Doctoral Dissertation Research in Political Science:
Who Gets Public Goods? The Politics of Public Service Provision in India

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January 2009

1 Research Problem and Objectives

How do governments apportion basic public services when budget constraints necessitate their rationing? The way states respond to this question has profound implications for patterns of poverty and regional inequality. Especially in the developing world, whether or not one has access to electricity, clean water, or education is largely determined by the choices of governments and their agents. Despite a long theoretical tradition extolling the virtues of democracy for development, doubts persist on how effectively democracies provide basic public services in the developing world, where electoral politics are often linked to clientelism, patronage, and ethnic favoritism. Scholars continue to disagree on whether competitive elections are associated with better services for the poor.

My research engages this critical debate by examining the provision of scarce electrical power in northern India over the last two decades at an unprecedented level of geographic precision. More people in India lack electricity than any other country in the world, and nowhere more so than in the state of Uttar Pradesh where an estimated 50 million people are unconnected to the power grid. For those fortunate enough to be on the grid, power cuts are both ubiquitous and unpredictable, imposing enormous costs to both businesses and citizens.

These patterns reflect more than simply the slow march of technological progress. Because in India, state governments hold a monopoly over electricity production, distribution, and transmission (as in much of the developing world), the distribution of scarce electrical power across time and space also reflects the accumulation of deliberate choices made by political actors under intense and competing political, economic, and social pressures. Drawing on a novel set of satellite imagery of nighttime lights in India, official government data on electricity distribution, and harnessing geographic information systems (GIS) technology and statistical methods to identify patterns of change over time, this research will analyze variations in electricity provision across Uttar Pradesh over four election cycles spanning nearly two decades. The result will be a detailed and precise analysis of how a critical public service is distributed in a democratic region with one of the highest concentrations of poverty in the world.

My study goes well beyond the standard claim that Indian politicians manipulate public spending to win votes (Wade 1982, Singh et al. 2003, Transparency International 2005, Wilkinson 2006). By using annual satellite imagery to identify how levels of electricity provision vary over two decades at the local- and state assembly constituency-levels, I quantify how much influence politicians have on the delivery of a basic public service, I identify which politicians are most effective at delivering services to their constituents, and I estimate the actual effects of improved service provision on vote totals for incumbents. This project expands upon over a year of intensive research and data collection, including two field visits to Uttar Pradesh. Building on my experiences and insights gained from dozens of interviews, documentary research, and preliminary data analysis, I propose two sets of parallel research activities:

1. Collect and analyze data on electricity provision and election results for all 403 state assembly constituencies across Uttar Pradesh from 1992 to 2007;
2. Conduct two-months of intensive fieldwork within a single assembly constituency, using interviews and qualitative methods to investigate the political determinants of electrification and

electricity provision.

While this project focuses on the politics of electrification in Uttar Pradesh, it has broader impacts and relevance to all developing democracies in which governments must decide how to distribute scarce resources. In addition, by intensively validating the use of satellite imagery as an indicator of electrification, I also open new opportunities for the study of electricity provision in the rest of the world. Given that we simply do not know who gets public services in much of the world, the use of this technology may make a significant contribution to social sciences research.

2 Literature Review

A generation of theorists have lauded the positive effects of democracy on the provision of public goods. The conventional wisdom holds that democracies provide more public services because basic services like electricity, water, and sanitation are highly valued by the poor. Since the typical median voter is poor, election results should reflect a preference for higher public services (Meltzer & Richard 1981, Wittman 1989, Gradstein 1993). A similar theme is echoed by Acemoglu & Robinson (2006, p. 18) who state, "nondemocracy is generally a regime for the elite and the privileged; comparatively, democracy is a regime more beneficial to the majority of the populace, resulting in policies relatively more favorable to the majority." Anecdotal observations — like Amartya Sen's (1999) famous claim that famines do not occur in democracies — and some empirical studies have supported this expectation (Lake & Baum 2001, Bueno de Mesquita et al. 2003). But if democracies are better at providing public goods than autocracies, why do 57% of India's citizens lack electricity compared to fewer than 2% in China (International Energy Agency 2002)? Even if we cannot generalize from this paired comparison, there appears to be little cross-national evidence that democracy improves the welfare of the poorest or most vulnerable segments of society (Keefer 2005, Ross 2006). Keefer & Khemani, drawing on experiences in international development, observe that "policymakers in poor democracies regularly divert spending away from areas that most benefit the poor or fail to implement policies that improve the services that are known to disproportionately benefit poor people" (2005, p. 2). Meanwhile, an internal evaluation of 120 World Bank electrification projects, most in democratic states, laments that "the larger share of benefits from rural electrification is captured by the non-poor" (World Bank 2008, p. xv). Some argue that the representative aspects of democracy itself can lead to economic inefficiencies in the public provision of goods and services (Besley & Coate 1998, Robinson & Torvik 2005, Mani & Mukand 2007). Numerous studies suggest that clientelistic and patrimonial practices may corrode the supposed virtues of electoral accountability in both the developing and industrialized worlds (Bratton & van de Walle 1994, Chandra 2004, Stokes 2005, Scheiner 2006, Diaz-Cayeros, Magaloni & Estévez forthcoming).

Underlying the debate on the effects of democracy on public service provision is concern over the quality of cross-national data underlying our tests (Behrman & Rosenzweig 1994, Ross 2006, Treier & Jackman 2008). How can we reliably estimate the effects of democracy when public service provision is so poorly measured due to variations in definitions, data-gathering practices, bureaucratic capacity, and the possibility of fraud? In much of the world we simply do not know who gets public services, and reliable data is most scarce precisely where poverty is most persistent.

My dissertation takes on this challenge by introducing new data to re-evaluate how electoral politics shape the distribution of electricity in the developing world. More than simply a modern convenience, access to electricity is a life-altering transformation that improves quality of life and enables economic development. Electric light extends a day's productive hours, allowing children to study after the sun has set and enhancing safety at night. Powered water pumps reduce the effort needed to

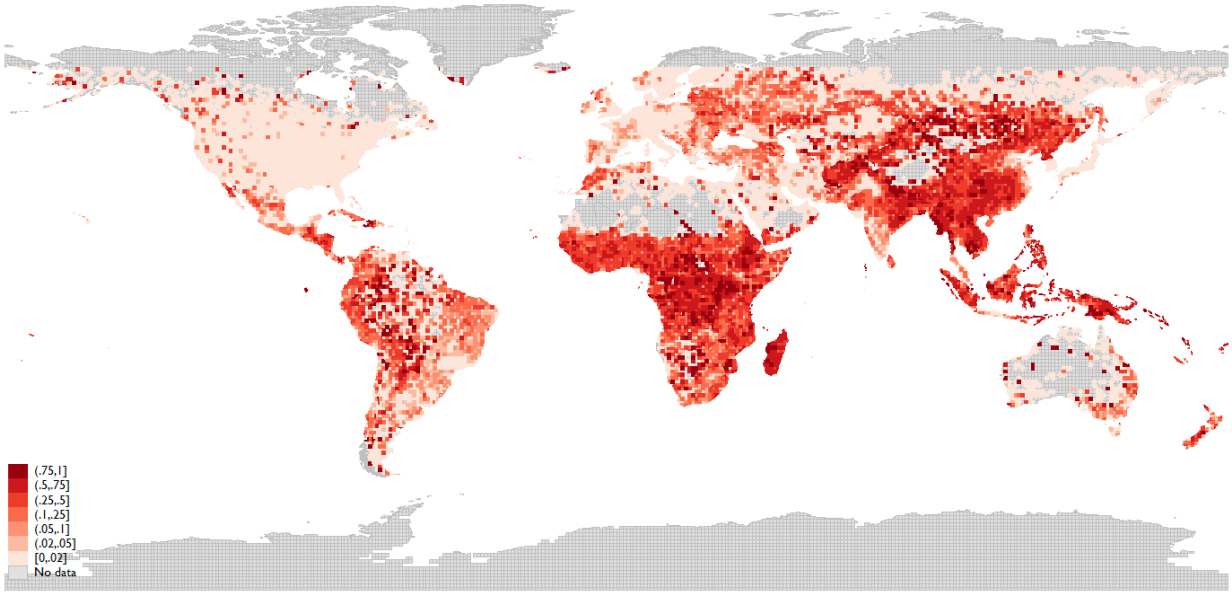

Figure 1: Living in the dark: Proportion of population living in unlit areas, 2003
Source: Author's computations based on NOAA National Geophysical Data Center satellite imagery and LandScan data.
Note: Each cell is 1-degree latitude by 1-degree longitude.

collect clean water. Refrigeration allows for the preservation of food and medicines. Electrical power promotes industrial development and job creation. Yet 1.6 billion people still lack electricity in rural villages and urban slums all across the developing world (International Energy Agency 2006). Because the decisions to extend and distribute electricity is typically made by governments, a critical question is whether democracies provide electricity any differently than non-democratic states. Using high-resolution satellite images of the earth at night that can detect light emissions from individual villages, I reveal dramatic differences in how states deliver electricity across and within all countries of the world from 1992 to the present (see Figure 1).[1]

Unlike traditional data that rely heavily on government self-reports, the satellite data are unbiased by human error or artifice, consistently recorded across time and space, and complete in their global coverage at an unprecedented level of geographic precision. I draw on this new data to evaluate the impact of democratic elections on the provision of electricity. Each part of my dissertation proceeds at a different geographic scale, from the global down to the local level, to build a compelling and consistent argument linking competitive elections to broader public service provision, even in the world's poorest states. This proposal requests funds to substantially strengthen my study of electrification in Uttar Pradesh, the primary case study of my dissertation.

3 Background: Politics and Public Service Provision in India

Since at least the time of Gandhi, India has had a longstanding commitment to alleviate poverty, especially in its rural villages where over 70% of Indians live. Yet aggregate levels of public service provision remain low and dramatic variations in access persist across the country (Kohli 1987, Varshney 1995, Chandra 2004, Chhibber & Nooruddin 2004), including in the provision of elec-

[1]Nighttime satellite images are collected by the Defense Meteorological Satellite Program and archived at NOAA's National Geophysical Data Center (Elvidge et al. 1997, Imhoff et al. 1997).

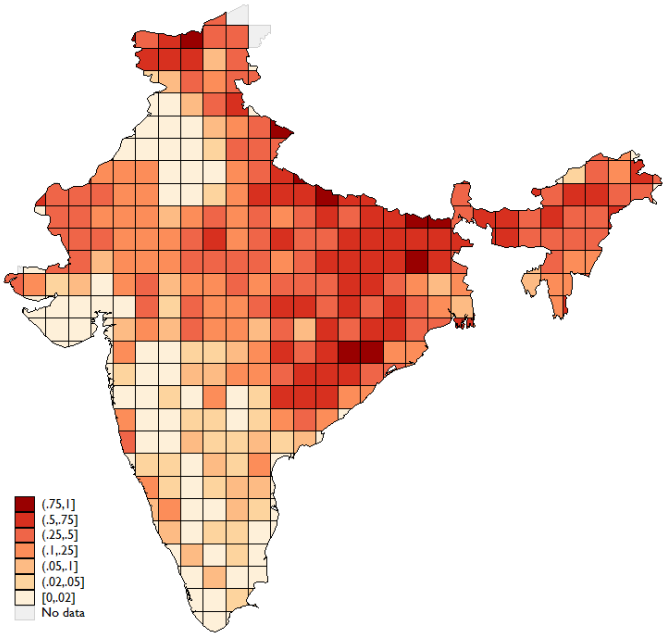

Figure 2: India in the dark: Proportion of population living in unlit areas, 2003
Sources: Author's computations from NOAA National Geophysical Data Center satellite imagery and LandScan data.

tricity. In 2007, peak national demand for electricity outstripped supply by 15%, not even taking into account the 600 million Indians who lack a household electrical connection. Official Ministry of Power data provide snapshots of inequality in electricity provision across the country: less than 60% of Uttar Pradesh's villages were electrified in 2005 compared with well over 90% of villages in neighboring Rajasthan and Madhya Pradesh. Supplementing these indicators, satellite image can provide much more nuanced estimates with repeated measurements over time, as in Figure 2 (higher resolution images down to 2.7 km are available).

In the world's most populous democracy, India has faced considerable difficulty in providing electricity, especially in rural areas where concentrations of poverty are highest. After decades of limited success by the Indian National Congress Party in achieving its universalist development goals, party politics fractured along sectarian and Caste lines, including the emergence Hindu nationalist Bharatiya Janata Party (BJP), as well as the Samajwadi Party (SP), supported by Other Backward Caste and Muslim voters in Uttar Pradesh. Also in Uttar Pradesh, the Bahujan Samaj Party (BSP) rose to national prominence, drawing on the numerical strength of Scheduled Caste voters, especially among the Chamar. The rise of these parties resulted in more clearly delineated distribution platforms and have strengthened the notion that Indian politicians use their discretionary power to direct infrastructure projects to their supporters and withhold public works from their opponents.

When the BSP seized control of the Uttar Pradesh government in the late 1990s, their leader, Chief Minister Mayawati Kumari initiated the Ambedkar Village program to provide over 11,000 Dalit villages with electrification, roads, and irrigation. The program was widely regarded as a targeted effort to solidify her base among Scheduled Caste voters. Although it was fashioned as a broad-based poverty alleviation program, the project was criticized for its blatant politicization of caste differences. Some characterized the program as a mismanaged "pet" project of Mayawati's, reflecting her "obsession with the Dalit agenda."[2] In an audit of the Ambedkar Village program,

[2] *Frontline*, "Mayawati in Deep Trouble," Volume 19, Issue 19, 14-27 September 2002.

numerous villages were found to have been illegitimately electrified, including six villages in the Barabanki district that had not obtained proper authorization. Several other villages were found to have been selected for electrification by intervention of the Energy Minister, contrary to program guidelines (Comptroller and Auditor General of India 2002). Studies of small infrastructure projects have found that many recipients of housing, latrines and wells were chosen on the basis of political affiliations (Wilkinson 2006). Another detailed study of local development grants in Madhya Pradesh from 2000–2002 documents how an MLA directed the bulk of infrastructure spending to sub-districts that had supported her in the prior election (Singh et al. 2003). That politicians manipulate the distribution of public works projects is explained by the great political value of such goods: public infrastructure is highly visible, offering conspicuous opportunities for ceremonies and credit-taking by politicians; they represent unique benefits that only office-holding politicians can provide; and they are durable reminders to voters of the benefits a politician has brought in the past.

A handful of studies have used statistical analysis to evaluate the role of politics on local public goods provision in India. Chhibber & Nooruddin (2004) link state-level variations in public goods provision to the number of effective parties competing in state assembly elections, though the level of aggregation does not allow for analysis of variations at the local level. Banerjee & Somanathan (2007) is the only study that collects data for all villages in India. However, they aggregate their data into national parliamentary constituencies and test only for the effects of social divisions on public goods provision and do not look at the effects of electoral competitiveness or other political processes. Two recent studies by economists examine the role of local-level councils on the provision of public goods to villages. Foster & Rosenzweig (2004) use a twenty-year panel dataset of 250 villages to measure the effects of local democracy. They find evidence that increases in the share of the poor lead village councils to invest more heavily in roads, which enhance the welfare of the landless, relative to irrigation facilities, which enhance the welfare of landowners. Drawing on survey data from 500 villages, Besley, Pande & Rao (2007) show that the heads of local-level councils (which govern over several villages) exercise substantial political opportunism by directing more public goods projects to their own villages.

4 Research Plan and Schedule

How do the competitive pressures induced by elections affect how politicians distribute valuable resources to their constituents? By comparing levels of electricity provision across Uttar Pradesh's 403 state assembly constituencies over the last four election cycles, I will study the link between electoral competition and the delivery of basic public services.

My choice of UP as the focal region of my research is motivated by its significance as home to the largest number of poor in India and by the existence of numerous surveys of living conditions in the state.[3] Focusing on one state also limits confounding from unmeasured factors, especially given large differences across India's states, including in electrification policies. I describe my plan to achieve this proposal's core objectives below.

4.1 Statistical Analysis of Electoral Politics and Electrification in Rural Uttar Pradesh

Do democratic elections lead politicians to allocate public goods efficiently and equitably, or do they lead officeholders to engage in favoritism and graft? I investigate these questions by analyzing patterns of electoral competitiveness and electricity provision across UP's 403 state assembly

[3]Particularly useful is the Uttar Pradesh/Bihar Living Standards and Measurement Survey, the India Demographic and Health Survey, and the India Human Development Survey

Table 1: Key Variables for Uttar Pradesh Dataset

Variable category	Description	Unit of observation*	Sources
Electrification	Status of electrification	Village	Indian Ministry of Power
	Intensity of nighttime lights	30 arcsec grid	DMSP satellite data
Political competitiveness measures	% vote for MLA	Constituency	Election Commission of India
	Length of service of incumbent MLA	Constituency	Election Commission of India
	Difference in vote between incumbent and second-place candidate	Constituency	Election Commission of India
	Number of effective political parties	Constituency	Election Commission of India
Demographic variables	Population / Number of households	Village	2001 Census India village profiles
	% Scheduled Caste / Tribe	Village	2001 Census India village profiles
	% Other Backward Caste / Upper Caste	Regional?	1999-2000 National Sample Survey
	% Muslim	District	2001 Census India
	% below poverty line	Village	2002 Below Poverty Line Census
	Literacy rate (%)	Village	2001 Census India village profiles
Economic measures	Presence of complementary infrastructure (school, clinic, drinking water, access road)	Village	2001 Census India village profiles
	Agricultural employment (% labor force)	Village	2001 Census India village profiles
	Industrial employment (% labor force)	Village	2001 Census India village profiles
Geographic controls	Distance to nearest major town	Village	2001 Census India; GIS calculations
	Roughness of terrain	30 arcsec grid	USGS Global Elevation Database

* Uttar Pradesh is comprised of 98,000 villages, 403 state assembly constituencies, and 70 districts.

constituencies from 1992 to 2007.[4] The key variables in my dataset are summarized in Table 1.

The dependent variable to be explained is change in the level of electricity provision over time. Data on electricity provision come from both satellite and official sources. Satellite images of the earth at night provide annual data from 1992 to 2007 on variations in nighttime light output.[5] Official data from the Census of India reveals village electrification status while the Uttar Pradesh Ministry of Power collects data on electricity consumption at the district level.

State assembly election results come from the Election Commission of India and will include complete data on candidate, incumbent, and party performance from the 1993, 1996, 2002, and 2007 elections. I will compute multiple measures of electoral competitiveness, including the effective number of parties (Laakso & Taagepera 1979), the margin of victory of the winning candidate, and the length of service of the incumbent. There is substantial variation in the competitiveness of constituencies: 105 of the 403 races were won by margins of victory of less than 3% while 154 contests were won with 10 point margins of victory or more.

Village-level data on demographic, economic, and geographic characteristics of all 98,000 villages in UP will be aggregated and matched to the assembly constituency level. The data come from the 2001 Census Village Profiles and Amenities data files and include population and percent Scheduled Caste or Tribe. The 2002 Below Poverty Line Census provides counts of poor households for all villages (Jalan & Murgai 2007). District-level data on economic output, literacy, percent Muslim, and other controls come from the UP Human Development Report and other sources. I also include geographic controls that might affect the cost and feasibility of electrification. Statistical analysis of this dataset will evaluate several hypotheses linking political factors to the manipulation of the electricity supply.

- Do longer-serving incumbents provide more electricity to their constituencies than

[4]The typical UP assembly constituency has 400,000 people, 80% of whom live in rural areas. Members are elected directly via a single-member simple-plurality rule. On average, each constituency has about 240 villages, roughly 100 of which were unelectrified in 2005.

[5]The DMSP-OLS satellite system detects nighttime lights at a resolution of 2.7 km with global coverage every night. Lights from U.S. towns as small as 120 people are detectable. See Elvidge et al. (1999) and Min (2007) for details.

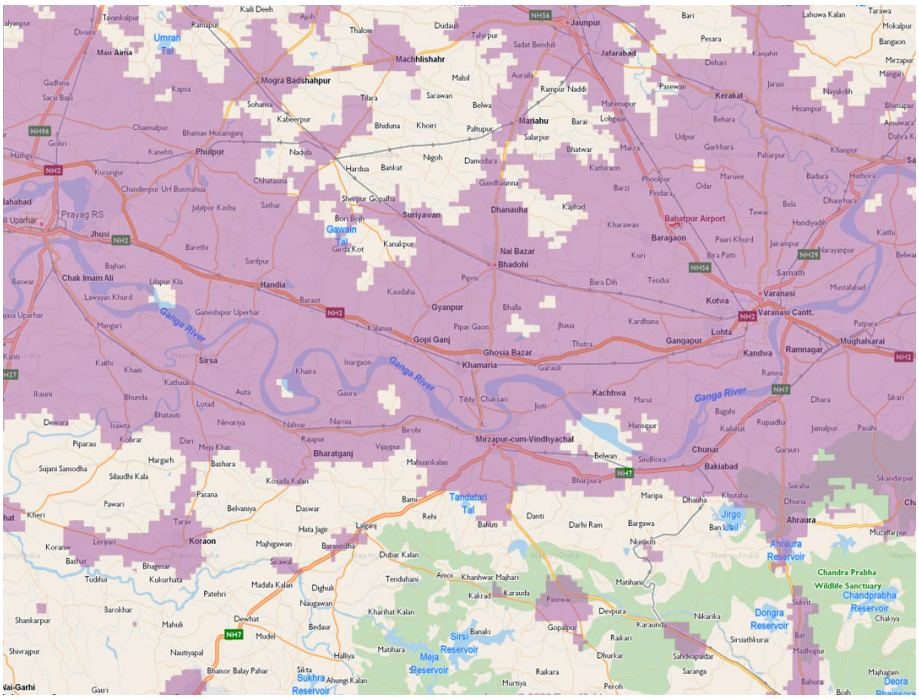

Figure 3: Lit and unlit areas in the Varanasi region, Uttar Pradesh, 2003
Note: Purple shaded areas are those in which satelllites detect light at night. Lighter areas are dark at night.
Sources: NOAA DMSP-OLS, MapMyIndia.com

- Do members of the ruling party provide more electricity than opposition party members?
- Do vulnerable MLAs who win by slimmer margins work harder to deliver more electricity in the following election cycle?
- Do voters punish incumbents when electricity provision declines in the previous election cycle? Do they reward incumbents when electricity improves?

4.2 Focused Interviews and Qualitative Data Collection in One Assembly Constituency

Statistical analysis alone cannot elucidate causal mechanisms. To better evaluate the mechanisms linking electoral politics to electrification, I propose to return to Uttar Pradesh for two months of additional fieldwork. This trip will build on two initial research visits I made in 2008 in which I visited eight villages, collected initial data, and conducted dozens of interviews with residents, business leaders, and government officials.

The goal of my fieldwork will be to study variations in electricity provision within a single state assembly constituency, to assess the impacts of variations in electricity access on voters and politicians, and to understand how choices are made to extend electrification to some villages and not others. A map of the Varanasi region where this work will be conducted is displayed in Figure 3. This region, which includes several potential constituencies for study, is among the less well-served regions of the state and was the site of much of my preliminary fieldwork. My goal is to better understand the political process by which electricity is delivered and to appreciate the interplay between politicians and state agencies that have the power to supply electricity and competing demands for electricity across villages and other interest groups.

In addition to extensive travel across the constituency to observe variations in electricity provi-

sion, I will interview actors at all key stages, from the highest state officials who have the power to order which villages are to be electrified, to the villagers who dream of having an electric bulb shining in their home someday. On the supply side, I will meet with the MLA and his/her staff, state power corporation officials, engineers at the state and local electricity boards, local technicians, and other bureaucrats. On the demand side, I will visit multiple villages to interview village officials including the Pradhan (chief), members of the Panchayat (local council), elders, and community members. The interviews will be semi-structured to encourage frank insights into the politics of electrification.

This work will leverage many critical contacts I established during two field visits to Uttar Pradesh in 2008, including senior officials at the state electricity corporation. During my proposed fieldwork in the Varanasi region, I will be affiliated with Banaras Hindu University and will continue to receive assistance from faculty members who supported my earlier work. By the time I arrive in the winter of 2010, I will have one and a half years of intensive Hindi language training which will facilitate more natural conversations in the field. As before, I will be accompanied by a local research assistant for all interviews in rural areas. Some questions I will seek answers to include:

- How did this village become electrified? Describe the process and people who were involved.
- Was there a ceremony when the village was electrified? Who was present at the ceremony? Who took credit for bringing electricity to the village?
- Who deserves credit for the fact that this village has electricity?
- Has the supply of electricity improved or worsened compared to 1/5/10 years ago?
- This village has electricity while nearby village *X* does not. Why do you think that is?
- What role did the MP/MLA/Village Pradhan play in getting this village electrified?
- Do you think that electricity service in your village would be better or worse had another candidate for MLA won in the last state assembly election?

4.3 Research Schedule

Summer 2009	Compile village-level dataset; begin statistical analysis
Jan–Feb 2010	Conduct fieldwork, interviews, and qualitative research in one district
Spring 2010	Present results at conferences; submit article for publication

5 Preliminary Studies and Research Competence of the Student

The proposed research builds on over a year of data collection, statistical analysis, and two research trips to Uttar Pradesh in June 2008 and December 2008. During my initial visits to India, I met with numerous scholars of UP politics and development in Varanasi, Kanpur, and Lucknow. In Lucknow, I also met with several government officials and engineers at the Uttar Pradesh Power Corporation. After gaining the blessing of UPPCL's Managing Director to speak with his staff, I was granted full access to UPPCL facilities, including the central command center responsible for managing the entire power grid in Uttar Pradesh. Because of a massive and chronic shortage of supply, the engineers there have the difficult job of rolling massive blackouts, shutting down power to a fifth of the state at a time. They shared the standard operating procedures dictating how power cuts are scheduled and also provided glimpses of how politics affects their daily choices. In one memorable account, a state assemblyman who had negotiated power cut exemptions from UP's Chief Minister, threatened to shoot a power engineer who had turned off the power to his constituency during a severe power crisis. I was also provided privileged access to detailed UPPCL data on electricity consumption at the district level. This was significant since it allows me to compare official UPPCL data against my satellite-derived estimates of electricity use. One comparison, shown in Figure 4, reveals that the

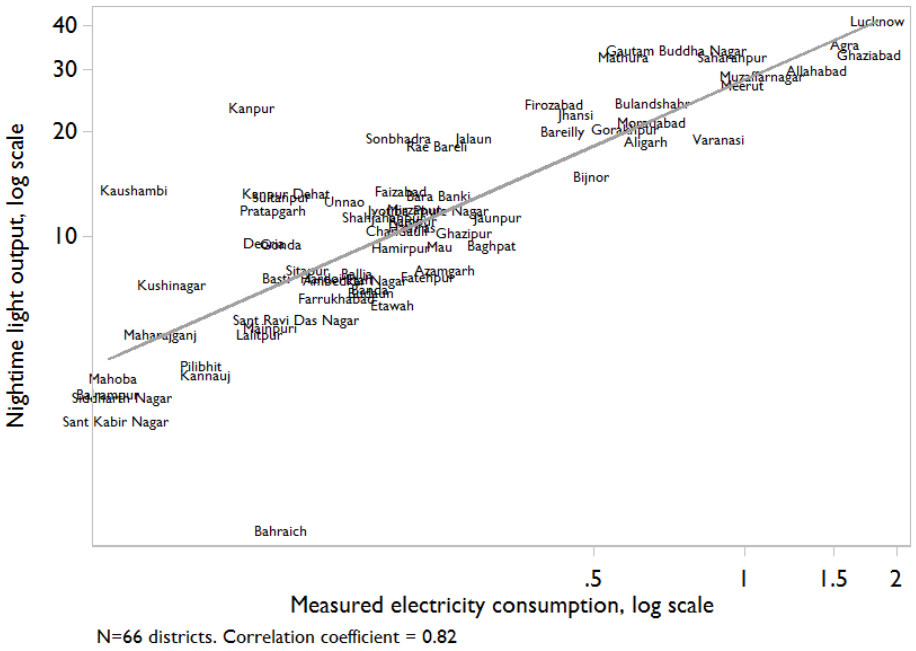

Figure 4: Comparing satellite-derived and official electricity data, Uttar Pradesh Districts, 2002
Sources: Author's calculations from NOAA and LandScan data; Uttar Pradesh Power Corp.

correlation between these independent measures is very high. This provides considerable confidence that satellite-derived data can be reliably used to estimate electricity use at the smaller assembly constituency level where UPPCL data do not exist. I look forward to returning to UPPCL and learning much more during my proposed fieldwork.

I also traveled to rural areas, including 8 villages in Mirzapur and Varanasi districts, where I spoke with dozens of locals about electricity access and service in their villages. Power shortages seriously affect people's livelihoods. As a result, I found that villagers from all walks of life — farmers worried about irrigation, students unable to study at night, cricket fans unable to watch matches on TV — were generous with their time and provided invaluable insights about why electricity is distributed the way it is in Uttar Pradesh.

In parallel with my earlier fieldwork, I have made substantial progress on the collection of my dataset, including all election results, satellite-derived electricity estimates, and many demographic and economic control variables. Funds from this proposal will allow me to acquire the remaining needed data from Census and other sources, as requested in my budget.

This work fits into a larger dissertation project, representing the third substantive study to complement my two cross-national analyses. In the first part, I compare national electrification rates by regime type around the world. The analysis, which avoids the missing data and measurement bias problems affecting previous research, shows an incontrovertible positive effect of democratic elections on electricity provision, even after controlling for differences in industrialization, settlement patterns, state capacity, and geography. Holding these other variables constant, democracies provide electricity to 10% more of their populations than do non-democracies, and the trend holds at every level of development. Even in the world's poorest countries, the data reveal that many million more people benefit from light in democracies than in comparable autocracies.

While democracy leads to greater electricity provision in poor *countries*, does democracy actually

benefit poor *people*? I evaluate this question in the second part of my dissertation. Examining a large set of countries for which sub-national inequality data exist, I ask whether those living in the poorest areas are more likely to receive electricity in democracies than in non-democracies. By dividing the world into 1-degree latitude by 1-degree longitude cells, I generate rich descriptions of the demographic, economic, and geographic factors associated with higher electrification rates. Then by using non-parametric matching techniques to match similar cells that differ only in their regime type, I estimate the treatment effect of democracy in the poorest regions of the world. Consistent with the cross-national results, I find again a positive effect of elections on electricity provision. The third part, documenting my intensive study of the politics of electricity in Uttar Pradesh, will provide an in-depth analysis of how competitive electoral politics affect rates of public service provision in one of the most significant regions in the developing world.

This research project requires the management of vast amounts of data and will benefit from the experience I have gained in managing multiple large data projects. In a four-year project with Andreas Wimmer, I created a massive dataset on all the world's territories from 1816–2001 to test a theory linking nation-state formation to war. Our study (Wimmer & Min 2006) recently received two best paper awards. In a collaboration with Andreas Wimmer and Lars-Erik Cederman, I coordinated an expert survey of nearly 100 area experts on the political status of all the world's politically relevant ethnic groups. This data formed the core of a much more complex dataset that we have used to link ethnic politics to civil war (Wimmer, Cederman & Min 2009). I also bring substantial statistical expertise to the project's core quantitative analysis. I have advanced training in regression analysis, maximum likelihood estimation, time series analysis, and have participated in two NSF Empirical Implications of Theoretical Methods Summer Institutes (2005 and 2007).

6 Significance of Proposed Research

Of the 1.6 billion people in the world that lack electricity, more than 1 billion live in democracies. My research on India seeks to illuminate the political and economic incentives that lead to the uneven distribution of local public goods in developing democracies. By explicitly intersecting electoral incentives with variations in the value placed on local public goods by voters, I offer a theoretical explanation for why large disparities persist in the distribution of valuable infrastructure. Since public infrastructure forms the building blocks of economic development, this research has critical implications for the world's poor.

This project will have broader impacts by informing scholars and policy makers of the ways in which political institutions mediate the delivery of infrastructure projects designed to help the poor. The project also makes a secondary contribution by legitimating the use of nighttime satellite imagery as a reliable indicator of electrical infrastructure in the developing world. By establishing a rigorous link between satellite images of nighttime lights and ground-level measurements of electrical infrastructure, my research will validate a new and novel data source on the distribution of a critical public good at the local-level across the globe, even in areas where data from traditional sources are unreliable or do not exist. The satellite data will also be useful to scholars as an objective indicator upon which to evaluate contested claims of regional or ethnic favoritism, estimate corruption through comparisons against reported government expenditures data, and identify high need regions for poverty alleviation projects and aid.