Abstract

Institutions and Local Public Goods Maintenance:

Ethnographic and Experimental Evidence from Rural Kenya

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In recent years, a large literature has provided an array of evidence attempting to explain variation in the availability of local public goods. Despite the theoretical and empirical contributions of this literature, there are two persistent puzzles that cannot be explained by existing approaches. First, research on local public goods focuses almost exclusively on explaining whether or not public goods are provided. However, what this focus overlooks is that in many cases where local public goods are provided, there is often variation in the extent to which these goods are maintained over time. Why are some communities able to maintain the viability of local public goods over time, while others are not?

Second, existing studies typically only focus on one type of institution when explaining public goods provision. One body of research focuses on how political institutions shape public goods provision by governments, while a separate literature focuses instead on how community-level institutions allow groups of citizens to overcome collective action problems and provide local public goods themselves. Despite this tendency in the literature, public goods outcomes are frequently jointly produced by state and community institutions. How do interactions between institutions shape public goods maintenance outcomes over

time?

This study develops a theory that attempts to explain these patterns and puzzles associated with the maintenance of local public goods by explicitly examining how both state and community institutions in a given locality interact with one another over time. The core of the theory is the idea that maintaining a local public good over time entails two distinct problems: 1) the dynamic provision problem, which is based in the incentive of individuals to free-ride on the provision of the public good over time and 2) the harmful action problem, which is based in the incentive of individuals to take actions that benefit themselves, but degrade local public goods.

Stable maintenance of local public goods entails creating institutions that can solve both types of problem. States and communities can both create institutions that solve both of these problems, but these institutions do not act in isolation. In particular, community institutions that provide public goods and prevent harmful action rely on shared social norms and direct, multiplex, and stable social networks. If new institutions complement local norms and networks, public goods will be maintained durably over time, but institutional interventions that either conflict with local norms or undermine local collective action will either lead to degradation of local public goods over time or more costly investments in public goods maintenance by governments.

I test the implications of this theory using qualitative and quantitative evidence from a case study of a public sanitation program that I designed and implemented in the Laikipia region of Kenya in 2007 and 2008. The empirical analysis proceeds in three parts. First, I use interviews, participant-observation,

and archival data to map the local institutional diversity in Laikipia, finding that although a wide variety of state and community institutions solve many public goods problems, none of these institutions are harnessed to maintain public sanitation in the region. Second, I utilize this institutional diversity as the basis for a large-scale field experiment that randomly assigned a waste management and anti-littering program to three different institutional arrangements that incorporated different mixes and types of state and community institutions. The major findings from this experiment are consistent with the theory developed in this study- localities in which there was no explicit punishment for littering experienced more sustained reductions in public waste and littering behavior vis-a-vis localities in which government bureaucrats could punish littering and localities in which traditional leaders could punish littering. Furthermore, survey evidence indicates that this difference is driven in part by lower rates of community clean-ups in localities assigned to one of the two treatments with rules allowing the punishment of littering.

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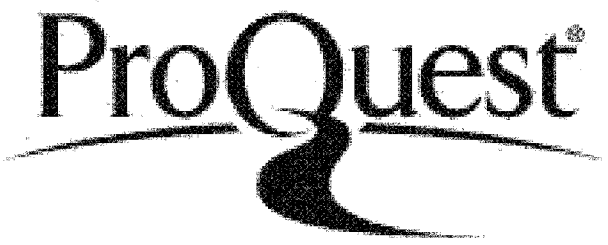

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Chapter 1: Patterns and Puzzles of Public Goods Maintenance

1.1 Introduction

Many Americans take the ongoing presence of local public goods and services for granted. They pay their municipality or county's income, property, and sales taxes, and the local government provides basic goods and services, such as operating the police force and public schools, ensuring that trash gets picked up and that the streetlights say lit, and maintaining the parks and libraries. However, the 2008-2009 recession has revealed to many Americans just how fragile even these apparently basic and essential public goods are. As a result of the economic downturn, many local governments have experienced substantial reductions in revenues from all types of taxes, leading to many severe budget crises, in which revenues are substantially below budgeted expenditures for services (Ammons and Fleck 2010; Hoene 2009).

Local governments have responded to these budget crises with a variety of responses including increasing taxes and cutting costs of government by attempting to increase the efficiency (Ammons and Fleck 2010; Hoene 2009). However, in many jurisdictions, these measures to increase revenues or reduce costs of government have either been politically unavailable or have been insufficient to make up for budget shortfalls, leading the local government to severely cut a wide range basic services. For essential services, such as policing and schooling, these cutbacks have taken the form of staff reductions through layoffs and early retirement. For the maintenance of other public goods, such as parks, streetlights, and public transportation, cities have severely curtailed

service areas or times, have ceased repairing or replacing broken or worn out equipment, or have closed or suspended entire departments (Pandey 2010; Wong and Woodrum 2009).

Despite the widespread use of these strategies in local governments throughout the country, news reports reveal tremendous variation between localities in the effect of these cutbacks on the actual availability of local public goods. In many cities and counties, the negative effects have been noticeable almost immediately: crime rates and traffic fatalities have increased and public spaces and buildings have fallen into disrepair (Glass 2012; Pandey 2010; Wong and Woodrum 2009). However in other localities, the depreciation of public facilities has been much less rapid, with efforts being taken jointly by governments and citizens to use resources more carefully, given fewer resources for maintenance. In still other cities, ad hoc groupings of citizens, business owners, bureaucrats, and/or politicians have taken action to maintain public spaces and infrastructure themselves by volunteering or donating funds for clean-ups, yard work, and repairs at parks, schools, and other public spaces and buildings (Ammons and Fleck 2010; Wong and Woodrum 2009) .

Moreover, there have also been reports of variation between neighborhoods in the same city, in terms of maintenance of local public goods after budget cuts. Following a severe budget crisis and the failure of a referendum raising taxes, the government of Colorado Springs, CO completely eliminated spending on a variety of public goods, including street lights and parks maintenance (Booth 2010)"Facing Budget Gap, Colorado City Shuts Off Lights," 2010}. Despite the impact of this policy across the whole city, some

neighborhood parks continued to be maintained as green, and clean public spaces; in others, playground equipment fell into disrepair, grass grew out of control, and trash started to accumulate.

Moreover, the neighborhoods that managed to maintain the their parks did so in a variety of ways. In some neighborhoods, one neighbor organized park clean-ups themselves; in other cases, trash-cans and ongoing park maintenance was adopted by a local non-profit organization; in still others, residents did not organize clean-ups, but took action to prevent accumulation of trash in parks by preventing careless use of the playground equipment and enforcing norms that individuals take their own trash with them (Glass 2012; Patton 2010).

In contrast, citizens in many developing countries are highly familiar with the fragility of local public goods and routinely experience the reality that freshly paved roads, new schools, or recently cleaned public spaces become worn down and dilapidated in a matter of months or years. In many countries, inadequate local government budgets for providing and maintaining basic public goods and services are the default status rather than a short-term response to an economic crisis. Just as in American cities and counties during tough times, governments and communities in developing countries routinely employ a diversity of strategies for attempting to provide basic local public goods and maintain them over time.

These forms of "institutionalized co-production" have been utilized to maintain the whole range of basic public services, and have taken a variety of institutional forms. In some cases, central and local governments partner with civil society organizations and international donors to ensure the quality public

spaces and infrastructure over time, while in other cases, communities and/or donors completely substitute for the state. These efforts have experienced a wide range of success, with no one model emerging as a well-defined global best practice. For every example of a particular configuration of governments, communities and donors successfully maintaining a school, road, water point, or other public goods project over time, there are cases from other contexts where the same configuration of actors successfully provided the same type of public good, only to have it rapidly be degraded.

I experienced the latter pattern of public goods provision and degradation first-hand in Dol Dol, a small rural town in Kenya's Laikipia North District. During my first visit to Dol Dol in 2006, I was struck by the amount of trash that had accumulated throughout the town and its periphery. As I returned to Dol Dol over the course of the next year, the amount of trash in public places remained high, even though several of my friends told me that the local chapter of the Kenya Red Cross occasionally collaborated with some of Dol Dol's small community-based organizations to pick up trash.

However, on one day in May 2007, I arrived in Dol Dol to find that all of the trash was gone, in preparation for an upcoming visit to Dol Dol from Kenya's president, Mwai Kibaki. In preparation for the President's visit government officials in the region paid for cleaners to pick up and dispose of the trash, and mobilized civil society groups and the broader community to assist with the efforts. Despite the effort that had been taken to clean Dol Dol in advance of President Kibaki's visit, no one had provided public trash cans, and throughout the day, the individuals gathered to hear the President's speech simply discarded

any food items and other pieces of trash that they had by dropping them on the ground. By the end of the day, the town was once again filled with trash. Within a matter of hours, any visible sign of the clean-up effort had been erased, and the trash that had re-accumulated as a result of littering reestablished the status quo that had existed before Kibaki's visit.

Juxtaposing these stories about the challenges associated with maintaining local public goods in the disparate contexts of America's cities and rural Africa reveals two sets of underlying patterns. First, both sets of anecdotes show that the availability of many basic public goods over time is far from guaranteed, and that the extent to which a local public goods is maintained over time or degrades rapidly is shaped by many factors. On the one hand, many public goods require constant upkeep. Whether in Colorado Springs or Dol Dol, streets need to be repaved, schools need new desks and books, parks and public spaces need to be cleaned up regularly. Without these types of constant inputs, any of these public goods can rapidly transform from being available for public use to being run-down and broken.

On the other hand, the rate at which local public goods are degraded also depends on the decisions that individuals make when they use these resources. Efforts to prevent careless or malicious actions and punish individuals who harm public goods can help to slow the rate of degradation. This pattern is also seen in both American cities and developing country contexts; in the face of low levels of ongoing maintenance and upkeep, some localities appear to be able to reduce the rate at which public infrastructure depreciates, while others do not.

Second, the examples from both contexts illustrate the wide diversity of

actors that can be involved in maintaining local public goods over time and the multiplicity of institutional arrangements that can be effective in solving the problems associated with maintaining local public goods over time. Although many Americans may have assumed that their consistent access to public goods was due solely to ongoing maintenance activities by their local government, the widely varying trajectories of public goods outcomes between and within local governments forced to cut services suggests deeper underlying heterogeneity between and within cities. In some cases, the cutback of government services has indeed led to a complete collapse in the availability of local public goods, indicating that the local government was solely responsible for public goods maintenance in that area.

However, in other cases, resilience in the availability of basic public goods even after cutbacks have revealed the role that some communities play as complements and substitutes to maintenance activities undertaken by governments. In many cases, these roles of community institutions in maintaining local public goods pre-existed the economic crisis, while in others, new forms of collective action have emerged to substitute for reduction in local government spending. Many of these forms of institutionalized co-production of public goods maintenance closely match strategies that have been used for years to maintain public goods in a variety of developing country contexts. The resonance between these trends in local public finance in America and what has been common practice in many developing countries indicates that institutional diversity may be an inherent characteristic of successful attempts to maintain local public goods over time, rather than a temporary response to crisis.

Despite the presence of these two features of local public goods maintenance across a wide variety of contexts, both of these patterns have largely been ignored by academic research on public goods. As a result, existing academic research is unable to explain many of the patterns described above, and the associated research and policy questions that they raise. First, research on local public goods focuses almost exclusively on explaining whether or not public goods are provided, implicitly assuming that once a local public good is provided, it will automatically be available indefinitely. However, given this focus, the variation in the extent to which these goods are maintained over time in both American cities and developing country contexts is extremely puzzling. **Why are some communities able to maintain the viability of local public goods over time, while others are not?**

Second, existing studies typically only focus on one type of institution when explaining public goods provision. One body of research focuses on how political institutions shape public goods provision by governments, while a separate literature focuses instead on how community-level institutions allow groups of citizens to overcome collective action problems and provide local public goods themselves. Despite this tendency in the literature, the anecdotes discussed above indicate that public goods outcomes are frequently jointly produced by a variety of different state and community institutions. **Why do the same sets of institutions lead to different public goods maintenance outcomes in different contexts? How do interactions between institutions shape public goods maintenance outcomes over time?**

In this manuscript, I develop a theory of public goods maintenance that

answers these research questions by explicitly building on these two sets of stylized facts associated with public goods maintenance. I provide an initial test of the observable implications of this theory using qualitative and quantitative evidence from the implementation of a solid waste management program in 36 communities in rural Kenya in 2007 and 2008. In the remainder of this chapter, I review the existing theoretical and empirical literature on public goods, with a particular focus on recent research attempts to explain patterns of public goods availability in developing countries. I then highlight the most salient puzzles and blind spots associated with this existing body of research and provide an overview of the alternative approach that I develop in this book, previewing the core theoretical arguments and empirical findings.

1.2 Literature

In this section, I provide a critical, synthetic review of the diverse, multidisciplinary literature on public goods to help motivate the central research questions that underpin the book and to provide the background for the central conceptual and theoretical arguments that I develop in Chapter 2. The literature review proceeds in three parts. I first introduce the concept of public goods, drawing both on economic approaches to the concept and on perspectives that emphasize the socially and politically constructed nature of public goods. Next, I review the literature on institutions and public goods, focusing on two subsets of the literature: theoretical analyses of public goods provision by economists and the more recent application of the concept to the study of the comparative politics and political economy of development by political scientists. I close the literature review by briefly examining blind spots in the literature on institutions

and public goods with respect to explaining the patterns of public goods outlined in the introduction to this chapter, focusing on the failure of existing theory and evidence to account for variation in patterns of public goods maintenance and the inability of existing research to reconcile the joint role of states and communities in maintaining public goods.

1.2.1 Public Goods-Concepts and Definitions

All of the anecdotes presented above are in some degree about the challenges associated with providing and maintaining public goods. Although the differences and distinctions between forms of public goods will be discussed in greater detail below, they can be defined as goods that are typically underprovided by markets due to a combination of two defining characteristics: non-rivalry and non-excludability. A good is non-rival if one individual's use of that good does not decrease the extent to which that good is available to others, and is non-excludable if individuals cannot be prevented from enjoying that good (Cornes and Sandler 1996; Kaul and Mendoza 2003; V. Ostrom and E. Ostrom 1999; Snidal 1979). Another way of thinking about these two characteristics is that they create interpersonal interdependencies, in which one individual or firm's consumption or production decisions create spillovers for other individuals, violating one of the basic assumptions underpinning microeconomic analyses of market exchanges (Cornes and Sandler 1996). A variety of stock examples are frequently used to describe goods that fit these criteria, such as lighthouses, moonlight, knowledge , and national security (Kaul and Mendoza 2003; V. Ostrom and E. Ostrom 1999).

In common usage by both policymakers and academics, the term public

goods is also used to refer to a number of different kinds of goods that do not meet the standards of pure non-rivalness and non-excludability. One common deviation is that spillovers associated with the production of a good may have a limited geographical range. For instance, education at a public school may be non-rival for the individuals living in a given area, but in contexts where not every village has a school, individuals from a wide area may travel to attend that school, increasing class sizes and straining resources of the school. Intuitively, this type of goods are referred to as "Local Public Goods", although the size of the "locality" depends on the geographic nature of the spillovers associated with a given good, ranging from a small neighborhood to an entire state or province of a country (Besley and Coate 2003; Tiebout 1956).

Goods that have some characteristics of publicness may deviate from the "pure" ideal type in a number of other ways. In general, rivalry and excludability are best understood as falling on a continuum rather than binary categories. Although these dimensions can be combined in a variety of ways, a number of kinds of "impure" public goods are singled out for attention by analysts. For instance, goods that are non-rival in consumption, but excludable are known club goods or toll goods (Cornes and Sandler 1996; Kaul and Mendoza 2003; V. Ostrom and E. Ostrom 1999). Unlike pure public goods, club goods make it possible to limit access to individuals who have paid a membership or access fee and to regulate usage to prevent crowding. In this way, many local public goods can be thought of as de facto club goods that are defined by the geographical nature of externalities (Berglas and Pines 1981).

The other noteworthy real-world deviation from pure public goods has the

opposite set of characteristics- rivalry combined with non-excludability. As with public goods, these goods will be underprovided by markets, due to the inability of producers to internalize the benefits of production (Cornes and Sandler 1996). However, unlike pure public goods, even if they are provided through some means, long term availability of this kind of good is not guaranteed over time, as the rival nature these goods means that they can be degraded or depleted through use.

The idea of a non-excludable, rival good is articulated most evocatively by the image of a grazing commons, in which the pasture is open to all farmers, but in which any grass that is eaten by one farmer's cows is not available for any other cows. These two attributes combine to constitute what Garrett Hardin famously described as the "tragedy of the commons"- because grazing lands are rival and non-excludable, no farmer will have the incentive to limit the size of his herd or the amount that his herd grazes, meaning that the resource will be depleted (Hardin 1968). This logic has been applied broadly to describe the problems associated with conserving a wide array of common pool resources- natural resources that are open access, but subtractable, meaning that actual units of the resource are removed through their use (Ostrom 1990)

Despite the popularity of the metaphor of the tragedy of the commons in both academic and policy circles, common pool resources are not the only type of good that is non-excludable, but rival. Even in cases where resource units are not directly subtracted by users, use by one individual may take away from another individual's ability to enjoy that good (Cornes and Sandler 1996; Leach 2004). For instance, many physical infrastructure products such as public roads,

buildings, and streetlights can be damaged and worn down through careless use by either users or operators. For this reason, this kind of "semi-rival" public good has much more in common with common pool resources than with pure public goods.

Although these conceptual distinctions between types of public goods are quite clear from the perspective of economic theory, they are often blurred in academic and policy writing and analysis. As a result the term "public goods" is frequently used to describe goods that vary substantially on both of these dimensions. At one extreme, some goods are frequently referred to as public goods, even though they appear to exhibit high levels of rivalry and/or excludability. In particular, many goods typically cited as public goods in work on development, such as health facilities, schools, improved water and sanitation, roads, have substantial degrees of both rivalry (they are subject to congestion, degredation, and depletion) and excludability (they can collect and monitor user fees).

What accounts for this paradox whereby many of the goods and services most closely associated with discussions of public goods actually exhibit substantial aspects of privateness, and are frequently provided through market transactions? One answer is that although the direct benefits of these goods are largely internalized by consumers, having a society filled with healthy, educated, mobile individuals produces general benefits for a country as a whole, and that from a social perspective many of these goods may be undersupplied by private markets. A second, related answer is that given both the basic necessity of the individual benefits and the general social benefits, these goods should be

provided universally, and that where necessary, state intervention should supplement market provision to ensure adequate access. That is, goods that from a physical standpoint are excludable are transformed into public goods because of the belief that no citizens should be excluded from access (Brennan and Lomasky 1983; Davis 2005; Fiorito and Kollintzas 2004; Musgrave 1987).

More generally, these examples indicate that the publicness of a good is only partially determined by its physical and technological characteristics, and that the degree of rivalry and excludability of a good can be substantially influenced by political, social, and cultural factors. Evidence for the socially and politically constructed nature of public goods has been provided across a variety of domains. For instance, the aforementioned discourse on the tragedy of the commons operates from the implicit starting assumption that non-excludability is an intrinsic characteristic of common pool natural resources. However, over the past 20 years, the wide body of research building on Elinor Ostrom's pathbreaking work on institutions governing common pool resources has shown that the publicness of a good is a combination of biophysical, institutional, and cultural factors, rather than being a direct, unchangable consequence of the common-pool nature of a resource itself (V. Ostrom and E. Ostrom 1999).

This literature shows that there is substantial empirical variation in the extent to which communities have been able to create systems of norms and rules regulating access to common property resources. Thus, while there are numerous cases in which forests, fisheries, and grazing lands are effectively open access, leading to outcomes that generally follow the predictions of Hardin's Tragedy of the Commons, there are also plentiful cases of communities ensuring

the long-term sustainability of common pool resources by creating institutions that transform the exact same sets of resources into club goods, with user fees for access and enforced regulations for use (Ostrom 1990).

Viewing public goods as socially and politically constructed has two important implications for the study of public goods, both of which will shape the approach adopted in this book. First, recognizing the socially and politically nature of public goods implies that making empirically-informed judgments about how the institutional and cultural context shapes the publicness of a good may be more important than classifying types of public goods ex ante. In this view, the ex ante classification of goods into broad categories based on the degree of rivalry and excludability may cause analysts to overlook the fact that the same good has different characteristics in different institutional and cultural contexts, leading to incorrect inferences and policy prescriptions. At the same time, this does not mean that the theoretical and conceptual distinctions discussed above are irrelevant. Rather, attempts to either apply models to given contexts or to generalize from one case to others should be an interaction between deductive theorizing about the formal characteristics of specific subtypes of public goods that is explicitly undertaken alongside empirical research designed to classify actual public goods based on the combination of physical attributes and the institutional and cultural context.

The second implication of recognizing the socially and politically constructed nature of public goods is that it makes the study of institutions central to both the theoretical and empirical study of public goods. As will be discussed in the next section, public goods are described, classified, and

explained primarily using the tools of microeconomics, and then institutions are used to explain variation in the ability of a government or community to "solve" a given public goods problem. In the perspective developed in this manuscript, government and community institutions are considered to be central to constituting and defining any given public goods situation, as well as determining the likelihood that a given public good will be provided and will be maintained over time. In the next section, I identify two distinct bodies of institutional approaches to public goods that exist in the literature, and briefly review the recent empirical evidence related to these two bodies of research.

1.2.2 Institutions and Public Goods

The linkage between institutions and public goods stretches back to some of the earliest research on the concept by Paul Samuelson (Samuelson 1954). In motivating his work on public goods, Samuelson used the concepts of non-rivalry and non-excludability to define pure public goods as a way to explain why some goods are provided by governments rather than markets (Samuelson 1954). That is, in articulating the concept of public goods, he moved between inductive and deductive reasoning by examining the characteristics of the types of goods typically provided by governments and then modeling the conditions under which such provision might be efficient (Samuelson 1954).

Following Samuelson's work to define the concept of public goods in this way, the concept quickly entered common usage in economics and the field of public economics expanded to help explain aspects of how and why governments intervened in markets and with what effects (Brennan and Lomasky 1983; Davis 2005; Fiorito and Kollintzas 2004; Musgrave 1987). This literature, which is still

active in economics and political economy, was a mix of theoretical studies that modeled the provision of goods with varying degrees of publicness, coupled with empirical studies of public goods, largely focusing on public finance in the United States and other developed economies (Atkinson and N. H. Stern 1974; Bergstrom and Goodman 1973; Besley and Coate 2003; Clarke 1971; Cornes and Sandler 1996; Dowding, John, and Biggs 1994; Edwards 1986; Leach 2004; McMillan, Wilson, and Arthur 1981; McMillan 1989; Tiebout 1956). .

The second next major branch of institutional approach to the study of public goods is grounded in Mancur Olson's 1965 book, *The Logic of Collective Action.* One of the puzzles motivating Olson's work is governments often do not provide goods that fit Samuelson's criteria of non-rivalness and non-excludibility, and instead groups of individuals often attempt to act collectively to provide such goods (Olson 1971). Due to the nature of the externalities inherent in the production of non-rival, non-excludable goods, a rational individual's best response is to not contribute to the provision of the good, free-riding on the contributions of others. However, other members of that group would also make the same decision, meaning that if everyone chose to free-ride, then in equilibrium the public good would not be provided. In Olson's perspective, groups are only able to solve the free-rider problem if they were able to provide selective incentives- rewards or punishments that could be assessed to group members based on whether or not they contributed to the public good (Olson 1971).

As with Samuelson's work on public goods, Olson's research has inspired a vast body of theoretical and empirical work. Later theorists looked more closely

at the specific characteristics of groups that allowed them to overcome collective action problems, showing mathematically why small groups had an advantage at the collective provision of public goods (G. Hardin 1968). Olson's theory has also inspired a substantial body of laboratory experiments that seek to understand how individuals actually behave in various kinds of collective action situations, finding that in many cases, individuals are motivated by norms of altruism, reciprocity, and fairness, leading to much higher rates of contributions to public goods than were predicted by the assumptions of Olson's theory.

Although Samuelson and Olson are both economists, the implicit focus on institutions in both of their theories helped to ensure that the study of public goods would take place at the boundaries of economics and political science and have defined the broad contours of the last five decades of research on the topic across both disciplines. Despite their shared conceptual and theoretical apparatus, the bodies of interdisciplinary research building on each scholar has largely remained separate. This is due to the fact that Samuelson's definition took state provision of non-rival, non-excludable goods as the starting point, while Olson's theory started from the problem of explaining collective provision of the same type of goods. While these two starting points could easily be synthesized into a unified theory of public goods availability, such a theory has been elusive in practice.

Because Samuelson and Olson's foundational works on public goods have led to a largely bifurcated literature, the empirical literatures building on each approach have also tended to focus on vastly different types of research questions and largely focused on very different kinds of institutions in their theoretical and

empirical analyses. For contemporary scholars who build on Samuelson's focus on state provision of public goods, provision failures are the puzzle that demands explanation. That is, because Samuelson by definition equated non-rival, non-excludable goods with those provided by governments, the empirical cases that elicit the most interest from scholars focusing on government provision of public goods are those where such goods are not provided or are underprovided. As a result, this subset of the literature has largely focused on how variations in representative and bureaucratic institutions can explain variations in state provision of public goods, particularly in the context of developing and transition countries.

This body of research posits that electoral institutions can provide incentives for politicians to provide public goods for their constituents, rather than clientelistic benefits to their coalition of supporters. In this view, pubic goods underprovision in developing countries can be explained by the weakness of electoral institutions. However, this blanket assertion does little to explain variation in public goods outcomes between localities within the same country. Recent studies have used clever research designs to help specify the mechanism through which accountability breaks down and can be established in new democracies and non-democratic political systems. Using a field experiment set during the 2001 Benin Presidential election, Wantchekon (2003) finds that the logic of ethnic politics creates an electoral incentive for politicians to promise private benefits for members of their group rather than public goods for the community at large. The implication of this finding is that the weaknesses of electoral institutions in new democracies encourage leaders to build coalitions

along ethnic lines, which in turn decreases incentives to provide local public goods. Wantchekon finds evidence that female voters and voters in some regions of the country respond positively to campaign messages promising public goods, indicating that creating institutions that represent broader segments of society are a necessary step in improving public goods provision in new democracies.

Tsai provides a more concrete set of conditions whereby politicians and bureaucrats in weak democracies or non-democratic systems can be induced to utilize tax revenues to provide local public goods. Tsai argues that in the case of contemporary rural China, where formal institutions do nothing to generate accountability, certain kinds of informal institutions can provide similar incentives; politicians will use government resources provide public goods insofar as it will raise their moral esteem in solidary groups to which they belong. However not all "traditional" social groups will provide the same kind of incentives; to replicate the accountability-inducing effects of democratic institutions, public officials must be active, embedded members of solidary groups, and those solidary groups must encompass all of the members of a local community. In rural China, only village temple organizations are both embedding and encompassing; other kinds of solidary groups, such as village churches and lineage groups, lack one of these two essential insititutional features. Using a mix of qualitative and quantitative evidence, Tsai finds that the provision of public goods by local government committees is much higher in communities with temple organizations, vis-à-vis communities with churches, lineages, or no solidary groups.

In contrast, in contemporary research on institutions and public goods

that builds on Olson, high levels of public goods provision and availability are the unexpected puzzle that demands explanation. That is, in the literature that emphasizes free riders and collective action problems, situations in which communities or other groups do succeed in providing and maintaining public goods are the anomaly that needs to be explained. As a result, this body of research has focused on how community-level rules and norms make it possible for groups of individuals to overcome collective action problems.

Much of the recent research focusing on collective action explanations has grown out of attempts to explain the well-established empirical relationship between ethnic diversity and the underprovision of local public goods. Using observational data from Western Kenya, Miguel and Gugerty (2005) find additional evidence that ethnic diversity causes low provision of public goods and argue that this finding is driven by the fact that ethnically homogenous communities have social institutions to sanction individuals who fail to contribute to public goods, but that such mechanisms are absent in diverse communities. Miguel finds complementary evidence from a cross-border natural experiment comparing the effect of ethnicity on public goods provision in Kenya and Tanzania. In this case, he finds that in Tanzania, there is no statistically significant effect of ethnicity on public goods provision, in contrast to the strong effect found in identical communities just on the other side of the Kenyan border. Miguel argues that policies regarding national identity are the key difference between the two countries; from independence onward, Tanzania adopted an aggressive nation-building program that emphasized Tanzanian identity over local ethnic identities and Swahili over local languages; Kenya adopted no such

policies, and if anything tended to implement policies that served to increase social distance between ethnic groups. The broader theoretical implication of this finding supports Miguel and Gugerty's result; policies that build social bridges across ethnic communities can create the cross-group linkages necessary for the operation of social sanctions.

Humphreys, Weinsten, Posner, and Habarymana utilize laboratory experiments conducted in Uganda to further examine how ethnic diversity impedes the collective action necessary for public goods provision. They use a variety of experimental economics games to test for the operation of various families of mechanisms that are hypothesized to effect public goods provision. They find strong evidence that the "co-ethnic advantage" in the collective provision of local public goods is explained by sanctioning strategies; players within ethnic groups choose cooperative strategies because they expect to be rewarded for cooperation and punished for selfish behavior, but there seems to be no such norm operating between players from different ethnic groups. They also find some evidence that members of the same ethnic group are more closely connected in social networks, making threats of punishment for noncooperative behavior more credible, two findings that together support the general logic of Miguel and Gugerty's finding.

Other work focusing on the importance of motivating collective action for solving public goods problems draws on a broader literature on self-enforcing institutions. Although these scholars also emphasize the importance of social sanctions in deterring free riding, they also suggest the importance of common knowledge in motivating and sustaining collective action. The underlying

assumption is that the underlying game theoretic structure of many public goods problems leads to multiple equilibria- some of which are socially optimal. In this framework, informal institutions that disseminate common knowledge about social rules can allow individuals to coordinate on cooperative outcomes. Patel uses a variety of micro-level data from Basra, Iraq to test the role of common knowledge in facilitating the provision of local public goods in the immediate aftermath of U.S. invasion in 2003. By exploiting exogenous variation in the overlap between mosque locations and local neighborhoods, Patel finds that Friday Mosque sermons provided common knowledge about local public goods actions; in neighborhoods where everyone attended the same mosque, provision of public goods such as sanitation and security was high; in neighborhoods with either no or many Friday Mosques, dissemination of common knowledge was difficult and public goods were underprovided.

1.2.3 Blind Spots and Puzzles in the Study of Public Goods

In summary, this brief review of the interdisciplinary literature on institutions and public goods reveals two broad tendencies. The first tendency in the literature is the implicit division of research between studies that primarily focus on how institutions shape the behavior of politicians and bureaucrats and another that primarily focuses on institutions that allow communities to prevent free riding and successfully ensure collective action. The second tendency revealed by the literature review is the implicit assumption that that provision is the primary problem associated with public goods.

Both of these tendencies are in tension with many of the stylized facts that I presented at the beginning of this chapter. These anecdotes indicated that in

fact a wide variety of organizations- states, communities, and donors- harness a wide variety of institutions to ensure the provision of public goods. Moreover, these examples indicate that even in spite of the ability of government and/or communities in these these localities to overcome the so-called "public goods problem" focused, there is tremendous variation with respect to the ability of these same localities to maintain the availability of these goods over time.

As a result, the major motivation for the research described in this manuscript is the desire to answer the research questions that result from the tension caused by the inability of existing research on institutions and public goods to answer the most pressing theoretical, empirical, and policy questions related to the availability of public goods. Why, in the face of such diverse, coordinated efforts to maintain basic local public goods, do so many people, communities, and countries around the world continue to lack access to these basic goods and services on a day to day basis? Why has the quality of public goods in some localities in developed countries been so fragile in the aftermath of service reductions, while other jurisdictions have been more resilient? Why have so many development projects contributed so little to actual sustained improvements in access to basic public goods for so many people, while other projects have led to durable changes the availability these same necessities?

1.3 Conclusion: Plan for the Dissertation

This study develops a theory that attempts to explain these blind spots that exist in the current literature on institutions and public goods by explicitly examining how both state and community institutions in a given locality interact with one another over time. The plan for the manuscript is as follows. In chapter

2, I outline my theory of public goods maintenance, derive testable hypotheses of this theory, and articulate a research design that can test these hypotheses. The core of the theory is the idea that maintaining a local public good over time entails two distinct problems: 1) the dynamic provision problem, which is based in the incentive of individuals to free-ride on the provision of the public good over time and 2) the harmful action problem, which is based in the incentive of individuals to take actions that benefit themselves, but degrade local public goods. Stable maintenance of local public goods entails creating institutions that can solve both types of problem. States and communities can both create institutions that solve both of these problems, but these institutions do not act in isolation.

In particular, community institutions that provide public goods and prevent harmful action rely on shared social norms and direct, multiplex, and stable social networks. If new institutions complement local norms and networks, public goods will be maintained durably over time, but institutional interventions that either conflict with local norms or undermine local collective action will either lead to degradation of local public goods over time or more costly investments in public goods maintenance by governments.

In the following three chapters, I test the implications of this theory using qualitative and quantitative evidence from a case study of a public sanitation program that I designed and implemented in the Laikipia region of Kenya in 2007 and 2008. In chapter 3, I use interviews, participant-observation, and archival data to map the local institutional diversity in Laikipia, finding that although a wide variety of state and community institutions solve many public

goods maintenance, none of these institutions are harnessed to maintain solid waste management in the region.

In chapter 4, I discuss how I utilized this institutional diversity as the basis for a large-scale field experiment that randomly assigned a waste management and anti-littering program to three different institutional arrangements that incorporated different mixes and types of state and community institutions. The major findings from this experiment are consistent with the theory developed in this study- localities in which there was no explicit punishment for littering experienced more sustained reductions in public waste and littering behavior vis-a-vis localities in which government bureaucrats could punish littering and localities in which traditional leaders could punish littering. In chapter 5, I present survey evidence which indicates that this difference is driven in part by lower rates of community clean-ups in localities assigned to one of the two treatments with rules allowing the punishment of littering.

Chapter 2: Public Goods Maintenance: Theory and Hypotheses

2.1 Introduction

In order to move beyond the blind spots that have prevented most research on local public goods from explaining the patterns and puzzles associated with the maintenance of local public goods, it is necessary to introduce a new theory that can account for the dynamic element of ongoing public goods maintenance, the rich diversity of social and political institutions that are brought to bear on public goods maintenance problems, and the range of variation in the performance of such institutions.

In this chapter, I develop a new theory of institutions and public goods maintenance that draws on a rich literature on institutions, culture, and social behavior from political science and related disciplines. I start by conceptualizing public goods maintenance as an inherently multi-actor, dynamic problem that is the result of two distinct challenges: ensuring the continual provision of the good over time and preventing actions that degrade the good.

Second, I classify and categorize the types of state and community institutions that can potentially solve both the dynamic provision and harm prevention problems associated with maintaining public goods in a given locality, and the conditions necessary for each of these institutions to function. Finally, I argue that a lack of congruence between norms associated with the state and community institutions in a given locality can create a negative feedback loop that decreases the effectiveness of both sets of institutions and can lead to the persistence of public goods maintenance problems and the creation of new

problems that did not previously exist. As I develop each of these components of the theory, I identify a total of four key hypotheses and contrast them with the predictions of alternative existing theories.

I conclude the chapter by discussing the implications of this theory and hypotheses for research design. First, I argue that a research design that combines in-depth ethnographic research with iterative field experimentation is well-suited for testing the implications of the theory of public goods maintenance developed in this chapter. Second, I briefly explain the criteria for selecting a case to test this theory, and use these criteria as a lens through which to motivate the selection of the case study analyzed in detail in this manuscript: rural solid waste management in the Laikipia region of Kenya

2.2 Theory and Hypotheses

2.2.1 The Public Goods Maintenance Problem: Multiple Actors, Multiple Dilemmas

To start developing a theory of public goods maintenance, I assume that multiple types of organization can be involved in public goods provision and upkeep in a given locality, and that these multiple actors can act as both substitutes and as complements to one another. In addition, although many localities will have a wide array of organizations may have the potential capacity to contribute to the provision and upkeep of public goods, acting on that capacity is by no means a foregone conclusion. In a case where none of the potential actors in a given locality actually acts to provide or maintain a public good, the good will not be provided. Although these types of "public goods actors" can be framed in abstract terms, such as "states", "communities", "donor agencies", and "private

firms", specifying the nature of a public goods problem and possible institutional solutions in a given locality requires identifying the range of organizations that are actually present and which are potentially capable of acting in a given context.

For the purposes of explicating the core logic of the theory, I focus on a hypothetical situation in which there are two kinds of public goods actors: a government and a community. I focus first on this stylized example because states and communities, given the extensive focus in the literature on public goods provision by these two type of organization. As Figure 2.1 shows, this assumption alone allows for a greater degree of complexity in potential public goods provision than is currently prevalent in the literature. Rather than being in a vacuum from one another, states and communities often both have at least the latent potential to provide many public goods in a given locality. The strongest evidence of the potential for both states and communities to provide public goods is in cases of "institutionalized coproduction," in which states and communities explicitly share responsibilities with respect to the provision of public goods (Joshi and Moore 2004). At the same time, the potential role of both states and communities as public goods providers is also seen in the strategic interactions and conflicts in localities in which there is primarily a single provider of public goods or complete provision failures (Gibson et al. 2005).

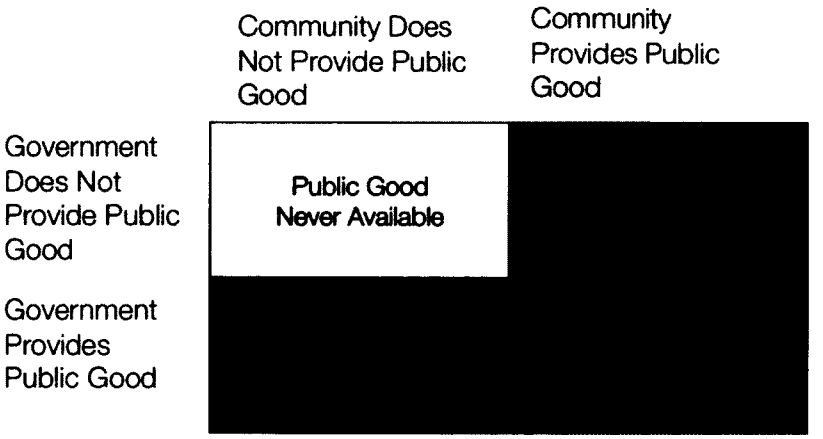

Figure 2.1 Community and State Public Goods Provision

Next, I assume that some public goods deviate from the assumption of non-rivalry associated with the canonical definition of pure public goods. As noted above, rivalry is defined as the extent to which one individual's consumption of a good decreases the ability of other individuals to enjoy that good, and is best conceptualized as a continuum rather than a binary. Once rivalry is viewed in this way, it becomes apparent that many of the goods that academics and practitioners frequently refer to as public goods in fact exhibit a wide variety of degrees and forms of rivalry. This is borne out by the examples and anecdotes presented in Chapter 1. Local public goods that can be degraded over time can be classified as semi-rival public goods, and is the most important scope condition for the theory of public goods maintenance developed in this

chapter. Two characteristics define the precise nature of semi-rival public goods and distinguish them from other types of goods discussed above, such as common pool resources and club goods.

The first defining characteristic of semi-rival public goods is that the rate of degradation caused by use of such a good is not constant, but rather can be increased or decreased by harmful actions. In this context, harmful actions can be defined as actions in which not taking an action will create a private cost for an individual, while taking that action will impose costs on the entire group of which that individual is a member. Framed in this way, individuals who engage in harmful actions are the inverse of free-riders, and accordingly, can be thought of as "costly doers".

Although the explicit discussion of harmful action is rare in the literature on public goods, bodies of theory and practice in philosophy and the law all recognize a wide array of intentional and unintentional actions that produce social harms (J. Bennett and J. F. Bennett 1998; Posner 1980; Shanley and Grossman 2007; Sparrow 2008). What is common to the forms of harmful action identified in these diverse literatures is that the degree to which a semi-rival public good is degraded can vary based on decisions made by individuals who have already decided to use the good. This is distinct from other kinds of semi-rival goods that are not subject to the harmful action problem. For this kind of good, the negative externality stems from the consumption decision alone, leading to congestion— the simple unavailability or decreased usefulness of a good based on the number of other users who are accessing it at a given point in time (Cornes and Sandler 1996).

This distinction is important for understanding how the semi-rival public goods are distinct from the club goods. In the case of congestion without harmful action, forming a "club" is the best option for maintaining the availability of the good. At their core, clubs regulate consumption or use of the good, either by explicitly excluding certain users by requiring membership or user fees, or by utilizing congestion pricing in which the fee associated with use is higher at times in which the demand is the highest (Cornes and Sandler 1996).

The problem associated with harmful action adds a level of complexity beyond the problem of congestion. For goods that can be degraded by harmful action, simply regulating entry is not sufficient to ensure availability over time. Students in a private school can still vandalize its facilities; drivers on a toll road can still drive recklessly. As a result, congestion and harmful action are not mutually exclusive and in may coincide with one another, as in the case of a club good where entry is regulated to reduce congestion, but there are still problems of theft, vandalism, or carelessness.

The second defining characteristic of semi-rival public goods is that the availability of such goods can be ensured by dynamic provision. Dynamic provision can be thought of as actions that are taken to replenish or reprovide a good after it has been consumed, congested, or degraded. Dynamic provision is the main conceptual distinction that separates the maintenance problems associated with semi-rival public goods from common pool resource problems. Although both types of good can be depleted by the actions of users, the major distinction is that common pool resources typically are unreplenishable, at least over the short and medium term (Ostrom 1990).

That is, the public goods typically classified as common pool resources, such as grazing pastures, forests, and fisheries, face a natural constraint on the rate at which they can be replenished, which is dependent on the lifespan and population ecology of the resource units themselves (Ostrom 2005). Although it may be possible to attempt to replenish common pool resources by transplanting or importing resource units, such interventions are costly, incomplete, and success is far from guaranteed. Compare the case of any of these common pool resources to a public library. Although the public library's task of preventing harmful actions- such as theft, loss, and vandalism of books is similar to the problems associated with regulating use of a grazing land or forest, it is also easier to replace books than it is to replenish destocked fisheries or depleted forests. As a result, the types of potential solutions to the problem of maintenance vary across the two types of goods. In the common pool resources situation, the difficulty of replenishment means that creating institutions to prevent harmful actions are vital to ensuring the maintenance of the resource over time (Ostrom 1990). In contrast, in the case of semi-rival public goods such as libraries, the quality of the books and facilities can be ensured by ensuring both dynamic provision and harm prevention.

Figure 2.2 combines these two characteristics of semi-rival local public goods with the two forms of public goods actor discussed above. Adding dynamic provision and harmful action explicitly introduces the dynamic element to the previously static conception of public goods provision. The way of understanding this simplified representation is that once a semi-rival public good is provided by some organization, maintenance of that good is dependent on the ability of that

organization or other organizations to solve the problems associated with the maintenance of the goods.

Although the schematic presented here only has only one post-provision period, this situation is in theory repeated indefinitely until the good reaches a state where it cannot be replenished, in which case the locality back to the a public goods provision problem. The exact amount of time that elapses between the provision decision and each subsequent maintenance decision depends on the physical characteristics of a given good, the specific nature of harmful action and replenishment, as well as on the effectiveness of harm prevention and replenishment activities on the part of the government, the community, and other actors.

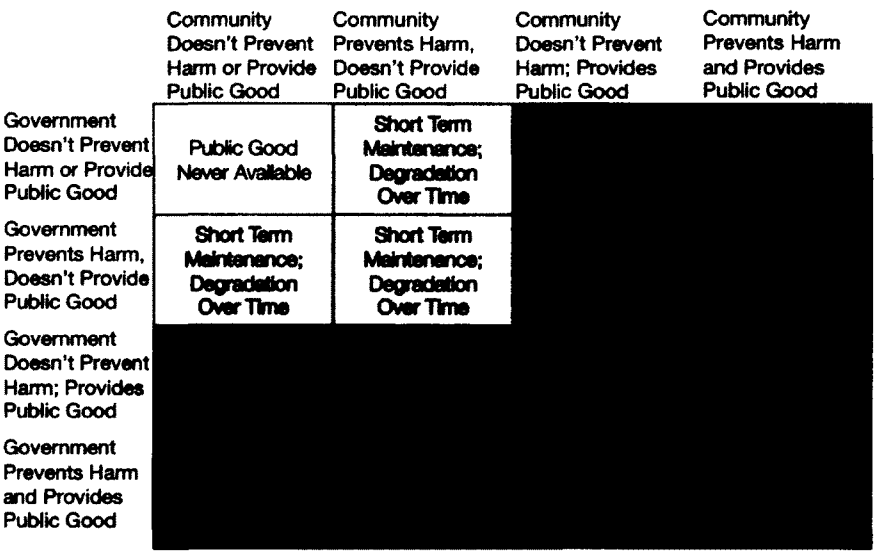

Figure 2.2: Possible Combinations of Dynamic Provision and Harm Prevention

This schematic also reveals that the maintenance problem is intrinsically more complex than the provision problem, even in this simplified case in which there are only two unitary public goods actors. This complexity has two implications for designing research on the maintenance of semi-rival local public goods maintenance. First, research designs attempting to explain the causes of maintenance outcomes will have to account for the possibility that different combinations of underlying factors can lead to observably equivalent outcomes. Second, in order to reconcile this theory with empirically observed variation in maintenance outcomes, it is necessary to identify dimensions in which different forms of public goods maintenance lead to measurably different outcomes from one another.

Figure 2.2 indicates that an additional way to empirically assess the nature of a given public goods maintenance problem or solution is to measure the specific types of temporal variations in public goods availability associated with the prevention of harmful action and dynamic provision. In particular, situations in which the primary method of public goods maintenance is the prevention of harmful action will be characterized by relatively stable and high availability of the public good over time, with gradual degradation as a result of normal wear-and-tear. In contrast, contexts in which the only approach to the maintenance problem is dynamic provision without preventing harmful action, public goods availability will oscillate substantially over time between high and low levels of availability.

In summary, in this section, I conceptualized the problem of local public

goods maintenance as a social setting in which multiple organizations can potentially solve the dynamic provision and harmful action problems associated with a semi-rival local public good. This conceptualization and the related theoretical arguments can be used articulate two hypotheses that can be subjected to empirical testing:

Hypothesis 1: Provision of semi-rival local public goods is not sufficient to ensure the maintenance of such goods over time.

Hypothesis 2: To durably maintain a semi-rival local public good, it is necessary both to ensure dynamic provision and to prevent harmful action

As noted in the literature review in Chapter 1, most existing research on public goods does not explicitly identify semi-rival public goods as a distinct category, and as a result does not identify the nature of the maintenance problem. The relative lack of theoretical and empirical attention to the problem of public goods maintenance means there is a paucity of competing hypotheses against which to test these two implications of my theory. Despite this gap, it is possible to use the implicit and explicit assumptions embedded in existing research on public goods to draw out observable implications of the differences between my theory and existing explanations.

One possible way to use the existing literature to derive a competing hypothesis about public goods maintenance interpret the lack of attention to maintenance in the existing literature is to infer that these theories assume that

provision is sufficient to motivate availability over time, and that there is no empirical relationship between the dynamic provision and harm prevention actions of governments and communities and the level of a given public good over time. If this found to be the case empirically, this indicates that a given good in a given context does not fit within my definition of semi-rivalness, and its availability can be explained by existing theories of public goods maintenance. Moreover, if this is found to be the case for a variety of goods and in a variety of contexts, then the the concept of semi-rival public goods and the theory of public goods maintenance have very limited empirical validity.

An alternative way to interpret the existing literature is to focus instead on the relative lack of attention to the prevention of harmful action. If it is the case that existing theories assume that harmful action does not exist or does not have an impact on public goods availability, then focusing in variation in public goods replenishment between localities and within localities over time should completely explain spatial and temporal variation in public goods availability.

2.2.2 Institutional Diversity and Public Goods Maintenance

In the first section of this chapter, the ability of governments and communities to replenish semi-rival public goods and prevent harmful actions was taken as exogenous, in order to focus on the dynamic, multidimensional, multi-actor nature of public goods maintenance problems. In this section, I take one step back to classify the four general types of institutions underlying attempts by states and communities to maintain local public goods.

By institutions, I am referring to a cluster of strategies, rules, and norms linking individuals and organizations. This definition explicitly builds on classic

formulations by North and Ostrom that equate institutions with rules and draw a clear distinction between institutions and organizations (North 1990; Ostrom 2005). At the same time, my definition also explicitly recognizes that in practice, the structures that constrain social behavior are tightly clustered configurations of formal rules, internalized norms and identities, and the groups of individuals held connected by such rules and norms. As a result, a narrow focus on rules limits the descriptive and explanatory potential of institutional theory (March and Olsen 1996; North 1990; E. Ostrom 2005; Wedeen 2002).

One implication of this broad definition of institutions is that nearly all social life is institutionalized in some way or another, and that social norms and community-level rules should be central to the study of institutions in political science. This is an important corrective to the mainstream perspective on institutions in a variety of disciplines that emphasizes only formal laws, constitutions, and the administrative, legislative, and judicial organizations of the state (Hall and Taylor 1996; Lijphart 1999; Linz and Stepan 1996; Persson and Tabellini 2005; Tilly 1992; Weingast and Marshall 1988).

At the same time, the purpose of the approach to institutions developed here is not to reject the study of "formal" institutions in favor of the study of "informal institutions" or "culture" or to explicitly reject the role of state institutions on either empirical or normative grounds. Rather, aim of the approach to institutions developed here is to demonstrate the theoretical and analytic leverage provided by directly engaging with the institutional diversity surrounding most social and political phenomena (E. Ostrom 2005).

With respect to studying public goods maintenance, embracing

institutional diversity follows directly from my classification of the problem as being constituted by dynamic provision and harmful action problems that can potentially by a government and/or a community. Building on this distinction, Figure 2.3 presents the four broad types of state and community institutions that can play a role with respect to either motivating dynamic provision of a semi-rival local public good: state accountability institutions, state law enforcement institutions, collective action institutions, and community governance institutions.

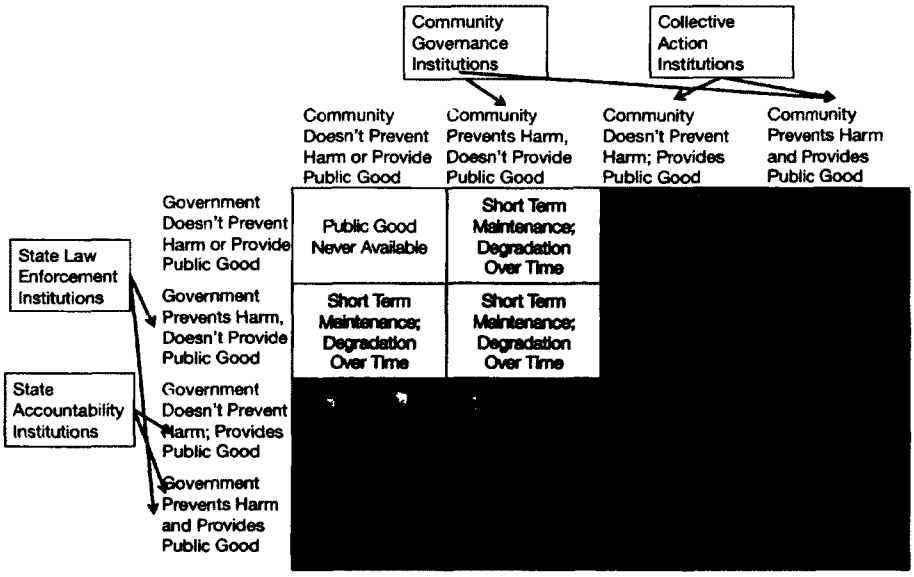

Figure 2.3: Government and Community Institutions and Public Goods Maintenance

Each of these broad types of institutions is the subject of a well-developed and robust literature in political science and several related disciplines. However, given the potential importance of each of these literatures in explaining variation in the availability of public goods, the lack of studies that explicitly theorize interactions between multiple types of institution is surprising. This lack of attempts to explicitly theorize relationships between these four broad types of institutions leads to missed opportunities for leverage over a variety of puzzles and problems.

As discussed in Chapter 1, contemporary research on public goods provision by governments primarily focuses on how institutions shape the ability of citizens to hold politicians and bureaucrats accountable (Besley and Coate 2003; Tiebout 1956). In contrast, research on public goods provision by communities primarily focuses on how variation in local norms and networks can explain variations in patterns of collective action. The relative lack of theoretical attention paid to the relationship between state and community public goods provision is surprising given that it is likely that there are a variety of possible feedback loops connecting social norms, collective action by communities, and the accountability of politicians and bureaucrats to community members.

Although some of the aforementioned research on public goods provision by governments explicitly focuses on how social norms and networks can shape the the ability of individuals to act collectively to hold politicians or bureaucrats accountable, relatively few of these studies explicitly examines the extent to which a community's efforts to hold the government accountable are complements to or substitutes for community efforts to provide and replenish

local public goods (Alesina, Baqir, and Easterly 1999; Tsai 2007; Wantchekon 2003) . Conversely, few studies in either of these lines of research examine how the quality of public goods provision by the government shapes future propensity towards collective action by community members.

While research on public goods provision is largely bifurcated between the literature on government accountability and the literature on collective action, studies of institutions that prevent harmful action are rarely even directly connected to the study of public goods. On the one hand, the study of government institutions that prevent harmful action is largely the domain of the broad literature on state formation, state building, and state capacity (Tilly 1992). While the state formation literature has focused to some extent on the creation of institutions that ensure accountability (Ertman 1997), the primary focus of this literature has been on explaining historical and spatial variations in the ability of governments to directly enforce laws within their territory (Boone 2003; Waldner 1999). Some scholars working in this tradition have focused primarily on how the ability of states to create institutions in the periphery affects their capacity to prevent a wide array of harmful actions (Herbst 2000), others place greater emphasis on how the legitimacy of the state can prevent harmful action by engendering voluntary (or quasi-voluntary) compliance with laws and policies (Englebert 2002; Levi 1989).

On the other hand, the study of community governance institutions that prevent harmful action is largely associated with Elinor Ostrom and the related literature on community governance of common pool resources. As noted in the literature review in Chapter 1, this literature has presented substantial evidence

of communities creating specialized monitoring and enforcement institutions, in which designated third parties are given the authority to monitor the use of a common pool resource and to enforce agreed upon penalties on individuals who engage in harmful actions that deplete the resource (Agrawal and Gupta 2005; Agrawal 2001, 2003; Dietz, E. Ostrom, and P. C. Stern 2003; E. Ostrom, J. Walker, and Gardner 1992; E. Ostrom 1998, 2002, 2003; Poteete and E. Ostrom 2004; Velez, Murphy, and Stranlund 2010). Although one of Ostrom's central arguments is that this kind of endogenously created governance institution is more effective than government institutions at preventing harmful actions toward common pool resources (Ostrom 1990), there are relatively few explicit attempts to draw on this literature to explain variation in the capacity of state law institutions to prevent harmful actions.

At the same time, Ostrom argues that the types of social norms that may facilitate public goods provision through collective action are often insufficient to prevent harmful action over a sustained period of time, which leads her to emphasize the role of locally-created community governance institutions that create specialized third-party enforcement of locally devised rules (E. Ostrom 2005). Given her focus on common pool natural resources, Ostrom pays much less attention to the conditions under which norms and networks might be sufficient to allow for the prevention of harmful action towards other kinds of semi-rival local public goods. Similarly, the literature on community governance institutions pays little attention to the extent to which the relationship between social norms and community governance institutions is shaped by engagement with a government's law enforcement or accountability institutions.

In summary, the approach to institutions and public goods maintenance developed here attempts to classify the broad range of institutions discussed in various literatures and to systematically link them to different aspects of public goods maintenance problems. This theoretical synthesis makes it possible for a single study of public goods to incorporate the wide array of institutional diversity and complexity that is present in many field settings. As a result, this aspect of my theory of public goods maintenance provides a general framework for approaching the study of institutions and public goods that moves beyond the typical rifts between state-centric and community-centric approaches, as well as between approaches that focus exclusively on dynamic provision of public goods and those that focus on the prevention of harmful action. This approach to linking institutions to the theory of public goods maintenance yields the following hypothesis:

Hypothesis 3: The dynamic provision and harm prevention problems associated with maintaining a semi-rival local public good can be solved either by one institution or can be co-produced by multiple institutions, and that this mix of institutions can vary between localities

As above, the empirical predictions of my theory of public goods maintenance can be contrasted with those of existing theories. If the assumptions of conventional theories are correct, empirical research should reveal a simple institutional landscape at the local level and low levels of heterogenity in institutional diversity between localities within the same country. An alternative

empirical prediction that is also consistent with the predictions of mainstream approaches is that local institutional diversity exists, but that there is no association, between the configuration of institutions in a given locality and public goods maintenance outcomes.

Despite the analytic strengths provided by identifying the complexity of local public goods maintenance problems and classifying the types of institutional solutions to those problems, there are additional puzzles identified above that can not be explained with only these two elements. In particular, as is, this theory generally predicts a relatively high level of success of public goods maintenance. Even after considering the pervasive nature of social dilemmas surrounding the prevention of harmful action and the replenishment of public goods, the predictions of this theory are still relatively optimistic in light of many of the instances of the long-term failure of public goods projects and institutional interventions that exist in practice. Similarly, the theory does little to explain how government and community institutions influence and interact with one another over time.

2.2.3 Institutions, Culture, and Power

In order to understand explain the apparent fragility and unintended consequences associated with many attempts to provide and maintain local public goods, it is necessary to incorporate theories of culture and power into the components of theory that I have developed so far in this chapter.

Although there are still active debates within political science about the definition of culture and its application to political phenomena, I follow Wedeen, who defines culture as a set of "semiotic practices"- a set of shared

understandings that make social action intelligible {Wedeen, 2002). The concept of power has also been the subject of a vast and often contentious literature within political science and related disciplines. In general, power can be defined as the ability of one person or organization to get another person or organization to do something that they would not otherwise do (Barnett and Duvall 2005; Moe 2005).

Although scholars of power have developed and debated distinctions between various forms of power, I will focus on two broad forms of power, which can be distinguished from one another based on the ways in which compliance is generated. One form of power is largely material in nature, and largely stems from the ability of one actor to affect the physical well-being of another actor, either through the use of force or the imposition of economic incentives or sanctions (Barnett and Duvall 2005).

The other category of power is described by analysts as being cultural or discursive, rather than material. This form of power is rooted in the ability to define categories of people, to categorize actions as appropriate or inappropriate, and to define the categories of social action that are thinkable or unthinkable in the first place. This form of power is less often consciously wielded by one actor over another, and is instead more deeply embedded in patterns of thought, discourse, habit, and social interaction (March and Olsen 1996; North 1990; E. Ostrom 2005; Wedeen 2002).

Material power is intimately related to the creation and transformation of institutions. As many institutions have distributive implications, the creation or change of a set of rules or norms can have implications for the long term

distribution of power within a community or a state. As a result, the choice of a set of rules may be shaped by the interests of those members of society with the greatest level of bargaining power, rather than efficiency concerns (March and Olsen 1996; North 1990; E. Ostrom 2005; Wedeen 2002).

Cultural power is also closely linked to the creation and change of institutions, albeit through the normative content of rules and identities. As Ostrom notes, institutions are "potentially linguistic entities"at their core. That is, even when they are not written down as formal laws, rules and norms can often be articulated verbally by participants. In this perspective, one of the key elements of both norms and rules is the articulation that certain actions are required, forbidden, or permitted (Ostrom 2005).

As a result, both the content and moral force of institutions is shaped dramatically by the cultural and discursive elements of power. Even in a case where institutions are not actively designed to benefit the interests of the "powerful", the contents of a set of rules and norms may reflect hegemonic understandings of who is a member of a given community and what obligations or rights they hold (Laitin 1986; Scott 1998). Rather than operating in isolation, material and cultural power often have an interactive effect on the design and evolution of institutions. If voluntary compliance with institutions depends in part on the extent to which an individual has internalized the rule or norm's prescriptive content, the linkage of hegemonic discourses to material bargaining power can substantially impact both the short-term and long-term effectiveness of a given institution (March and Olsen 1996; North 1990; E. Ostrom 2005; Wedeen 2002).

This perspective can explain the fragility and unintended consequences frequently associated with many local public goods interventions, particularly those that originate from states and international donors in developing countries (Escobar 1994; Ferguson 1990; Scott 1998). The difference in material power between states or donors and local communities means that the powerful actor's favored set of institutions will be used to deliver or maintain a given public good (Evans 2004, 2005). However, the prescriptive content of these institutions will be shaped by the culturally inscribed understandings of what constitutes "good behavior" and "good outcomes" employed by the powerful actor.

However, these attempts to create new institutions rarely take place in a vacuum. Rather, these attempts are often imposed onto a set of local norms and rules surrounding the use of a given public good or set of public goods. Given the aforementioned linkage between the normative component of institutions and the degree of voluntary compliance that it elicits, a conflict between a new institution and the normative prescriptions of an existing set of institutions can result in the new institution being ignored, resulting in a failure to effectively solve the associated public goods maintenance problem or the unintended creation of new problems (Ferguson 1990; Scott 1998).

In summary, an institutional intervention to provide or maintain a local public good by a state, community, or other organization does not act in isolation, but rather interacts with the content of other rules and norms governing that public good. This argument can be articulated as the following testable hypothesis:

Hypothesis 4: A normative mismatch between the multiple institutions maintaining a semi-rival local public good can reduce the effectiveness of both institutions, leading to the persistence, reemergence, or creation of dynamic provision problems and harmful action problems.

As above, the empirical predictions of my theory of public goods maintenance can be contrasted with those of existing theories that primarily focus on material incentives and sanctions as the basis for compliance with institutions. If the assumptions of conventional theories are correct, empirical evidence should reveal that the relationship between the normative content of institutions has no relationship to the effectiveness of institutions with respect to motivating dynamic provision, preventing harmful action, and maintaining semi-rival local public goods over time.

2.3 Conclusion-Research Design

In the previous sections, I articulated a theory of public goods maintenance that started by articulating the concept of semi-rival public goods, synthesized multiple approaches to institutions and public goods from the political science literature, and incorporated elements of theories of cultural power. Given the diverse epistemological backgrounds of these conceptual building blocks, testing the observable implications of this theory requires a research design that combines methods that allow both for thick descriptions of local institutional diversity with methods that provide leverage with respect to making causal inferences about the effect of institutions on public goods maintenance outcomes (Brady and Collier 2010; King, Keohane, and Verba 1994).

The specific combination of methods that I decided to utilize for this study was an in-depth ethnography combined with a randomized field experiment, a research design that has been increasingly used in empirical research on the political economy of institutions and development (Bamberger, Rao, and Woolcock 2010; Humphreys and Weinstein 2009; Lesorogol 2005; Paluck 2010). The specific way that I planned to combine these methods was to start with long-term, in-depth fieldwork in a given locality and use a combination of interviews, participant observation, and archival research to map the institutional landscape with respect to public goods maintenance and governance in that region. While conducting the ethnographic fieldwork, I planned to simultaneously compile and analyze my field notes. In addition to allowing for the process of critical reflection on the qualitative evidence, engaging in this process of analysis while in the field was designed to allow me to look for new puzzles and patterns and for opportunities to develop a field experiment drawing on the detailed reading of the institutional landscape captured during the ethnographic fieldwork. If this process identified a feasible opportunity for a field experiment, I would then implement the experiment, while turning the lens of the ethnographic fieldwork on the experiment itself.

My goal in combining ethnography and experimentation through this kind of iterative process was to bridge the epistemological and ontological divides that typically separate experimental and ethnographic research by implementing a randomized field experiment that allowed me to estimate the effect of a given intervention, while at same time reflexively analyzing the institutional context and process of implementing that experiment as a way to understand the way

that institutions, culture, and power shape the practice of development and politics in the study site (Brown and Tandon 1983; Hoppe 1999; Lewin 1946; Wacquant 2002, 2004, 2005).

My criteria in choosing a country and a locality within a country was to find a context in which there was likely to be both substantial local institutional diversity and variation between and within localities with respect to local pubic goods maintenance outcomes. The reason for this case selection strategy was to choose a context in which the qualitative evidence suggested fit well with the general scope conditions of my theory, which assumes that multiple actors are involved in maintaining semi-rival local public goods. Using this strategy, if I was unable to find evidence of institutional diversity related to dynamic provision and harm prevention, in a case where I could reasonably expect to find it, then this raises important concerns about the validity of the theory (Flyvbjerg 2006; Gerring 2007). However, if the ethnographic and experimental evidence from a "most likely" case provides support the general observable implications of the theory in a most likely case, it is then possible to assess the extent to which the theory can be applied to other contexts.

Based on these criteria, I chose to conduct the ethnographic fieldwork in the Laikipia region of Kenya. The secondary literature on Kenya indicates a high degree of variation with respect to local institutional diversity and public goods maintenance outcomes. As described in more detail in the next chapter, the system of Provincial Administration inherited from the British allows the government to penetrate even the most remote rural areas. At the same time, numerous anthropological studies record a tremendous diversity of local

institutions and report that these institutions shape daily life far more than the government (Anderson 1986; Ensminger 1997; E. Fratkin and Smith 1995; Galaty 1982; Nathan, E. M. Fratkin, and Roth 1996).

Similarly, Kenya is the site of countless major local development initiatives by donors, yet many individuals lack access to basic public goods, such as improved roads, water points, schools, and health centers. These contractions are also manifested at the national level. At the time at which I began my fieldwork in 2006, Kenya was often described as a flourishing multi-party democracy and one of the most stable states in Africa. However, shortly after my fieldwork ended in December 2007, the country was shaken by three months of violent ethnic conflict in the wake of a fraudulent presidential election.

Within Kenya, I chose Laikipia as my study site for similar reasons. Laikipia is located in the ecological and cultural frontier zone between the agricultural regions of central Kenya. As a result, the population is a mix of farmers from the Kikuyu ethnic group (which is the largest ethnic group in the country), and variety of Maasai and other semi-nomadic pastoralists, including the Samburu, Kikuyu, Meru, Somali, Turkana, Pokot, and Borana communities. At the same time, Laikipia was also a major area of European settlement during the colonial period, and much of the land in the region is In addition, the region has mixed availability of infrastructure and public services- as of 2009, over 88% of households have access to improved sanitation facilities, while only 6.3% have access to improved roads (Commision on Revenue Allocation 2011). Until 2007, Laikipia was governed as a single administrative district, but during the course of that year, it was divided twice, first into Laikipia East and Laikipia West Districts,

with Laikipia North later being carved out of Laikipia East. The whole region covers a total of 9,462 square kilometers and has a population of 399,227; 75% of the population is rural and 50% of the population lives below the poverty rate (Commision on Revenue Allocation 2011).

Finally, once my fieldwork in Laikipia was underway, I chose solid waste management in the region's rural shopping centers as the local public good that would be the main focus of my iterative ethnographic and experimental research. One of the primary reasons that I chose to focus on public waste in rural centers was its simple visibility as a problem. As I travelled around Laikipia conducting my initial interviews, I was struck by the fact that that litter and waste were huge problems in nearly every rural center that I visited. These centers form the backbone for economic exchange in Laikipia, and throughout rural Kenya in general, as they are aggregations of small shops, cafes, and both short and long-term lodgings.

Given the generally low population density outside of the Laikipia's regional urban centers of Nanyuki, Rumuruti, Nyahururu, and Timau, these rural centers are the major instance of the kind of incipient urbanization that is necessary for the level of spillovers necessary for trash to accumulate in any serious way. That is, although households and family farms in Laikipia do produce trash, the distance between homes means that the accumulation of trash in the areas around a given home is minimal. In contrast, the permanent population density of centers, along with the volume of daily visitors ensures that that the volume of trash accumulation is such that solid waste management appears to have the characteristics of a local public good. Moreover, solid waste

management in rural centers appears to be a potential case of a semi-rival local public good. Solid waste management can be dynamically provided through clean-ups and the provision of trash cans, while littering is a harmful action that degrades the local public good of cleanliness within the center.

In the following three chapters, I present the results of both data collection efforts, starting with the results of the qualitative analysis of Laikipia's institutional landscape. I then describe how the initial findings of the ethnographic research led me to start a nongovernmental organization called the SAFI Project and to implement SAFI's first waste management program as a randomized field experiment that was designed to test the implications of my theory of public goods maintenance. In the subsequent chapters, I present the quantitative analyses of village-level and individual-level data from the SAFI Project experiment. Throughout each of these chapters, I assess the evidence with respect to the hypotheses articulated in this chapter and supplement the interpretation of both sets of experimental results using additional ethnographic evidence.

Chapter 3: Institutional Diversity, Waste Management, and Public Goods Maintenance in Laikipia

3.1 Introduction

In chapters 1 and 2, one of the major weaknesses that I identified in the existing literature on public goods is a consistent failure to account for institutional and organizational diversity typically involved in the maintenance of local public goods. As defined above, institutional diversity means that a variety of organizations, rules, and norms can work as substitutes and complements with respect to public goods provision and maintenance in a given locality, and that the same institution can play multiple roles with respect to the same public good in a given locality(E. Ostrom 2005). Despite the plausibility of this concept and the potential theoretical leverage it provides, the literature review above highlights tendency of most existing studies of public goods to abstract away from the real world complexity by focusing on either states or communities or on only provision or only harm prevention.

Although the theory developed above forms the basis of an argument for why to study the full diversity of institutions involved in providing and maintaining local public goods, it provides little guidance about how to do so? What is the appropriate method for mapping the organizational and institutional diversity with respect to maintaining a particular public good in a given locality? In this section, I propose and develop an approach to qualitative fieldwork to complement the theory of public goods maintenance that draws on three strands of qualitative research methods: ethnographic exploration of social and political institutions (Brady and Collier 2010; King, Keohane, and Verba 1994), case study

research that explicitly allows for an iterative cycle linking deductive and inductive theorizing (Bennett 2004; Bennett and Elman 2006), and interpretevist analyses of culture, language, and practice (Wacquant 2005; Hopf 2006).

In particular, I used this set of qualitative methods to map the institutional and organizational diversity linked to public sanitation in Laikipia through the following process. First, I utilized the broad, interdisciplinary literature on Kenyan politics, society, and history to assess the extent to which institutions identified in theories of public goods provision can be mapped onto the social and political landscape of rural Kenya. This dialogue between theory and the existing body of evidence on Kenya gave me a sense of which institutions to focus on and allowed me to frame an initial set of research questions. As noted above, this process was also used to select Kenya and Laikipia as locations for the field research. Second, upon arriving in Laikipia, I started conducting semi-structured interviews and participant observation regarding institutions and public goods maintenance. Both of these modes of qualitative data collection were aimed at uncovering how individuals living in Laikipia engage with the range of governance institutions, as well as how public officials in the region view their organizations and the community. Interviews with younger community members and officials tended to focus on the contemporary period, while interviews with older respondents explicitly compared institutional performance across multiple periods of colonial and post-independence history. The participant observation was designed to complement the interviews by deliberately recording and analyzing the processes and practices that I

experienced as I observed community members and myself interacting with both state and community institutions. Third, I supplemented the ethnographic research by accessing the records on governance in Laikipia from both the colonial and immediate post-colonial periods that are stored in the Kenya National Archives. These records provided evidence about the processes whereby the institutional landscape in Laikipia was constructed, maintained, and transformed over time, and also provided a complementary perspective to the descriptions of institutions during the colonial and early independence period provided by my oldest informants.

Engaging in these three research activities in a continuous, iterative process made it possible to both identify a set of institutions to focus on, but also allowed sufficient flexibility to adjust the scope and theory as a result of discoveries made throughout the course of the fieldwork (Bennett 2004). Although the initial questionnaires, sample of interviewees, and selection of participant observation activities was driven by the exercise of matching theory to the Kenyan context, the topics and institutions included in the study evolved over the course of the field research as a result of the patterns revealed throughout the interviews and participant observation. The initial survey questionnaire focused on community organizations and institutions, particularly pertaining to land use and security, due to the emphasis on these institutions in the literature on pastoralism in Kenya. Through the process of conducting interviews and visiting rural centers and homes, the importance of additional organizations and institutions became apparent, and additional questionnaires were developed and informants were selected accordingly. In particular, the interviews and

participant observation highlighted the importance of a variety of state institutions that had been mentioned in various secondary sources, including the county council, the constituency system, the provincial administration, and group ranches. As discussed above, it was during this process of conducting these interviews and participant observation that I first became aware of the public waste problem in Laikipia, and as I continued my set of interviews mapping out the institutional landscape of governance in the region, I started explicitly inquiring and making observations about the extent to which the organizations, rules, and norms that I was identifying were formally assigned a role with respect to public waste management and the extent to which they actually were engaged with waste management in practice.

Through the iterative process of carrying out these three research activities, I was able to develop a sense of the major organizations and institutions purportedly and actually responsible for various aspects of solid waste management in Laikipia, as well as indications of the roles played be these institutions with respect to public goods maintenance more generally. The institutions that I identified and classified through this process of qualitative research span both dimensions of the theory of public goods maintenance developed above. In the sections that follow, I present the results of this analysis by providing a brief overview of each of the institutions that I identified through the course of the qualitative research. For each institution, I give a brief background of the history and structure of the institution, drawing on primary and secondary sources on Kenya, and then draw on the fieldwork to provide an overview of the institution's de jure and de facto roles in Laikipia. I use the core

components of my theory of public goods maintenance to structure and organize the discussion, starting by discussing government institutions then discussing community institutions. Within each of these groups of institutions, I group them further by organizing them with respect to their relationship with public goods maintenance problems. That is, when discussing the state institutions, I start with institutions that are primarily associated with the provision and reprovision of public goods and move to institutions that attempt to prevent harmful action. In the discussion of community institutions, I reverse this order, starting with institutions that primarily play a role with respect to harm prevention and then move to institutions that primarily play roles with respect provision and replenishment of local public goods. I then synthesize the findings of the qualitative analysis and assess the extent to which these findings provide leverage in testing the implications of my theory of public goods maintenance. I conclude by briefly discussing how these findings provided the motivation for the SAFI Project anti-littering experiment and influenced its design.

3.2 Mapping Laikipia's Institutional Diversity

3.2.1 Local Government

The Laikipia County Council (LCC) is the primary government institution with de jure responsibility for the provision and maintenance of local public goods such as sanitation in the non-urban areas of Laikipia. In order to understand the LCC's de facto and de jure roles with respect to sanitation in the region, it is necessary to provide a small amount of background on Kenya's local authorities in general, and then move to a discussion of rural local government in the context of Laikipia.

The initial seeds of elected local government in Kenya were the town and county councils that governed European-occupied localities during the colonial period (Southall and Wood 1996). In the late colonial period, there was an effort to extend similar forms of elected local government to African areas, in the form of "African District Councils" (ADCs) (Kipkorir 2009). At independence in 1963, these forms of elected local government were merged and assigned governance functions according to the "Local Government Act" {"Local Government Act," 1963}, which created four distinct types of local authorities. County councils are the local authorities that serve rural areas, while city, town, and municipal councils serve urban areas of varying size and scope (Kibua and Mwabu 2008; Southall and Wood 1996). All of these local authorities are divided into wards, with each ward electing a councilor in elections that are held every five years.

At the time of Kenya's independence, local authorities were incorporated into a larger federal structure, in which provinces served as the first tear of decentralized government, and local authorities were the second tier. Within this framework, local authorities were expected to play substantial roles in service delivery and were designated a mandated portion of provincial revenues collected from the Graduated Personal Tax (GPT) (Muia 2008). However, after the abrogation of the federal constitution in 1964 and the abolishment of the GPT in 1974, the effectiveness and autonomy of Local Authorities was gradually undermined by the central government, which increasingly sought to remove powers from county councils, overturn decisions, and where possible, shift responsibility towards bureaucrats appointed by the central government and ruling party (KANU) (Kipkorir 2009; Southall and Wood 1996). Even under this

substantially constrained role, it was still envisioned that local authorities would play a role in providing some basic public services including solid waste management and would support the maintenance of many others, including water and sewage services, roads, and health and education infrastructure.

By 1980, nearly all independent authority and policymaking power had been stripped from local authorities, and they were largely turned into another conduit for KANU's politics of control (Southall and Wood 1996).It was during this time that local governments became synonymous with graft and incompetence on one hand and inflated budgets and deficits on the other. Even after the transition to multiparty politics in 1992, many of these institutional features remained in place (Southall and Wood 1996). Council bureaucrats are still appointed by the central Ministry of Local Government rather than by the locally elected councilors, political parties holding the most seats in a given council have the power to nominate unelected councilors, and councils are largely dependent on transfers from the central government through the Local Authority Transfer Fund (LATF). Recent reforms have attempted to leverage this transfer program to jointly improve service delivery and increase the accountability of Local Authorities to citizens by requiring that the bulk of government transfers be spent on capital expenditures for service delivery infrastructure and that projects be chosen by citizens in a series of ward-level planning meetings known as the Local Authority Service Delivery Action Plan (LASDAP) process.

This historical background and overview of the politics of local government in Kenya informs several patterns associated with the Laikipia County Council's roles vis-a-vis public goods maintenance in general and solid

waste management in general. Overall, individuals hold broadly contradictory and conflicting beliefs and opinions about the County Council. On the one hand, residents of the region frequently identify councilors as important local leaders and signal the importance of the Council in providing public goods. On the other hand, the same individuals will also express the belief that the Council is ineffective and corrupt, and may even have a vague idea of how the process of local representative government works. In particular, individuals in rural areas throughout Laikipia routinely confuse the Laikipia County Council and the Nanyuki Municipal Council. In particular, individuals in rural areas are likely to ascribe the provision of a variety of day-to-day public services to the "Municipal Council", even though they live quite far from anything that could be considered a municipality.

Solid waste management by the County Council in rural Laikipia is emblematic of the gap between the council's de jure responsibilities and its de facto performance of those responsibilities. Although many interviewees identified that the council has responsibility for solid waste management, it was frequently difficult to observe the council's actions with respect to sanitation in most rural centers. In approximately one center per ward, individuals identified that a community member was paid by the county council to pick up trash, but the center trash collectors that I interviewed frequently complained of being underpaid and lacking adequate tools for the collection and disposal of trash.

The county council's budgetary records support this account of limited financial support for public sanitation activities. Although specific line-items for solid waste management are not available, records show that for the 2010/2011

fiscal year, 1,770,738 KSH (approximately $22,000) was allocated to the Public Health and Environment Department, which is less than 2% of the county council's annual budget of 100,224,263 KSH. Over 90% of the budget for Public Health and Environment is allocated to personnel, with only 5% allocated to operations and maintenance, respectively. Although information on ward-level allocations for Public Health and Environment is not available, this allocation breaks down to an average of approximately 65,500 KSH ($820) per ward per year. Even with 90% of this allocation going to salaries, it is impossible to employ more than one or two individuals per ward, nearly ensuring that coverage of public waste management services are provided to only a subset of any given ward or a subset of the 27 wards in the county council. Moreover, the limited amount of funds allocated to operations and maintenance creates means that even in the centers where the county council has hired someone to collect trash, these employees have very few resources to ensure that trash is collected and stored effectively. There is also little evidence that the lack of funds for sanitation and waste management infrastructure in the recurrent budget are funded through the LATF processes, with allocations from that project largely being allocated to the construction and refurbishment of roads and health and education infrastructure.

3.2.2 The Constituency Development Fund

The Constituency Development Fund (CDF), which was created in 2003, is a second government institution that is heavily involved in the maintenance of local public goods in rural Laikipia. Like the LASDAP process administered through the Laikipia County Council, the aim of the CDF is to utilize a

participatory process to allow citizens to decide how to allocate devolved funds from the central government. Rather than being linked to the local authorities, the CDF is administered by the Kenyan National Assembly. Locally, CDF funds- totalling 2.5% of government revenue for a given fiscal year— are allocated to each of the country's 210 parliamentary constituencies, which are the single member electoral districts that elect Members of Parliament to the National Assembly (Kimenyi 2005). Because constituencies have no formal linkage to local authorities in terms of boundaries and jurisdiction, there are a variety of different types of interactions between the two sets of institutions. In some cases, there is explicit coordination and collaboration between the two institutions in the selection and completion of projects (Kirui 2009). In other cases, MPs and local councilors engage in turf wars, with either MPs trying to influence county council elections and projects or the councilors trying to pull the CDF funds and projects under the jurisdiction of the Local Authority (Kibua and Mwabu 2008; Southall and Wood 1996).

Formally, the CDF is to be administered by a Constituency Development Committee (CDC) that is nominated by the local MP, but which is broadly representative of the population of the constituency and is formally independent of him or her. The CDF was designed in this way to jointly ensure citizen participation in project selection, while at the same time strengthening the accountability of politicians to their constituents (Kibua and Mapesa 2008). Informally, politicians are frequently highly involved in the CDC's activities in a number of ways that deviate from the de jure design of the institution. The commonly held perception throughout Kenya is that MPs use their power to

appoint the CDC, so that it is filled with family members and close supporters, and that MPs frequently use their influence over the committee to push for CDF funds to be spent on projects that serve his or her political aims, rather than the demands of citizens (Kibua and Mwabu 2008; Southall and Wood 1996). In addition, audits of CDF projects by citizen monitoring groups routinely find many projects in every constituency that are either "ghost projects" in which funds are allocated, but no project exists and many other projects in which the infrastructure is either built poorly or so slowly that projects are still not completed several years after construction started(National Taxpayers Association 2012).

This tension between the de jure aims of the CDF and its actual peformance can be seen in Laikipia's two parliamentary constituencies- Laikipia East and West. On the one hand, the CDF process has allocated a substantial amount of money to a large number of projects throughout the region. Since 2003, 401,111,826 KSH (approximately $5,000,000) have been allocated to 271 CDF projects in Laikipia East and 436,715,889 KSH (approximately $5,450,000) have been allocated to 150 projects in Laikipia West (Constituencies Development Fund Board 2012; Mzalendo). Although projects are distributed widely throughout the geographical regions in both constituencies, residents in both constituencies frequently argue that more projects are allocated to the MP's communities, that the speed and quality of project completion is higher in those areas, and that the CDC provides tenders to contractors closely affiliated with the MP. This perception has led the pastoralist communities that form a substantial ethnic minority in both of Laikipia's constituencies to lobby for the creation of a

new parliamentary constituency to ensure that they get a larger share of CDF projects.

In both of these constituencies, the CDF fund is largely used to fund the provision and refurbishment of the same types of public infrastructure that are funded through the Laikipia county council's LASDAP process. In particular, most CDF projects are relatively large-scale construction and rehabilitation projects that focus on public infrastucture. The most common projects are building and repairing structures for schools, dispensaries, and police posts, and building and refurbishing water infrastructure (Mzalendo). Although public waste and sanitation infrastructure such as waste bins and waste storage and processing facilities fits within this general class of projects, no projects of this type have been approved in Laikipia since the inception of the CDF in 2003, despite the lack of such facilities throughout rural areas in the region.

3.2.3 Group Ranches

Laikipia's thirteen group ranches are another government institution that is involved in public goods maintenance in the region. Although the group ranches only exist in the Maa-speaking pastoralist communities in Laikipia North district, they both complement and substitute for other state and community institutions in this set of communities.

The group ranch is an institutional innovation that was developed as part of the Kenya Livestock Development Programme that was started in the late 1960s by Kenya's Ministry of Agriculture and Livestock Development, with the support of the World Bank (Mwangi and E. Ostrom 2009). The aim of the group ranch program was to formalize collective land tenure in arid and semi-arid areas

by granting communities joint title over a piece of land and establishing a management committee to regulate the use of the land and to encourage destocking. The deeper aims of these two institutional features of the program were to speed the transformation of pastoralist communities from subsistence herders into commercial ranchers. Granting formal title to communal land was supposed to facilitate this transition by allowing group ranches to use the title deed to obtain loans to finance investments in shared infrastructure, such as boreholes, cattle dips, and roads to market centers (R. K. Davis 1970). In addition, the program's designers believed that granting a title deed over a fixed, defined property and the creation of a management committee would create the incentives and abiliy for communities to reduce the amount of cattle on the land, and therefore reduce overgrazing and increase the long-term sustainability of the rangeland (Ng'ethe 1993).

The initial site for the group ranch project was southern Maasailand, with adjudication and registration starting in Kajiado district in 1964 and 1965 and expanding to Narok district shortly thereafter, resulting in a total of 94 group ranches in the two districts that were operational or undergoing adjudication by 1978 {International Livestock Center for Africa, 1979 (Oxby 1981). The institution then spread to 13 other semi-arid and arid districts throughout the country over the next 10 years, resulting in 159 group ranches across the country (Ng'ethe 1993). However, even as new group ranches were starting to be created throughout Kenya, enthusiasm for the project was already starting to wane in the project's initial pilot sites in southern Maasailand. On many ranches, the management committees proved to be ineffective at encouraging reductions in

herd sizes among their members (Ng'ethe 1993). In addition, uptake on loans for improving group ranch infrastructure was relatively low , resulting in limited expansion in cattle dips and boreholes (Oxby 1981; Rutten 1992). These factors combined with the newly restricted mobility relative to the less firmly bounded communal tenure that had been utilized during the colonial era in Maasailand, to create a situation in which not only did the group ranches fail to accelerate the transition of pastoralists into commercial ranchers, but in many cases the project increased rates of overgrazing and accelerated the degradation of land (Mwangi and E. Ostrom 2009). Against this backdrop, members and leaders of group ranches started to agitate for subdivision of the commonly held ranches into private property, with Poka Group Ranch in Kajiado district completeing subdivision in 1981 (Ng'ethe 1993). By 2006, 47 of the 52 group ranches in Kajiado had either subdivided or resolved to subdivide, with the group ranches in Narok district exhibiting similar patterns as well (R. K. Davis 1970; Mwangi and E. Ostrom 2009) . Subsequent research has provided evidence that these subdivisions were typically highly unequal, with the largest tracts of private land going overwhelmingly to group ranch management committee members and members connected to local politicians (R. K. Davis 1970; Mwangi and E. Ostrom 2009). In contrast, the majority of group ranch members ended up on much smaller plots, which has exacerbated the problem of limited mobility, further increasing overgrazing and increasing the drought vulnerability of individuals living on small plots (C. Boone 2003; Waldner 1999).

In contrast to the narrative of failure and collapse that is typically used to describe southern Maasailand's experience with group ranches, Laikipia's

experience with the institution has followed a very different trajectory. The first set of eight group ranches in the region were adjudicated by the late 1970s, with the other five created throughout the 1980s and 1990s {International Livestock Center for Africa, 1979}. Since that time, none of the thirteen group ranches have faced credible attempts to disband and subdivide, even in spite of growing numbers of people and livestock on the ranches. Furthermore, the majority of the group ranches in the region have moved beyond their initial vision of being commercial livestock ranches, and have started to diversify into alternative commercial activities such as conservation ecotourism and harvesting sand from seasonal rivers to sell as raw materials to cement companies.

On average, Laikipia's group ranches play a variety of different roles related to providing and maintaining several different local public goods. On the one hand, one of the core de jure aims of the group ranch institution was to create a formalized system for managing commonly owned rangelands. In the language of the theory of public goods maintenance developed above, the process of creating and enforcing grazing boundaries and targets for livestock numbers can be categorized as institutions designed to solve the particular types of harmful action problem that arise in common pool resource situations (Ostrom 1990). As the group ranches in the area have diversified into other types of business, the scope of this type of harm prevention has expanded. The group ranches that engage in ecotourism and wildlife conservation now routinely hire scouts to identify and report instances of illicit grazing, poaching, and human-wildlife conflict by members and nonmembers. Similarly, the group ranches that have started to harvest sand now monitor and punish unauthorized sand harvesting by

individual community members and other group ranches by halting unauthorized extraction and commandeering trucks that are caught illicitly removing sand.

Laikipia's group ranches also undertake a variety of activities with respect to public goods provision and replenishment. Since their inception, most of the group ranches in the area have been involved in providing and refurbishing local public goods related to livestock management such as cattle dips and water points. As many of the group ranches have started to accumulate increased revenues from expanding into other businesses, they have started to use a portion of these resources to build and refurbish a variety of other types of local public goods, in particular school and health center buildings and salaries for teachers and medical personnel.

Despite the involvement of Laikipia's group ranches in maintaining a variety of different types of local public goods through both repeated provision and prevention of harmful action in a variety of domains, as of 2007, they were not heavily involved in either providing waste management infrastructure or punishing littering behavior. Part of the reason for this lack of involvement is a mismatch between the jurisdiction of group ranches and the geographical scope of rural solid waste problems. As noted above, each of Laikipa's group ranches is large enough that residential population density on the entire group ranch is relatively low. As a result, the only areas in Laikipia North that are densely populated enough to create the conditions for public waste problems are the district's four shopping and market centers- Il Polei, Dol Dol, Kimanjo, and Ewaso. However, all of the first three of these centers are located on the boundary between two more group ranches, host weekly or bi-weekly agricultural

markets, and are home to substantial numbers of traders and shopkeepers who are not members of the Maa speaking communities and are thus not eligible to be members of the group ranches. Given the confluence of these three factors, it is not surprising that group ranches that are located next to commercial centers do not invest in providing or maintaining public sanitation. commercial center In contrast, because Ewaso shopping center is located entirely within Koija group ranch, group ranch members reported attempts by the group ranch committee to organize clean-ups and occasionally provide public trash cans sponsored by Losiaba (a neighboring private ranch). However, even in this center, this public sanitation was not effectively maintained over time. At the time of my first visit to Ewaso in 2007, the level of public waste was not noticeably different from the other centers in the region, and there was no visible sanitation infrastructure in the center.

3.2.4 Chiefs and the Provincial Administration

Kenya's Provincial Administration also plays several roles with respect public goods maintenance in Laikipia, primarily through the office of the chief. The Provincial Administration is part of the Ministry of State for Provincial Administration and Internal Security in the Office of the President and operates as part of the same government ministry as the police. Kenya's administration is divided into five levels of territorial sub-units, with each unit having an appointed administrator who represents the executive authority of the president in that jurisdiction. From most encompassing to the most specific, these units (and corresponding administrators) are: Provinces (provincial commissioner), Districts (district commissioner), Divisions (district officer), Locations (chief),

and Sub-Locations (assistant chief). Chiefs also have the power to appoint village headmen or elders below Assistant Chiefs, but the unit of "village" is less clearly defined than the others and selection and management of elders is less closely monitored by the central government. Chiefs, assistant chiefs, and village elders are always from the community that they are chosen to serve, while District Officers and District Commissioners are deliberately chosen from other ethnic groups in other parts of the country.

The de jure structure and roles of the Provincial Administration are due to the institution's roots in the system of governance employed by the British during the colonial period. The institution of the chief was initially conceived within the British colonial strategy of indirect rule, in which colonial administrators devolved authority to "traditional elders" that they identified in the African communities over which they sought to exercise control. The local European representatives of Kenya's Provincial Administration— district commissioners and district officers— were responsible for recruiting and overseeing chiefs, as well as for coordinating security and development activities in the Native Reserves (Branch and Cheeseman 2006; Gertzel 1966). Although the total size of Kenya's Provincial Administration was initially small (as in other British colonies), the size increased steadily throughout the 1940s and 1950s, in reaction to needs for increased taxation in the aftermath of the two World Wars, as well as the security needs related to the Mau Mau Emergency (Branch and Cheeseman 2006; Gertzel 1966).

There are a number of reasons why the Provincial Administration in Kenya employed a more direct form of rule than many other British colonial

governments in Africa. First, the Provincial Administration was intimately concerned with maintaining the boundaries between land that had been alienated for use by Europeans and the areas designated for African settlements. In the area that is currently Laikipia, the majority of land was alienated for use by Europeans, which necessitated moving the Maasai communities living in the area to Narok district and ensuring that the Kikuyu communities that had previously lived in the area stayed in the designated areas of Central Province (Bates 2005). In contrast, the mixed Maa-speaking pastoralist and hunter-gatherer societies that were collectively called the "Dorobo" community, were allowed to stay in what became known as the Mukogodo Native Reserve (or the Dorobo Reserve), which overlaps with the boundaries of contemporary Laikipia North District (Cronk 2002, 2004). Because of the large number of European-owned ranches in Laikipia, the British backed the three chiefs in the Mukogodo Native Reserve with a substantial amount of direct coercive force (relative to other territories), stationing a district officer and police forces in Dol Dol, the largest market center in the area {National Archives, 1933-1935}.

A second reason that the colonial Provincial Administration backed their chiefs so directly was the fact that in many communities in Kenya, including the Maasai and Kikuyu communities that now live in Laikipia, the convention of identifying one chief to enforce rules and arbitrate disputes had no basis in the form of authority exercised by elders in the pre-colonial period (Tignor 1971). In the pre-colonial period, governance over issues of land use and security was carried out by groups of elders, meaning that governance by a single chief was largely imposed and invented by the British and had little legitimate basis in local

institutions and practice.

The combined effect of these two aspects of colonial governance was that law enforcement by chiefs during this era more closely resembled direct rule by agents of a central government than the co-optation of local governance institutions into a system of indirect rule. Throughout this period, chiefs in Laikipia carried out a variety of responsibilities: punishing and reporting cattle thefts from European-owned farms, preventing cycles of cattle raiding between neighboring ethnic communities, assisting with tax collection, and compelling labor on public works projects and on European-owned ranches {National Archives, 1949-1962}.

As noted above, Kenya's independence in 1963 was supposed to mark a transition from centralized rule through appointed administrators to decentralized governance by elected assemblies and councils at the provincial and county level. However, as the Kenyatta government made moves to dismantle the federal commission and undermine the powers of the county councils, it also made steps to strengthen and support the Provincial Administration, replacing white DCs and DOs with Africans, and retaining the positions of chief, assistant chief, and Village elder (Berman 1992; Branch and Cheeseman 2009). The roles of chiefs in independent Kenya were explicated in the Chiefs' Authority Act of 1964 (also known simply as the Chiefs' Act), which defined the the primary role of the chief to be "to maintain order in the area in respect of which he is appointed" {"Chiefs' Authority Act," 1964}. In particular, the act specified that chiefs can take actions to prevent and punish crimes, can issue and enforce orders regarding behavior in their locality, and can require

labor on public works projects {"Chiefs' Authority Act," 1964}. Despite this continuity in practices from the colonial period to the post-colonial period, the law also formally abolished some of the most coercive practices enacted by chiefs during the colonial period, such as not paying community members for compelled labor and holding suspected criminals in the chief's own improvised holding cell {"Chiefs' Authority Act," 1964(Tignor 1971).

The public perception of chiefs in contemporary Laikipia reflects the colonial and post-colonial history of the institution in the region. On one hand, many residents of the region- especially older men and women- are still acutely aware of the imposed nature of the chief. As one elder from the Mukogodo sub-tribe succinctly put it, "chiefs are no different than any one else; they are just a common person". At the same time, the visibility and activity of chiefs within the region indicates that even though they possess no special traditional authority, they are widely recognized as agents of the central government. Many chiefs have offices, and even those that do not can frequently found throughout their jurisdiction, especially whenever there is a public gathering or event. This constant presence allows chiefs to keep track of what is going on in their locality, using their network of assistant chiefs and village elders to monitor day-to-day activities.

Beyond this role, there is heterogeneity among individual chiefs about how they interpret their role; some focus most narrowly on security and policing, wearing military fatigues on a day-to-day basis, while others describe themselves more as civil servants and describe their primary role as assisting with "service delivery". The former largely interface with the police and councils of elders (see

below) to apprehend and punish suspected criminals, whereas the latter typically collaborate with civil society organizations, councilors, and group ranches (in Laikipia North) to support public goods provision and refurbishment. Given the de jure and de facto ability of chiefs to motivate collective action and punish harmful action within their locality, it was reasonable to expect that they would play a role in maintaining public sanitation. In some parts of the Laikipia, there were reports of some chiefs punishing individuals for littering and of other chiefs mobilizing a clean-up of a public space, usually before a pubic ceremony or visit from a politician. At the same time, there was little evidence of any of the chiefs or assistant chiefs in the region using their authority to either motivate clean-ups or to punish littering on a consistent basis.

3.2.5 Age Sets and Kinship

In addition to the array of government institutions involved in maintaining local goods in Laikipia, there are a variety of community institutions that promote collective action and prevent harmful action. One set of community institutions that play important roles with respect to public goods maintenance are kinship and age-set networks. These institutions are noteworthy because they played a central role in governance in the pre-colonial period, were resilient to the introduction of colonial rule, and continue to shape social, economic, and political behavior today. Despite the role of these institutions in governance throughout multiple historical periods, they should not be viewed as immutable isolated "traditional institutions"(Hobsbawm and T. O. Ranger 1992; T. Ranger and Vaughan 1993). Rather, kinship and age-set institutions in Laikipia have evolved in tandem with institutions imposed by Kenya's colonial and post-

colonial governments, with government and community institutions shaping each other over time.

This long-term, mutual interaction between community and government institutions can be seen in the initial similarities and divergent evolution of kinship and age-set institutions in Laikipia's Maa and Kikuyu-speaking communities over the course of the 19th and 20th centuries. Reports from the earliest European explorers and ethnographers in East Africa reveal fundamental structural similarities in the kinship and age-set institutions of the various communities living in what is now Laikipia, regardless of whether they were primarily farmers, pastoralists, or hunter/beekeepers (Dundas 1908; Harris 1968; Kenyatta 1962; Lambert 1956; Lawren 1968; Orde-Browne 1916). In addition, more recent oral histories reveal that although linguistic and social divisions did map onto these different livelihoods strategies, boundaries between communities were relatively permeable (Cronk 2002, 2004). In this context, labels of individuals and families as "Kikuyu", "Maasai", or "Dorobo" were less a marker of a distinct social and political groupings, and were instead a more fluid descriptor of one specific set of subsistence strategies and associated linguistic and cultural practices that were part of a larger multi-ethnic social grouping in the region (Cronk 2002, 2004). In this interpretation, there were dense social, economic, and political linkages between Kikuyu, Maasai, and Dorobo communities, with families and clans moving between pastoralism, hunting, and farming communities as part of a reaction to fluctuation in family and herd sizes due to war and disease (Lawren 1968; Mungeam 1970).

In pre-colonial Laikipia and the surrounding region, kinship was one of

the most important dimensions around which exchange, cooperation, and reciprocity took place. Several important factors characterized kinship networks and descent groups in the various communities the region. In Kikuyu, Maasai, and Dorobo communities, clans and lineages (sub-clan groupings) were patrilineal, meaning that individuals became a member of their father's clan at birth (Bates 2005). Given this automatic membership, clans constituted a natural primary group for many important collective activities including the socialization and care of children, the provision of social insurance in the presence of unexpected economic shocks, and the allocation of rights to use land for farming, grazing, and hunting (Anderson 1986; Ensminger 1997; E. Fratkin and Smith 1995; Galaty 1982; Nathan, E. M. Fratkin, and Roth 1996) . This patrilineal structure of clans and lineages was supported by complementary rules and norms related to marriage. During the pre-colonial period, polygyny was permitted in all of the communities in the region and marriages typically took place between members of different clans, with women becoming members of their husband's clan at marriage (L. Cronk 2002, 2004). In order to marry, a prospective husband needed to pay cattle as bridewealth to the family of his wife-to-be, meaning that polygamy was most feasible for older men who had amassed substantial herds (Bates 2005). Despite the importance of intra-clan relationships, most individuals also maintained close relationships with cousins, uncles, and aunts in their mothers' families and with their sisters who married into other families, providing mutual support and assistance to one another and their respective families in times of need (Ferraro 1973). Taken together, the patrilineal structure of clans and marriage rules jointly served to create kinship

networks that allowed for collective action at varying levels of geographic scope.

Networks centered on age-sets (also known as age-grades) were a community governance institution in pre-colonial Laikipia that cut across clans and kinship networks. In the Laikipia Maasai communities, as in many other nomadic and semi-nomadic pastoralist societies, age-sets were constituted as a result of the circumcision and initiation of teenage boys into adulthood (Jacobs 1965; Spencer 1965, 1998). Twice every year, boys aged 11 to 15 were circumcised in public ceremonies, and after a brief period of being sequestered in their mothers' houses, the boys were initiated as warriors. All cohorts of boys circumcised over a period of 5-8 years were grouped into age-sets, which pass through stages of adulthood together, from warriors to junior elders to senior elders. Ethnographies and oral histories show that pre-colonial Kikuyu communities also had very similar institutions of age grades comprised of cohorts of men who underwent circumcision and initiation together. These institutions of age-sets and age-grades constituted created dense, reciprocal ties between young men of approximately the same age who go through circumcision and initiation rituals together(Lambert 1956; Lawren 1968; Mbito and Malia 2009). As part of these smaller circumcision groups and the larger age-set groups, young men spent their early adult years providing security against cattle raids and migrating with herds of cattle so that communal grazing lands will not become depleted during the dry season. The Maa-speaking and Kikuyu communities also both practiced female circumcision during the pre-colonial period (L. Cronk 2002, 2004). Although this institution served to indicate which women were eligible to be married, women were not grouped into age-sets or age-grades through this

process.

The age-set institution also had the effect of creating an age-based hierarchy across cohorts, which resulted in the creation of distinct Councils of Elders that played an important governance role (Adt 1954; Tignor 1971). Councils of elders are comprised of members of the oldest age-sets alive at any point in time, and primarily operated by creating and enforcing social rules designed to prevent harmful actions in a wide range of domains, including marriage and family affairs, grazing patterns and land use, and security and crime (Bates 2004). Councils of elders generally operated within clans or sub-tribes, but in the case of disputes that crossed sub-tribal lines, councils that incorporated elders from multiple clans or sub-tribes could be convened. In the case of violations of social rules, elders would hear the complaints of the parties to a dispute, make a decision of guilt, and assign a punishment; all of these steps are carried out by consensus of all of the elders of the most senior living age sets (Jacobs 1965; Lambert 1956). Punishments were typically in the form of fines (either monetary or in livestock) and are roughly proportional the nature of the infraction. Minor incidents such as one-time violations of grazing rules or small brawls were usually punished with a small fine of a few goats; major instances of theft or violence were typically punished with fines of substantial numbers of goats and cattle.

Despite the underlying institutional similarities and existing patterns of interaction between the various communities living in Laikipia during the pre-colonial period, British colonial policy in this region (and in the colony more generally) largely focused on drawing clear social boundaries between "tribes"

and then assigning those tribes to live in specific territories. As discussed in the description of the evolution of the institution of chiefs, this policy was created as a result of the alienation of African lands to settlers in the White Highlands. Implementing this policy in Laikipia meant that the British created and codified social and territorial boundaries in a social system that had previously been marked by substantial fluidity and permeability. In practice, this meant distinguishing between Kikuyu farmers, who were to be moved to reserves in Central province, cattle-herding Maasai communities, who were to be moved to reserves in southern Kenya, and hunting/foraging Dorobo communities, who were to stay in the Mukogodo native area (Bates 2005). As a result of the gap between this policy and social reality in Laikipia, a considerable amount of correspondence within the Provincial Administration regarding the Mukogodo area focused on distinguishing which of the five major communities living in the region were "true Dorobo", and which were Maasai or Kikuyu invaders who needed to be forcibly moved to other areas (Bates 2005; Hughes 2006; Tignor 1971).

Despite the institutional similarities in kinship and age-sets between the Maa-speakers and Kikuyus at the onset of colonial rule, differences in the dynamics of the economic activities practiced on each community's native reserves contributed to divergent trajectories in the transformation of these community governance institutions that started during the later colonial period and persisted after Kenya's independence. In the Mukogodo native reserve, the dominant livelihoods were hunting and livestock herding. Moreover, although the British had moved the Maasai that had been living in Laikipia to Narok in

1912, many of these families attempted to return to the Mukogodo reserve, by migrating back with their cattle and in many cases by marrying their sons to daughters of members of the five Maa-speaking communities that were allowed to continue living in the reserve (Bates 1984; Hughes 2006; Tignor 1971). This led these communities to assimilate into Maasai clans and lineages and to rapidly transition to pastoralism or a mix of pastoralism, hunting, and bee-keeping (L. Cronk 2002, 2004). The mobility permitted by pastoralism and these other livelihood strategies, combined with the reserve's proximity to less populated frontier areas, contributed to the maintenance and continued importance of kinship and age-set institutions by allowing families and clans to move away from the area, either in search of pasture outside of the native reserve, or to get away from the state, ranchers, and missionaries.

The mobility that persisted in the Maa speaking communities throughout the colonial period maintained the incentive for families to maintain large kinship networks and age-sets for the purposes of coordinating migrations and spreading cattle herds among multiple extended family members to reduce risks of losing cattle to drought and disease. Despite pressure from missionaries and the colonial and post-colonial governments, polygamy, bridewealth, and circumcision rituals for both boys and girls have continued until present, which in turn has contributed to the continued importance of the councils of elders in governance. Interviews and participant observation in contemporary Laikipia North revealed that the authority of the elders within a given community is modeled closely after the authority of fathers within families. In their role in adjudicating land-use disputes and prevents theft and violence, the council of

elders in Maa-speaking communities draw directly on practices legible as "household management" including deciding where cattle will be grazed, arbitrating quarrels between rowdy youths, and maintaining order within the homestead. Moreover, the domestic authority roles of elders shape and reinforce the effect of fines and other punishments at their disposal. Because each elder has many sons and daughters by each of their several wives, they are at the center of local marriage markets. As a result, being in their good graces is crucial for ensuring a marriage within the community. The primary social networks that connect individuals throughout the Laikipia Maasai community and the governance practices that constitute elders' authority are mutually reinforcing.

Despite the variety of roles that kinship and age-set institutions continue to play with respect to collective action and harm prevention in Laikipia's Maasai communities, their direct role in providing and maintaining public sanitation was limited at the time of the qualitative research in 2007. As with group ranches, part of the reason for this gap is a mismatch between the institutions and the public waste problems. Whereas kinship and age-set institutions connect individuals who may be spatially dispersed and mobile, public waste problems are territorially concentrated and are the direct by-product of dense population settlements. However, given that the Maa-speaking communities in Laikipia North have increasingly started to settle into semi-permanent homesteads, some interviewees indicated that individual elders do create and enforce rules pertain to waste management within their individual homesteads. Although there were no reported cases of a whole council of elders creating and enforcing such rules in 2007, the cases of individual elders creating rules regarding trash in their home

shows how elders could create and enforce a broader system of litter prevention.

In contrast, in Kikuyu communities, the prevalence of high population density, increased value of land, and relative lack of easy "escape routes" for cattle grazing created pressures for elders that controlled land resources to reduce exchange and intermarriage with members of their community who lacked land resources (Bates 2005). In addition to contributing to the land crisis and political conflict that provided the impetus for the Mau Mau rebellion in Kikuyu communities, this had the impact of creating incentives for elders leading landholding lineages to reduce the size of their kinship networks and engage in fewer polygamous marriages (Bates 2005). These economic pressures coincided with a higher density of Christian missionary activity and education in Kikuyu reserves, which in turn lead to the spread of norms against polygamy and public initiation rituals for men and women (Lonsdale 1999; Mbito and Malia 2009; Sandgren 1982, 1989). By the time that Kikuyu families started to move from reserves in Central province into Laikipia after independence, massive transformations in kinship and age-set institutions had already started to take place.

Despite the pressures placed on Kikuyu kinship and age-grade institutions during the colonial and post-colonial periods, these institutions have not disappeared completely in contemporary Laikipia, but rather have persisted in altered forms. Although Kikuyus have the lowest reported polygamy rates among Kenya's ethnic groups, individuals still use the lineage group and extended family networks created through marriage as a primary resource for organizing social, economic, and political activity (Adams and E. Mburugu 1994;

Clark 1980; Coast 2006; L. Cronk 1991; Lee Cronk 1990; E. K. Mburugu and Adams 2004). Similarly, although the circumcision and initiation rituals practiced before colonialism have largely disappeared, ethnographic evidence indicates that circumcision of both men and women continues in many Kikuyu communities(Ahlberg et al. 2004; Mbito and Malia 2009). In both of these cases, both men and women continue to see the practice as essential to the transition adulthood and place substantial social pressure on young men and women who do not wish to participate (Ahlberg et al. 2004).

The de facto persistence of these aspects of the kinship and age-set institutions contributes to the continued importance of elders in village life, even as the more intensive governance roles of councils of elders has waned along with the decreases in polygamy and initiation rituals. In Kikuyu communities, the role of elders has fused more fully with the provincial administration, with the legitimacy of the elders bolstering support for chiefs harm prevention activities, and conversely allowing elders to resolve some local disputes and engage in the maintenance of local order with the implicit support of the government (L. Cronk 2002, 2004). Although there are reports of individual Kikuyu elders occasionally motivating clean-ups and punishing littering, there were no instances of coherent attempts by these leaders to maintain public sanitation infrastructure, either with or without the support of the local chief.

3.2.6 Civil Society- CBOs and NGOs

Civil society organizations and the associated networks are a second set of community institutions that influence public goods maintenance in Laikipia. In this context, civil society organizations can be defined broadly as voluntary

organizations that are constituted outside the state and the family, but which act in the public sphere (J. C. Ng'ethe 1993). The voluntary aspect of membership in civil society organizations is what distinguishes civil society organizations and networks from community governance institutions based around kinship and age-sets. As discussed above, individuals become members of a clan or an age-set automatically at birth or by reaching the prescribed age. While individuals can actively distance themselves from their clan or can forego age-set initiation, the result is often being completely disconnected from their community and associated sources of social interaction and support.

In contrast, scholars of citizenship argue that participation in civil society organizations is based on a liberal conception of citizenship, which "bestows on a person the status of a citizen as an individual member of the modern state" (Ndegwa 1993; N. Ng'ethe and Kanyinga 1992). This liberal conceptualization of civil society also undergirds the theoretical linkage between voluntary associations, social capital, and the quality of democratic governance (Fukuyama 2000). That is, if participation in civil society organizations is grounded in free association between equal individuals, then participation in such organizations should be expected to create networks and norms that encourage individuals to engage in the types of collective action necessary to provide public goods themselves and to hold politicians accountable (Portes 1998; Putnam, Leonardi, and Nanetti 1994). Since the late 1980s, these theoretical arguments have been highly influential among international development agencies, which have increasingly channeled development aid to civil society organizations to both support the direct implementation of development projects, as well as to support

the forms of associational life believed to be necessary to support robust democratic politics (Woolcock and Narayan 2000).

Research and practice related to civil society organizations typically distinguishes between two types of organization: Community Based Organizations (CBOs) and and Nongovernmental Organizations (NGOs). These two types of organization differ with respect to the relationship between the members of the group and the intended beneficiaries of that group's collective action. In CBOs, members are drawn from the same geographically constrained locality, such as a neighborhood in an urban area or a village in a rural area. A CBO's activities may benefit only the group's members or may produce public goods for all members of their locality, regardless of whether they are group members (Gugerty and Kremer 2008).

This conceptualization of CBOs as civil society organizations based in a single locality is reflected in legal practice; they are registered under the Ministry of Youth Affairs and legally can only operate within one location. Although the dispersed nature of CBOs makes it difficult to collect aggregate data on them, one World Bank Study estimates that over 200,000 CBOs operate in rural Kenya (Woolcock and Narayan 2000). Kenyan CBOs are closely tied to the concept of Harambee that was popularized during the Kenyatta administration, in which communities came together to fund local public works projects, usually with substantial personal contributions from local MPs and councilors (Barkan and Holmquist 1986; Mbithi and Rasmusson 1977; Thomas 1987; Widner 1993). As such, many CBOs are organized around providing and maintaining specific local public goods, such as water projects, schools, health clinics, and solid waste

management (Barkan and Holmquist 1986; Molyneux et al. 2007; Rotich, Yongsheng, and Jun 2006; Were, Roy, and Swallow 2008). Other CBOs are framed more explicitly as "self-help groups" for specific subsets of the population, most notably women and youth. Women's and youth groups typically provide private and club goods, such as access to revenue from income generating activities or access to insurance, credit, or savings, but also are active in providing or contributing to the maintenance of local public goods (Brennan and Lomasky 1983; J. Davis 2005; Fiorito and Kollintzas 2004; Musgrave 1987).

In contrast, the activities of NGOs are meant to primarily benefit individuals who are not members of the group (N. Ng'ethe and Kanyinga 1992). This way of defining NGOs encompasses both international NGOs such as CARE and Oxfam, and national and local NGOs in which citizens volunteer to provide public and private goods for members their country or community. Despite the differences between international and local NGOs, both of these types of organizations are distinct from CBOs, in which there is a far greater overlap between the group's members and its beneficiaries. As with CBOs, the legal framework governing NGOs fits this this conceptualization: NGOs are registered nationally and may operate anywhere in the country.

Although NGOs in Kenya have their roots in the charitable and religious organizations that were founded by missionaries throughout the colonial period, NGO activity in the country was relatively limited throughout the first two decades following independence. However, as noted above, in the 1980s, the international community started to express increased interest in using NGOs as mechanism for delivering aid and supporting service delivery in developing

countries (Hornsby 2012). As a result, a number of international NGOs started to open offices in Kenya, and a variety of donors started to offer funding to Kenyan NGOs. As a result of these trends, the number of registered NGOs jumped from around 120 in the early 1970s to over 400 by 1988 (J. C. Ng'ethe 1993). Although the wave NGOs that appeared in the 1980s largely focused on service delivery, by the early 1990s, donors started to fund a variety of governance and human rights NGOs, to help support the ongoing transition to multi-party politics (Ndegwa 1993; N. Ng'ethe and Kanyinga 1992). By the late 1990s, there were over 1,000 registered NGOs in Kenya, giving the country the highest concentration of NGOs in sub-Saharan Africa (Hornsby 2012; Rees 2000). Although many of these NGOs continued to play important service delivery and advocacy roles throughout this period, many other NGOs served to further the personal enrichment or political careers of their founders (Hornsby 2012).

Both of these forms of civil society organization are present in Laikipia and are involved in a wide variety of public goods provision and maintenance in the region. Most rural villages in the area have at least one each of a women's group, a one youth group, and a church, and there are also a variety of CBOs focusing on water, the environment, health, and sports and leisure, which often cover several villages, using a small shopping center as their base of operations. These CBOs largely are funded through voluntary contributions by their members, and many engage in a variety of small scale economic activities to generate revenues for their members and to cover the cost of their activities. There are also a variety of NGOs working in Laikipia, most of which have their offices in the major towns in the region, most notably Nanyuki, Rumuruti, and Nyahururu. Some of these

NGOs are local branches of international and national NGOs, including WorldVision, Caritas, the Kenya Red Cross, and the African Wildlife Foundation.

Many other NGOs operating in the region were founded by educated men and women from the Maa-speaking communities in Laikipia North. Although these local NGOs work on a array of areas ranging from public health, to conflict resolution, to gender issues, most are also deeply involved in the politics of reclaiming the traditional land rights of the communities living in Laikipia North. By framing their activities in this way, these NGOs have succeeded in linking up with the international movement supporting the rights of indigenous peoples, and have been successful in securing funding for their activities from a variety of donors involved in this movement (Carrier 2011; Hodgson 2002; Igoe 2006). These NGO have advanced a variety of legal challenges in national courts and UN bodies demanding that the substantial properties that were alienated to European ranchers be redistributed to the communities living in the comparatively small group ranches on the territory of the former Mukogodo Native Area. Although many of the organizations use the term "Laikipia Maasai" to make the claim that they are the decedents of the broad set of indigenous communities who lived in the region before the colonial period, the leadership of each of these NGOs are usually made up of individuals from only one or two of five communities living in Laikipia North. As a result, there is a fair amount of competition between these NGOs about which organizations truly represent indigenous communities and leaders splitting off from existing groups to start their own group. As part of this dynamic of competition, members of the Mukogodo community have started NGOs based around Yaaku ethnicity in order

to stake an even stronger claim as the indigenous residents of the region vis-a-vis the other communities (Carrier 2011). Moreover, many of the leaders of these Laikipia North NGOs are deeply involved in politics in the region, either directly as candidates for MP and councilor, or by indirectly brokering support for other candidates.

Given these political activities of these NGOs and the fact that most of these organizations are based in Nanyuki, rather than in Laikipia, many community members express a substantial amount of cynicism about these organizations and express that they do not know what the organizations do for their community. Fitting with this impression, there was little evidence of any of the Laikipia North NGOs being involved in providing or maintaining public waste management infrastructure. In contrast, the interviews and participant observation did reveal that many CBOs, religious groups, and national/international NGOs were occasionally involved in public waste management by organizing cleanups of the commercial centers where they were based. In addition, two different CBOs in the region were involved in recycling plastic waste- one was a women's group that made craft products out of used plastics bag, and the other was a group of men that used simple manufacturing processes to make fence posts and roofing tiles out of used plastics. In most of these cases, this involvement in managing solid waste was on an ad hoc basis, with no regular schedule for clean-ups, limited investment in waste management infrastructure such as trash cans or storage pits, and no explicit actions taken to prevent or punish littering or improper dumping.

3.2.7 Ranchers and Researchers

Networks of white ranch owners and the NGOs and research centers associated with those ranchers comprise a distinct set of community institutions that play an important role with respect to public goods maintenance in Laikipia. Although these institutions are in many ways formally similar to the group ranches and civil society organizations discussed above, they play a distinct set of roles with respect to maintaining public goods in the region due to their basis in colonial land alienation policies and their subsequent connection ongoing political disputes over land in the region.

As noted above, Laikipia was one of the largest areas of European settlement during the colonial period, with most of the private land in the region allocated to large cattle ranches and a relatively smaller proportion of the land devoted to the kind of smaller mixed farming that was more common in the rest of the White Highlands (Morgan 1963). At independence, most of the European farmers in the highlands opted to leave the country and sell their property to the government (Jones 1965). The Kenyatta government then allocated the land to its supporters, with large tracts of land going to key politicians aligned to Kenyatta, and other farms subdivided and allocated as smaller plots to Kikuyu peasants relocating from the reserves through the government's settlement schemes. Although some of Laikipia's colonial settlers followed the same pattern as their counterparts in the other parts of the White Highlands, a critical mass of European landowners in the region opted to stay in the country at independence. As a result, although there were several large settlement schemes in the southern and western parts of Laikipia, in 1979, 72% of the district's registered land area was still held by white ranchers, primarily on ranches over 4000 hectares

(Graham 2007; Thouless and Sakwa 1995; Wales and Chabri 1979). Moreover, 65% of the remaining registered land in Laikipia at that time was held on 12 large ranches that were owned by African Kenyans (Wales and Chabri 1979).

Throughout the 1970s and 1980s, the ranches in Laikipia largely continued to focus on commercial livestock production. However, by the late 1980s, many ranches in the area started to shift into conservation ecotourism in response to a variety of factors, including low global beef prices, increased tourist traffic to Kenya, and global intellectual currents supporting viability of ecosystem services approaches to wildlife conservation outside of national parks (DePuy 2011; Georgiadis 2011). To support this transition, Laikipia's ranchers founded the Laikipia Wildlife Foundation (LWF) in 1991 as a nonprofit company that was designed to help manage and coordinate conservation and ecotourism activities between the region's private ranches and group ranches (DePuy 2011; Georgiadis 2011; Sortland 2009). Over the past 20 years, these efforts have been successful, both in terms of leading to increases in wildlife density throughout the region, as well as in turning the region into Kenya's largest destination for wildlife tourism outside of the major national parks (Georgiadis 2011). As discussed above, many of the group ranches in the region became interested in emulating the private ranchers' successful shift from livestock raising to conservation ecotourism and many forged partnerships with the private ranches and/or the LWF to start their own community-run ecotourism enterprises (Sumba et al. 2007; Yurco 2011).

Concurrent with this shift into wildlife conservation, Laikipia also became a major site for research on ecology and natural resources management. The hub of this researcher-rancher nexus is the Mpala Research Trust (MRT) and Mpala

Research Center (MRC), a non-profit research organization that is based on the private Mpala Ranch. MRT was founded in 1991 by a consortium of American and Kenyan institutions including Princeton University, the Smithsonian Institution, the National Museums of Kenya, and the Kenya Wildlife Service. Since that time, it has emerged as the one of the world's leading ecological research centers, attracting top professors, grad-students, and post-doctoral researchers through its combination of state-of the art facilities and access to Laikipia's unique diversity of wildlife species (DePuy 2011; Yurco 2011).

The shift of ranchers into wildlife conservation, ecotourism, and research has been contested by many of the Laikipia North NGOs claiming to represent the communities living in the region. They portray the LWF and MRT as narrowly representing the interests of white ranchers and of using community conservation partnerships as window dressing to avoid the deeper issue of inequitable land distribution in the region (Bates 1984; Hughes 2006; Tignor 1971). Ranchers have pushed back on by changing the terms of the debate, arguing that Maasai cattle herding practices lead to overgrazing and land degradation and threaten wildlife and livelihoods in the area, and that the techniques and practices developed at Mpala and the other private ranches have the strongest potential to allow for sustainable rangeland management in the region(DePuy 2011). Although this discourse positions the rancher community as the most effective stewards of the environment, both the individual ranches and the LWF also frame themselves as partners in development and poverty reduction for all residents of Laikipia (DePuy 2011; Sortland 2009).

In addition to partnering with group ranches to create and operate

community conservancies and ecotourism enterprises, the rancher community contributes to the provision and maintenance of a variety of local public goods in the region, including schools, health clinics, water resources, and roads. Although the LWF is directly involved in funding some large construction and infrastructure projects (such as a community museum on Kuri Kuri group ranch), most public goods maintenance activities by ranchers takes the form of an individual ranch funding projects or mobilizing collective action in the community or communities closest to their property.

Following this model, the rancher community has also been involved in solid waste management in the centers located next to them. Many of the private ranches in the region have organized provided public trash cans for the shopping centers closest to them, and others have organized clean-up days and have considered hiring a community member to clean the center on a regular basis. However, many of the ranchers that I interviewed expressed skepticism about the effectiveness and sustainability of these efforts, reporting that their interventions had little to no effect on the waste management behavior of the community members and that the trash cans that they had donated were often stolen for household use or damaged through carelessness or misuse. As a result, several of ranchers that I spoke to expressed reluctance to make any further contributions to waste management infrastructure in neighboring communities, and instead were focusing their trash-related efforts on recycling the waste streams produced from their tourist lodges.

3.3 Conclusion: Interpretation of Results

To what extent is this qualitative analysis of institutions and solid waste

management in Laikipia consistent with the predictions of the theory of public goods maintenance developed above? To help answer this question, it is useful to array each of the institutions involved in local public goods maintenance in Laikipia according to the two key conceptual distinctions that I introduced in chapter 2 above: whether institutions are operated by community members or by the state, and whether institutions primarily contribute to public goods maintenance by ensuring that the public good is provided over time, by preventing actions that harm the public good, or both (Figure 3.1). In addition to placing each of the institutions on these two axes, I also briefly summarize the findings with respect to that institution's de jure and de facto roles related to maintaining solid waste management.

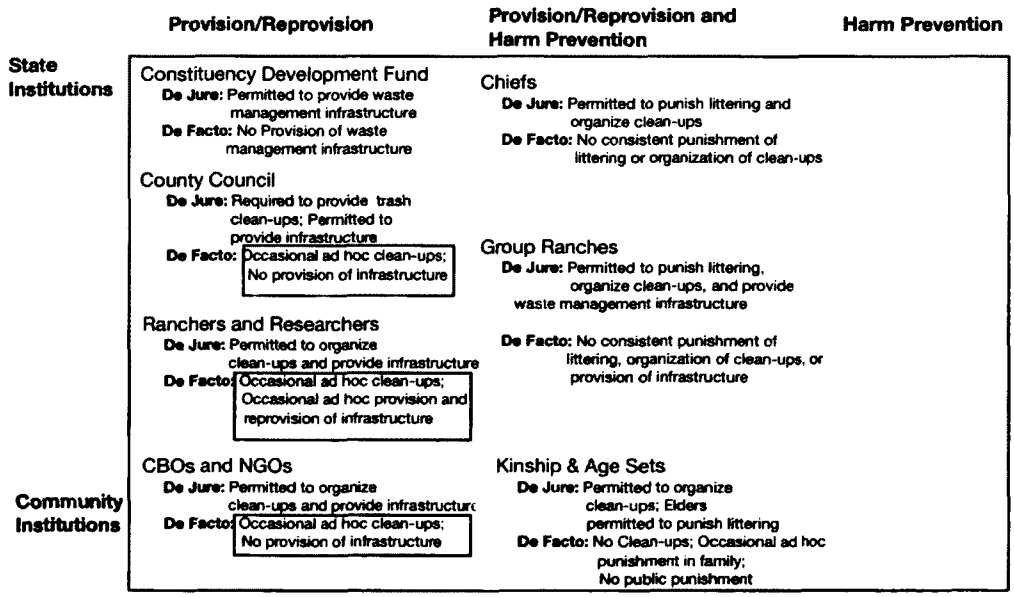

Figure 3.1: Institutions, Public Goods Maintenance, and Solid Waste Management in Laikipia

Synthesizing the qualitative analysis in this way provides initial leverage regarding some of the key observable implications of the theory of public goods maintenance that I developed above. For instance, the prediction of Hypothesis 1 is that for semi-rival local public goods, simply providing those public goods is not sufficient to ensure their availability over time. The qualitative findings presented above provide tentative support for this hypothesis. Although residents of rural Laikipia told me numerous anecdotes in which solid waste management had been provided through a clean-up or the provision of public trash cans, none of the centers were clean or had trash cans during any of my visits.

Although it is possible that interviewees overstated the presence of clean-up activities in order to impress me, I did observe several clean-ups and visited several other centers after they had been cleaned. However, in all of these centers, I found that when I returned several weeks later, trash had re-accumulated, reaching levels similar to the previous status quo. For at least this subset of commercial centers, the accumulation of public waste is not due to an inability of the government or community to provide that public good. Rather, the problem in this subset of the cases was an inability to maintain the level of cleanliness that followed form a clean-up effort.

The qualitative evidence reported above also provides tentative support for Hypothesis 3, which predicts that the dynamic provision and harm prevention problems can be solved either by one institution or can be co-produced by multiple institutions, and that this mix of institutions can vary between localities.

Even though the qualitative discussion was not explicitly framed as an inter-locality comparison, the sheer diversity and complexity of the institutions that I encountered and engaged with in Laikipia supports my theory over the predictions of theories that frame public goods in terms as the result of the effectiveness of only government institutions or only community institutions.

With respect to solid waste management, a wide array of government and community institutions are either explicitly mandated or implicitly permitted to organize regular clean-ups or to punish littering. Moreover, the evidence does not support the alternative explanation that if any of these institutions were actually effective in maintaining public goods, then the observed institutional diversity would be much lower. Although the qualitative fieldwork did reveal multiple instances of community and government institutions failing to provide public goods, it also revealed numerous instances in which public goods were provided, either by one institution acting alone, or through joint or concurrent action by multiple institutions.

Although the consistency between the findings of the qualitative fieldwork and several of the hypotheses developed in chapter 2 provides preliminary support for my theory of public goods maintenance, several aspects of this evidence makes it difficult to test all of the hypotheses necessary to assess the viability of the theory. In particular, Hypotheses 1 and 3 are primarily descriptive, which made it possible to find support for these two hypotheses using the qualitative evidence. In contrast, Hypotheses 2 and 4 make predictions about the causal relationship between institutions and public goods. Hypothesis 2 predicts that to maintain a semi-rival local public good over time, it is necessary

for to solve both the dynamic provision and harmful action problems. Hypothesis 4 predicts that a normative mismatch between multiple institutions maintaining a semi-rival local public good can reduce the effectiveness of all of the institutions, leading to the persistence or reemergence of public goods maintenance problems.

While a variety of different types of qualitative research design and evidence can provide the leverage necessary to make this kind of inference through careful case selection or process tracing, the specific patterns associated with institutions and waste management outcomes in Laikipia make this kind of inference difficult. In particular, Figure 3.2 shows that although the qualitative fieldwork uncovered some variation in both the nature of local institutions and in public goods maintenance outcomes, there is not enough variation on either the independent or dependent variables in order to test Hypotheses 2 and 4. That is, in my initial fieldwork in Laikipia, it was not possible to find cases where public goods were maintained in a stable way over time, regardless of the multiple institutional configurations that could potentially lead to that outcome. This due to the fact that the qualitative evidence did not show evidence of state or community institutions actually punishing or preventing littering behavior. Given that the theory predicts that sustained, stable maintenance is impossible without at least one institution actually performing this function, it is actually impossible to test the hypotheses derived from this component of the theory using qualitative data from Laikipia if that modality does not exist in any form in the region.

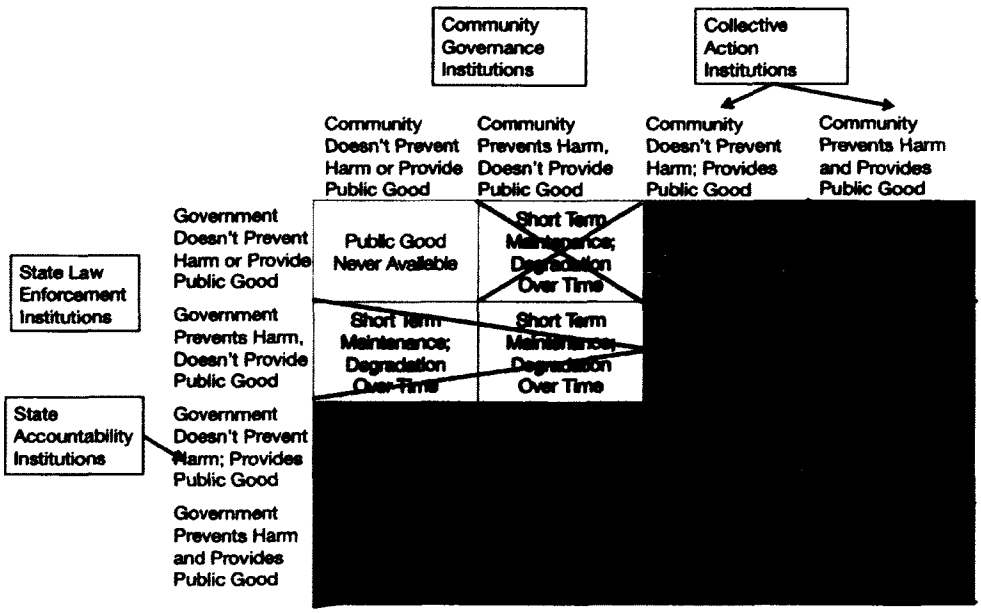

Figure3.2: Qualitative Patterns of Institutions and Waste Management Outcomes in Laikipia

Moreover, the inferential challenge presented by the patterns in Figure 3.2 would persist even if it were possible to collect a dataset of institutions and public goods outcomes for the entire Laikipia region. Even if this type of data might allow for more precise measurement of both institutions and public goods maintenance outcomes, this type of measurement would not solve the potential selection bias in the actual clusters of institutions that exist in villages in Laikipia that is revealed by the qualitative data. Put differently, better measurement would not help to solve the underlying problem that a substantial range of the

variation on the independent variable is not observed in reality. While this type of selection bias is a challenge for any kind of comparative institutional analysis, the lack of any institutions make it impossible to even start to engage in comparative analysis designed to assess the impact of institutions on public goods maintenance outcomes (Besley 2006; Persson and Tabellini 2005; Przeworski 1999, 2000).

Even though the qualitative evidence did provide initial support for Hypothesis 1 and Hypothesis 3, the nature of the qualitative evidence also limits the strength of those inferences as well. This is due to the fact that the theory of public goods maintenance and all of the hypotheses derived from it are intrinsically focused on time- it is only possible to assess whether as public good is maintained by observing it over time. In contrast, the qualitative evidence only gathered data on public goods outcomes at one point in time, which limits the ability to actually assess maintenance outcomes. This is the reason that some of the stronger qualitative inferences came from repeated visits to centers that had been cleaned. The leverage provided by that type of observation reveals that stronger inferences about the effect of institutions on public goods maintenance outcomes requires measurement of both public waste levels and littering behavior over time.

In conclusion, conducting an in-depth, long-term qualitative study of institutions, public goods maintenance, and solid waste management in Laikipia both supports the basic premises of the theory of public goods maintenance, but also raises new puzzles and questions about the most effective way to solve this particular public goods maintenance problem in this particular context. In

particular, this analysis shows that although there is a rich diversity of institutions that can and do solve both dimensions of the maintenance problem for a variety of local public goods, recurring public trash clean-ups by any actor were rare and consistent punishing of littering was non-existent. From a practical perspective, this finding indicates that public waste management is not an intractable problem and creates the motivation to draw on Laikipia's institutional diversity to attempt to develop a solution. From an empirical perspective, the lack of naturally occurring variation in institutional arrangements that govern solid waste management create the motivation to attempt to create and evaluate localized institutional variation through a randomized field experiment. In the next chapter, I will describe how these practical concerns motivated me to found the SAFI Project as an NGO focused on providing and maintaining solid waste management in Laikipia, just as the social scientific concerns motivated me to implement the project as a randomized field experiment that was designed to test the implications of the theory of public goods maintenance.

Chapter 4: The SAFI Project: Experiment Design, Implementation, and Results

4.1 Introduction

In the previous chapters, I motivated and developed a new theoretical approach to local public goods maintenance and demonstrated the initial plausibility of this theory by presenting results from a qualitative analysis of the diverse institutional landscape shaping public goods maintenance in Laikipia, Kenya. One of the key findings of the qualitative analysis is that although there is a rich array of government and community institutions that maintain a variety of local public goods throughout rural Laikipia, none of them were actively engaged in maintaining solid waste management services or infrastructure. As discussed above, the question of what combination of institutions could be effective maintaining solid waste management over time in rural Laikipia presented struck me as both a compelling policy problem and an intellectual puzzle. Put differently, because I was a political scientist who was in Laikipia to conduct fieldwork, I was deeply puzzled by the failure of any institutions in Laikipia to solve the waste management problem, but as an individual who had been living and working in the region for over a year, I became increasingly interested in simply taking action to solve the problem for its own sake.

The convergence of these motivations led me to found the SAFI Project- a new civil society organization focused on waste management- and also led me to design SAFI's initial program implementation as a randomized field experiment that could test the hypotheses derived from my theory of local public goods maintenance. In this chapter, I describe the context, design, and

implementation of the SAFI Project Field Experiment and present the empirical analysis of the effect of the three different institutional arrangements deployed in the experiment on levels of public waste and the frequency of littering behavior.

In the first section, I describe in detail how the findings of the qualitative analysis reported in chapter 3 shaped the organizational structure of the SAFI Project and the design of the organization's anti-littering field experiment. I start by describing how my relationship with a group of educated youth and a broader constellation of civil society groups served as the impetus to create a new organization focused on sanitation in Laikipia and how we drew on existing efforts to provide solid waste management and other public goods to design the new organization's core set of activities.

I then describe the decision to utilize the SAFI project as the basis for a randomized field experiment and the process of designing the three treatment groups, which built on the existing institutional diversity related to public goods maintenance in Laikipia to test several of the key observational implications of the theory of public goods maintenance developed in chapter 2. In particular, I describe the decision to create three experimental variations of the SAFI Project program: one in which the SAFI project mobilized a clean-up and encouraged community-based organizations to continue to organize local clean-ups, one in which mobilization was supplemented by an anti-littering rule enforced by the local chief, and one in which mobilization was supplemented by an anti-littering rule enforced by the local council of elders. I then go on to describe the core elements of the design and implementation of this field experiment, focusing on the sample selection and randomization protocols and the methods used to

collect data on the two key outcome variables- the amount of public waste on the ground and and the frequency of littering behavior.

In the second section of this chapter, I describe and analyze the data from the SAFI Project experiment. I start by presenting the basic descriptive statistics, as well as graphs that provide an overview of the impact of the implementation of the three treatments on both the cross-sectional and time-series patterns of public waste and littering behavior. I then present the results of a set of analyses, starting with very simple cross-sectional analyses and then gradually adding more aspects of the time-series element of the dataset.

The finding of these analyses are that although the simple cross-sectional and before-after analysis do not reveal any significant differences between the treatment groups, I find that significant differences between the elders, state, and civil society groups do emerge when the "After Treatment" period is partitioned into three 32 week blocks. In particular, this analysis yields two significant results: 1) the two treatment groups that incorporate punishment for littering lead to immediate reductions in public waste, in contrast to more gradual reductions in the group in which there is no punishment for littering, and 2) although all three treatments lead to a short-term reduction in littering behavior, this is maintained in the long-term in only in the group in which there is no punishment for littering behavior, but not in the other two treatment groups. I conclude by discussing the more general methodological, theoretical, and policy implications of this set of results and by using these findings as the starting point to motivate the individual-level analysis that I undertake in chapter 5.

4.2 The SAFI Project: Institutional Design Meets Experiment Design

4.2.1 Creating a Waste Management Program

The widespread nature of the public waste problem, the implications of sanitation for poverty reduction, and the lack of sustained efforts to address public waste and littering all provided a perfect opportunity for a randomized evaluation of the effect of institutions on public goods maintenance. The standard arrangement in most development field experiments is for researchers to partner with an organization that is planning a specific intervention. In this arrangement, the researcher helps to design different versions of an intervention, which usually correspond to hypotheses they are investigating. The NGO, donor agency, or government agency then implements the protocol and may help the research collect data on the performance of the interventions, as well as data in a set of non-implementation units that can serve as the treatment group. The researcher then analyzes the data using statistical and econometric methods to estimate causal effects, producing both formal research papers as well as policy briefs and operational advice for the partner organization.

Although the lack of focused NGO and government initiatives providing sanitation and preventing litter in Laikipia provided part of the initial motivation for the field experiment, this also meant that there was a conspicuous lack of viable partners with whom to implement a large scale randomized evaluation. Although I pursued partnerships with civil society groups and government agencies working in areas of public health and environmental conservation, I

determined that the best option in this context was to create from scratch the organization that would implement the treatments and collect data. Although creating a grassroots development organization posed significant challenges in terms of start-up costs and logistics, there were several advantages. In particular, by being a self-contained project, the field experiment could be placed at the heart of the fledgling organization's mission and prerogatives, rather than competing with other types of organizational or political concerns.

Creating an organization to implement the anti-public waste field experiment was a viable option in large part because I had developed a broad-based network of young men and women in villages throughout the Laikipia region during two prior long-term stints of fieldwork in the region. In general, this network of approximately 80 young Kenyans were educated, interested and experienced in community development work and research, and unemployed. Starting in May 2007, I started working with this network to brainstorm options for what kind of organizational form would be necessary to address public waste problems, to identify how different theories could be operationalized as treatment groups, and to develop a system whereby data measuring outcomes could be effectively collected and managed. The end result of these initial brainstorming sessions was the SAFI Project Community Waste Management Program. SAFI stands for Sanitation Activities Fostering Infrastructure; the word also means clean in Swahili, succinctly summing up the overall aim of the project.

There are four interrelated components of the SAFI Project Community Waste Management Program: **Mobilization**, **Education**, **Waste Disposal Infrastructure**, and **Local Capacity Building**. These components were

identified in consultation SAFI project volunteers, local leaders, government officials, and a variety of experts from the NGO sector as being the bare minimum components of a successful grassroots waste management program.

Large-scale public mobilization and collective action were consistently identified as being crucial components in ensuring the success of the prospective community waste management program. To this end, each project implementation included two large-scale public events that aimed to mobilize the entire community surrounding the village where the implementation was based. The first major mobilization event was a large planning meeting introducing the project and stimulating discussion about trash. The purpose of this meeting was to make community attitudes and preferences regarding the public waste problem and the SAFI project implementation common knowledge within in the area around the village. This meeting was also the forum for identifying the community members who would serve as the volunteer committee that would manage the town's waste disposal program. The second major public mobilization that was part of the project program was a community cleanup day, which featured music, theater, and other entertainment, leading up to a joint effort by the whole community to clean the area in and around the center of the village. The obvious role of this day was to help clean the village, so that the village's waste management program would be starting operation with a relatively clean area. However, the clean-up day also served to show everyone in the community that everyone else was also committed to contributing time and effort to cleaning the village, with the aim of providing a focal point to facilitate coordination around the continued provision of the public good of sanitation.

A wide number of smaller public educational activities complemented these mass mobilizations, including visits to homes, schools, and shops in the village center, as well as small group discussion sessions with specific segments of society (women, youth, elders). All of these educational activities were undertaken in conjunction with civil society groups based in the town, such as local nongovernmental organizations, churches, and community self-help groups. Two main topics were covered in SAFI Project education sessions: the negative effects of litter and the importance of the environment and conservation. This core curriculum was developed in conjunction with local and national environmental and public health organizations from both the government and civil society and was led by trained SAFI Project coordinators. Education sessions were organized as participatory discussions with groups of community members and were tailored towards the specific goals, needs, and missions of each community group.

The two main components of the physical waste management infrastructure in each village were public trash cans and trash pits. As noted above, the status quo in all villages in the project area was to have no public trash cans and no more than 2 or 3 private trash bins that were used publicly. Given the relatively small size of each village, it was determined that 10 trash cans (which were made out of halves of oil drums), along with 5 trash pits would be a sufficient improvement above the status quo to make proper waste disposal considerably more convenient for individuals in the village center. The SAFI Project covered the cost of bins and mobilized volunteer labor to dig the pits.

Currently, the trash pits serve two roles in the waste management system- trash storage when trash cans are full and as burn pits for disposing of waste. Eventually, these pits will be divided into organic waste (which will be composted), inorganic recyclables (plastics and metals), and non-recyclable items.

The final component of the SAFI Project Waste Management program was the creation of local capacity to continue the maintenance of the village-level public sanitation project. Thus, even though the SAFI project helped to motivate the provision of public goods by organizing meetings, holding information and education sessions, and providing free trash cans, the plan was to delegate responsibility for the ongoing maintenance of the community waste removal program to a village-level committee. At the town planning meeting each of the major civil society groups in the center and the surrounding community were asked to nominate 1-2 members of their organization to serve on the town trash committee. The responsibilities of the town trash committee are to organize semi-regular cleanups of the village, to empty the trash cans into the pits, to encourage the community living around the village to not litter, and to ensure that no one steals trash.

4.2.2 Treatment Groups: Institutional Design and Hypothesis Testing

The first treatment, the "Civil Society" group, creates a social setting in which horizontal enforcement institutions are activated through collective action to provide public sanitation, but in which vertical enforcement institutions are not explicitly activated to maintain this public good. Through the lens of the theory developed above, the mobilization, education, and capacity building

components of the SAFI Project Community Waste Management Program can be understood as attempting to activate, strengthen, and forge the kinds of horizontal social linkages that have been hypothesized to motivate public goods provision through common knowledge, coordination, and credible threats of social sanctions. The other theoretically relevant component of this program is that it has no explicit linkage to systems of third party enforcement by either the Provincial Administration or by customary leaders. If this treatment leads to both significant reductions in the amount of public waste on the ground in villages and reduced littering by residents of that village, the implication is that social sanctions are sufficient to motivate public goods provision and public bads prevention. If the treatment is effective only at reducing public waste, then the indication is that social sanctions alone are not capable of maintaining public goods.

The second treatment creates a situation in which vertical enforcement institutions are activated to prevent the public bad of littering, but in which these law enforcement institutions are not fully embedded in local networks. To do this, the program coordinators added an explicit rule against littering to the structure of the SAFI Project Community Waste Management Program and recruited agents of the Kenyan state to formally create and enforce that rule. Chapter 128 of the Laws of Kenya makes this treatment possible, by giving government chiefs authority to devise and enforce working rules over issues of local public order, including sanitation and environmental management. At the onset of the program rollout, none of the chiefs in the Laikipia region had exercised their authority to make rules regarding littering. This allowed the

research team to create a situation where villages assigned to the "Collective Action" treatment would have a waste disposal program, but no anti-littering rules, whereas villages assigned to the "State Enforcement" treatment would have a waste-disposal program and an anti-littering rule. When introducing this treatment program to the chief in a given village, the implementation coordinator asked that chief to use his authority under the Chief's Act to create and enforce an anti-littering rule. The punishment agreed upon by the implementation team was a day of labor on community projects for the first infraction and a fine of 500 shillings (approximately $3.00) for the second infraction. In addition, chiefs agreed that individuals caught stealing a trashcan would be fined three times the cost of the bin (approximately $30).

The final treatment group adds third-party enforcement by customary leaders to the waste management program and the anti-littering rules created by chiefs. Villages receiving this treatment have a full waste management program, as in the other two treatment groups, and a rule against littering created by the government chief, as in the "State Enforcement" group. However, this "Elders & State Enforcement" treatment is unique in that elders (*wazee)* from the community or communities surrounding the village have authority to enforce the anti-littering rule and punishments. If this treatment leads to greater reductions in public waste and littering relative to the other treatment groups, this indicates that it is important to supplement state enforcement with governance by community leaders to prevent public bads. If the effect of this treatment is minimal, then explanations that emphasize social sanctions and state enforcement carry more weight.

Like the State Enforcement treatment, this treatment was implemented with the permission and assistance of the local chief. When introducing the Elders & State Enforcement treatment to the chief, the coordinator asked the chief to create an anti-littering rule, and to delegate some of the authority to enforce that rule to the elders in the surrounding community. The coordinator then asked the chief to introduce him to the most important elders in each of the ethnic communities living in the area around the village, and to have them nominate a representative to serve on the village waste disposal committee alongside the representatives of the civil society groups based in the village. The coordinator then interviewed a selection of individuals living in and around the village to confirm that the elders identified by the chief in fact were active in dispute resolution and the enforcement of local norms. In villages in which there was only a single ethnic community, several elders from that community were selected to serve on the village committee. In multi-ethnic villages, one elder from each community was nominated to serve on the committee. In both homogenous and heterogeneous villages, chiefs granted the elders on the trash committee authority to enforce anti-littering rules using the same structure of fines as in the State Enforcement treatment group. In addition, it was agreed that cases that could not be resolved by elders would default back to the chief.

4.2.3 Training and Implementation

A number of steps were taken in order to ensure the consistent application of each of the waste management program components across villages. First, a team of coordinators was recruited and trained together. The implementation

team consisted of one head coordinator and four implementation coordinators, all of who were chosen from the broad network of interested volunteers who had been helping with the SAFI project since its inception. The head coordinator had a secondary degree and was in the process of obtaining a post-secondary degree in community development at the time of recruitment, all four implementation coordinators had secondary school degrees and previous experience either as a research assistant or working for a community development project. Coordinator training took place over a two-week period and consisted of a two-day seminar covering the aims of the research project and the design of the waste management program, and a practice implementation, in which all four coordinators and the head coordinator implemented the waste management project together in a town that was not included in the sample for the experiment.

The second method for ensuring consistency between project sites was to develop a clear, explicit implementation timeline that each coordinator could follow, clearly arranging the four broad types of program components discussed above into a two-week implementation schedule. The head coordinator and I decided that two weeks was the optimal amount of time to implement the waste disposal project in village, as it would allow the coordinator to ensure that each project component was implemented thoroughly, but also prevented the implementation from dragging out indefinitely. Each of the two weeks of the program were designed to lead up to the one of the two major public mobilizations; the village planning meeting was scheduled at the end of the first week of educational meetings and networking, and the community cleanup day was scheduled after the second week of small group meetings, door-to-door

visits, and village committee training sessions.

4.2.4 Units of Analysis and Random Assignment

The unit of analysis for the SAFI project experiment is the rural shopping center, known in common parlance in Kenya simply as a center or town center. As noted in chapter 2, these centers form the backbone for economic exchange in Laikipia, and throughout rural Kenya in general, and the bulk of public solid waste problems in rural Laikipia are localized in this kind of locality.

For the purpose of implementing the SAFI Project experiment, Laikipia was divided into six regions of six centers each, for a total sample of 36 centers. Three of these regions were located in Laikipia East District, two were in Laikipia West District, and one was located in Laikipia North District. The 36-center sample is not a random sample of all centers in the Laikipia region; centers were included in this sample based on considerations of accessibility, security, and size. Centers with fewer than three buildings in the central area were excluded, as were towns that supported a densely settled population of over 1000 individuals.From the sample of 36 villages, 6 villages were assigned to each of the three treatment groups, creating a total of 18 treatment villages and 18 control villages.

Practical considerations dictated that the project be rolled out over the course of six consecutive two-week periods separated by one week of break, creating a full implementation period of 18 weeks. The practical necessity of implementing the experimental waste management in only one region at a time created the opportunity to randomly assign clusters to roll-out periods, while simultaneously assigning villages within clusters to treatment or control groups.

Randomly assigning the timing of treatment rollout effectively partitions each treatment village into a "control period" before the implementation and a "treatment period" after the implementation.

4.2.5 Data Collection

In order to analyze the effect of each of the three institutional arrangements described above on the availability of sanitation and the prevention of littering, the research team devised measures of these two concepts and developed a system to collect and manage the data. The public good of sanitation is measured using techniques originally developed in the field of community waste management (Galli and Corish 1998). The basic strategy of these techniques is to make the estimation of the amount of public waste in a large area feasible by sampling a number of smaller areas and counting all pieces of trash in those smaller areas. For the purpose of this analysis, we selected five 3 x 2 meter plots in each of the 36 villages in the sample. The research team selected plots to try to achieve variation in proximity to shops, roads, and dumping sites. In each village, the project staff trained a high school graduate to count all of the trash in each of the five plots once a week and to record the number of pieces of plastic waste, food waste, and other kinds of waste in a notebook.

To measure littering behavior, enumerators in each village collected observational data on the waste-disposal decisions of individuals. The project staff trained an enumerator to sit in an inconspicuous but central location in each village and to record what happened each time they saw someone with a piece of trash in his or her hand. For example, if an enumerator saw an individual who had just finished eating a banana, she then watched to see what that person did

with it- did he drop it on the ground, did he keep it with him when he left the area, or did he put it in a trash can or pit? The enumerator recorded the result of each "littering opportunity" on a small scrap of paper and then transferred the records to a notebook at her home. Each enumerator was instructed to sit and record observations one hour per week; across all 36 villages, the average number of "littering opportunities" recorded in a given one hour session was around 13. In order to not have the results driven by the fact that some enumerators might observe more "littering opportunities" in a given hour than others, the raw data were transformed to create a measure of the proportion of individuals observed littering, which was calculated by dividing the number of individuals observed dropping a piece of trash on the ground by the total number of littering opportunities, producing a decimal between 0 and 1.

Data collection started 9 weeks before the first set of project implementation, providing information on the baseline rates of littering in all treatment and control villages. Table 1 (below) indicates that the baseline measures of the amount of trash counted and the proportion of individuals observed littering were balanced between the three treatment groups and the control groups. There were some pre-treatment differences in the average number of pieces of trash counted at baseline between the three treatment groups; in particular villages assigned to the Elders & State Enforcement group had on average 5 fewer pieces of trash than villages assigned to the State Enforcement group. However, regressing average amounts of trash at baseline on assignment to treatment did not reveal any statistically significant effect of assignment to treatment groups on pre-treatment levels of public waste. The

same was also the case for the baseline measure of the proportion of individuals observed littering.

4.3 Empirical Analysis

4.3.1 Data, Descriptive Statistics, and Graphical Analysis

In this section, I use a series of time-series graphs to provide a brief overview of the structure of the dataset, describe the general patterns of both measures across both space and time, and to identify instances in which data was either missing or irregular due to carelessness or malfeasance on the part of enumerators.

Figure 4.1 presents the 102 week time series graph of the amount of trash on the ground in each of the 36 centers included in the sample for the SAFI Project Waste Management Project. The measure is the average of the number of pieces of trash counted in each of five observation plots in each center.

The graph's organization reflects the structure of the experiment. Each column is one of the three randomly assigned treatment or control groups. From the left, the first column is centers in the Elders Enforcement Group, the second column contains centers in the State Enforcement Group, and the third column centers from the civil society group. The centers in the third through sixth columns are all in the control group.

Each of the rows contains the six centers from a given region- the regions are sorted in order of roll-out with the earliest region on the top row of the graph, the second region on the second row, and so forth. The staggered nature of program implementation can be seen in how the the break between the pre-treatment and post-treatment lines shifts further to the right in each row,

indicating that in each region, program implementation took place 3 weeks later than in the previous region. For centers assigned to the control group in each region, the "treatment" week is coded as the week in which the SAFI Project program was implemented in the three treatment centers in that region.

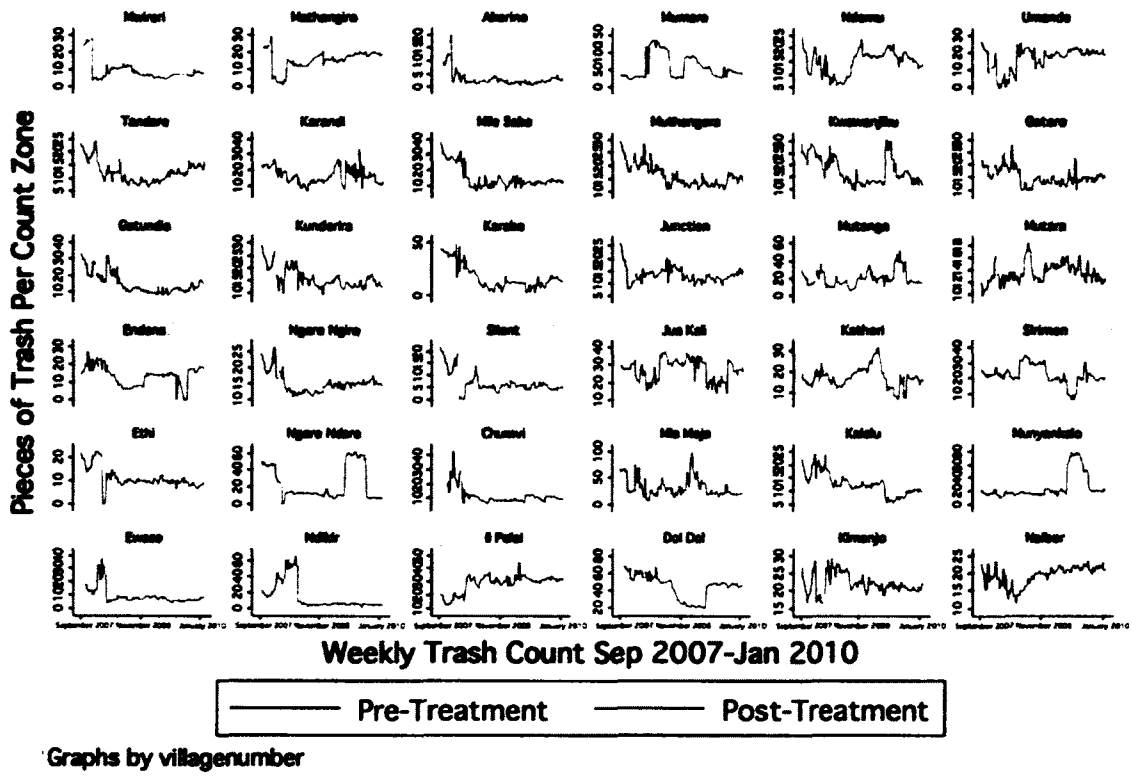

Figure 4.1: Cross-Sectional Time-Series Graph of Trash Count

Presenting the data in this way useful for describing several aspects of the trash count measure. On the one hand, the data indicates that there is center-level heterogeneity in the temporal patterns of public waste in this sample. In most centers, there appear to be both short and long cycles of accumulation and reduction in waste, while in others, the level of waste is much more stable over

time. Finally, there several other centers in which the levels of public waste increase or decrease suddenly, and then revert to the previous level after some period of time. During audits, some of these sudden jumps were revealed to be the result of error or falsification on the part of enumerators, while others were revealed to be the result of seasonal changes in public waste levels, due to weather or migration. For the analyses that follow, I omit data from periods in which audits revealed evidence of enumerator malfeasance.

On the other hand, despite this apparent center-level heterogeneity in the time trends of public waste levels, there are some consistent patterns across the centers. One is that, despite the tendency of cycles and more brief fluctuations in trash count levels, there does not seem to be evidence of unbounded increases in trash in any of the centers. That is, even in control centers, some type of natural or social process appears to at least hold trash levels relatively constant. These patterns are consistent with the qualitative reports of sporadic trash clean-ups by the county council, as well as the reported tendency for wind and rain to lead trash to wash away or break down.

At the same time, this graph does indicate that the levels of trash differ between treatment and control centers. In many treatment centers, there appears to be a sudden decrease in the number of pieces of trash in counting zones after the treatment implementation, with the post-treatment level of trash remaining stable over time. In contrast, in most control centers, there does not seem to be a noticeable break in the level or trend of public waste at the treatment week, with pre-treatment levels of the trash count measure being maintained throughout the observation period. Despite these differences

between treatment and control centers, it is more difficult to discern visible differences between centers randomly assigned to each of the three treatment variations.

Figure 4.2 presents the disaggregated center-level time series for the measure of the frequency of littering behavior, which is calculated by dividing the number of individuals observed littering in a given week by the total number of individuals that the enumerator saw with a "littering opportunity" during a given week's observation period. The layout is identical to the graph above- the first three columns are the elders punishment centers, chief punishment centers, and civil society treatment centers in order, followed by three control centers. Each row contains all of the centers from one region, and rows are organized in order of roll-out, from earliest to latest.

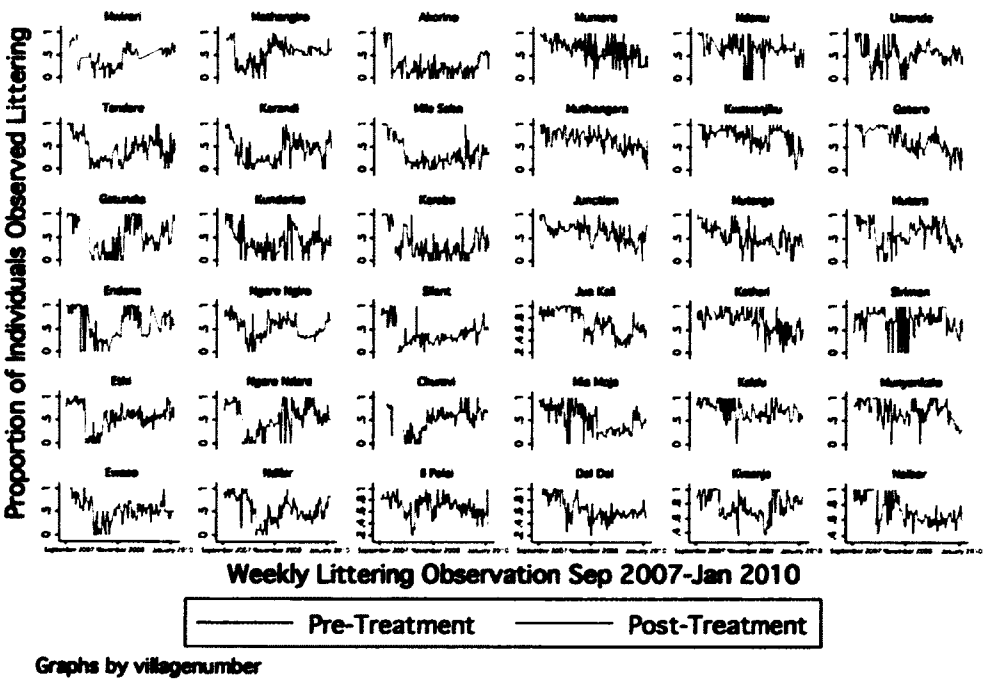

Figure 4.2: Cross-Sectional Time-Series Graph of Littering Behavior

In contrast with the trash count measure, the measure of littering behavior shows much more week-to-week volatility. This is due in part to the nature of the measure, which can vary as a result of fluctuations in both the number of people observed littering and the number of people with a "littering opportunity". Similarly, whereas the trash count simply captures the process of accumulation and removal of physical objects, the littering behavior measure is much more a product of the specific individuals who are in a center at a given time, which may vary even if the measure is collected at the same time and same location every week. Despite this volatility, the littering behavior measure appears to exhibit the same general type of differences in temporal patterns between treatment and control centers that can be observed in the trash count measure. In many treatment centers, the proportion of people observed littering appears to drop suddenly after the treatment implementation, while there is a less visible association between the treatment roll-out week and the littering behavior measure in the control centers.

As noted above, both of these graphs present the results in "real time", from the onset of weekly data collection in September 2007 until the conclusion of monitoring in January 2010. Given that the project's treatment implementation was spread over a period of four months, I convert these real dates to the "treatment time" for each region, and use this renormalized time scale in the analyses that follow. That is each center's time-series is normalized to the week of implementation in that center's region, producing a variable called "timetotreat". For each region, timetotreat is equal to 0 in the week in which the program was implemented in the treatment centers in that region. Weeks before

treatment implementation are denoted by negative values of timetotreat, while weeks after treatment are denoted by positive values of the measure. Since the staggered roll-out means that each region has a different number of observations before and after treatment, the range of this graph is limited to the number of weeks in which data was collected before the first roll-out group (all observations in which timetotreat is greater than or equal to 9) and the number of weeks in which data was collected after the last roll-out group (all observations in which timetotreat is less than or equal to 95).

Table 4.1 indicates that the baseline measures of the amount of trash counted and the proportion of individuals observed littering were balanced between the three treatment groups and the control groups. There were some pre-treatment differences in the average number of pieces of trash counted at baseline between the three treatment groups; in particular villages assigned to the Elders & State Enforcement group had on average 5 fewer pieces of trash than villages assigned to the State Enforcement group. However, regressing average amounts of trash at baseline on assignment to treatment did not reveal any statistically significant effect of assignment to treatment groups on pre-treatment levels of public waste. The same was also the case for the baseline measure of the proportion of individuals observed littering.

	Collective Action Treatment	State Enforcement Treatment	Elders & State Enforcement Treatment	Control
Trash Count-Baseline Mean	22.628	25.667	20.502	24.770
Effect of Treatment Assignment	-2.142	.897	-4.268	
t- Statistic	-0.31	0.18	-0.92	
Proportion Littering-Baseline Mean	0.8769	0.8674	0.8935	.8890
Effect of Treatment Assignment	-.0121	-.0217	.0045	
t-Statistic	-0.62	-1.20	0.12	

Table 4.1: Baseline Village-Level Trash Count and Littering Rates Across Treatment Groups

4.3.2 Cross-Sectional Analysis

The first set of analyses ignores the time-series dimension of the data completely, focusing instead on the extent to which assignment to treatment groups explains variation in the trash count measure between villages. To do this, I average the trash count measure for all weeks after "treatment rollout" (all weeks where "timetotreat" is greater than or equal to 0) for each village. Collapsing the time dimension to just one post-treatment transforms the data into a cross-sectional dataset with 36 observations. Figure 4.3 shows the simplest way of examining the effect of the SAFI Project's program on public waste: partitioning the sample of 36 villages into the 18 villages that were randomly assigned to receive some variant of the SAFI Project waste management program and the 18 villages that were assigned to the control group. Viewing the data in this way reveals that treatment villages have a statistically significant average of 8.78 fewer pieces of trash per 3x2 meter count zone, which

is approximately 40% less trash on the ground than control villages (Table 4.2).

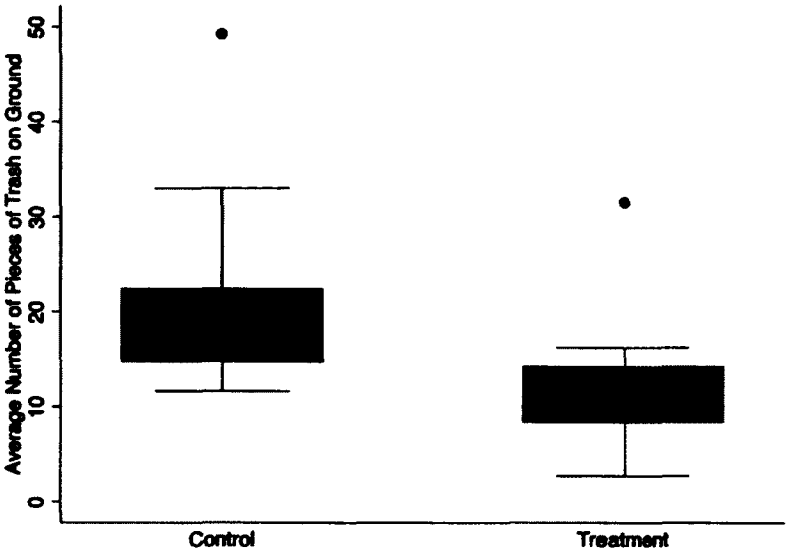

Figure 4.3: Average Number of Pieces of Trash Counted on the Ground, Control vs. Treatment

	Trash Count	Proportion Littering
Control Centers (n=18)	20.77 (2.16)	0.65(0.02)
Treatment Centers (n=18)	11.99(1.46)	0.42(0.03)
Difference	8.78**(2.61)	0.23***(0.03)

Table 4.2: Difference in Means, Treatment-Control Comparison

This effect persists after further dividing the "treatment" group into the three subgroups to which treatment villages were randomly assigned: mobilization only, state punishment, and elders punishment. As Figure 4.4 shows, average levels of public waste in all three of these subgroups are less than the average amount of public waste counted on the ground in control group villages. The box plot also shows that there may be differences between the treatment groups in the variability of the trash count measure. In particular, the

measures of the civil society group are spread over a much larger range than the measures for the elders group and the state group. Regressing the trash count measure on treatment group dummies indicates that villages in the elders punishment group had on average 10.67 fewer pieces of trash on the ground than the control group, compared to a difference of 8.31 in the state punishment group and 7.92 in the mobilization only group (Table 4.3). Although each of these program groups are significantly cleaner on average than the villages receiving no treatment program, the Wald post-estimation tests indicate that it is impossible to detect a significant difference between the magnitude of these treatment effects.

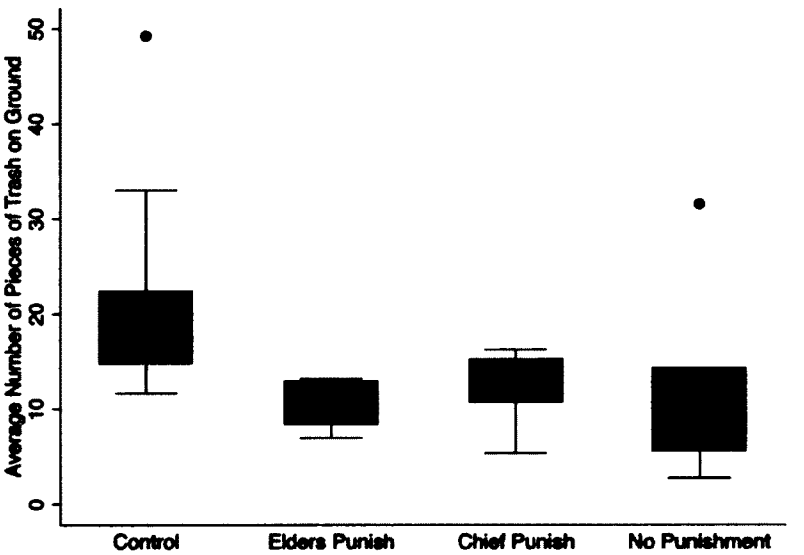

Figure 4.4: Average Number of Pieces of Trash Counted on the Ground, Control vs. Three Treatment Groups

	Trash Count	Proportion Littering
Elders Punish	-10.67***	-0.211***
	(3.863)	(0.0483)
Chief Punish	-8.310**	-0.198***
	(3.863)	(0.0483)
Civil Society (No Punish)	-7.921**	-0.283***
	(3.863)	(0.0483)
Constant	20.77***	
	(1.891)	
Wald coefficients		
Elders vs. Chief	0.25	0.05
Elders vs. Civil	0.34	1.48
State vs. Civil	0.01	2.09
Observations	36	36
R-squared	0.259	0.600
Standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Table 4.3: Cross-Sectional Regressions of Trash Count and Proportion Littering on Treatment Groups

The overall effectiveness of the SAFI Project waste management program can also be assessed by comparing the frequency of littering behavior in treatment and control villages. The simple treatment-control comparison indicates that littering behavior is much less prevalent in villages in which there is a waste management program, compared with villages with no program (Figure 4.5). In control villages, an average of 64.64% of all individuals dropped trash on the ground (as opposed to using a trash can or carrying the trash with them), while in treatment villages, 42.06% of individuals were observed littering (Table 4.2).

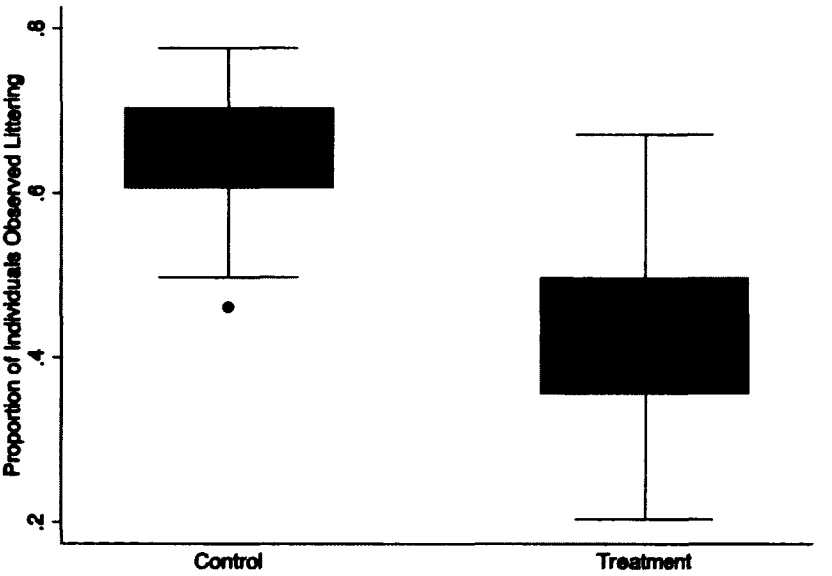

Figure 4.5: Proportion of Individuals Observed Littering, Control vs. Treatment Villages

As with the trash count measure, this large and statistically significant treatment effect is robust to partitioning the treatment group into the three program groups. The boxplot indicates that villages in each of the three variants of the waste management program have a lower incidence of littering behavior than control villages (Figure 4.6). The regression estimates of the difference in littering behavior between the control and treatment group range from 19.8 percentage points in the state punishment treatment group, to 21.11 percentage points in the elders punishment treatment group, to 28.31 percentage points in the treatment group with only civil society mobilization (Table 4.3), but the between-treatment differences in the size of these effects is not statistically distinguishable from zero.

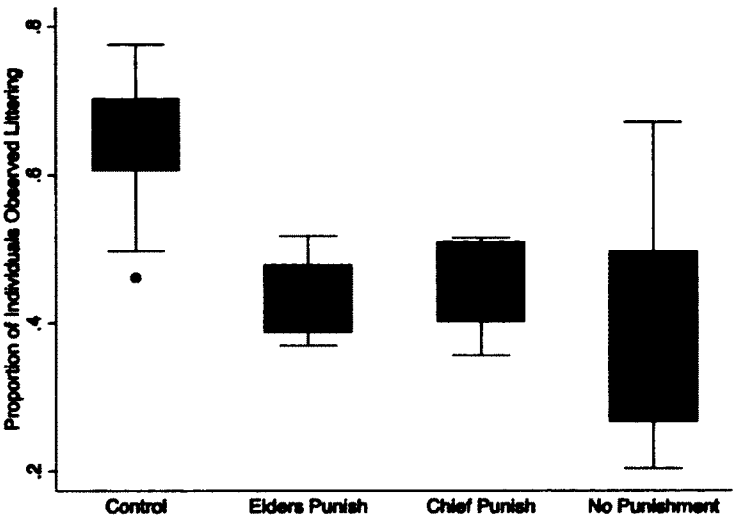

Figure 4.6: Proportion of Individuals Observed Littering, Control vs. Three Treatment Groups

Although the simple cross-sectional comparison of treatment and control groups is sufficient to show that all three treatment groups lead to large and significant reductions in the level of trash and the frequency of littering behavior, it is not possible to test the implications of the theory of public goods maintenance using this analytic approach. Although the purely cross-sectional treatment-control comparison is adequate to demonstrate that each of these three treatments have an effect, this analysis provides no traction at assessing the effect of each of the three treatments groups on the ability of communities to maintain a high level of sanitation over time.

4.3.3 Before-After Analysis

I first introduce the time dimension to the analysis in the simplest possible manner: collapsing the weekly observations from each village into two periods: a "Before" treatment period (all weeks where timetotreat is less than 0) and an

"After" period (all weeks where timetotreat is greater than or equal to 0). Combining this time period dummy with and the treatment group dummy variables used above, I estimate a difference-in-differences model, which makes it possible to compare the change in the outcome measures before and after the treatment implementation between the treatment groups and the control group (Wooldridge 2002). Although difference-in-differences in models are frequently used to strengthen the inferences in the analysis of quasi-experiments and non-experimental data, the estimator is also appropriate to the hypotheses about public goods maintenance that are being tested in this study, as it make it possible to make inferences about pre- and post- intervention levels of public waste and littering behavior across the three institutional variations of the SAFI Project program.

As the primary motivation for delving further into the time series analysis is to try to discern differences between the three versions of the treatment program with respect to patterns of maintaining waste management over time, I skip the simple treatment-control comparison and instead focus on the comparison of the elders, state, and civil society groups with the control group and with each other. Regression analysis reveals the relative size of each of these effects across the three treatment groups- the point estimates for each of the treatment groups range from a reduction of 8.29 pieces of trash in the civil society group, to a reduction of 10.71 pieces of trash in the elders enforcement group, to a reduction of 12.24 pieces of trash in the state enforcement group (Table 4.4).

	Trash Count	Littering Behavior
After Treatment	-1.777	-0.208***
	(3.039)	(0.0314)
Elders Punish	0.0384	-0.0612
	(4.298)	(0.0444)
Elders Punish*After Treatment	-10.71*	-0.149**
	(6.207)	(0.0642)
State Punish	3.848	-0.0960**
	(4.298)	(0.0444)
State Punish*After Treatment	-12.24*	-0.0995
	(6.207)	(0.0642)
Civil Society (No Punish)	0.356	-0.0621
	(4.298)	(0.0444)
Civil Society * After Treatment	-8.285	-0.220***
	(6.207)	(0.0642)
Constant	22.55***	0.855***
	(2.149)	(0.0222)
Wald coefficients		
Elders vs. Chief	0.04	0.39
Elders vs. Civil	0.1	0.82
State vs. Civil	0.27	2.34
Observations	72	72
R-squared	0.236	0.778
Standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Table 4.4: Difference-in-Differences Regressions of Trash Count and Proportion Littering on Treatment Groups

For the littering behavior measure, the difference-in-differences regression model indicates that the no punishment and elders punishment group reduce littering behavior by 22 and 14.9 percentage points respectively, and are indeed statistically significant (Table 4.4). In contrast, the state punishment treatment only reduces littering behavior by 9.95 percentage points, and is not statistically significant. However, as before, the differences between the coefficients of the three treatment groups are not statistically significant.

This set of before-after analyses both supports and subtly qualifies the

results of the cross-sectional analyses. In both of the models, there are generally large and statistically significant treatment effects and no significant differences between treatment groups. However, adding the time dimension does somewhat call into question the significance of the effect of the three treatment programs on the amount of trash on the ground. In both the simple treatment-control comparison and the analysis with all three groups, the p-value of the difference-in-difference estimator is above conventional levels of statistical significance. In contrast, the large effect of treatment on littering behavior indicates that even though littering behavior did decrease over time across all villages in the program sample, villages in which there was either no punishment for littering or punishment for littering by elders experienced a statistically significant reduction in littering, compared to the size of the reduction in control villages and villages in which littering was punished by the government chief.

4.3.4 Multi-Period Analysis

Although the set of before-after analyses conducted above provide additional evidence regarding the effect of the three institutional variations of the SAFI Project program on public waste and littering behavior, they provide very little leverage in assessing whether there are any substantively or statistically significant differences between treatment groups with respect to maintenance outcomes. In particular, the results of the difference-in-differences analysis of the trash count measure indicates that post-treatment changes the three treatment groups cannot be distinguished from the change over time in the control group. However, to make the kinds of inferences about maintenance that are necessary to test the implications of the theory developed in this manuscript,

it is necessary to look more closely at the patterns of public waste over time. Dividing the post-treatment period into multiple periods makes it possible to attempt to separate short-term effects of the initial clean-up and mobilization from long-term effects that may be due to the local institutions created during project implementation.

Given these goals, the second way that incorporate the time-series element of the data into the analysis is to further divide the "after" period into multiple periods and run both the cross-sectional and differences-in-differences models separately for each time period. As there are 96 weeks of post-treatment data for each of the villages in the sample, it is convenient to collapse the post-treatment time-series into three 32 week period periods: "After 1" (all weeks where timetotreat is greater than or equal to 0 and less than or equal to 31); "After 2" (all weeks where timetotreat is greater than or equal to 32 and less than or equal to 65), and "After 3" (all weeks where timetotreat is greater than equal to 66 and less than or equal to 95). As in the prior analysis, "Before" is coded as all weeks where timetotreat is less than zero and greater than –9.

Because splitting the after treatment period into three periods makes it difficult to graph the data using a boxplot, I use the full time-series graphs to provide a general description of the patterns of the trash count measure in the control group and the three treatment groups (Figure 4.7). Overall, there is relatively little discernible movement in the level of public waste over time in the control group, with the group average oscillating around 20 pieces of trash per count zone for the entire period. In contrast, both the Elders and State treatment groups exhibit very similar time-series patterns. In particular, in both groups,

there is a large immediate effect of the waste management program, which appears to persist across all three post-treatment periods. In the Civil Society treatment group, the over-time changes follow a pattern that appears to be distinct from both the control group and the two treatment groups in which littering behavior is punished. What this graph indicates is that in the villages in which there is mobilization without punishment, there is not a major change in the level of trash on the ground in the first three months following implementation, but that by the latter two periods, the amount of trash counted on the ground has decreased substantially.

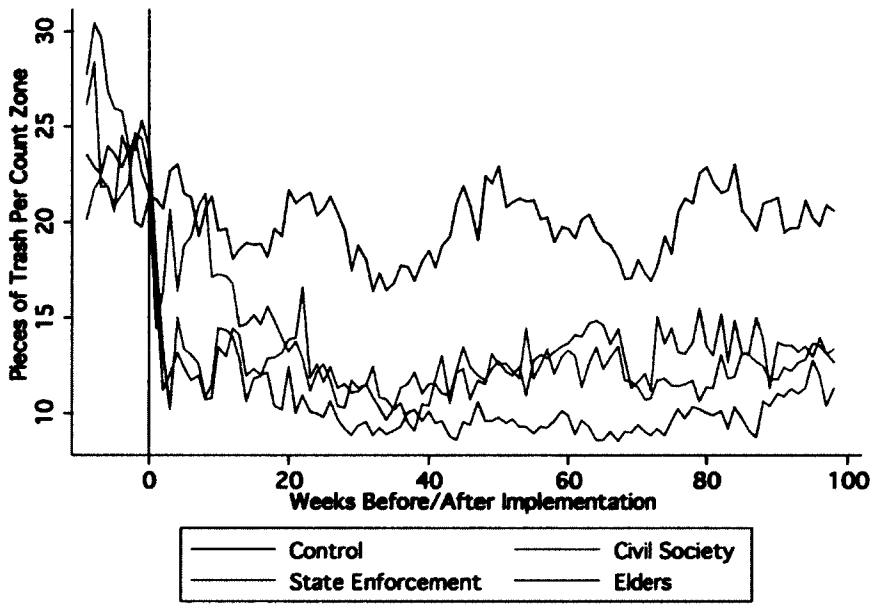

Figure:4.7: Treatment Group Time-Series Line Graph, Trash Count Measure

The regression analyses and the associated post-estimation tests put these results in starker relief (Table 4.5). In this section, I utilize two different models: cross-sectional regressions in which the post-treatment period is divided into three 32-week periods, and difference-in-difference models that are divided in

the same way. As in the previous section, the primary coefficients of interest in the cross-sectional regression are the treatment-group dummies, while in the difference-in-difference models, the treatment group-time period interactions are of primary interest.

The results of both sets of models both support and qualify the general patterns in the time-series line graph. In the cross-sectional regression, the effect of the elders and state punishment treatments on the trash count measure are statistically significant in all three periods, while the effect of the civil society mobilization treatment is only significant in the second and third periods (Table 4.6). This supports the general pattern that can be observed in the time-series line graph- whereas the amount of public waste reduced immediately in the two treatment groups in which the chiefs and elders were involved in punishing littering, it appears to have taken several months to reach that same level in the treatment group in which there is no punishment for littering.

VARIABLES	Cross-Sectional Regression-Period 1	Cross-Sectional Regression-Period 2	Cross-Sectional Regression-Period 3
Elders Punish	-9.380**	-11.68***	-10.75**
	(4.274)	(3.926)	(4.015)
Chief Punish	-8.321*	-9.000**	-7.599*
	(4.274)	(3.926)	(4.015)
Civil Society (No Punish)	-5.717	-9.321**	-8.334**
	(4.274)	(3.926)	(4.015)
Constant	20.52***	21.12***	20.42***
	(2.003)	(1.963)	(2.008)
Wald coefficients			
Elders vs. State	0.04	0.31	0.41
Elders vs. Civil	0.49	0.24	0.24
State vs. Civil	0.25	0	0.02
Observations	36	36	36
R-squared	0.183	0.294	0.243
Standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Table 4.5: Cross-Sectional Regressions of Trash Count on Treatment Groups, Divided By Period

Some aspects of this pattern disappear when these three periods are used in the difference-in-differences models (Table 4.6). In particular, the difference-in-differences estimator for the civil society mobilization treatment is not significant in any of the three time period models, the estimator for the elders punishment treatment is only significant in the second and third periods, and the estimator for the state punishment treatment is the only one that is significant in all three periods. In both sets of regressions, none of the differences between the coefficients of interest for the different treatment groups are statistically significant.

VARIABLES	Diff-in-Diff Regression-Period 1	Diff-in-diff Regression-Period 2	Diff-in-diff Regression-Period 3
Elders Punish	0.0384	0.0384	0.0384
	(4.398)	(4.362)	(4.402)
Elders Punish*After Treat	-9.421	-11.71*	-10.79*
	(6.635)	(6.169)	(6.226)
Chief Punish	3.848	3.848	3.848
	(4.398)	(4.362)	(4.402)
Chief Punish*After Treat	-12.43*	-12.85**	-11.45*
	(6.635)	(6.169)	(6.226)
Civil Society (No Punish)	0.356	0.356	0.356
	(4.398)	(4.362)	(4.402)
Civil Society*After Treat	-6.097	-9.678	-8.691
	(6.635)	(6.169)	(6.226)
First Period	-2.029		
	(3.110)		
Second Period		-1.426	
		(3.084)	
Third Period			-2.122
			(3.113)
Constant	22.55***	22.55***	22.55***
	(2.199)	(2.181)	(2.201)
Wald coefficients			
Elders vs. State	0.14	0.02	0.01
Elders vs. Civil	0.17	0.07	0.08
State vs. Civil	0.61	0.18	0.13
Observations	72	72	72
R-squared	0.192	0.259	0.241
Standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Table 4.6: Difference-in-Differences Regressions of Trash Count Littering on Treatment Groups, Divided By Period

The general conclusions that can be drawn from this analysis are thus somewhat mixed. The lack of a significant effect of the civil society group in the first period, coupled with the significance of the rest of the treatment group-period effects indicates that different causal mechanisms may drive the maintenance of public sanitation in this group compared with the other group. Despite relatively large standard errors, analyzing the interaction between the three variations of the treatment program and the passage of time helps to

sharpen the conclusions from the cross-sectional and before-after analysis, providing additional details about how the three treatment groups may have divergent impacts on solid waste management outcomes.

As with the trash count measure, graphing the time-series line plots of the control group and three treatment groups makes it possible identify differences in the temporal patterns of littering behavior between the three treatment groups (Figure 4.8). In particular, it is possible to discern three distinct patterns in the change of littering behavior over time. First, in the civil society group, there is a large initial drop off in littering behavior, which is maintained over time. Second, villages in the groups in which the chief or elders punish littering appear to experience an initial treatment effect of a similar magnitude that is maintained for almost a year, but by the second period (32 to 65 weeks after treatment), littering rates have increased again. Finally, the level of littering behavior in the treatment group does not remain constant over time, but rather decreases throughout the post-treatment period. Thus, it appears that even in villages in the sample where there is no waste management program, littering behavior is becoming less prevalent over time.

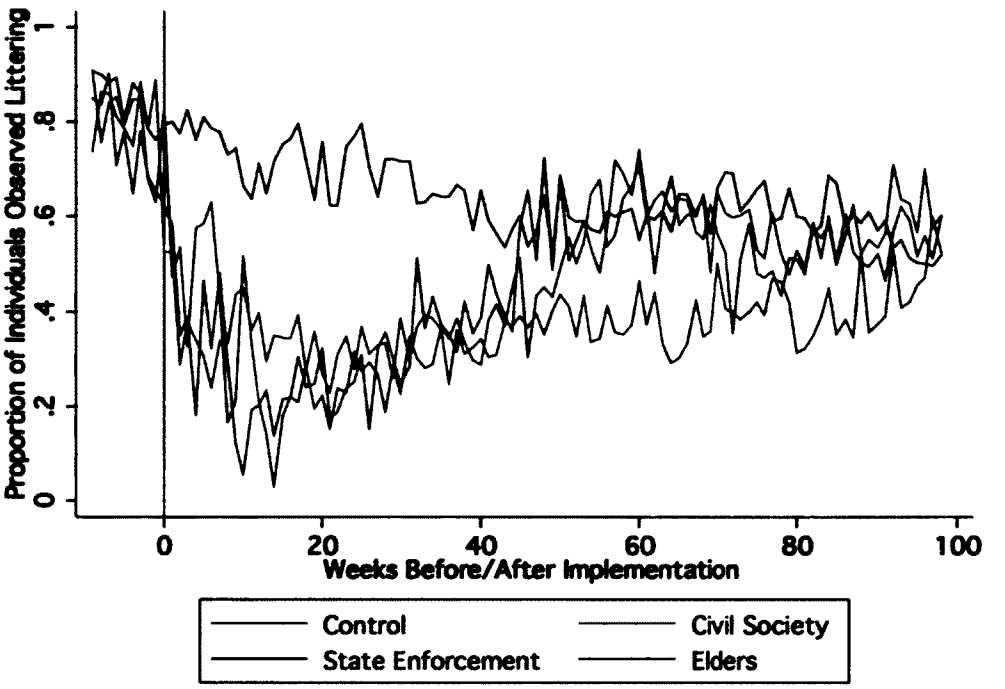

Figure 4.8 Treatment Group Time-Series Line Graph, Proportion Littering Measure

As with the trash count measure, I utilize cross-sectional regressions in which the post-treatment period is divided into three 32-week periods, and difference-in-difference models that are divided in the same way. In contrast to the analysis of the trash count measure, the inferences that can be drawn from the graphical analysis are more strongly borne out by the regression and difference-in-differences analyses and the post-estimation tests.

In the cross-sectional analysis for the first period, all three treatments have a large and significant effect on the proportion of individuals observed littering (Table 4.7). Each of the three treatments are associated with differences in littering behavior of between 41.95 and 48.38 percentage points vis-a-vis the treatment group, and the differences between the coefficients for the three

treatment groups are not statistically significant. However, the civil society mobilization group is the only treatment in which the effect on littering behavior remains substantively large and statistically significant in the cross-sectional regressions for the second and third periods. In the second and third periods, this treatment is associated with differences in littering behavior of 22.99 percentage points and 21.45 percentage points, respectively.

VARIABLES	Cross-Sectional Regression-Period 1	Cross-Sectional Regression-Period 2	Cross-Sectional Regression-Period 3
Elders Punish	-0.454***	-0.126*	-0.0456
	(0.0579)	(0.0678)	(0.0589)
Chief Punish	-0.484***	-0.0752	-0.0548
	(0.0579)	(0.0678)	(0.0589)
Civil Society (No Punish)	-0.420***	-0.230***	-0.214***
	(0.0579)	(0.0678)	(0.0589)
Constant	0.732***	0.597***	0.610***
	(0.0271)	(0.0339)	(0.0295)
Wald coefficients			
Elders vs. State	0.17	0.38	0.02
Elders vs. Civil	0.24	1.56	5.48**
State vs. Civil	0.82	3.47*	4.9**
Observations	36	36	36
R-squared	0.794	0.283	0.293
Standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Table 4.7: Cross-Sectional Regressions of Proportion Littering on Treatment Groups, Divided By Period

The elders treatment is also statistically significant in the second period, even though the point estimate is reduced to 12.62 percentage points, but by the third period the point estimate is further reduced to 4.5 percentage points and is no longer statistically significant. The third-period difference in the size of the coefficients between the civil society mobilization group and the elders

punishment group is statistically significant. In contrast, the size and significance of the coefficient of the state enforcement treatment disappears in both the second and third periods, reducing to 7.52 percentage points and 5.48 percentage points, respectively. The difference in the size of the treatment effect between the civil society mobilization group and the state punishment is significant in the second and third periods. The results of the three-period difference-in-differences models are consistent with the cross-sectional regressions (Table 4.8). In the first, period the difference-in-differences estimators for all three treatment groups are substantively large and statistically significant, while only the estimator for the for the civil society mobilization group is significant in the second and third period regressions. As in the cross-section, the difference between the civil society treatment and state punishment treatment is statistically significant in both the second and third periods, and the difference between the civil society treatment and the elders punishment treatment is significant in the third period.

VARIABLES	Diff-in-Diff Regression-Period 1	Diff-in-diff Regression-Period 2	Diff-in-diff Regression-Period 3
elders	-0.0612	-0.0612	-0.0612
	(0.0483)	(0.0562)	(0.0509)
received_elders	-0.389***	-0.0651	0.0156
	(0.0728)	(0.0794)	(0.0720)
state	-0.0960*	-0.0960*	-0.0960*
	(0.0483)	(0.0562)	(0.0509)
received_state	-0.381***	0.0208	0.0412
	(0.0728)	(0.0794)	(0.0720)
civil	-0.0621	-0.0621	-0.0621
	(0.0483)	(0.0562)	(0.0509)
received_civil	-0.353***	-0.168**	-0.152**
	(0.0728)	(0.0794)	(0.0720)
first_period	-0.123***		
	(0.0341)		
second_period		-0.257***	
		(0.0397)	
third_period			-0.245***
			(0.0360)
Constant	0.855***	0.855***	0.855***
	(0.0241)	(0.0281)	(0.0255)
Wald coefficients			
Elders vs. State	0.01	0.78	0.08
Elders vs. Civil	0.16	1.12	3.63*
State vs. Civil	0.10	3.76*	4.82**
Observations	72	72	72
R-squared	0.831	0.671	0.665
Standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Table 4.8: Difference-in-Differences Regressions of Trash Count Littering on Treatment Groups, Divided By Period

Analyzing the proportion littering measure in this way reveals the clearest and most statistically significant difference between the three randomly assigned variations of the SAFI Project waste management program. Although the simple before-after analysis provided some tentative evidence that the chief punishment treatment had a smaller effect on littering behavior than the other two treatment groups, the difference in average littering rates between the state enforcement group and the other two groups was not statistically distinguishable from zero.

In contrast, the results of the regressions in which the post-treatment period is divided into three separate periods indicates that although the differences in average post-treatment littering frequency are not statistically significant, there are differences in the ability of each of the three treatment groups to induce long-term behavioral change. In particular, the bulk of the statistical evidence supports the conclusion that while all three of the treatment groups lead to a reduction in littering behavior in the short-term, this effect is only sustained over the medium-term in the elders and civil society treatment groups, and in the long-term, only in the civil society treatment group. By approximately a year after the implementation of the waste management program, any discernible effect of treatment on littering behavior has disappeared in villages that received the chief and elders punishment versions of the treatment group.

4.4 Conclusion: Interpretation of Results

In summary, the previous analyses of the results of the SAFI Project Experiment yielded three main results. First, all three versions of the SAFI Project experiment led to substantively large and statistically significant reductions in the amount of trash on the ground that were sustained for over two years after the initial intervention, regardless of the nature of punishment formally embedded in the design of the project. Second, the punishment of littering by either government chiefs or local elders appears to have led to more rapid reductions in the amount of trash on the ground than in the treatment group in which the SAFI program consisted only of the mobilization of civil society groups and no formal punishment for littering. Third, although all three

treatments led to large reductions in littering behavior over the short-term, this reduction was only sustained over time in the group in which there was no punishment for littering.

There are two ways to interpret whether these findings support the hypotheses derived from the theory of public goods maintenance that I developed in chapter 2. One interpretation is that these patterns contradict Hypothesis 2, which predicts that durable maintenance of semi-rival local public goods requires that institutions solve both the dynamic provision and harmful action problems. As noted above, when designing the treatment groups, one possible interpretation of the qualitative evidence of public goods maintenance in Laikipia was that the chief and elders were the two institutions that appeared to have the largest potential de jure and de facto roles with respect to preventing harmful action. In this interpretation, the two treatments in which chiefs and elders punish littering should lead to the most stable reductions in littering behavior and durable decreases in public waste. This prediction is not supported by the evidence- these two treatments in fact performed the worst with respect to preventing littering behavior over the total duration of the post-implementation monitoring, and yet despite the return to high rates of littering in these two treatment groups, rates of public waste remained relatively low in both groups.

A related argument is that the quantitative findings also provide evidence that contradicts Hypothesis 4, which predicts that institutions that do not match local norms will reduce the effectiveness of other institutions involved in local public goods maintenance, leading to an increase in harmful action, a reduction in dynamic provision, and a decrease in public goods maintenance. As noted

above, an interpretation of the qualitative evidence from Laikipia that views the elders as more legitimate than chiefs would predict that the treatment in which elders punish littering would outperform the other two treatments with respect to both littering rates and levels of public waste accumulation over time. As above, the results presented in this chapter do not support this linkage between the theory and the qualitative evidence, and the quantitative analysis. That is, the version of the SAFI Project program in which there was no punishment for littering was the most successful at reducing littering behavior over time, yet also performed no better than the elders punishment group with respect to maintaining reductions in trash count over time.

An alternative interpretation of the linkage between the results of the ethnographic research reported in chapter 3 and the design of the experimental treatments makes it possible to reconcile Hypothesis 4 with the empirical findings presented in this chapter. As discussed above, civil society organizations are more actively involved in addressing public waste problems in Laikipia than either chiefs or elders and that support in the form of infrastructure, training, and coordination would help to make their clean-up activities more frequent and effective. Moreover, although the qualitative evidence from Laikipia primarily identified civil society groups with collective action to provide public goods over time, the discussion also indicated the role of civil society organizations in creating shared norms and allowing for decentralized monitoring of those norms through social networks as a potential method for preventing harmful action.

As a result, one interpretation of these qualitative patterns is that the maintenance of a solid waste management project by local civil society groups

alone is more legitimate in the context of rural Laikipia than civil society mobilization coupled with punishment by either chiefs or elders. In this interpretation, increasing the resources available to community based organizations increases the effectiveness and frequency of their clean-up efforts, which in turn leads to the creation and enforcement of community-wide anti-littering norms. Conversely, although chiefs and elders both prevent harmful actions using punishments in other domains, their connection to collective action by community organizations is actually illegible from the perspective of local practices. This could have the effect of reducing the legitimacy of the entire project, leading to reductions in the frequency of clean-ups and increases in littering rates. Alternatively, if chiefs or elders fail to actually enforce a de jure littering rule, this could reduce compliance, both due to a lowered deterrent effect of the punishment, as well as a decrease in community members' perception of the effectiveness and legitimacy of that institution with respect to preventing harmful action.

Using this alternative interpretation of the qualitative results form chapter 3 means that in this context, results that would be consistent with Hypothesis 4 would find that the treatment group with only civil society mobilization will lead both to the endogenous creation and enforcement of anti-littering norms and more frequent clean-ups. In contrast, coupling civil society mobilization with punishment of littering by elders or chiefs would lead to the opposite outcomes- increased littering and fewer clean-ups. In the context of this interpretation of the qualitative evidence, the results presented in this chapter are broadly consistent with the predictions of Hypothesis 4. In particular, this interpretation is

precisely consistent with the results of the analyses- the civil society treatment led to sustained reductions in littering behavior, whereas the two treatments in which there was an explicit rule against littering experienced increases in littering behavior over the long-term.

The empirical finding that the trash count measure decreased more slowly in the civil society treatment group is also consistent with this interpretation of Hypothesis 4 . One possible interpretation of this pattern is that in the chief and elders treatments, turnout at the initial community clean-up was higher than in the civil society group, leading to larger initial reductions in the level of public waste. In contrast, in the civil society treatment group, the community based organizations that were tapped to manage the waste management program were less effective in mobilizing their community for the initial clean-up, but actually took ownership over the project, continuing to stage regular clean-ups and empty the trash cans, leading to the more gradual reductions in public waste in that treatment group.

However, even if this alternative interpretation of the empirical findings is valid, the lack of significant differences in long-term trash-count levels across the three treatment groups is still puzzling from the perspective of the theory public goods maintenance developed here. However, as noted in chapter 2, the prediction in Hypothesis 2 is contingent on the assumption that rural solid waste management is a semi-rival local public good and that littering behavior is the main determinant of its degradation. In contrast, the analyses in this chapter indicate that levels of public waste in rural centers generally tend to stay relatively stable, even though littering rates remain high. As a result, it appears

that rates of littering and frequency of clean-ups are only two of multiple human and natural factors that shape the accumulation and reduction of rural public waste. This indicates that although this study focused on the institutional landscape surrounding solid waste management in rural Laikipia, further understanding of and more effective intervention in this problem requires a more in-depth study of the how the ecological and biophysical dynamics interact with social factors to constitute the nature of the public goods problem in this context.

In conclusion, the empirical findings presented in this chapter are consistent with two different interpretations that have very different implications for the theory developed in chapter 2. The crucial evidence with respect to adjudicating between these explanations is the linkage between the experimental treatments and individual-level norms, attitudes and behavior As a result, although more sophisticated econometric analysis of the center-level trash count and littering behavior is possible, fine-grained data on individual behavior, beliefs, and attitudes can provide the crucial leverage with respect to interpreting the theoretical implications of the results presented in this chapter. As result, in the next chapter, I present evidence regarding the effect of the three experimental treatments on individual attitudes and behavior towards trash and littering, using data from a survey of 1,080 individuals from all 36 of the centers included in the SAFI Project experiment.

Chapter 5: Linking Institutions, Individuals, and Public Goods Maintenance

5.1 Introduction

The evidence in the previous chapter revealed that although the SAFI Project Waste Management program had statistically significant and substantively meaningful effects on levels of public waste and on the frequency of littering behavior, these effects varied across treatment groups and time periods. In particular, the strongest and most surprising effect was in the differences between the group in which there was no formally introduced rule against littering and the two treatment groups in which anti-littering rules were enforced by government chiefs or village elders. On the one hand, villages that had been assigned to the no punishment/civil society mobilization group exhibited a much slower movement to lower levels of public waste, while at the same time being characterized by substantially more durable reductions in the frequency of littering behavior.

These results are particularly surprising and puzzling in light of existing theories that emphasize the importance of third party enforcement for creating stable cooperation and behavior change. Taking these results on their own leads to the conclusion that social mobilization may be sufficient to lead to sustainable provision of local public goods. This result somewhat contradicts the general pessimism towards sustained collective action that is typical of rational choice theory, and appears to generally support perspectives that emphasize the abilities

of communities to evolve norms and rules that allow them to overcome collective action problems.

This chapter presents the results of a large-scale survey that was designed to assist with the interpretation of the main results of the SAFI Project experiment, particularly with respect to testing the implications of the theory of public goods maintenance developed in this manuscript. The survey results provide evidence that although the experimental treatments appeared to have been implemented correctly, the long term evolution and assimilation of those treatments into local social practices resulted not in a convergence of treatment groups, but in fact in an unexpected reversal of fortune.

In particular, the story that emerges from this set of analyses is that the patterns of public waste and littering behavior in the civil society mobilization treatment group are associated with a high frequency of sustained collective trash cleanups over time in the group without punishment and the creation and enforcement social norms against littering, as well as norms regarding the appropriateness of engaging in costly action to punish littering behavior. In contrast, in centers in which either chiefs or elders were designated authority over punishing littering, individuals report less frequency of collective action and beliefs and behaviors that are less consistent with social norms against littering .

This chapter proceeds as follows. I first provide an overview of the design and implementation of the SAFI Project Survey, focusing on the sample size calculations, sampling protocol, and survey implementation. I then review the major findings from the survey and discuss these findings in the context of the

environmental and behavioral data discussed above. I conclude this chapter by providing the broader theoretical and methodological implications of this interpretation, as well as the questions for future research raised by these findings.

5.2 Survey Design and Administration

Because the trash count and littering behavior measures were collected weekly, it was possible for me to analyze these results on an ongoing basis. By July 2009, the ongoing analysis revealed the empirical patterns in the trash count and littering described in chapter 4. In order to adjudicate between the two competing implications of these findings with respect to the key hypotheses of my theory of public goods maintenance, I developed and administered a survey to 30 individuals in each of the 36 centers included in the sample for the SAFI Project experiment. Data was collected over the course of 4 weeks in August 2009.

Given that the population of interest in this survey is people who could potentially litter or engage in public cleanups in each of the 36 centers included as either control or treatment center in the experiment, I decided to to interview people as they moved through the center, rather than at their homes. This manner of sampling may not have produced a representative sample of the population in and around each village, as individuals who live in the village or visit more frequently will tend to be overrepresented through such a sampling scheme. However, given that for the purpose of this study, the population of interest is the people who take actions that relate to the maintenance of waste

management in each center, this sampling method is appropriate for sampling this population.

Following the precedent of marketing surveys conducted in shopping centers and surveys of mobile, hard-to-enumerate populations, the sampling strategy depended on sampling spatial-temporal clusters, observing littering behavior for an hour in each sampled place during the designated time slot, then randomly selecting interviewees from the list generated by the observation of littering opportunities. In each village, I chose three different observation areas within the center. In addition, each day was be divided into two time periods: Early (10 AM-Noon) and Late (4 PM to 6 PM). Stratifying by day of the week, two observation area/time of day clusters was be selected on each of three days in a given week, for a total of 6 observation areas/time slots in each center.

In each selected day/time, one of the two enumerators at for the first hour the sampled time period in the sampled observation area and recorded the outcome of each littering opportunity, just as in the existing littering behavior observation protocol. From each list of littering opportunities observed in a given counting area/time slot, the enumerator chose a random start point and then selected interviewees off of this list, based on a predetermined sampling interval. As the target was to interview 30 individuals per center, each enumerator interviewed 5 individuals per enumeration period. The sampling interval for each center was based on the average number of Littering Opportunities observed in that center during August of the previous year.

After the enumerator selected the four potential interviewees in this manner, he/she then located each of them within the center (or at home if they have left the center), asked them if they are available to answer a short questionnaire, read them the disclosure/oral informed consent statement, and completed the interview. The enumerators were trained to find each of the selected individuals within 2 hours of the counting period, as trips to the center from people living in the periphery typically last about 3-4 hours. In the event that the individual could not be found within the specified time period, the enumerator continued to search for them until they found them. If they could not find them in the center by the end of the day, they were instructed to interview them at home, which is possible because the location of residence is relatively well known for most individuals living in or near each center.

5.3 Individual-Level Analyses

In the section that follows, I discuss the results of the SAFI Project survey by grouping the various outcome measures into five subsections that correspond to the major dependent variables measured in the study: attitudes towards trash and littering, self-reported and observed littering behavior, self-reported cleanup frequency and participation, self-reported actions against littering, reported actions of elders and chiefs against littering. In each section, I proceed by first presenting graphs that provide a general sense of the size and direction of the effect of treatment on aggregate attitudes and behaviors. I then present the marginal effects results of individual-level logit regressions, which are corrected

for survey design effects. Table 5.1 presents the descriptive statistics for the individual-level variables included in the analyses.

	Control (n= 542)	Elders Punish (n= 180)	Chief Punish (n = 183)	Civil Society (n = 181)	Total (n =1086)
Gender (% Male)	37	40	46	42	40
Age (mean (st dev))	30.1 (9.5)	29.2 (9.5)	29.1 (9.5)	31.5 (11.6)	30.0 (9.9)
Completed Secondary Education (%)	39	26	33	43	36
Completed College or University (%)	10	7	12	13	10
Live Less Than 1 KM From (%)	23	30	24	29	26
Number of Visits to Center Per Week (mean (st dev))	5.4 (1.9)	5.3 (2.0)	5.7 (1.9)	5.1 (1.8)	5.4 (1.9)
Tribe_Pastoralist (%)	30	34	25	36	31

Table 5.1: Descriptive Statistics

5.3.1 Attitudes towards Trash

Figure 5.1 shows the aggregate patterns of individuals' answers to the question of whether they consider trash to be a major problem in their center, grouped by treatment group. There are two important patterns in this graph. The first is that agreement that trash is a major problem is nearly universal among individuals surveyed in the 36 centers included in the sample for the SAFI Project experiment. The second pattern is that this agreement is not effected in any apparent or visible way by any of the three treatments, and is at the same high level across the control group and all three treatment groups. This graphical finding is supported by the results of the logit analysis (Table 5.2), which finds that none of the treatment dummies nor any individual-level characteristics are significantly associated with attitudes about trash.

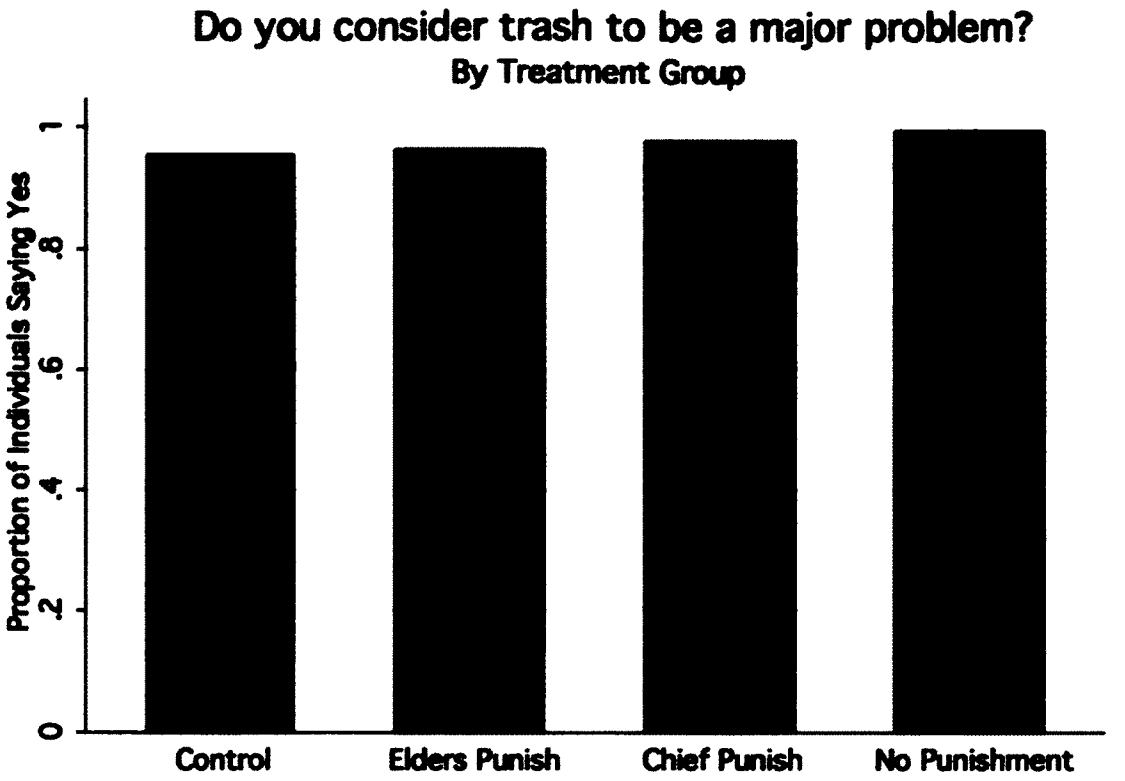

Figure 5.1: Attitudes Toward Trash, By Treatment Group

Is Trash A Major Problem?	
	(1)
	Yes
Elders Punish (d)	0.0346
	(0.68)
Chief Punish (d)	0.0580
	(1.13)
No Punishment (d)	0.0923
	(1.58)
Gender (d)	0.0369
	(0.67)
Age	0.0112
	(1.23)
Age2	-0.000133
	(-1.35)
Primary Ed. (d)	0.0538
	(1.31)
Secondary Ed. (d)	0.0671
	(1.73)
< 1 KM From Town (d)	0.0346
	(0.82)
1-5 KM From Town (d)	-0.0136
	(-0.23)
5-10 KM (d)	-0.0242
	(-0.21)
+10 KM From Town (d)	0.0271
	(0.30)
Num. Visits Per Week	0.0259
	(1.84)
Pastoralist (d)	0.0203
	(0.42)
Observations	917

Marginal effects; t statistics in parentheses
(d) for discrete change of dummy variable from 0 to 1
* p<0.05, ** p<0.01, *** p<0.001

Table 5.2: Marginal Effect of Treatment on Attitudes Towards Trash

5.3.2 Self-Reported and Observed Littering Behavior

Although the survey responses revealed relatively little variation in attitudes about trash and littering, the patterns associated with respect to self-reported and observed littering behavior are more interesting. Figure 5.2 shows indicates that self-reported littering behavior was quite low across all treatment groups. In addition, the self-reported frequency of littering in treatment group in which there was no punishment for littering appears to be slightly lower than the control group and the other two treatment groups, which supports the general patterns in the long-term observation of littering behavior reported in chapter 4. In contrast to self-reported littering behavior, the observed littering behavior of the individuals in the survey sample is both substantially higher and does not follow the same pattern as either the self-reported littering behavior or the long-term observation of littering behavior.

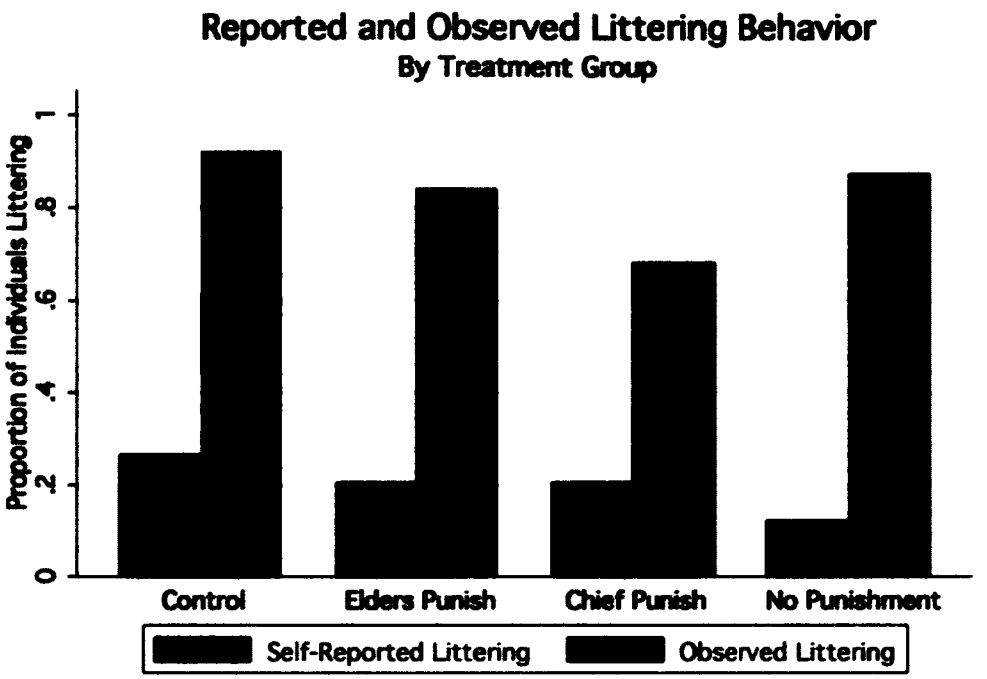

Figure 5.2: Reported and Observed Littering Behavior, By Treatment Group

The discrepancy between self-reported and observed littering behavior is highlighted in Figure 5.2, which graphs the proportion of individuals whose observed littering behavior matched their self-reported behavior, by treatment group. Across all four experimental groups, the average rate of matches between self-reported and observed littering was low. The match between self-reports and behavior appears to be slightly higher in the chief punishment group, although as noted above this is driven by the somewhat lower observed rates of littering in that treatment group, rather than higher self-reported rates of littering.

As Table 5.3 indicates, some of these patterns are supported by the individual-level logit analyses. In particular, individuals who live in centers that were randomly assigned to the no punishment variant of the SAFI project waste management program were 21% less likely to report littering, vis-a-vis

individuals living in centers assigned to the control group, all else held equal. Columns 2 and 3 indicate that none of the treatment group dummy variables have a significant effect on the probability of an individual's observed littering behavior, or the match between their reported and observed littering behavior.

	(1) Self-Reported	(2) Observed	(3) Match
Elders Punish (d)	-0.118	-0.0276	0.00138
	(-1.07)	(-0.53)	(0.01)
Chief Punish (d)	-0.0857	-0.129	0.133
	(-0.68)	(-0.94)	(0.88)
No Punishment (d)	-0.211*	-0.0187	-0.0491
	(-2.18)	(-0.38)	(-0.39)
Gender (d)	-0.0188	0.00273	0.000416
	(-0.41)	(0.55)	(0.01)
Age	-0.00272	-0.00228	0.0117
	(-0.33)	(-1.15)	(1.70)
Age2	0.0000411	0.0000346	-0.000120
	(0.41)	(1.15)	(-1.48)
Primary Ed. (d)	-0.123*	-0.0437	-0.0562
	(-2.12)	(-1.32)	(-0.91)
Secondary Ed. (d)	-0.267***	-0.0156	-0.168**
	(-4.76)	(-0.61)	(-3.03)
Post-Sec. Ed. (d)	-0.345***	-0.0392	-0.125
	(-4.15)	(-0.71)	(-1.37)
< 1 KM From Town (d)	0.0325	-0.0682	0.134
	(0.51)	(-1.43)	(1.91)
1-5 KM From Town (d)	0.0932	-0.0173	0.103
	(1.21)	(-0.84)	(1.81)
5-10 KM (d)	0.173	-0.0223	0.140
	(1.72)	(-0.43)	(1.34)
+10 KM From Town (d)	0.00853	-0.147	0.147
	(0.08)	(-1.66)	(1.05)
Num. Visits Per Week	-0.00238	-0.0102	0.0235
	(-0.12)	(-1.44)	(1.34)
Pastoralist (d)	-0.0876	0.0160	-0.0815
	(-1.43)	(1.24)	(-1.30)
Observations	1020	875	853

Marginal effects; t statistics in parentheses
(d) for discrete change of dummy variable from 0 to 1
* p<0.05, ** p<0.01, *** p<0.001

Table 5.3: Marginal Effect of Treatment on Reported and Observed Littering Behavior

Taken together, these results provide some qualified support for the patterns reported in the analysis in chapter 4. The significance and size of the effect of the treatment with no punishment for littering on self-reported littering indicates that only that treatment may have resulted in the creation of shared social norms against littering behavior. This interpretation is consistent with the large and stable effect of this treatment on littering behavior reported above, and supports the interpretation of the experimental results that links civil society organizations, anti-littering norms, littering behavior, and collective action. In this interpretation, allowing chiefs or elders to punish littering behavior fails to lead to the creation of a new social norm against littering, which inhibits sustainable changes in littering behavior, particularly in the event that punishment for littering is no longer credible. In contrast, mobilizing civil society groups to maintain the public good of solid waste management may facilitate the creation of new social norms regarding littering, explaining the long-term success of those communities with respect to preventing littering.

The interpretation that the linkage between the no punishment treatment and self-reported littering behavior is due to the creation of anti-littering social norms is supported by the sign and significance of the effect of education on self-reported littering behavior. The results in column 1 of Table 5.3 indicate that completion of each additional level of education (primary, secondary, post-secondary) is associated with an even greater reduction in the probability of an individual reporting that they litter. Moreover, individuals who have completed

secondary education are significantly less likely to accurately report their littering behavior. One possible interpretation of these two findings is that increased levels of education increase individuals' awareness of anti-littering norms, but do not necessarily lead to internalization of those norms, which may lead them to assert to interviewers that they do not litter, even if their behavior reveals otherwise.

In spite of this evidence, the social norms interpretation is challenged in part by the results in column 2 of Table 5.3, which echo the generally anomalous patterns in observed littering behavior that are described visible in Figure 5.3. Although the lack of an effect of this treatment on the alternative measure of littering behavior collected in this survey raises some concerns about the tightness of the link between the treatment, norms, and behavior, this discrepancy may also be an artifact of a variety of possible differences in how the two littering behavior measures were collected. This interpretation is supported by the fact that the differences between the two measures of observed littering behavior were not particular to the no-punishment treatment group.

There are two potential explanations for why the measures of littering behavior collected via the littering survey might systematically diverge from the same measures that were collected weekly. One explanation is that the methods of counting littering behavior differed in several important ways in each study. In particular, the litter observation for the survey took place on a different set of days and locations, and for a shorter period of time during each observation period than in the main litter observation exercise. A second, and closely related explanation for this discrepancy is that because enumerators were both collecting

littering behavior observations and place-based sampling, their method of observing littering and non-littering may have been much less systematic, and may have been biased towards observing instances of littering and missing instances of non-littering.

5.3.3 Self-Reported Cleanup Participation and Frequency

Collective action is the second key component of the interpretation that is necessary for the empirical findings from chapter 4 to be consistent with the theory of public goods maintenance developed in this manuscript. That is, evidence that ongoing collective action to clean a center is higher in the civil society group vis-a-vis the control group and the other treatment groups will help to support the interpretation that whereas the civil society treatment encourages collective action and discourages littering behavior, the two treatments in which littering is punished by either chiefs or elders have the opposite effect, on average.

In the SAFI Project survey, there are four different measures of collective action aimed at removing public waste: 1) the respondent's reported willingness to participate in a hypothetical clean-up on that day, 2) the respondent's self-report of whether they had ever participated in a clean-up in their center, 3) the respondent's self-report of whether anyone that they know had ever participated in a clean-up in the center, and 4) the respondent's estimate of the average number of clean-ups that take place in that center each month. These measures attempt to capture two different aspects of the concept of collective action. The first two measures both capture an individual's willingness to engage in collective

action to remove waste from the center, while the latter two measures attempt to assess the overall frequency of collective action to remove trash in that center.

Figure 5.3 presents the aggregate results of the answer to the question, "If a public cleanup were organized today, do you think you would participate?" Visually, the results appear quite similar to the attitudinal questions reported above. Overall, a majority of individuals in all treatment groups said that they would participate in a hypothetical cleanup.

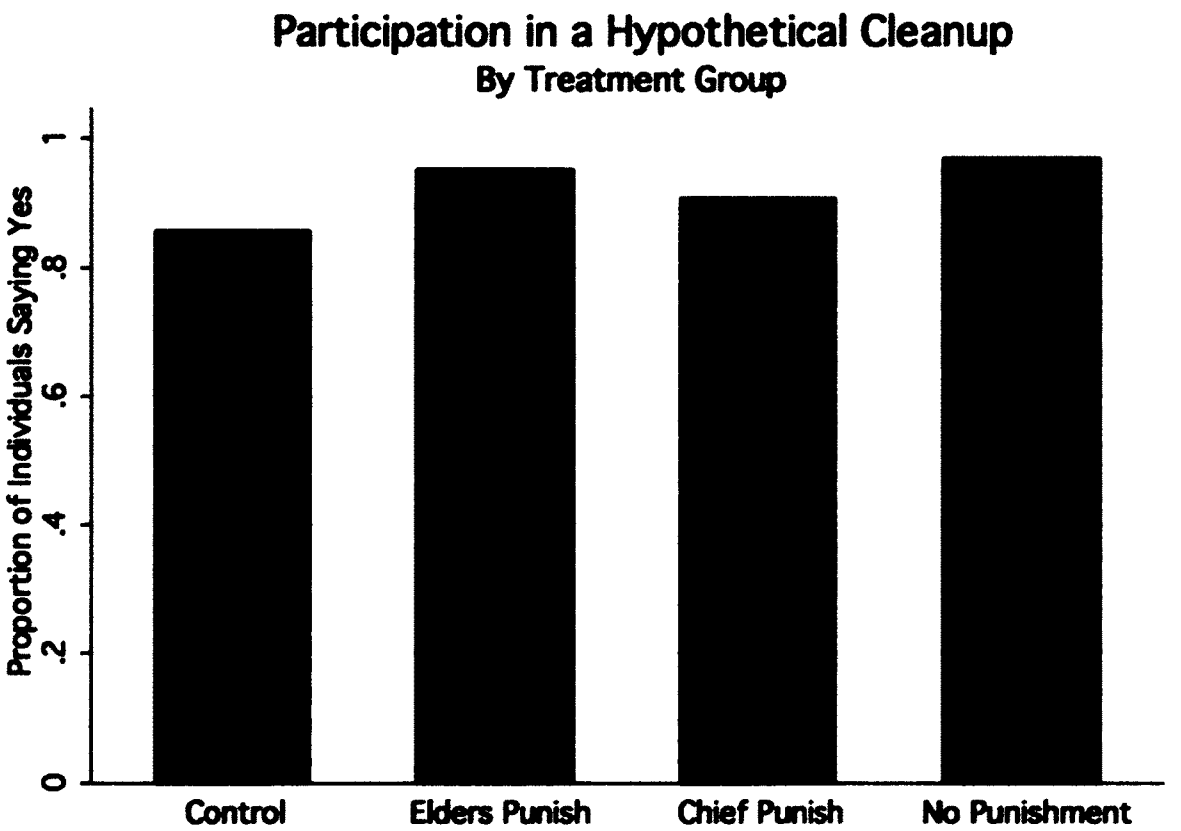

Figure 5.3: Participation in a Hypothetical Cleanup, By Treatment Group

Figure 5.4 shows the aggregate answers to the question of whether individuals reported participating in a cleanup themselves or whether they knew someone who participated. Several trends are apparent from examining these two measures side by side. First, both measures of actual participation in clean-ups appear to be lower than individual's assessments of participation in a hypothetical cleanup, even though the measures of actual participation are also self-reported. Second, across all three treatment groups, individuals appear to be less likely to report that they had participated in a cleanup themselves than to report they someone that they knew had participated in a cleanup. Third, reported participation in all three treatment groups appears to be higher on average than in the control group. Figure 5.5 shows the combination of these two measures, summing all people who participated themselves, knew someone who participated, or both.

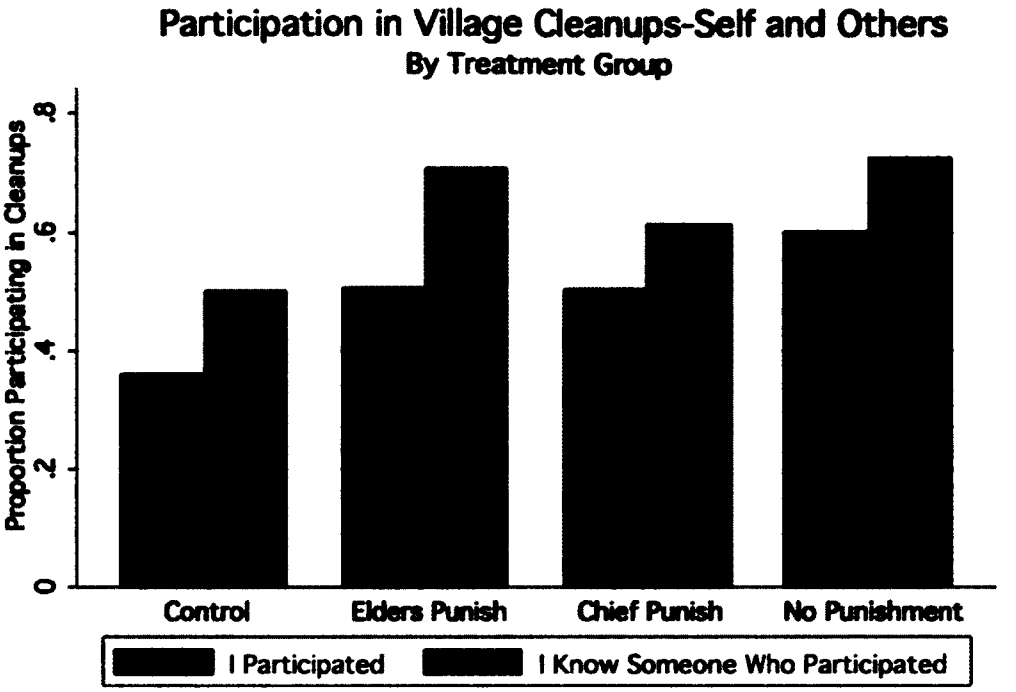

Figure 5.4: Self-Reported Participation in Village Cleanups, By Treatment Group

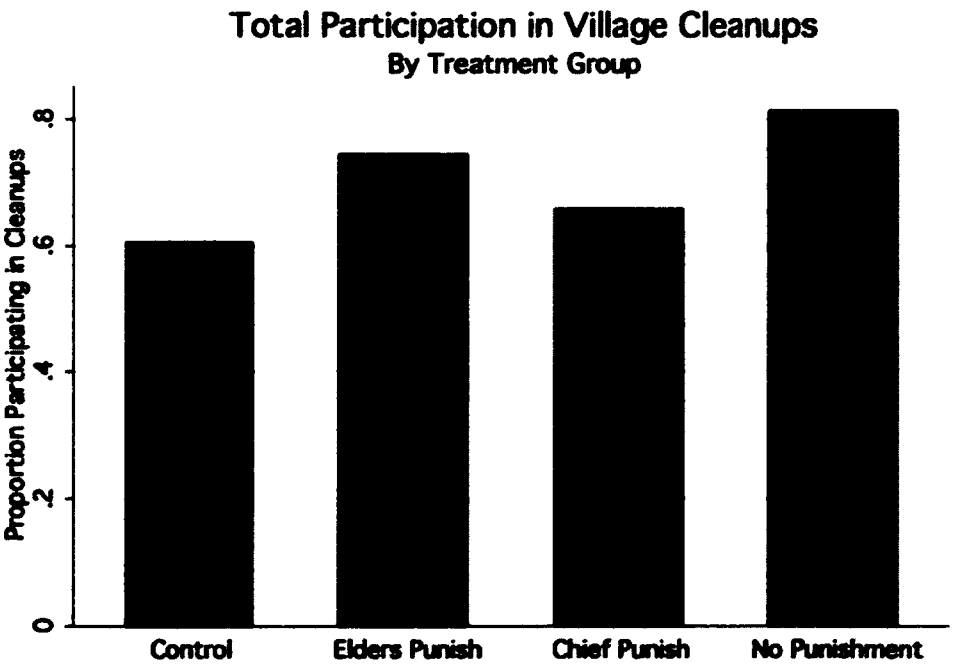

Figure 5.5: Total Self-Reported Participation in Village Cleanups, By Treatment Group

Finally, Figure 5.6 shows the average number of center cleanups per month reported by individuals in each of the four experimental groups. In contrast to the other three measures of cleanup participation, the graph indicates relatively stark differences in levels of collective action across treatment groups.

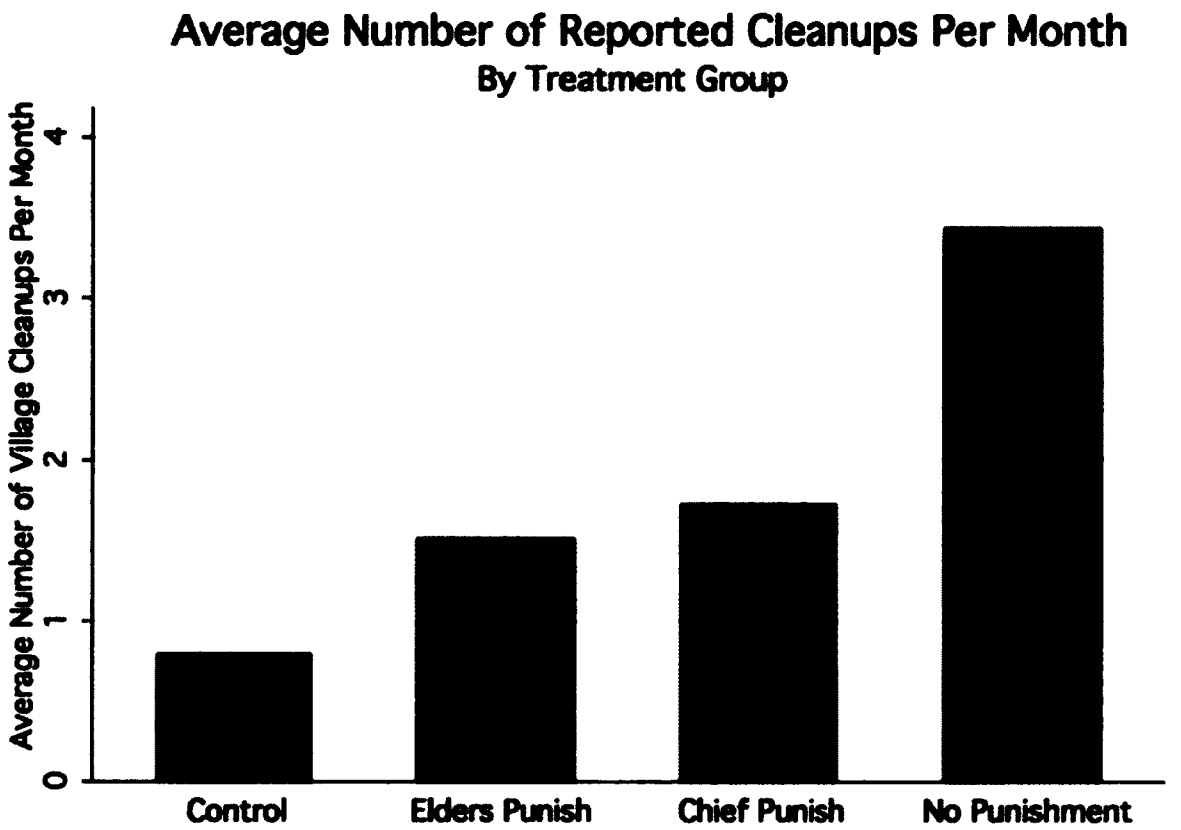

Figure 5.6: Average Number of Reported Cleanups Per Month, By Treatment Group

Table 5.4 shows results of the logit regressions for four of the outcome measures described above, which confirm and deepen the insights from the visual examination of the graphs. The most consistent result that emerges from these four models is the relationship between the No Punishment treatment

group and self-reported participation in and frequency of public trash clean-ups, which is statistically significant and substantively large across all four of the measures of participation. Compared to individuals in the control group, individuals in the civil society mobilization treatment were 18.1 % more likely to state willingness to participate in a control group, were 23.8 % more likely to report having participated in a clean-up themselves, and reported on average 2 more trash cleanups per month, all else held equal. In contrast, the relationship between the other two treatments and cleanup participation is not statistically distinguishable from zero, with the exception of the effect of the Elders punishment treatment on hypothetical participation in a cleanup.

In addition to the apparent effect of the civil society mobilization treatment on patterns of participation in public trash cleanups, several additional individual-level covariates are associated with individual self-reports of hypothetical and actual littering behavior and assessments of frequency of collective action to remove trash in the center. As with littering behavior, completion of both secondary and post-secondary education are significantly associated with increased participation in clean-ups, with each level of higher education associated with a greater than 10% increase in the likelihood of intended or actual participation in a clean-up.

	(1) Hypothetical	(2) Actual-Self	(3) Actual-Total	(4) Cleanups-C~t
Elders Punish (d)	0.165*	0.138	0.153	0.732
	(2.17)	(1.42)	(1.50)	(1.45)
Chief Punish (d)	0.128	0.0973	0.129	0.862
	(1.44)	(0.81)	(1.36)	(1.29)
No Punishment (d)	0.181*	0.238*	0.284*	1.987***
	(2.05)	(2.38)	(2.53)	(3.77)
Gender (d)	0.0473	0.0628*	0.0359	0.189
	(1.09)	(2.18)	(1.21)	(1.43)
Age	0.00957	0.0147*	0.0111	0.109**
	(1.16)	(2.37)	(1.75)	(3.20)
Age2	-0.0000734	-0.000178*	-0.000104	-0.00125**
	(-0.73)	(-2.29)	(-1.30)	(-2.87)
Primary Ed. (d)	0.0721	0.0608	0.105	0.532*
	(1.02)	(1.19)	(2.02)	(2.65)
Secondary Ed. (d)	0.137	0.137*	0.167**	0.667***
	(2.01)	(2.28)	(2.76)	(3.85)
Post-Sec. Ed. (d)	0.158*	0.142*	0.183**	0.665*
	(2.38)	(2.42)	(3.37)	(2.68)
< 1 KM From Town (d)	0.00356	0.0268	0.00762	0.0800
	(0.04)	(0.56)	(0.15)	(0.38)
1-5 KM From Town (d)	-0.0995	-0.0663	-0.0628	-0.290
	(-0.82)	(-1.30)	(-1.16)	(-1.15)
5-10 KM (d)	-0.317*	-0.0880	-0.117	-0.0519
	(-2.16)	(-1.35)	(-1.98)	(-0.19)
+10 KM From Town (d)	-0.197	-0.0638	-0.124	0.313
	(-1.06)	(-0.77)	(-1.38)	(0.70)
Num. Visits Per Week	0.0121	0.0378*	0.0296*	0.169**
	(0.68)	(2.52)	(2.17)	(2.92)
Pastoralist (d)	0.127*	0.115*	0.100	0.0133
	(2.19)	(2.32)	(1.96)	(0.05)
Observations	985	989	1051	906

Marginal effects; t statistics in parentheses
(d) for discrete change of dummy variable from 0 to 1
* p<0.05, ** p<0.01, *** p<0.001

Table 5.4: Marginal Effect of Treatment on Reported Cleanup Behavior

In addition, increased education is also associated with a slightly higher report of the number of monthly cleanups in a village. As discussed above, one explanation is that this result could be an indication of educated individuals being more aware of pro-cleanup social norms, and accordingly inflating their estimate of the number of monthly cleanups in the center, possibly along with their reports of their own hypothetical and actual participation in cleanups in the center. A second interpretation of this pattern is that more educated individuals

are more informed about public events, such as cleanups, that take place within the center, and thus their higher report of the number of cleanups is closer to the true number of monthly cleanups.

Examining the other significant individual-level covariates of participation in and assessment of frequency of center cleanups can help to interpret the relation between education and participation. In particular, the number of visits that an individual makes to the center in which they were interviewed is significantly associated with increased probability of reporting having participated in a cleanup, knowing someone who participated in a cleanup, and the number of cleanups reported in the center. The significance of this personal characteristic provides suggestive evidence in support of the information interpretation of the association between education and reported number of center clean-ups per month. In this interpretation, individuals who visit a center more frequently have more opportunities to participate in cleanups and are more likely to know people who have participated in clean-ups in the center, leading them to a more accurate perception of the frequency of cleanups.

In addition, individuals who are members of one of the 5 pastoralist tribes in Laikipia (Maasai, Samburu, Turkana, Borana, or Somali) are substantially more likely than non-pastoralists to report hypothetical and actual participation in clean-ups. Given that this effect on participation appears to be independent of assessments of the participation of others and frequency of clean-ups, this seems to indicate an higher propensity of individuals from these communities to engage in collective action to remove trash.

These analyses focusing on the measures of collective action to remove trash from public spaces in a center help to interpret some of the patterns in the trash count and littering data that were discussed in chapter 4 and in the preceding section of this chapter. In particular, the higher propensity towards and frequency of cleanups in villages assigned to the treatment with civil society mobilization but no punishment is consistent with the temporal patterns revealed in the time series trash count data, in which trash count measures were indistinguishable from the control-group for the first ten weeks, and then took almost another ten weeks to reach the same level as the other two treatment groups.

Taken together with the data on actual and self-reported littering behavior reported above, this linkage between collective action and the maintenance of a trash-free center also presents some evidence in favor of the interpretation linking collective action, social norms, and the prevention of harmful action, and by proxy for the theory of public maintenance developed in chapter 2. Although the lack of panel survey data makes it impossible to establish causality between collective action, social norms, and littering behavior, the data that I have presented here suggests that in the context of Laikipia, interventions to provide and maintain public sanitation that introduce explicit rules that allow chiefs or elders to prevent harmful action littering may inhibit, or at the very least fail to encourage ongoing collective action.

Conversely, in centers in which the provision of public solid waste management through basic infrastructure provision and mobilization of civil society groups was not supported by punishment, short-term reductions in trash

in public areas and in littering behavior lagged behind centers with littering. However, over a period of nearly two years, centers in this treatment group had the lowest observed rates of littering on a weekly basis, the lowest self-reported littering behavior, and highest reported rates of collective action, indicating the emergence of a distinct set of local institutional arrangements supporting the maintenance of solid waste in these centers. Although these results are particular to the case of public waste management and littering in Laikipia, taken together, they provide compelling support for the core observable implications of the theory of institutions and public goods maintenance developed in chapter 2.

One weakness of the data, which limits the strengths of the inferences that I can make in this section is the lack of behavioral observations regarding propensity towards and frequency of cleanup participation. The lack of this data prevents me from directly pairing observations of actual behavior with the self-reported data on cleanup behavior, as I did with the measures of littering. The discrepancies between the self-reported and observed measures of littering discussed above demonstrated the value of pairing self-reported survey data not just with behavioral observations, but with behavioral observations from multiple sources.

As discussed above, one possible interpretation of the patterns in the littering behavior data is that although the civil society mobilization treatment appears to have raised awareness of an anti-littering norm, the inconsistencies between the various measures raise the possibility that the link between

awareness of the norm, internalization of that norm, and behavior is not particularly strong. Similarly, results from the self-reported data on cleanups is that the civil society mobilization treatment is associated with an increase in awareness of the existence of social norms encouraging participation in cleanup activities.

5.3.4 Self-Reported Actions Against Littering

One of the strongest findings in the preceding sections was the statistically significant and substantively meaningful association between the civil society mobilization treatment and self-reported littering and clean-up behavior. This set of findings generally supported the analysis of the trash count and littering behavior data from chapter 4, which showed that the civil society treatment outperformed the two punishment groups with respect to inducing long-term changes in littering behavior. Taken together, this set of findings raises a set of secondary questions about the relationship between the punishment regimes embedded in the three treatment groups and respondents' perceptions of the likelihood of chiefs, elders, and their fellow community members punishing littering.

One such set of questions is whether the civil society mobilization treatment lead to a greater tendency of individuals to informally punish individuals who litter. If this is the case, it would provide further evidence in support of the interpretation that this variation of the SAFI Project program was effective at inducing long-term change through the linkage of collective action, the creation of informal anti-littering social norms, and the mutual enforcement of those norms within the community. Figure 5.7 shows the patterns in

individuals' self-reported willingness to take action when they see someone littering in the center, either by means of verbally scolding or warning the person or reporting the incident to someone else, while Figure 5.8 shows the combination of both types of action.

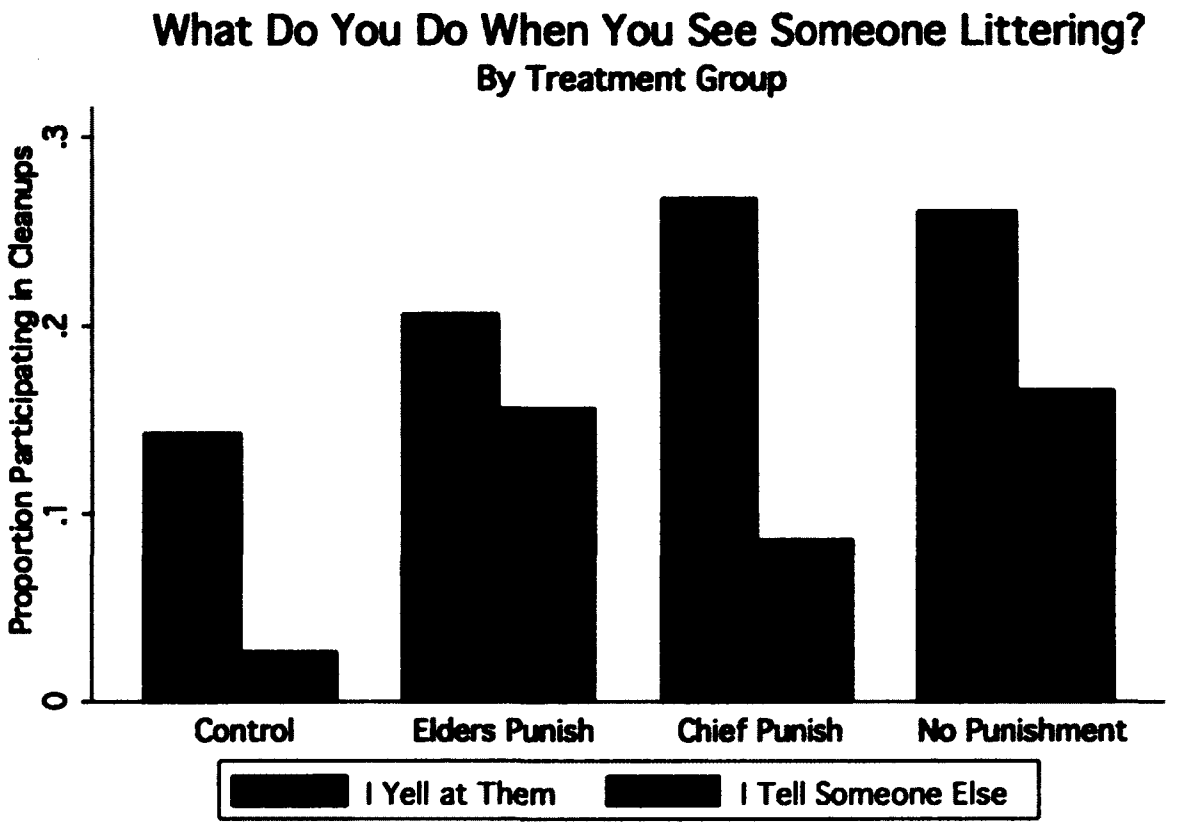

Figure 5.7: Self-Reported Responses to Littering: Type of Action Taken

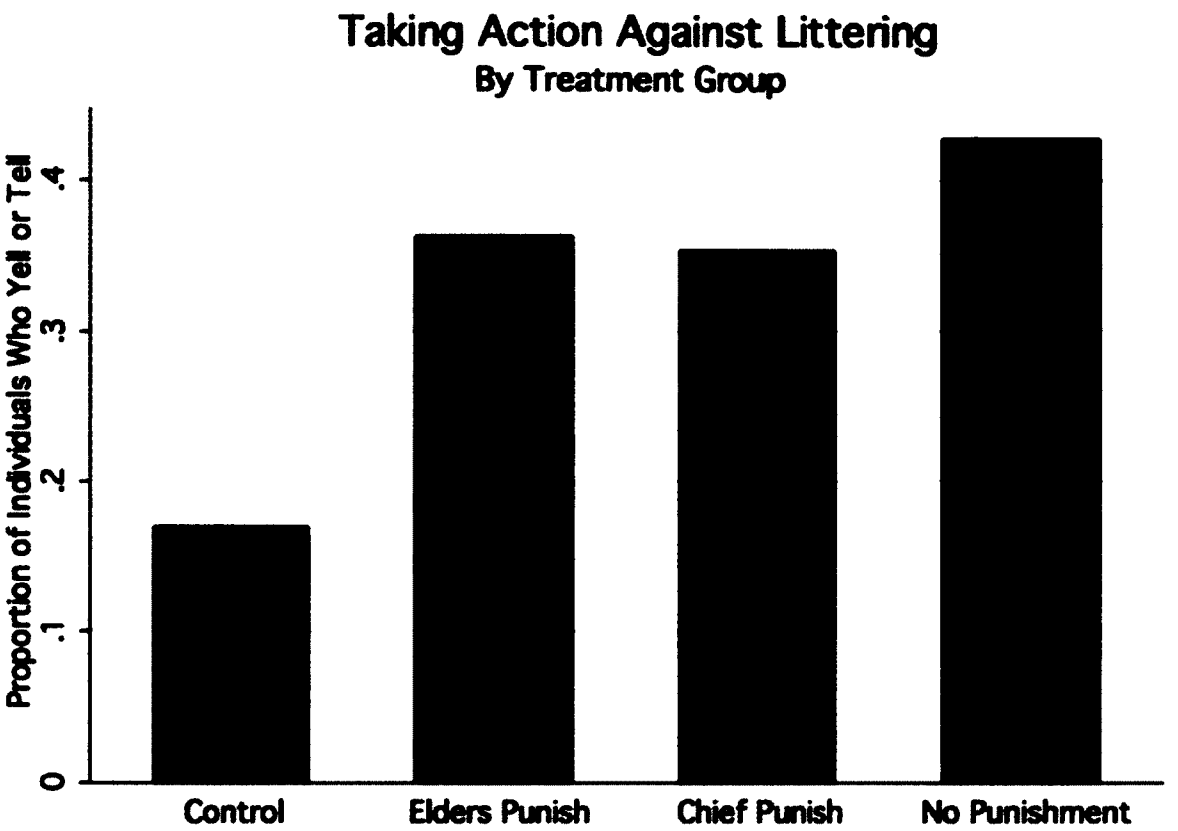

Figure 5.8: Self-Reported Responses to Littering, By Treatment Group

Both graphs indicate several patterns about respondents' willingness to take action against littering. First, across all of the experimental groups, individuals reported a higher willingness to verbally scold others for littering rather than telling someone else. Second, both taken individually and combined, self-reported willingness to take action against littering is relatively rare. Third, despite the modest rates of self-reported action when observing littering, there are several visible differences in patterns between the three treatment groups. Most notably, although both "Yelling" and "Telling" are both reasonably prevalent in the civil society mobilization group, the chief punishment group is characterized by low rates of reporting littering to someone else. In contrast,

individuals in the elders punishment treatment exhibited the opposite pattern, exhibiting relatively lower frequency of direct interpersonal sanctions for littering, but a higher relative frequency of reporting littering to someone else. Because the civil society mobilization group is the only one in which both kinds of action against littering are relatively prevalent, it has the highest average total rate of individuals who report that they take action against littering.

Fourth, when individuals answered that they report littering behavior to someone else, enumerators were instructed to ask a follow-up question inquiring who they usually tell. Figure 5.9 shows the proportion of individuals in each treatment group who reported telling elders when they observe littering. There are two implications of this graph. On the one hand, individuals in the elders punishment group were more likely than anyone else to say that they would report littering to an elder. On the other hand, even in the treatment group in which elders are permitted to punish littering, the overall rates of individuals reporting littering to the elders is quite low.

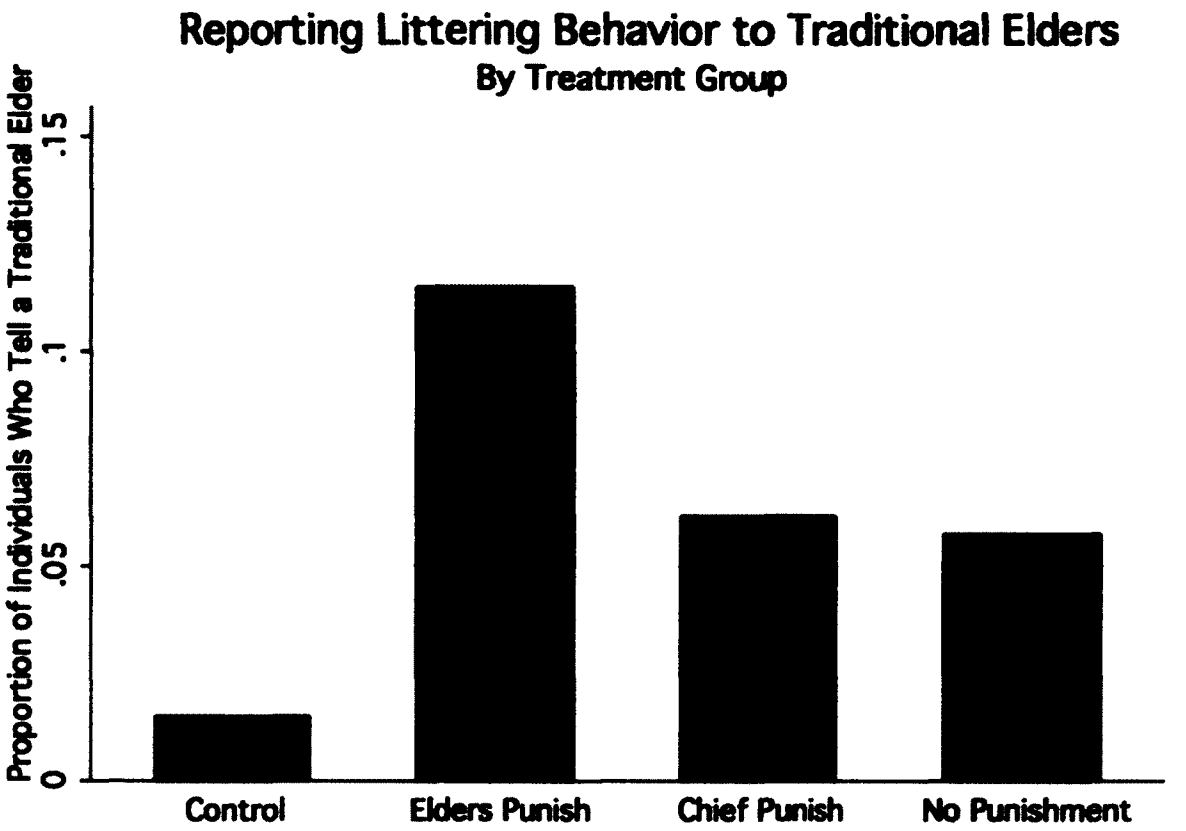

Figure 5.9: Reporting Littering Behavior to Traditional Elders, By Treatment Group

Table 5.5 presents the results of the logit analyses of the effects of the experimental treatments on self-reported social sanctioning and reporting behavior. After controlling for individual-level characteristics, none of the three treatment groups has a statistically significant effect on "Yelling" or "Telling", nor on the frequency of reporting littering to elders. In general, all of the individual-level characteristics are also insignificant, with the exception of the dummy variable that is coded 1 if an individual is a member of a pastoralist community. All else held equal, pastoralists are 14% percent more likely to yell at individuals for littering than members of other ethnic communities, and are overall 12% more likely to either yell at or report a litterer. This finding is consistent with the

previously discussed finding that individuals from pastoralist communities are also systematically more likely to report both hypothetical and actual participation in cleanups.

	(1) Yell	(2) Tell	(3) Yell/Tell	(4) Tell-Elders
Elders Punish (d)	0.0364	0.0462	0.122	3.98e-09
	(0.87)	(1.32)	(1.84)	(0.32)
Chief Punish (d)	0.0770	0.0158	0.114	1.49e-09
	(1.27)	(0.62)	(1.18)	(0.30)
No Punishment (d)	0.0641	0.0527	0.180	1.49e-09
	(0.90)	(1.28)	(1.76)	(0.42)
Gender (d)	0.0140	-0.00109	0.00989	-8.46e-11
	(0.99)	(-0.79)	(0.71)	(-0.31)
Age	-0.00197	0.00304	-0.000443	1.84e-10
	(-0.91)	(1.41)	(-0.19)	(1.99)
Age2	0.0000336	-0.0000518	0.00000749	-3.31e-12*
	(1.28)	(-1.41)	(0.26)	(-2.19)
Primary Ed. (d)	0.0238	0.0240	0.0581	0.0225
	(1.24)	(1.71)	(1.92)	(1.90)
Secondary Ed. (d)	0.0163	0.0282	0.0553	0.0248
	(0.74)	(1.70)	(1.78)	(1.61)
Post-Sec. Ed. (d)	0.0150	0.0276	0.0585	0.0114
	(0.49)	(1.47)	(1.51)	(1.02)
< 1 KM From Town (d)	0.00343	-0.00426	-0.0171	-3.55e-10
	(0.26)	(-1.43)	(-1.18)	(-0.38)
1-5 KM From Town (d)	-0.00914	-0.00353	-0.0236	-2.56e-10
	(-0.57)	(-1.31)	(-1.28)	(-0.34)
5-10 KM (d)	0.00117	-0.00262	-0.0155	
	(0.04)	(-0.66)	(-0.55)	
+10 KM From Town (d)	0.0377	-0.00407	0.0166	
	(0.78)	(-1.09)	(0.45)	
Num. Visits Per Week	0.00864	-0.000764	0.00618	-9.47e-11
	(1.81)	(-0.83)	(1.34)	(-1.25)
Pastoralist (d)	0.142**	-0.00144	0.124**	-1.12e-11
	(3.21)	(-0.50)	(3.01)	(-0.06)
Observations	922	922	922	836

Marginal effects; t statistics in parentheses
(d) for discrete change of dummy variable from 0 to 1
* p<0.05, ** p<0.01, *** p<0.001

Table 5.4: Marginal Effect of Treatment on Actions Against Littering

What is striking about this pattern of pastoralist participation is that monitoring and sanctioning are themselves public goods, indicating that vis-a-vis other ethnic communities, pastoralists may possess some kind of advantage with respect to mobilizing both kinds of collective action involved in solving public goods maintenance problems. This is consistent with a variety of findings from the literature on institutions and the management of common pool natural resources, which provides substantial evidence that communities of resource users linked by dense, multiplex, long-lasting social relationships are capable of engaging in long-term collective action to provide and maintain common pool resources (Singleton and Taylor 1992).

The discussion of kinship and age sets in chapter 3, as well as the broader literature on pastoralism in East Africa indicates that many of the pastoralist communities in Laikipia do have a set of norms, networks, and governance structures that play a role with coordinating rangeland management (Anderson 1986; Ensminger 1997; E. Fratkin and Smith 1995; Galaty 1982; Nathan, E. M. Fratkin, and Roth 1996). The results from this survey provide some tentative evidence that these institutions and social organizations may have positive spillovers for other kinds of local public goods, such as solid waste management.

5.3.5 Reported Actions of Elders and Chiefs against Littering

A second set of follow-up questions is whether the strong relative performance of the civil society mobilization treatment group is actually a reflection of a counter-productive effect of punishment of littering behavior by chiefs and elders. In order to make an inference about the effect of punishment

on littering, it has to be the case that the specified punishment regime was implemented as designed in each of the three treatment groups, and that that punishment was common knowledge throughout each center.

In the SAFI Project survey, I attempted to answer this question by asking respondents what they thought that Elders and Chiefs would do if they saw someone littering in that center. Figure 5.10 presents the proportion of individuals in each treatment group who answered either of these questions by saying that the authority figure in question usually either "Warn" or "Punish" individuals that they observe littering in that center. A number of the patterns in this graph indicate that citizen beliefs about punishment behavior across all four of the experimental groups diverge substantially from those that would be predicted by strict adherence to the punishment scheme created by each treatment.

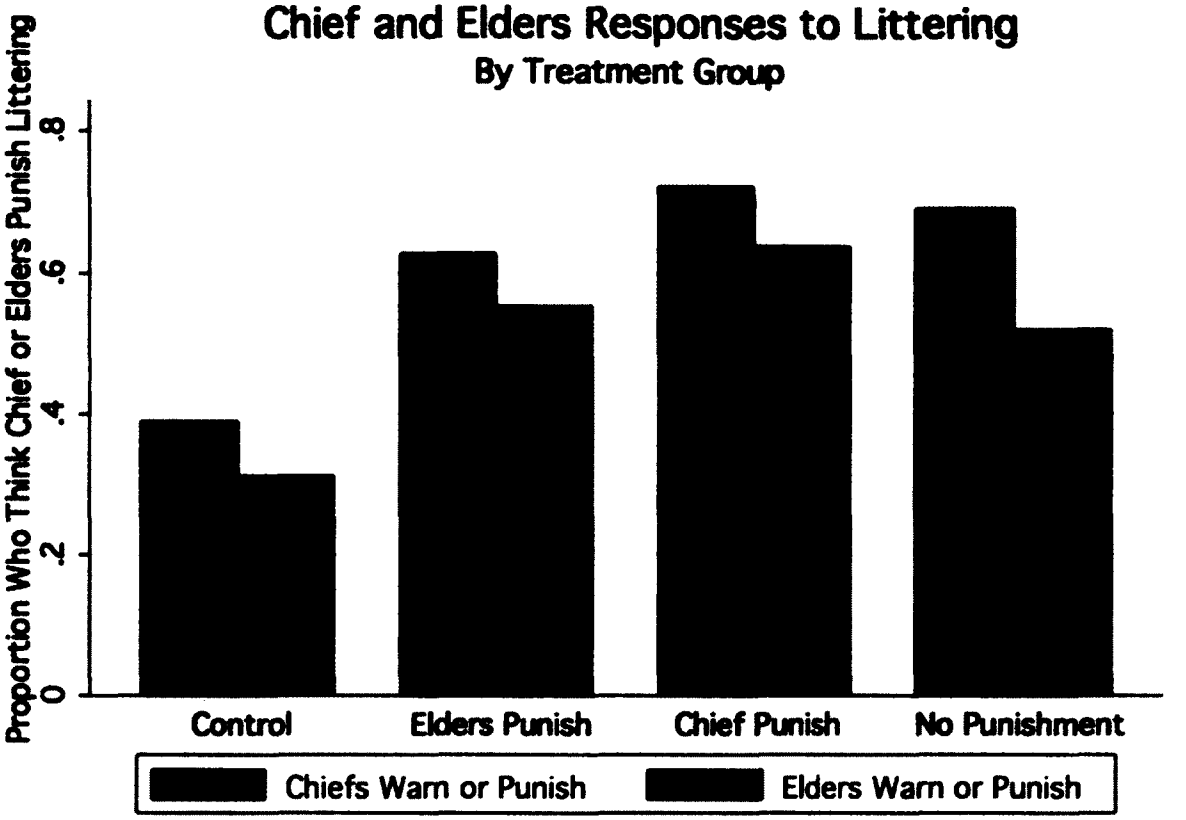

Figure 5.10: Chief and Elders Responses to Littering, By Treatment Group

The most noticeable pattern is that individuals in a center in which a SAFI project program was implemented appear to have a greater expectation of either elders or chiefs taking action against littering, vis-a-vis individuals in control group centers. There are several aspects of this pattern that are puzzling. First, individuals in all three of the treatment groups have relatively similar beliefs in the likelihood of punishment by elders and chiefs, in contrast to the divergent beliefs that would be consistent with the punishment regimes in each of the three treatment groups. More specifically the fact that nearly all of the treatment groups are identical with respect to beliefs of the likelihood of punishment

behavior by elders and chiefs means that none of the treatment groups follow the expected pattern of littering behavior described above.

Table 5.6 indicates that the anomalous patterns in beliefs about punishment behavior by elders are generally supported by the logit analysis. In particular, Column 1 indicates that when belief in elders warning and punishing litterers is combined as the dependent variable, only the chiefs punishment group has a statistically significant impact on individual expectations of elders taking action against littering. Columns 2 and 3 indicate that this result is largely driven by beliefs in elders warning, rather than explicitly punishing littering. As column 2 indicates, beliefs in elders formally punishing littering are very low on average and neither assignment to one of the SAFI treatment groups nor any individual covariates are significantly associated with individual belief in the likelihood of elders punishing littering.

In contrast, when looking only at elders warning individuals for littering, the coefficients on both the chiefs punishment treatment, and the elders punishment treatment are statistically significant and substantively large. In addition, the other noteworthy result from these analyses is the significant and large association between being a member of a pastoralist tribe and expectations that elders warn or punish littering behavior, which is consistent with the qualitative evidence from chapter 3 regarding the harm prevention roles played by elders in pastoralist communities, along with the evidence presented above regarding pastoralist propensities towards engaging in collective action to both remove trash and punish littering behavior.

	(1) Warn	(2) Punish	(3) Both
Elders Punish (d)	0.254*	0.00692	0.278*
	(2.36)	(0.57)	(2.12)
Chief Punish (d)	0.287**	0.0173	0.350**
	(2.76)	(0.75)	(2.94)
No Punishment (d)	0.230	0.00118	0.235*
	(1.98)	(0.38)	(2.11)
Gender (d)	0.0138	-0.000514	0.0126
	(0.46)	(-0.34)	(0.42)
Age	-0.0115	0.00182	-0.0100
	(-1.33)	(0.84)	(-1.20)
Age2	0.000149	-0.0000315	0.000123
	(1.41)	(-0.84)	(1.19)
Primary Ed. (d)	-0.00258	0.0239	0.0334
	(-0.05)	(1.58)	(0.68)
Secondary Ed. (d)	0.0353	0.0248	0.0773
	(0.49)	(1.75)	(1.05)
Post-Sec. Ed. (d)	0.0488	0.0315	0.103
	(0.61)	(1.15)	(1.16)
< 1 KM From Town (d)	0.113*	-0.00401	0.0651
	(2.22)	(-0.87)	(1.20)
1-5 KM From Town (d)	-0.0548	-0.00207	-0.0807
	(-0.95)	(-0.61)	(-1.30)
5-10 KM (d)	-0.101	-0.000373	-0.115
	(-1.44)	(-0.08)	(-1.57)
+10 KM From Town (d)	0.160	0.00104	0.165
	(1.39)	(0.15)	(1.25)
Num. Visits Per Week	0.0156	0.000542	0.0185
	(1.01)	(0.60)	(1.09)
Pastoralist (d)	0.135**	0.00129	0.150**
	(2.75)	(0.69)	(2.96)
Observations	937	937	937

Marginal effects; t statistics in parentheses
(d) for discrete change of dummy variable from 0 to 1
* p<0.05, ** p<0.01, *** p<0.001

Table 5.6: Marginal Effect of Treatment on Perceptions of Elders Warning and Punishing Litterers

Taken together, these results aid in the interpretation of the discrepancies in individual beliefs about punishment behavior in several ways. First, these results indicate that it is not necessarily the case that the elders punishment treatment "failed" completely. That is, the significance of the elders treatment, coupled with the suggestive evidence regarding the effect of this treatment on the likelihood of individuals reporting littering to elders, indicates that the treatment did have an impact on beliefs about the participation of elders in preventing littering behavior, which in turn supports the interpretation that the treatment program was implemented as designed.

At the same time, the insignificant and substantively small association between the treatment and actual expectations of elders punishing individuals for littering indicates that this kind of formal monetary sanction may not be part of elders' usual legitimate repertoire of sanctions, and that the SAFI project treatment was not enough to change this deeper set of social norms. The higher propensity of individuals from pastoralist ethnic communities, regardless of their treatment center, supports this interpretation, indicating heterogeneity in norms surrounding the governance role of elders. Conversely, the significance of the chief punishment treatment in shaping beliefs in both warning and punishment indicates that this treatment may have primed citizens expectations for punishment of littering by all authorities in the center, regardless of whether they were specified in the treatment.

Table 5.7 shows the results of the logit regression of respondent expectations of punishment behavior by chiefs on the treatment group dummy variables and individual-level characteristics. This analysis confirms that all

three of the experimental variations of the SAFI project intervention had a significant and large positive effects on individual beliefs in the likelihood of chiefs punishing or warning litterers. As with the examination of beliefs in punishment by elders, disaggregating between beliefs in chiefs issuing warnings and in administering fines indicate that this finding is largely driven by the effect of treatments on beliefs in chiefs warning litterers.

When examining the determinants of beliefs in chiefs warning litterers, it is worth noting that only the chiefs and elders punishment treatment groups have a significant effect; the coefficient on the civil society mobilization treatment is not statistically distinguishable from zero. In addition, a slightly larger proportion of individuals in the civil society mobilization treatment believe that chiefs punish littering behavior (column 3). Although neither this effect nor its difference from the other treatment groups is statistically significant, adding beliefs in chiefs punishing litterers to beliefs in chiefs warning litterers is what leads to the overall significance of the effect of this group on respondent beliefs about chiefs taking action against littering.

In addition, columns 1 and 2 indicate that a number of individual characteristics- namely education and proximity to the center where they were interviewed are significantly associated with individuals' beliefs in chiefs warning individuals for littering. This indicates that increased education and closeness to a center increases a belief in the role of the governnment in preventing harmful action, in contrast to beliefs in punishment by elders, which was largely driven by membership in pastoralist communities.

	(1) Warn	(2) Punish	(3) Both
Elders Punish (d)	0.221*	0.0151	0.250*
	(2.14)	(0.79)	(2.05)
Chief Punish (d)	0.339**	0.0119	0.368*
	(2.82)	(0.29)	(2.57)
No Punishment (d)	0.229	0.0407	0.299
	(1.64)	(1.75)	(1.98)
Gender (d)	0.0214	0.00841	0.0379
	(0.76)	(0.75)	(1.37)
Age	0.00186	0.00579	0.00503
	(0.27)	(1.00)	(0.71)
Age2	-0.0000166	-0.000100	-0.0000730
	(-0.21)	(-1.08)	(-0.86)
Primary Ed. (d)	0.0156	0.0363	0.0529
	(0.32)	(1.19)	(1.04)
Secondary Ed. (d)	0.0760	0.0545	0.144**
	(1.45)	(1.88)	(2.83)
Post-Sec. Ed. (d)	0.128*	0.0578	0.204**
	(2.12)	(1.47)	(3.14)
< 1 KM From Town (d)	0.121**	-0.0201	0.0816
	(2.80)	(-1.06)	(1.75)
1-5 KM From Town (d)	0.0314	-0.0215	-0.0141
	(0.54)	(-0.95)	(-0.21)
5-10 KM (d)	0.0590	-0.0296	-0.0130
	(0.81)	(-1.32)	(-0.20)
+10 KM From Town (d)	0.193	-0.0329	0.106
	(1.53)	(-1.21)	(0.85)
Num. Visits Per Week	0.0249	-0.00625	0.0181
	(1.79)	(-0.82)	(1.12)
Pastoralist (d)	0.0802	0.00377	0.0996
	(1.55)	(0.32)	(1.60)
Observations	968	968	968

Marginal effects; t statistics in parentheses
(d) for discrete change of dummy variable from 0 to 1
* p<0.05, ** p<0.01, *** p<0.001

Table 5.7: Marginal Effect of Treatment on Perceptions of Chiefs Warning and Punishing Litterers

As above, these patterns indicate that the experimental treatments interacted with preexisting local beliefs and norms regarding punishment of harmful action. Given that the chief and elders versions of the SAFI Project program both had an effect on beliefs in the elders' propensity to warn litterers

indicates that these treatments activated a general norm of elders looking after local projects in the center, even if the change in local bylaws to include actual punishment for littering proposed by the chiefs punishment treatment had no effect on citizen beliefs.

In contrast, the slight differences between the civil society mobilization treatment and the two treatments which were supposed to include punishment provide some suggestive indication that the treatment group without punishment led citizens to expect action by chiefs through an endogenous process that was triggered over time, especially when viewed in light of the other divergences between this treatment group and the other two.

5.4 Conclusion: Interpretation of Results

In summary, the individual-level survey evidence presented in this chapter help to tie together the arguments and findings presented throughout this manuscript. In particular, the most important findings in this chapter are that the version of the SAFI Project program in which civil society mobilization was not accompanied by any explicit anti-littering rule led to the high self-reported rates of public clean-ups and the low self-reported rates of littering behavior. The evidence presented in this chapter also indicates that by the time of this survey, individual beliefs regarding punishment of littering by chiefs and elders were largely incorrect from the perspective of each of the three experimental treatments. That is, individuals in all three treatment groups had similar beliefs about the likelihood of chiefs and elders punishing littering, regardless of whether or not their version of the SAFI Project program actually specified a formal fine for littering.

More generally, both of these patterns are consistent with the findings of the ethnographic and center-level analyses, which interpret the civil society intervention as more legitimate from the perspective of local norms and practices concerning public waste management. Paradoxically, the treatments that attempted to explicitly impose institutions designed to prevent harmful action appear to have failed to actually accomplish that goal and may have deterred dynamic provision of public waste management. Conversely, the treatment in which there was no punishment for littering appears to have actually led to the endogenous creation of norms or rules that prevent littering behavior and encourage continued clean-ups. Although these results are be puzzling from the perspective of many existing theories of public goods provision, they are broadly consistent with the theory developed above, which focuses on how interactions and feedback loops between the normative content of the multiple institutions operating in a given locality can shape public goods outcomes.

In this interpretation, even if the treatments were implemented as designed, long-term compliance with the specific punishment rules may have been relatively low due to a tendency for individuals to react to the program using internalized norms, habits, and scripts. Because the actual treatment protocol in the civil society mobilization treatment was relatively close to existing practices related to solid waste management, community members proceeded to mobilize ongoing collective action new outside project, and may have also expected modest increases in activity by chiefs and elders, even if expectation was not explicitly created by the SAFI Project staff members who implemented the mobilization. In contrast, because the treatments in which either elders or chiefs

deviated more strongly from local practice, community members disengaged from participation in clean-ups. At the same time, because the punishment treatments called upon elders and chiefs to engage in activities somewhat outside of their usual repertoire, their limited commitment to enforcing the anti-littering fine over time failed to lead to sustained changes in littering behavior.

Future iterations of this experiment in Laikipia and in other contexts can further test this interpretation by supplementing the long-term weekly environmental and behavioral measures with more-frequently repeated surveys and sustained, systematic observations of collective action and punishment behavior.

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