invested their personal money, along with loans, into the enterprise. And finally, the investors requested that the district government take steps to mitigate their financial damages.

A key point of protest for the investors was the fact that the decision to close their factory was based not on scientific monitoring data but on mere visual observation. The investors of the zinc smelter produced records of an EPB monitoring session that had taken place some three years previously, in late 1999, the results of which showed that the smelter was in violation of sulfur dioxide emissions standards set by the national government. Since that time, however, the investors had paid RMB 40,000 (nearly $5,000) to the Technology Zinc Ore Development Company (*Keji Xinyuan Fazhan Gongsi*) for the installation of a new smokestack that would aid in the dispersion of pollutants from coal combustion—including sulfur dioxide. Such technologies, they argued, served to mitigate the pollution emitted by their factory, and in any case the

Environmental Monitoring Bureau had an obligation to base its decisions on scientific monitoring methods rather than mere sensory information.

Mr. Zhang, the Monitoring Station Chief, conceded that no scientific monitoring of the zinc smelter's emissions had been done since 1999. The investors were incensed that the Environmental Protection Bureau would force their factory to close based on a monitoring report that was three years old and whose data was rendered moot by technological improvements that had been made during the intervening years. Nevertheless, the zinc smelter still produced a thick black plume with a metallic, sulfurous odor, and it was these sensory factors that Mr. Zhang's team used to determine that the factory was still in violation of standards. In the end, the investor's pleas for justice and compensation were not heeded by district officials. Their smelter, along with the other factories in Futian, was forced to close, and investors recouped only part of their losses by selling off factory equipment and raw coal.

A Tale of Two States

The central government, of course, is responsible for the creation of policy and the dissemination of development discourse, but it is the regional- and local-level governments that are left with the job of enforcing compliance.[40] The district government

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[40] Under the current bureaucratic structure, EPBs at the district and county levels represent the most peripheral reach of the State Environmental Protection Administration (SEPA), which is directly under the authority of the State Council (Jahiel 1998: 760). Governments at the township level and below typically lack the resources and, as will be shown here, the political will to carry out environmental protection.

in Renhe is torn between its dual responsibilities of promoting industrial development and enforcing emissions standards. The Renhe District government produced, in 2002, a series of brochures, published in Chinese and English, designed to attract outside—and even foreign—investors to the area. The glossy brochure, entitled Renhe District Investment Guide (*Renhe Qu Touzi Biaozhi*), cites the rich natural resources in the area, including coal, zinc, titanium, vanadium and iron ores, and outlines plans for developing local industry by offering one-year tax holidays and three-year periods of reduced taxes for new investors.

The district government has also overseen the creation of "open districts" (*kaifaqu*), areas designated for private investment, within many of its townships, including Futian. An area on the northwestern edge of Futian, just outside Wuzitian village, was zoned as an open district in the mid-1990s, a precursor to the privatization of Futian's factories. The district government has thus helped to position Futian to take advantage of economic reform and to develop its local industries to the greatest extent possible.

On the other hand, the Renhe District Environmental Protection Bureau is charged with monitoring air and water pollution emissions and enforcing emissions standards for Futian's rural enterprises. When I interviewed Mr. Zhang, the monitoring station head at the Renhe District EPB, in the winter of 2003, he told me that, from his perspective, the most pressing problem facing his agency was sustainable development (he used the same term as President Jiang Zemin, *kechixu fazhan*, which he defined as balancing economic development and environmental protection). "It's particularly difficult in backward places, like Futian, that have poor technology. Places with backward technology, heavy

polluters, will be phased out." Speaking of China in general, he added, "Once you've reached a certain level of development, then you need to start considering environmental protection."

Mr. Zhang recognized that the task of enforcing environmental regulations made him, and his agency, unpopular among certain segments of Futian's population which depended on the factories as a source of income and tax revenue. When I asked whether this fact bothered him, he shrugged, "This is a war, and I'm on the front line" (*wo zai qianxian*).[41] As a scientist within an EPB located in a rural backwater jurisdiction, Mr. Zhang's remarks struck me as poignant for their mastery of the discourse of sustainability currently circulating within the highest levels of government in China, which I described earlier in this chapter. The enforcement of emissions standards is a local act, but the logic underlying enforcement is profoundly shaped by national and international discourse.

The township government in Futian, by contrast, was less sanguine about sustainable development. Because the bulk of township government revenue comes from taxing industrial outputs, the township government's interests align closely with those of industry, and the closure of local factories by the district EPB had potentially disastrous

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[41] It is interesting to note that, despite its discursive shift toward sustainability, the language of government officials retains elements of the techno-rational development policies of the past. To some extent, sustainability will be accomplished in much the same way as the Maoist era development: through struggle and through science. The logic is that within the domain of human-environment interactions, the interests of human beings, mediated through proper ideology and buttressed by techno-scientific solutions, must prevail.

consequences for township finances.[42] Mayor Zhang showed me a letter, written in the fall of 2002, from the township government to the Renhe District Bureau of Public Finance, and this letter illustrates the degree to which local government interests are intertwined with industrial success. According to the letter, during the late 1990s, when all local factories were under the ownership of the township government, the government staggered beneath debts totaling more than RMB 5 million (roughly $610,000). Of this sum, roughly half of the debt was in the form of bank loans; the remaining portion was owed to various branches of the Panzhihua City and Renhe District governments.

The letter was, in essence, a plea to the district government to absolve Futian of its debt, but it also revealed that local township cadres were active in pursuing private investors to come to Futian in order to rejuvenate local industry. These private investors would be allowed to use the capital investments of the existing factories (the zinc smelter, the coking plant, and the coal washing plant), and to hire their own labor forces. In exchange, the investors would pay to the township government a set of fees and taxes. The group of investors that owned the zinc smelter, for example, were taxed an annual land-use fee of 2,000 yuan per coking oven, as well as a monthly tax on outputs of 150 yuan per oven and a monthly management fee (*guanli fei*) of 400 yuan per oven. These taxes and fees would be used to offset some of the township government's debts and to cover the month-to-month operating costs of running the government.

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[42] Li Xingxing has noted that up to 85% of the government's operating revenue in Futian during the 1990s came from local factories (Li Xing Xing 1995).

It is no surprise, then, that industrial development was the number one priority of local government officials in Futian. Due to market forces and to the scarcity of raw coal in Futian, which forced industry investors to purchase coal from neighboring Huaping County, industrial activity had already slowed in recent years; in response, government revenues had declined rather precipitously, from 1.1 million yuan in 1998 to approximately 500,000 yuan in 2001. The closure of local factories threatened to make a bad situation much worse.

Local cadre reactions to the Renhe District Environmental Protection Bureau's decision to shut down Futian's factories were split between the fatalistic and the furious. Mr. Hu, a Shuitian cadre in charge of Futian's office of industrial development, for example, said that nothing could be done about the factory closures: "The upper level of government has spoken" (*shangji zhengfu yijing shuohaole*). Party Secretary Wang's response was similar: "One thing's for sure: we're going to be a lot poorer."

Mayor Zhang, however, told me that the most vexing thing about the factory closures was the insensitivity of the district government to matters of local economic well-being. They could, he lamented, help Futian by investing money in improved environmental mitigation technologies and allowing the factories to reopen. "That's the first part of the Three Represents," he said, "to represent the common people. But they're not going to do it." [43]

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[43] The "Three Represents" (*sange daibiao*), put forward by former President Jiang Zemin in 2000, is considered a body of "important thought" (*zhongyao sixiang*) by the Central Committee. In it, Jiang argues that the Chinese Communist Party's role in negotiating a positive future for the country lies in 1) promoting

Wenbao Wenti, Huanbao Wenti: Competing Definitions of Sustainability

The head of the Agricultural Technology Office in Futian, a local Shuitian man, contextualized the debate over sustainability and local industry closures by defining sustainability with a colloquial play on words. "Sustainability," he said, "is trying to solve the *wenbao* problem without exacerbating the *huanbao* problem." *Wenbao* (literally, "warm and full") is how rural Chinese describe the standard of living just above poverty, when one's belly is sated and there is a roof beneath which to sleep. It is a standard of living that has been attained in Futian only recently; anyone more than thirty years old has tales of eating grass during especially lean times, or slaughtering a single 200-jin pig to provide the annual meat supply for a family of six. *Huanbao* (an abbreviation of *huanjing baohu*, or "environmental protection"), by contrast, is a rather new concern for Futian, as for most rural Chinese, and one that has taken on salience only in the last decade or so since township and village enterprises have altered the local landscape and industrial pollution has become an intractable problem. The problem of *wenbao* versus *huanbao*, then, involves a question of values: should the township promote industrial development, thereby increasing the living standards for industrial

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the advanced forces of production (ie. capitalist development), 2) encouraging the advancement of culture, and 3) representing the basic rights of the "overwhelming majority of the Chinese people." By invoking the Three Represents, Mayor Zhang was simultaneously demonstrating his familiarity with this new dictum from the Party, with which all cadres are expected to be familiar, and critiquing the Party by saying essentially that it has lost sight of the interests of common people.

laborers and investors and providing critical revenue for the township government, or should it take meaningful steps toward preventing further degradation of the local environment? This is a question that ultimately hinges on the meaning of "bao," the second syllable in both *wenbao* and *huanbao*, the former meaning "fullness" and the latter meaning "protection."

I have outlined in this chapter the ways in which the state in China might be more productively viewed as multiple states, each competing for its own definition of sustainability. As Derman and Ferguson (2003) have written, environmental politics often involve "struggles at the ideological and discursive levels including, but not restricted to, definitions of science, knowledge, environment, sustainability, and biodiversity." These are struggles of meaning that take place "in the cultural dimension" (Moore 1996: 127) as the central government, district government, and township government debate about the particular model of sustainability that should prevail in regards to rural industry. The central government, via the district-level Environmental Protection Bureau, promotes a model of sustainability that emphasizes addressing the *huanbao* problem by implementing and enforcing industrial emissions standards. The township government, on the other hand, puts forward a literal, albeit resourceful model of sustainable development, conflating the concept with *sustained* development, a kind of development in perpetuity unhindered by the constraints of environmental regulation. This model argues for an emphasis on solving the *wenbao* problem by preserving the income and tax revenue generated by local industry.

Finally, it is worthwhile to ask what the central government gains by espousing a discourse of sustainable development, given that this represents a significant shift from

Maoist and early reform-era discourse. First, by adopting the discourse of sustainability, which is fundamentally an internationalist discourse, the state gains a measure of credibility within international political arenas. A substantial amount of foreign aid and foreign direct investment flows to the central government because of its effective use of the internationalist discourse of sustainability (Vermeer 1998: 953).[44]

A major step toward participating in the internationalist discourse of sustainability began with the construction of the Three Gorges Dam, the largest hydroelectric facility in the world and a magnet for opposition by environmental groups. Located on the Yangtze, the third longest river in the world, the dam became partially operable in 2003 and has a planned completion date of 2009. Its history is much deeper, having been conceived of by Sun Yat-sen, leader of the Chinese Nationalists, in the 1920s. Mao Zedong, who viewed

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[44] Of course, the role of citizens' groups and environmental social movements cannot be entirely ignored. As Dasgupta and Wheeler (Dasgupta and Wheeler 1996: 3) have pointed out, the National Environmental Protection Agency (currently the State Environmental Protection Administration, or SEPA) received over 130,000 complaints annually between 1991 and 1993. Similarly, the anthropologist Jun Jing documented cases in Gansu province and Chongqing municipality in which citizens gained redress for environmental pollution through legalistic means such as petitions and lawsuits and also through various forms of public protest, including appeals to local government officials and the blockading of local factories (Jing 2000). I have outlined in the previous chapter a case in which several farmer's in Wuzitian village sought and received compensation (though minor) from polluting factories in the neighboring township of Daxing, with the district environmental protection bureau serving as arbiter. The momentum created by these concerned citizens has almost certainly driven the central government, as well as local governments, to make changes in environmental policy and practice.

the dam as a potential symbol of socialist pride, got behind the planning of the project, and some of the feasibility and engineering studies of the 1940s were conducted by the United States Bureau of Reclamation. Once complete, the dam will stand 185 meters above the Yangtze, which is just over two kilometers wide at the project site. A 600 kilometer-long reservoir will be created behind the dam, and the turbines will produce a significant portion of the region's current energy needs, reduce the likelihood of catastrophic flooding along the Yangtze's lower reaches, and increase navigability upriver (China Yangtze Three Gorges Project Development Corporation 1999).

The dam became a rallying symbol for international groups concerned about the social impacts associated with the displacement of more than a million people from the area surrounding the reservoir and for environmental groups, who protested a host of projected environmental problems including the buildup of silt behind the dam, the loss of estuarine habitat, and the destruction of rare species. The outpouring of environmentalist sentiment surrounding the Three Gorges Dam has largely been an internationalist phenomenon. To be sure, there have been citizens' protests, primarily by disgruntled farmers resettled during the construction process (Jing 1997) some of whom openly defy government orders to move by chanting slogans like "Refuse to move up into the mountains," and "Never leave the river" (Ding 1999). But the overwhelming volume of opposition to the dam's construction was by international intellectuals and by Chinese intellectuals writing for an international audience. Two recent books edited by the famous journalist and anti-dam activist Dai Qing, for example, have been banned in China and widely circulated abroad (Dai 1994; Dai 1999). Such international exposure prods the central government toward at least a tacit espousal of sustainability.

Second, the discourse of sustainability, and its extension through law and policy, provides an avenue for the central government to exercise power over peripheral areas such as Futian. Policies designed to protect the environment can often become a way for the central government to gain control over other state- and non-state actors, a process Nancy Peluso calls "coercing conservation" (Peluso 1993). The closure of rural factories in remote locales such as Futian provides a means for the government to enact sustainable policies while keeping the economic impacts of such closures minimal and localized. The enforcement of emissions standards is a selective process that depends on which actors are capable of defending themselves and garnering the necessary connections and resources. Despite the fact that emissions from mega-industries like the Panzhihua Iron and Steel Company surpass Futian's emissions by an order of magnitude, such industries remain to pollute another day because they are important sources of employment and because they carry symbolic and political import. The small-scale factories in Futian bore the uneven consequences of emissions enforcement not because closing them would yield significant cuts in regional emissions but because their closure would result in the least hassle possible while providing concrete evidence of the government's commitment to act on its policies of sustainability in regards to rural industry.

The township government, however, should not be thought of simply as a victim of state discourses and practices of sustainable development. On the contrary, by viewing the sustainability question as a problem of meaning, and by actively insisting that sustainability is as much about *wenbao* as it is about *huanbao*, local government officials sought to create a model of sustainability that had practical value in the local context.

In sum, recognizing the multiplicity of state-held views in regards to rural industry is important, particularly in China where the political arena is dominated by the Communist Party and where scholarship on environmental politics is often quick to see the state as a hegemonic feature. Such a view runs the risk of creating what Donald Moore (1996: 126) has called a "misleadingly monolithic model of the state." In the domain of environmental politics, where key terms like sustainability become the focus of contestation, it is perhaps more useful to see that contestation as a process of negotiation between different state actors.

CHAPTER 8—CONCLUSIONS: TOWARD A POLITICAL ECOLOGY OF RISK

Evaluation of Hypotheses

I have asserted in this dissertation that my goal was to understand the production and perception of environmental risks in Futian. Bringing a political-ecology lens to the study of risk perception allowed me to make the following hypotheses regarding the specific sociopolitical factors involved in risk perception:

1) Poor communities, despite the need for economic development, still perceive risk associated with industrial development;
2) Economic stake in TVE success is a predictor of individuals' perceptions of environmental risk; that is, community members who stand to gain more from the economic success of the TVEs will perceive a lower degree of environmental risk;
3) Other factors such as health status, ethnicity, education, and length of tenure in the local community serve as mediators that affect risk perception. I make the following predictions:

    a. Community members with poor health status will perceive a higher degree of risk from pollution.
    b. Han Chinese residents will perceive a lower degree of environmental risk than Yi minority community residents.
    c. Community members with higher education will perceive a higher degree of risk from pollution.
    d. Long-term residents will perceive a higher degree of risk from pollution.

Hypothesis 1: Poor Communities and Risk

Conventional wisdom in risk studies holds that poor countries and communities will ignore environmental risks either because they lack the education necessary to understand the problem sufficiently or because they consider environmental quality secondary to economic development. This is a line of thinking codified most poignantly by Ulrich Beck's insistence that "economic scarcity and blindness to risk coincide." But I have shown in this dissertation that such a formulation is not entirely warranted.

First, at the community level in Futian, most individuals in this study, regardless of their relationship to local industry, perceived a relatively high degree of risk from industrial pollution. As the statistical model presented in Chapter Five illustrates, most residents recognized that industrial pollution caused specific problems for their health, their livelihoods, and the local ecosystem. I was often surprised during ethnographic interviews at the level of sophistication of people's understanding of the effects of industrial pollution. Informants with only a junior middle school education sometimes used technical terms such as "sulfur dioxide" (*erliang hualiu*) and "inhalable particulate matter" (*kexiru keliwu*) in their assessments of the local pollution problem. Some discussed in great detail how the pollution problem had changed through time, how it affected their families' livelihood and health, and what political processes were behind the monitoring of factories and the dissemination of information about pollution. Perception of and concern about industrial pollution was not the unique province of the educated and the wealthy; rather, everyday people with humble means possessed a nuanced understanding of the health and ecological effects brought by rural industry.

Secondly, at the individual level, the marginalized segments of society, those unable to mobilize much in the way of sociopolitical and economic assets, nevertheless perceive risk—and not in spite of their marginalization but *because* of it. The most economically marginalized segments of the local population in Futian, namely the agricultural households, did not resign themselves placidly to exposure to industrial pollution in order to attain development. Rather, they were acutely aware of the risks they faced from industrial pollution and they consistently showed a degree of risk perception much higher than other community members in industry.

The problem with Beck's theorization of risk perception, and its common applications in China regarding the attitudes of the poor toward pollution (Edmonds 1998: 726; Wheeler, et al. 2003), is that it doesn't pay adequate attention to the distribution of benefits from the risk-producing activity. Risk distribution and wealth distribution are, in fact, two sides of the same coin. While agricultural households and others who did not benefit financially from industrial activity in Futian perceived a greater degree of risk than their peers, industrial laborers and investors practiced "strategic risk repression," consistently downplaying the threat of pollution to their health and to the local ecosystem. This suggests the need for a more holistic approach to the study of risk perception, one that takes into account the fact that individuals are embedded in social, political and economic systems and that this embededness is a key component shaping how risks are perceived.

Hypothesis 2: Financial Stake in Industry and Risk Perception

The second hypothesis guiding this study is related to the first. It was my goal to understand the ways in which risk perception is reflective of social relations in the local community. I hypothesized that financial stake in local industry—as measured by the percentage of household income derived from industrial wages—is a predictor of risk perception related to industrial pollution. In fact, the statistical model presented in Chapter Five showed significant differences in risk perception between high- and low-stake groups. Overall, informants with household members in industrial labor perceived a lower degree of risk from industrial pollution compared to informants without household members in industrial labor. In terms of the seven risk themes comprising the risk perception index (RPI), statistically significant differences in risk perception were detected between the high- and low-stake groups across five of the seven "risk themes."

In Chapter Six I discussed why these differences in risk perception were so pronounced. Sociopolitical and economic changes, such as the privatization of industry and an influx of investors and laborers from outside the community, played a part in shaping the way that community members not connected to industry felt about local factories and pollution. Agricultural households were particularly vulnerable to the ecological changes wrought by rural industrialization in Futian. At the same time that these households were excluded from the benefits of industrial development—especially higher wages—they also experienced tangible effects of industrial pollution such as health problems, crop damage, and a threat to their livelihoods.

Explaining the mechanisms behind non-industry community members' heightened sense of risk, however, is only part of the equation. Those informants who benefited directly from industrial activity also consistently downplayed the risks to themselves and their families from industrial pollution. I have called this process "strategic risk repression," in that it does not preclude the possibility of recognizing that pollution presents some risk; rather, industrial laborers and investors have determined that the financial benefits of industry outweigh the risks.

Hypothesis 3: The Effects of Other Factors on Risk Perception

In addition to accounting for the economic factors behind the perception of risk, my approach also hypothesized that ethnicity, health status, tenure, and education would influence risk perception.

Ethnicity and Risk Perception: It was hypothesized that Han informants, having more access to the benefits of industrial development, would perceive a lower degree of risk than ethnic minority (primarily Shuitian) informants. Han informants did report lower RPI scores, and lower scores on all seven "risk themes," than their Shuitian counterparts, but the difference was not statistically significant. Ethnographic evidence suggests that there may be cultural differences in how Shuitian and Han view the costs and benefits of local industry, but these differences are confounded by other variables such as length of tenure in the community and financial stake in industry.

Pollution-Related Respiratory Health and Risk Perception: It was hypothesized that informants with poor respiratory health would perceive a higher degree of risk from industrial pollution. The results of the t-tests show that respiratory health was partly related to overall risk perception, but that this relationship was driven by very specific concerns about the threats posed by industrial pollution to human health. In particular, respiratory health status was related to community members' perceptions of direct health effects from pollution; those who had experienced the health consequences of air pollution were more likely to perceive a direct health threat.

Tenure and Risk Perception: It was hypothesized that informants with a longer history of residence in the community would perceive a higher degree of risk from local industrial pollution. The statistical model presented in Chapter Five showed a moderate, positive correlation between years of residence in the community and RPI score, indicating that longer-term residents in the community perceived a higher level of risk from local industrial pollution. In addition, tenure showed a moderate, positive correlation with four risk themes.

In fact, after financial stake in industry, tenure proved to be the most significantly correlated with risk perception in Futian. Part of the explanation lies in the fact that most of the longer-term residents in the community also happen to be farmers, and these individuals and households have been systematically excluded from the benefits of industry, as I described above. But length of tenure in the community also positions people to better understand the ecological changes wrought by rural industrialization in recent years. Older residents and residents whose families have lived in Futian for

multiple generations tended to place industrial pollution along a continuum of local environmental degradation that has progressed for the last half-century. Many residents recall with clarity the deforestation that took place in Futian and the greater Panzhihua area during the 1950s and 1960s. The industrial pollution that has steadily worsened in Futian during the past two decades, while qualitatively different from previous ecological changes such as deforestation, is nevertheless part of a steady decline in local ecological integrity; those individuals who have resided locally for many years or generations are perhaps best capable of appreciating this pattern of change. While previous scholarship on the link between attachment to place and the perception of risk from industrial pollution has found that longer-term residents tend to view their communities and neighborhoods as less polluted than recently arrived residents (Bickerstaff and Walker 2001), my findings suggest the opposite. In Futian, where people have survived on subsistence and small-scale market agriculture for many generations, long-time residents possess a keen knowledge of the ecosystem in which they live. This knowledge serves as a backdrop against which they can compare the current state of the local environment and assess the damage wrought by local factories.

Education and Risk Perception: It was hypothesized that higher education would correlate with higher perception of risk from local industrial pollution. There was no statistically significant direct correlation between education and RPI score. After using step-wise multiple regression to control for other variables, a moderate positive relationship between educational level and magnitude of risk perception was detected. In addition, there is some evidence to suggest that education, while not related to overall

RPI score, is a factor in perceived risks to human health in particular. Education was related to risk perception on two risk themes—direct health effects and indirect health effects—but neither of these relationships was statistically significant.

Practical and Theoretical Implications

One objective of this dissertation was to explore the usefulness of applying a political ecology approach to the study of risk perception. The preceding chapters illustrate that political ecology does indeed serve as a useful analytical tool for interpreting intra-community differences in risk perception. The analytical approach of much of the literature on risk perception tends to investigate how risk perception is tied to both universal patterns of cognition and the "character" of the specific risks in question. I suggest that such an approach, while valid in many instances, would have missed much of the richness involved in people's perceptions of risk in Futian, where the dynamics of political, economic, and social change were clearly implicated in how people viewed industrial pollution.

By examining risk perception through the lens of political ecology, an interesting picture emerges in which risk perception is bound up with the changing nature of ownership of rural industries, the dynamics of insiders and outsiders within the community, and the threats to livelihood posed by industrial pollution. Ignoring these aspects of risk in favor of a cognitive approach may make for clean, easily quantifiably variables to measure, but ultimately misses the essence of how risks are embedded within

people's wider social experience. Mary Douglas, the foremost proponent of a cultural theory approach to risk, opined the relegation of risk to the cognitive domain:

> Though they [risk analysts] recognize that the grime and the heat of politics are involved in the subject of risk, they sedulously bracket them off. Their professional objective is to get at the real essence of risk perception before it is polluted by interests and ideology. The risk analysts have a good reason for seeking objectivity. Like all professionals, rightly and properly, they do not wish to be politically biased: this is important for their clientele. To avoid the charge of bias, they exclude the whole subject of politics and morals. (1992: 11)

What I am suggesting here is that politics and morals make up the very essence of risk perception. It is almost impossible to imagine a scenario in which risk—from industrial pollution, from nuclear power, from natural hazards—did not contain an element of politics.

There are two reasons why I draw such a conclusion. The first is theoretical. Bringing the lens of political ecology to bear on risk perception means that one pays explicit attention to issues such as resource distribution and access. I have argued that the perception of risk, an epistemological question, is inherently linked with the ontological creation of risk. In Futian, the question "who loses from industrial pollution" cannot be separated from the question "who gains from industrial profit?"

The second reason I argue for the necessity of bringing politics into the field of risk perception relates to the research design of this project. Much of the work in risk studies takes whole nations and regions as the focal points for analysis and asks respondents to "rate the risks" (Slovic, et al. 1990) associated with pre-set lists of hazards chosen by the researchers. By contrast, this study is explicitly geared toward

understanding the community-level dynamics of risk production and perception. Its resolution is fine-grained. In this regard, anthropologists have a unique role to play in shaping the dialogue about how best to study risk perception. If, as I have argued, questions of meaning are central to risk perception and risks must be understood within their sociopolitical contexts, then it is necessary to employ research methods that allow local formulations of that meaning to emerge. The tool of ethnography is uniquely suited to this task. Rather than replicate previous studies by using identical or similar sets of hazards and then claiming that we understand risk perception, we might do well to first ask our research subjects what constitutes risk *for them*. In this dissertation, the ethnographic approach to defining risk had several advantages. First, by allowing informants to tell me what constituted risk, I felt that I was less likely to omit important constructs underlying the concept being measured; because the constructs were allowed to emerge from the interview process, I could be more certain that I captured as accurate and complete a picture of risk as possible. Second, the "risk perception index" (RPI), created by compiling the seven "risk themes" that emerged from ethnographic interviews and used as the basis of a statistical model of risk perception, was locally relevant. Conducting ethnographic fieldwork and allowing this fieldwork to inform the survey tool produced quantitative measurements of risk perception that could then be interpreted in light of, and triangulated by, ethnographic data. Finally, the risk perception index constructed from ethnographic interviews had very high reliability in statistical tests—much higher than studies in which the researchers defined risk themselves.

This approach essentially turns the field of "risk communication" on its head. While describing and characterizing the risks people face in their environments and

making the information available to public officials and to the public at large may remain an important task, involving the public in the formulation of the research questions and in the defining of risk will undoubtedly produce a more valid and nuanced understanding of risk perception.

Political ecology is an approach that inherently recognizes the political nature of environmental problems. It has informed this dissertation in several important ways. First, the political ecology framework understands that categories such as "environment," "pollution," and "risk" are as much social constructions as they are material realities. Part of the task of understanding risk perception lies in uncovering the way that scientific assessments of risk become naturalized and accepted as definitive and in recognizing that risk presents an epistemological problem in that it is caught between expert knowledge and local knowledge. This was, in fact, the point of departure for some of the earliest and most influential studies in risk perception, which set out with the goal of understanding how expert and lay attitudes toward technological hazards differed, if at all (Fischhoff, et al. 1978).

In addition to its theoretical import, the recognition that risk is socially constructed carries with it some very pragmatic promises. As experts in the field of risk communication have struggled with how best to present the facts and numbers of professional risk analysts to a public often deemed incapable of understanding complexity, there has been a gradual dawning of the idea that public opinions shape and constrain responses to risk and that the public should actively participate in risk assessment (Fischhoff 1995). All of this suggests that definitions of risk demand greater nuance than that accorded to them by scientific or technocratic treatments. I am

particularly partial to the remapping of risk by Steve Rayner (1992 95), who has suggested an addendum to the techno-scientific equation of risk (R=PM), where P is the probability of a risk event occurring and M is the magnitude of its consequences. His "polythetic definition" of risk (R=PM+TLC), where T is trust, L is liability, and C is consent, suggests that social and ethical implications are present in any risk problem.

The second contribution political ecology makes to this dissertation and to studies of risk perception is its recognition that environmental problems are often problems of meaning. As I showed in Chapter Six, different stakeholder groups often defined risk in wholly different ways. While farmers tended to focus on industrial pollution as a threat to their livelihoods and their health, industrial laborers and managers saw environmental regulation itself as the threat of greatest concern. It is important to recognize that such contestations of meaning are key parts of the risk debate, and that differences in individual perceptions of risk are sometimes indicative of deep differences in the definition of key terms.

Finally, the political ecology framework encouraged me to include multiple scales of analysis in my research. It became clear early in my fieldwork that, while risk perception was something that had to be measured at the individual level, there were political, economic, and discursive forces at work in the community and beyond that had a profound effect on shaping local understandings of industrial pollution. As I illustrate in Chapter Seven, a new discourse of sustainable development, adopted from international discourse by the central government, circulates within the environmental bureaucracy in China all the way down to the county and district levels. This discourse, bolstered by a growing corpus of environmental law and bureaucracy in China, has the potential to bring

far-reaching consequences for heavily polluting rural industries. Furthermore, by including multiple scales of analysis in my research, I was able to recognize the competing interests of different levels of government and to theorize about the existence of multiple states in China in regards to attitudes about sustainability and the enforcement of environmental regulations.

Applying the political ecology framework in order to understand risk perception has potentially beneficial implications for political ecology, too. Much of the research in political ecology is conducted by anthropologists and cultural geographers with a deep distrust of quantitative methods. From the standpoint of the political ecology literature, this dissertation takes a unique approach insofar as it represents an empirical testing, using both quantitative and qualitative methods, of assumptions that have been borne out in previous ethnographic scholarship.

In addition, this dissertation contributes to the political ecology literature by expanding its scope to include research in industrial settings. The body of political-ecological research as it currently exists suffers from extreme "land-centrism," and, as Bryant (1998: 89) points out, unequal power relations are as likely to be "inscribed" in the air or the water as they are to be "embedded" in the land. Political ecologists have produced no shortage of scholarship that sheds light on environmental problems within agrarian, forestry, and pastoral environments; theorization has not, however, been extended in any significant way to include industrial systems. My work is an explicit attempt to employ the political ecology framework in an industrialized landscape, thereby stretching its boundaries and increasing its explanatory power.

Why Risk Perception Matters

I have argued in this dissertation that risk perception takes place in the social domain. The importance of risk perception—to anthropologists, other scholars, and to policymakers—follows from this simple assertion. Examining the ways in which risk perception is shaped by social, economic, and political processes gives us a window into the processes themselves. A study of risk, therefore, is also a study of ethnic relations, of the struggle for economic livelihood, of political power and regulatory oversight, and of economic and environmental justice. It tells us a great deal about how people live in the world.

In China, understanding the perception of environmental risk has particular theoretical and practical significance. Never before have so many people faced such drastic ecological changes in such a short time period. As the PRC heads into a third decade of economic reform, bringing with it one-fifth of the world's population, the magnitude of the environmental problems it faces—industrial pollution, deforestation, agricultural runoff, desertification, solid waste disposal—suggests a need for a serious consideration of the environment-society nexus. In rural China, where unchecked industrial development has produced pollution problems of unknown proportion as well as a growing divide between the wealthy and the poor, exposure to environmental risk has particular significance. Left unchecked, these problems constitute an ecological and public health experiment whose outcome is unknown but likely undesirable.

Examining risk perception in China is an important task not only because of the magnitude of that country's environmental problems but also because a substantial body of literature promotes the idea that environmental consciousness there is either weak or

non-existent. It is true that socialist China has hampered the recognition of environmental ills in general and industrial pollution in particular, in two important ways. First, socialist ideology has been an impediment to the rise in environmental consciousness. Externalities such as industrial pollution were, in the eyes of socialism, the products of a corrupt capitalist mode of production and therefore could not have been caused by the socialist state, which lacks a profit motive.

Second, and perhaps more importantly, the de facto ownership of township and village enterprises by local governments prior to reform meant that any criticism of the factory was ultimately criticism of the state. As rural factories have undergone economic reform, becoming the private property of citizens, they have been to some extent decoupled from the state. This means that in theory citizens may recognize the ills of environmental pollution without posing any direct affront to state power. Whether or not this development will produce the space necessary for any meaningful public protest over pollution produced by these factories remains an open question.

Environmental risks by their nature have political consequences. If, as Robert Weller (1999: 127) has suggested, the environment "provides a forum where people can begin to push the boundaries of political possibility," then we need to begin thinking about risks as politically reflexive, carrying with them consequences for individuals, families, communities, and the political stability of the current system. In short, we need to begin thinking about the role that environmental and technological risks play in shaping the social world in which people live. Ultimately, such a close examination of risk requires a shift toward what Ulrich Beck (1992) has called "reflexive modernity,"

where the benefits of technological and economic development can no longer be considered apart from their consequences.

Future Directions

This project has opened up several avenues for future research. The first relates to forging a more thorough link between scientific air quality monitoring and lay perceptions of risk from pollution. I have alluded to the fact that laypeople's perceptions of risk often conflict sharply with expert assessments, and that the latter are generally more closely related to "real" risk as measured by actuarial data. Because of a dearth of air quality monitoring studies in rural China, the precise level of pollution people are exposed to is often unclear. The results of air quality monitoring I presented in Chapter Four are a step toward obtaining a fuller picture of pollution levels in Futian. A logical next step in this process might be to link individual risk perception with individual exposure to air pollution and to ask whether actual exposure is correlated in any meaningful way with risk perception. Such an approach would require a spatial model which, taking into account emissions levels and atmospheric data, could show where the greatest concentrations of pollution are being distributed locally. This dispersion model could then be linked to individual perceptions of risk collected from residents in different parts of the township to see whether exposure is correlated with perception of risk. Such a project would constitute a powerful next step toward understanding the precise relationship between exposure to pollution and individual perception of it.

Another possible avenue for future research relates to the institutional structure of environmental regulation in rural China. I have suggested that the regulation of emissions from rural factories reveals deep differences in goals and opinions between the national, regional and local levels of government. A key piece of this problem is the way decisions are made about which factories to monitor, how to approach enforcement, and what role the regional government should play in helping local factories to meet emissions standards. An ethnographic study of decision-making within a district- or county-level Environmental Protection Bureau would go a long way toward understanding these problems. It is clear that, while environmental policies are formulated at the national level, implementation of these policies—which is often irregular at best—is a responsibility that rests with local and regional EPBs. Moreover, because enforcement is often pointed to by scholars as the most elusive part of environmental protection in China, an examination of the lower-level agencies responsible for enforcement may yield information with both practical and theoretical significance.

Finally, I wish to underscore the unique role that anthropology may play in the understanding of risk and risk perception. As anthropologists, our role should start with the insistence upon the inclusion of other types of knowledge, alongside "expert" science, within the discursive arena of environmental risk problems. As Bickerstaff and Walker have noted, risk has remained too long within the purview of scientific assessment, effectively dismissing the importance of the public's understandings as mere perceptions that do not accurately reflect "real" risk:

> Distortions of power remain; the policy dominance of techno-scientific definitions is unquestioned, obliterating and marginalizing the corporeal, placed and practiced understandings of most people. (2003: 60)

Where the study of risk was once solely the purview of scientists and others operating from a techno-centric worldview in which risk was defined narrowly as the probability of an adverse event multiplied by the magnitude of its consequences, anthropologists and other social scientists are positioned to change this trend by ensuring that local knowledge figures prominently in decisions about risk management. Ultimately an engaged anthropology is best suited to carry out such important work.

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APPENDIX A: ETHNOGRAPHIC INTERVIEW AND PROTOCOL

TOWNSHIP AND VILLAGE ENTERPRISE STUDY, FUTIAN TOWNSHIP, PANZHIHUA MUNICIPALITY

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Interviewer:

Location:

Date:

Start Time:

End Time:

Subject Group:

Subject ID Code:

A. INTRODUCTION AND SCREENING FOR ELIGIBILITY

READ THE FOLLOWING: "As you may know, I'm conducting a study about the township and village enterprises in your community and about local economic and environmental conditions. I would like to ask you to take about thirty minutes of your time to participate in this study."

B. INFORMED CONSENT

READ THE CONSENT FORM TO THE SUBJECT AND PROMPT FOR VERBAL "YES" OR "NO" RESPONSE.

Consent given? (Yes/No)

C. PERSONAL INFORMATION

1. Age
2. Sex
3. Hukou status: urban/rural
    a. Location of Hukou registration
4. Ethnicity
5. Education level
6. Length of residence in Futian
7. Occupation
8. Number of household members
9. Does anyone in your household work in a local factory?
    a. If yes, who?
    b. If yes, what percentage of your household income comes from factory labor?

D. DEFINING QUALITY OF LIFE

10. What does "quality of life" mean to you? What elements are included in your definition of a high quality of life? (Prompting: Are any of the following elements important to quality of life: relations with other people, involvement in social and community affairs, personal development and fulfillment, recreation and leisure, etc.?)

    a. Are some elements more important than others in your definition of "high quality of life"? Rank these elements from most important to least important.

11. What does "standard of living" mean to you? What elements are included in your definition of a high standard of living?

    a. Are some elements more important than others in your definition of "high standard of living"? Rank these elements from most important to least important.

12. In your opinion, how does quality of life in Futian compare with other parts of China? With other rural areas in Panzhihua municipality?

13. Is your quality of life better, about the same, or worse than it was 5 years ago?

    a. 10 years ago?

    b. Why?

14. Looking toward the future, do you expect your quality of life to be better, about the same, or worse than it is today?

    a. Why?

E. DEFINING ECONOMIC DEVELOPMENT

15. What does "economic development" mean to you? What elements are included in your definition of economic development?

    a. Are some elements more important than others in your definition of "economic development"? Rank these elements from most important to least important.

16. Have you heard of the phrase "sustainable development"?

    a. If you have heard of sustainable development, in your opinion, what does it mean? What elements are included in your definition of sustainable development?

    b. Are some elements more important than others in your definition of "sustainable development"? Rank these elements from most important to least important.

17. In your opinion, is Futian an example of sustainable development?

    a. Why or why not?

18. In your opinion, how has development affected Futian over the past 5 years?

    a. Over the past 10 years?

F. DEFINING ENVIRONMENTAL POLLUTION

19. Are there benefits to having TVEs in Futian?

    a. If yes, what are these benefits?

    b. Are some of these benefits more important than others? Rank these benefits from most important to least important.

20. Are there bad aspects related to having TVEs in Futian?

a. If yes, what are these bad aspects

b. Are some of these bad aspects more serious than others? Rank these bad aspects from most serious to least serious.

21. In your opinion, what does "environmental pollution" mean? What elements are included in your definition of environmental pollution?

a. Are some elements of "environmental pollultion" more serious than others? Rank these elements from most serious to least serious.

22. Have you experienced environmental pollution directly?

a. If yes, how?

23. Is environmental pollution harmful?

a. If yes, in what ways is it harmful?

b. To whom is it harmful?

24. Where do you get information about pollution in your community? (e.g. from government officials, the media, friends and family)

a. Are some information sources about pollution more important than others? Rank these information sources from most important to least important.

25. If you consider pollution harmful, how does the present pollution problem compare to the past? Is it better, about the same, or worse?

a. If you feel that the pollution problem has changed over time, how has it changed?

26. If you consider pollution harmful, who is responsible for cleaning it up?

27. Are there actions a person can take to avoid or lessen the effects of pollution?

a. If yes, what actions can a person take?

28. Have you taken any actions to avoid or lessen the effects of pollution?

a. If yes, what actions have you taken?

29. In your opinion, how has/will the closure of factories in Futian affect the community?

Thank you for participating!

APPENDIX B: SURVEY QUESTIONNAIRE AND PROTOCOL

TOWNSHIP AND VILLAGE ENTERPRISE STUDY, FUTIAN TOWNSHIP, PANZHIHUA MUNICIPALITY

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Interviewer:

Location:

Date:

Start Time:

End Time:

Subject Group:

Subject ID Code:

A. INTRODUCTION AND SCREENING FOR ELIGIBILITY

READ THE FOLLOWING: "As you may know, I'm conducting a study about the township and village enterprises in your community and about local economic and environmental conditions. I would like to ask you to take a few minutes of your time to participate in this study. You can read and answer the questions yourself or, if you prefer, I can read the questions to you."

B. INFORMED CONSENT

READ THE CONSENT FORM TO THE SUBJECT AND PROMPT FOR VERBAL "YES" OR "NO" RESPONSE.

Consent given? (Yes/No)

C. PERSONAL INFORMATION

1. Age:
2. Sex: ([1]Male)_____ ([2]Female)_____
3. Place of residence: ([1]Futian)_____ ([2]Shilongba)_____ ([3]Other)_____
4. Ethnicity: ([1]Han)_____ ([2]Yi)_____ ([3]Other)_____
   a. If other, which ethnicity?_____
5. What is the highest level of education you completed?
6. How long have you lived in Futian?
7. Occupation:
8. Number of family members in household:
9. Are any household members involved in TVE labor? ([1]Yes)_____ ([2]No)_____
   a. If yes, who?
10. What percentage of your household monthly income comes from industrial labor?

D. OCCUPATION AND INCOME

11. How many hours, on average, do you work per day?
12. How many days, on average, do you work per week?
13. What is your household's monthly income?

E. CONSUMPTION

Do you or your family own any of the following items? Please use a check (√) to mark the items you own.

Item	Own	Don't Own
14. bicycle		
15. motorcycle		
16. automobile		
17. washer		
18. black and white TV		
19. color TV		
20. satellite TV		
21. telephone		

F. QUALITY OF LIFE

This section contains a series of statements. Please use a check mark (√) to indicate whether you agree or disagree with each statement.
(1=strongly agree; 2=agree a little; 3=don't agree or disagree; 4=disagree a little; 5=strongly disagree).

22. I feel that I benefit from the Reform and Opening policies
    (1_____ 2_____ 3_____ 4_____ 5_____)

23. My family has attained a xiaokang lifestyle.
(1_____ 2_____ 3_____ 4_____ 5_____)

24. I feel that my family's income is enough.
(1_____ 2_____ 3_____ 4_____ 5_____)

25. I can buy the things I want.
(1_____ 2_____ 3_____ 4_____ 5_____)

26. My family's basic needs (food, clothing, shelter) are met.
(1_____ 2_____ 3_____ 4_____ 5_____)

27. I feel that I benefit from local industrial development.
(1_____ 2_____ 3_____ 4_____ 5_____)

28. I'm satisfied with my recreational opportunities.
(1_____ 2_____ 3_____ 4_____ 5_____)

29. I'm satisfied with my relationships with family and friends.
(1_____ 2_____ 3_____ 4_____ 5_____)

30. Economic development is more important than environmental protection.
(1_____ 2_____ 3_____ 4_____ 5_____)

31. My physical health is good.
(1_____ 2_____ 3_____ 4_____ 5_____)

32. My mental health is good.
(1_____ 2_____ 3_____ 4_____ 5_____)

ENVIRONMENTAL RISK PERCEPTION

This section contains a series of statements. Please use a check mark (√) to indicate whether you agree or disagree with each statement.
(1=strongly agree; 2=agree a little; 3=don't agree or disagree; 4=disagree a little; 5=strongly disagree).

33. Environmental pollution is a problem in Futian.
(1_____ 2_____ 3_____ 4_____ 5_____)

34. In Futian, pollution makes people sick.
(1_____ 2_____ 3_____ 4_____ 5_____)

35. In Futian, pollution limits people's ability to live a long life.

(1_____ 2_____ 3_____ 4_____ 5_____)

36. In Futian, pollution harms animals.
(1_____ 2_____ 3_____ 4_____ 5_____)

37. In Futian, eating animals that have been exposed to pollution harms peoples' health.
(1_____ 2_____ 3_____ 4_____ 5_____)

38. In Futian, pollution harms plants.
(1_____ 2_____ 3_____ 4_____ 5_____)

39. In Futian, pollution results in economic losses due to crop damage.
(1_____ 2_____ 3_____ 4_____ 5_____)

40. In Futian, pollution destroys the local scenery.
(1_____ 2_____ 3_____ 4_____ 5_____)

41. I notice the air pollution from local factories.
(1_____ 2_____ 3_____ 4_____ 5_____)

42. I notice the water pollution from local factories.
(1_____ 2_____ 3_____ 4_____ 5_____)

43. Burning coal in the home for heating or cooking is harmful to people's health.
(1_____ 2_____ 3_____ 4_____ 5_____)

PERSONAL HEALTH

Have you experienced any of the following symptoms during the past month?

44. Coughing ([1]Yes)_____ ([2]No)_____
45. Difficulty breathing ([1]Yes)_____ ([2]No)_____
46. Cold ([1]Yes)_____ ([2]No)_____

OTHER

47. Do you smoke? ([1]Yes)_____ ([2]No)_____
48. Does anyone in your household smoke? ([1]Yes)_____ ([2]No)_____
49. Do you burn coal for heating or cooking in your home? ([1]Yes)_____ ([2]No)_____
50. If you have any other comments you wish to add about the local economy, living conditions, or environment, please note them here.

Thank you for participating!

VITA

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Education

2004	Ph.D. Anthropology, University of Washington
2001	M.A. Anthropology, University of Washington
1998	B.A. Asian Studies, Utah State University
1998	B.A. Technical Writing, Utah State University

Publications and Research Paper Presentations

2004	Sepez, Jennifer, Bryan Tilt, Ismael Vacarro, Heather Lazrus and Christina Package. "Fishing Communities of the Northern Pacific, Volume I: Alaska." Technical Report. Seattle: National Oceanic and Atmospheric Administration (In preparation).
2004	Tilt, Bryan. "Locating the State: Narratives of Pollution as Resistance in Southwest China." Society for Cultural Anthropology Annual Meeting, Portland, Oregon, May 2004.
2004	Tilt, Bryan. "Linking Expert and Lay Assessments of Pollution from Township and Village Enterprises: A Case Study from Sichuan." University of Washington China Colloquium, Seattle, February 2004
2004	Tilt, Bryan. "Balancing the Risks and Benefits of Rural Development: The Political Ecology of Industrial Risk Perception in Sichuan, China." Society for Applied Anthropology Annual Conference, Dallas, Texas, March 2004.
2004	Norman, Karma, Jennifer Sepez, Bryan Tilt, and Amanda Poole. "Fishing Communities Inside and Out: A Multi-method Approach to Social Science Research in West Coast and North Pacific Fishing Communities." World Fish Congress Annual Meeting, Vancouver, British Columbia, May 2004.
2002	Tilt, Bryan. "Framing Development and Environmental Risk in Rural China: A Study of a Sichuanese Township and Village

Enterprise Community." International Association for the Study of Traditional Environments, Hong Kong, December 2002.

2001 Tilt, Bryan. "Degraded Livelihoods: Institutional, Economic, and Cultural Factors Contributing to Land-use Change in Inner Mongolia, China." University of Washington Interdisciplinary Colloquium on East Asian Studies, May 2001.