ELSEVIER

Political Geography ■■ (2004) ■■■–■■■

Political Geography

www.elsevier.com/locate/polgeo

Paving the way to political change: decentralization of development in the Brazilian Amazon

J. Christopher Brown[a,*], Scott W. Desposato[b], David S. Brown[c]

[a]*Department of Geography, University of Kansas, 1475 Jayhawk Blvd., 223, Lawrence, KS 66045, USA*
[b]*Department of Political Science, University of Arizona, 315 Social Sciences, Tucson, AZ 85721, USA*
[c]*Department of Political Science, University of Colorado, Boulder, UCB 333, Boulder, CO 80309, USA*

Abstract

Previous research by the authors examined the political consequences of internationally funded, decentralized development programs that target local nongovernmental organizations (NGOs). The Planafloro Community Initiative Projects, sponsored by the World Bank from 1995–1998, had powerful effects on politics, increasing electoral support for the Left in the 1998 presidential race. In this paper, we test whether those effects diffuse across space. Using Exploratory Spatial Data Analysis (ESDA), we find that the diffusion of political change is constrained by infrastructure: political change diffuses from one municipality to the next only when connected by a major highway—an important distinguishing feature in landscapes with difficult terrain. From a methodological standpoint, the study demonstrates the importance of contextual knowledge when performing ESDA. From a practical standpoint, our results imply that programs designed to diffuse information or program benefits in developing areas operate under important physical geographic and infrastructural constraints.

Keywords: Politics; Decentralization; Electoral returns; Rural development; Brazil; World Bank; Diffusion

* Corresponding author.
E-mail addresses: jcbrown2@ku.edu (J.C. Brown), swd@u.arizona.edu (S.W. Desposato), dsbrown@colorado.edu (D.S. Brown).

0962-6298/$ - see front matter © 2004 Published by Elsevier Ltd.
doi:10.1016/j.polgeo.2004.06.001

Introduction

Profound changes have occurred in the administration of development projects over the last two decades. In the 1980s, national, large-scale development plans worth billions of dollars led to major social and environmental disasters (Bodley, 1982; Mahar, 1989; Schwartzman, 1986a, 1986b; Scott, 1997). Those failures fueled campaigns by the international human rights and environmental community to call for decentralizing decision-making in development to improve the social and environmental conditions of peoples' lives (Brohman, 1990; Diaz-Polanco, 1997; Friedmann & Rangan, 1993; Porter & Brown, 1996; Stiefel & Wolfe, 1994; WCED, 1987). Whether described as products of re-scaling, jumping scales, glocalization, or the boomerang effect, new relationships now exist between and among interest groups organized locally, regionally, nationally, and internationally (Keck & Sikkink, 1998; Smith, 1993; Swyngedouw, 1997).

One of the guiding principles of such efforts involves channeling significant funds to community organizations. The new central role for locally organized civil society is intended to improve the programs' quality and effectiveness, while simultaneously fostering social capital and community organization. The new programs are also expected to be catalysts for economic, social, and political change, reaching not only the individuals directly affected by the project but the broader population as well. For example, the school constructed by a farmers' cooperative with decentralized development funds is an addition to the built environment—a very tangible, beneficial result of people mobilizing to improve their community. Neighbors, in turn, see and experience the benefits of an organized community, producing the diffusion effect as they attempt to re-create the same developments in their neighborhood or town. Until now, the diffusion of technology, sustainable agricultural practices, and infrastructural improvements have been the primary focus of decentralized development. Attempts to diffuse new forms of community organization—social capital and civil society—have only recently figured prominently in development planning.

The object of this study is a program notable for its attempt to diffuse both technical information *and* new forms of community participation. In the Brazilian Amazon state of Rondonia, World Bank loans to the federal government were channeled to grassroots organizations throughout the state as grants to promote sustainable development and build civil society. Officials in the Rondonia State Government, which administered the program, hoped the effects of the projects would diffuse across space. Projects were designed specifically to diffuse technology and agricultural production practices via educational programs and training. One major funding area, entitled "Ações Demonstrativas de Difusão de Tecnologia Ambiental" (literally, Demonstration Actions of Diffusion of Environmental Technology) paid for so-called "demonstration projects" of ecologically friendly production systems such as fish farming, agroforestry, and beekeeping. This program was designed to benefit farmers that participated directly in the program and to spread knowledge to adjacent communities. Other funding activities included constructing meeting halls in the countryside and urban areas, providing rural electrification and telephone services, building or renovating schools and health posts, and training teachers along with rural health agents (Rondonia, 2003).

Previous work by the authors established an important empirical pattern between the program's activity and political change (Brown, Brown, & Desposato, 2002). Specifically, we found that a significant positive relationship exists between funds disbursed to grassroots organizations and the change in voting for leftist presidential candidates in Rondonia (Brown, Brown, & Desposato, 2002). In this paper, we test whether political change diffused using Exploratory Spatial Data Analysis (ESDA). We confirm what geographers have long known. Diffusion, in this case the diffusion of political effects, occurs only when some form of communication exists across space: mere spatial proximity or contiguity is not enough (Abler, Adams, & Gould, 1971; Gould, 1969). Our work brings into stark relief earlier arguments concerning infrastructural constraints. A variety of spatial analytic approaches have been used over the years to study infrastructure and its effects on politics, economics, and society in developing areas, especially Africa (see Osei-Kwame & Achola, 1981 and Altschul, 1980 for useful reviews). When contiguity is determined spatially and with knowledge of transportation/communication routes linking spatial units, we find that an important spatial component to political change exists. Specifically, when highways are factored into the definition of contiguity, we find an important diffusion effect. For development policy, our results imply that diffusion effects will be constrained by the lack of infrastructure. Isolated communities will be those least likely to benefit from programs that rely on diffusing resources, technology, or new forms of community participation. Our results confirm that the meaning and mechanisms of diffusion must be carefully specified and grounded in a detailed understanding of the local context under examination.

Model and variables

Our previous work established a strong connection between external resources and political change in Rondonia, Brazil. Changes in voting behavior were modeled as a function of NGO activity (measured in dollars per capita received) and a number of political and economic controls, using municipality as the unit of analysis.[1] The percentage change in the left's vote share between 1994 and 1998 in

[1] Political change = a + b_1(NGO activity) + b_2(% rural) + b_3(% govt. employed) + b_4(% migrant) + b_5(education) + b_6(mayoral ideology) + e. The model's key parameter is b_1, which estimates NGO activity's impact on support for the left. The model also controlled for a number of contextual factors that could influence voting behavior: how rural the municipality is, the number of jobs provided by the government, the municipality's average level of education, the size of the immigrant population, and the political orientation of the municipality's mayor. The contextual variables are static from one period to the next, while the dependent variable measures change in voting behavior. Thus, the estimated control parameters allow us to capture how different kinds of municipalities reacted to political events between 1994 and 1998. An alternative model specification would include the same independent variables expressed in elasticities (change over time). Unfortunately, there are no data: although data exist for 1996, comparable data do not exist for an earlier time period. We were able to calculate the change in each municipality's rural population from 1996 to 2000. Including it in the regression model did not affect our results.

Table 1
The impact of NGO funding on political change

Variable	(1)	(2)	(3)
Constant	−0.538 (.274)	−0.619* (.247)	−0.415 (.221)
Spatial lag		−0.044 (.035)	0.128** (.035)
dollars per capita	0.004** (.001)	0.004** (.001)	0.003* (.001)
% of population in rural areas	−0.026 (.123)	−0.021 (.110)	−0.057 (.099)
Years in school	0.001* (.0004)	0.001** (.001)	0.001** (.0004)
% of migrants (logged)	0.006 (.022)	0.009 (.019)	−0.0003 (.0174)
% of jobs in public sector	−0.012 (.049)	−0.022 (.044)	−0.024 (.039)
Change in mayoral ideology	0.023 (.021)	0.024 (.019)	0.005 (.017)
Adjusted *R*-squared	.60	.68	.74
Observations	40	40	40

Dependent variable: change in vote share for leftist presidential candidates, 1994–1998. Standard errors in parentheses: * signifies significance at the .05 level; ** signifies significance at the .01 level. (1) OLS model; (2) Maximum likelihood estimates with spatial lag (contiguity matrix); (3) Maximum likelihood estimates with spatial lag (road weights matrix).

the presidential race is our dependent variable. Each of Rondonia's 40 municipalities has a corresponding value for change in the left's vote share. We measure NGO activity using the amount of money per capita distributed to NGOs in each municipality between 1995 and 1998. Our data on funding came from the reports of the Planafloro program office in Porto Velho, Rondonia (Planafloro, 1996, 1997, 1998) and the Ministry of the Environment for eight projects that were funded by the G-7. Demographic data were obtained from IBGE's (*Instituto Brasileiro de Geografia e Estatística*, Geography and Statistics Institute of Brazil) 1996 *Contagem da População* (Census) (IBGE, 1996).

We found a strong, significant, and positive relationship between NGO funding and political change. The estimates are substantively and statistically significant (Table 1).

Consider the substantive nature of the results by examining the municipalities of Corumbiara, Cacaulândia, and Monte Negro. None of them received Planafloro funds during the period examined. The model predicts in those cases that the left's share of the vote should decrease by 7 percentage points (±2; standard error of the prediction) from 1994 to 1998. In well-funded municipalities such as Theobroma, Candéias do Jamari, and Rio Crespo, the prediction is an increase of 7 percentage points for the left (±4 percentage points; standard error of the prediction). The center-right candidates won most of Rondonia's vote in 1994 and 1998, but the differences between their gains and losses in municipalities receiving low and high levels of funding was approximately 14 percentage points.

The diffusion of political change

The previous results make a strong assumption—that political change in each municipality is independent of events in neighboring municipalities. Although many political scientists admit that the geographic clustering of like objects such as people, places, and things is the norm, there has been a reluctance to account for geographical processes in political science research (O'Loughlin, 2003). In this case, taking spatial auto-correlation into account is particularly important since we know the Planafloro program was designed specifically to diffuse technology, knowledge, and organizational capacity. Several features of the programs could have led to spatial diffusion across municipal boundaries. First, political campaigning can spill over into adjacent municipalities and communities. Political rallies, advertising, etc., influence not only residents of a particular municipality, but those who come into contact with political messages as they pass through. Second, the Planafloro projects were designed to draw people not only from the cities but also from the outlying rural areas which often cut across municipal boundaries. Third, the Planafloro money went to some groups with the expressed purpose of empowering previously excluded political actors by encouraging associative activity. These groups often crossed municipal boundaries, getting their message out to as many individuals as possible. In that effort, networks developed between groups from different municipalities.

The diffusion processes described above imply that an important assumption in the OLS framework is violated: errors generated by the model are not independent of each other. Changes in one municipality will be associated with changes in its neighbors.[2] Consequently, we need to test whether the kinds of effects observed within each municipality spill over into adjacent areas.

Spatial methods

There are a number of different ways to account for spatial processes. First, one can test whether any spatial auto-correlation remains after performing OLS using the Moran's I statistic. Moran's I is defined as:

$$I = (N/S_o) \sum_i \sum_j w_{ij} x_i x_j \Big/ \sum_i x_i^2$$

where w_{ij} is an element of a spatial weights matrix $\mathbf{W}$ that indicates whether i and j are contiguous. The spatial weights matrix is row-standardized such that its elements sum to 1 and x_i is an observation at location i (expressed as the deviations from the observation mean). S_o is a normalizing factor equal to the sum of all weights ($\sum_i \sum_j w_{ij}$). Moran's I usually falls in the range of $+1$ to -1. Positive values indicate a clustering pattern while negative values indicate a chessboard-like arrangement of alternating dissimilar values (Cliff & Ord, 1981; O'Loughlin, 2002).

We tested the diffusion hypothesis using several spatial auto-correlation measures. The results, displayed in Table 2, suggest that spatial auto-correlation is

[2] For a treatment of the problem and its application to political science, see O'Loughlin and Anselin (1991) and O'Loughlin (2003, 2002).

Table 2
Diagnostics for spatial dependence

Test	MI/DF	Value	Prob
Contiguity matrix			
Moran's *I* (error)	−0.049005	−0.075416	0.939884
Lagrange multiplier (error)	1	0.225207	0.635100
Lagrange multiplier (lag)	1	2.324346	0.127364
Road weights matrix			
Moran's *I* (error)	0.189600	1.959451	0.050060
Lagrange multiplier (error)	1	2.264734	0.132349
Lagrange multiplier (lag)	1	6.817142	0.009029

non-existent. The Moran's I for the regression is $-.07$ (prob = .93). Unfortunately, the Moran's I is somewhat unreliable: it is sensitive to misspecification errors, non-normality, and heteroskedasticity (Anselin & Rey, 1991a). The Moran's I statistic also fails to provide any guidance as to which solution is appropriate if, in fact, spatial auto-correlation is detected. Spatial dependence may occur in the dependent variable or in the error structure. Fortunately, there are two additional test statistics that provide an indication where the spatial dependence exists. The Lagrange multipliers—LM (error) and LM (lag)—reported in Table 2 indicate there is no reason to worry about modeling the diffusion process.[3] All spatial analyses were conducted using ArcView 3.2 (ESRI) and Space Stat 1.91 (Luc Anselin).

Usually, the story would end there: having found there is no spatial auto-correlation, the OLS results are confirmed. At first glance it appears that the events in one municipality are not being affected by developments in its neighbors. There are, however, a number of different ways to measure the contiguity between units (municipalities in our case). In the regression above, we used the common rook weights matrix, a representation of contiguity that simply registers whether municipalities share boundaries. As O'Loughlin and others have argued, the spatial dependence one finds is determined in large part by the kind of weights matrix chosen (Anselin, 1988; O'Loughlin, 2002). In fact, using a simple contiguity matrix in the context of the Amazon, and Rondonia in particular, makes little sense. Although municipalities may share a boundary, there may be little if any substantive contact between their populations. Human and physical geographic barriers such as large indigenous reserves and national parks, rivers, and dense rainforest preclude regular contact between some adjacent municipalities. Consider Fig. 1 below. The map delineates the main state and federal highways that connect the municipalities. Less significant roads are usually not paved and are often rendered impassable during the rainy season.

A quick look at the map suggests that simple boundary-based measures of contiguity may be problematic. Simple contiguity matrices for the analysis of spatial

[3] For a description of these tests and their properties see Anselin & Rey (1991b).

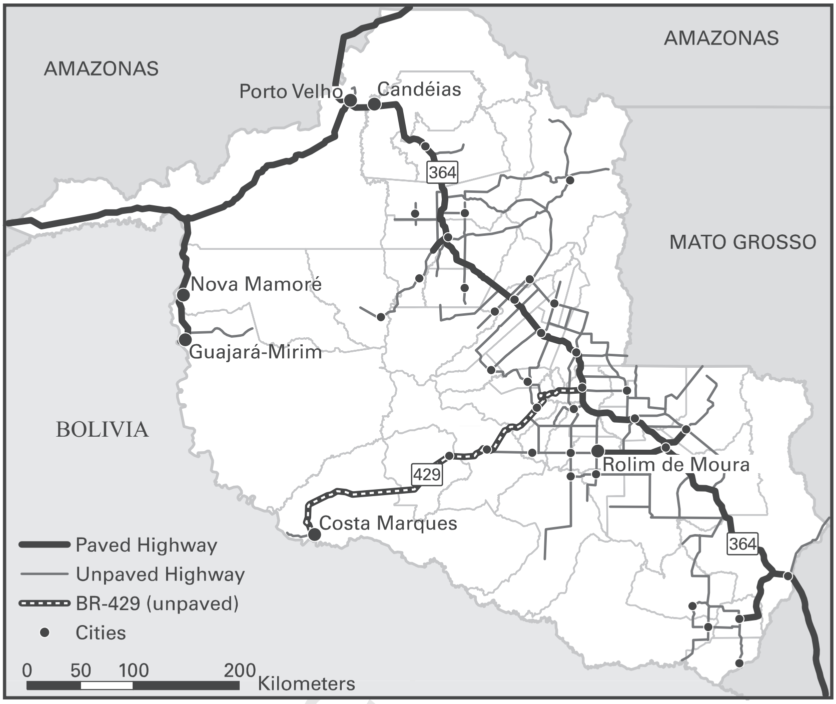

Fig. 1. The state of Rondonia, Brazil, showing municipal boundaries and roads.

auto-correlation assume that the potential spatial interaction is equal between the units. This is an incorrect assumption for the case of Rondonia, an area that has been undergoing modern colonization only since the 1960s, when the first-ever road (today called the BR-364) was constructed from Vilhena (extreme southeast) to Porto Velho. The settling of Rondonia by cattle ranchers and small landholding farmers accelerated in the 1970s and 1980s with the implementation of official government programs to develop Brazil's northwestern frontier. Since then, a few major overland routes connecting remote areas of the state to the central road represent the principle means of interaction.

The consequence, in a state still mostly covered by humid tropical forest, is that some municipalities sharing a common boundary actually have no practical interaction. For example, Costa Marques and Guajará-Mirim are spatially contiguous—they share a 100 km boundary in the western part of the state. But this contiguity and shared boundary do not result in easy contact or travel between their urban centers. In fact, travel from Costa Marques to Guajará-Mirim can be time-consuming and difficult. Travel by bus between these two municipalities would take at least two to three days (depending on road conditions) and would involve passing through 12 municipalities.

There is little reason, therefore, to expect any diffusion between Costa Marques and Guajará-Mirim. None of our hypothesized mechanisms are likely to be in evidence. The likelihood that local community groups in Guajará involve farmers from Costa Marques is low. Political candidates in Costa Marques will avoid making the difficult journey to Guajará. Demonstration effects are unlikely—voters in Guajará will rarely observe and learn from the projects implemented by NGOs in Costa Marques.

To correct for the interaction of contiguity and infrastructure, we constructed what we call a road weights matrix. For contiguity to exist, municipalities must share a boundary *and* have a major state or federal highway crossing that boundary. Using the new road weights matrix we re-estimated the models presented earlier. The results are displayed in Table 2. With the more sophisticated measure of contiguity, the Moran's I for the road weights matrix is significant, indicating there is a significant amount of spatial auto-correlation. The Moran's I for the road weights matrix is 1.96 (prob = .05). Note that the test statistic for the Lagrange Multiplier (lag) is significant, indicating that the recommended solution is a Maximum likelihood estimation with a spatial lag term. In other words, the spatial dependence results from the dependent variable rather than the structure of the errors. The test statistic for the Lagrange multiplier (error) is not significant.

To account for the spatial auto-correlation, we employed a Maximum likelihood model that includes a spatial lag on the right-hand-side of the equation. To demonstrate the difference between the two kinds of matrices, we report the results from two separate models—one using the contiguity matrix and the other using the road weights matrix (Table 1). As the results indicate, the spatial lag term is significant when we use the road weights matrix but insignificant when we use the common contiguity matrix. The coefficient for the spatial lag is −.044 (prob = .21) when using the common contiguity matrix and .128 (prob = .0002) when using the road weights matrix. To understand the magnitude of the diffusion effect, note that the coefficient on the Planafloro money variable is cut by roughly a fourth (decreasing from .004 to .003). To be more precise, 12.8 percent of the political change that occurs in one municipality is the result of diffusion. For every 100 voters that switch to the left in neighboring municipalities, roughly 13 voters will be influenced by effects that diffuse from neighboring municipalities.

Having found significant spatial diffusion effects, we follow-up by using the Getis statistic G_i^*. The G_i^* helps identify geographic hotspots, indicating where the most significant processes of diffusion occur. By examining the G_i^* of our dependent variable, political change, we can correlate those hotspots with other variables that can explain their similarities, adding a richer account of the causal mechanisms at play. The G_i^* is calculated as follows:

$$G_i^* = \frac{\sum_j w_{ij} x_j - \sum_i (w_{ij} + w_{ii})_i^* \bar{x}}{\hat{\sigma}_x \sqrt{n \sum_j w_{ij}^2 - \sum_i w_{ij}^2/(n-1)}}, \quad j \neq 1$$

where w_{ij} denotes element i, j in a binary contiguity matrix and x_j is an observation at location j. The G_i^* measure is normally distributed and indicates the extent to which similarly valued observations are clustered around a particular observation i. A positive value for the G_i^* measure at a particular location implies spatial clustering of high values around that location; a negative value indicates a spatial grouping of low values (O'Loughlin, 2002). Negative values indicate a region where a cluster of municipalities recorded political shifts away from the left. Positive values identify groups of municipalities where there were shifts toward the left.

Hotspots indicating similar negative values are found in the most remote parts of colonized Rondonia. A negative hotspot area centers on the development corridor along the highway BR-429, which until the early 1990s was not officially opened for colonization. The BR-429 begins near one of Rondonia's largest cities, Ji-Paraná and travels southwest to the city of Costa Marques on the boundary with Bolivia (Fig. 1). For years, the entire region was designated off-limits to colonization because the soils are poorly suited to agricultural development. A relatively recent push by pro-development forces to construct the BR-429 and settle small landholders has been a strategy of conservative interests to gain votes from peasants in elections for local and state-wide offices. Despite the left's attempts at mobilization in that area, the presence of large landholders and the conservatives' impetus behind the genesis of the settlements results in negative G_i^* values.

A hotspot indicated by positive values marks a logical region of intense spatial interaction in the Guajará-Mirim/Porto Velho corridor (significance values for the G_i^* values are mapped in Fig. 2). Two neighboring municipalities are part of this

Fig. 2. G_i^* significance values for the dependent variable, change in vote share for leftist presidential candidates, 1994–1998.

corridor: Nova Mamoré, situated between Guajará-Mirim and Porto Velho, and Candéias, located only a few dozen kilometers to the southeast of Porto Velho. These areas possess the earliest settlements in Rondonia, dating back to colonial times and having gained greater importance during the lucrative rubber trade of the late 1800s and early 1900s. Not all of these areas received large amounts (per capita) of grant money from Planafloro. Nova Mamoré, Porto Velho, and Guajará-Mirim all received moderate amounts of NGO funding, less than 17 dollars per capita, yet all have greater-than-expected gains for leftist politicians.[4]

We can explore how both hierarchical and expansion diffusion processes led to the significant spatial lag in our model by referring to the municipalities contained in the significant positive hotspot (Fig. 2). This c-shaped region, from Candéias to Guajará-Mirim, has as its center the state capital Porto Velho. Since the Planafloro program office is located in Porto Velho, hierarchical diffusion is suggested. There is a disproportionate amount of politically charged and influential intermediate NGOs based in Porto Velho. Less powerful NGOs are located in Guajará-Mirim. The more powerful NGOs are staffed by leftist, well-educated professionals that have worked since the early 1980s to organize the indigenous, rubber tapper and *ribeirinho* communities in the region. A key characteristic of the more powerful NGOs is that their reach extends beyond the municipalities where they are based. The ability of these intermediate NGOs to mobilize groups in other municipalities via their Planafloro projects produces the diffusion effects we detect. Moreover, both the intermediate NGOs and the grassroots organizations they represent received Planafloro money, allowing for greater coordination of efforts across municipal boundaries. In addition, these funds generated a disproportionately high level of visibility in neighboring communities. This hierarchical diffusion is complemented by expansion diffusion among less important groups that have some direct contact across municipal boundaries with groups that did not receive project funds. Diffusion via expansion along the highway corridor appears to have stopped abruptly in Guajará-Mirim. Costa Marques, to the south, has numerous rubber tapper and indigenous groups with whom the intermediate NGOs could work, but the lack of infrastructure linking the two municipalities limits contact and thus prevents diffusion from taking place.

The cases of Nova Mamoré and Candéias are instructive in other ways. Their hotspot reveals other processes are responsible for diffusion. Nova Mamoré is situated between Porto Velho and Guajará-Mirim; it is a town most people merely pass through along the well-traveled route between the two major cities. It is not a seat of power and has no tradition of strong organizing by the left. It did not have an office for a municipal rural worker's union fully established until 1999. Travel from the Planafloro office by NGO and Planafloro officials through Nova Mamoré,

[4] In addition, we mapped the residuals of our dependent variable to see the spatial pattern of where our model underestimated the left vote, and we calculated G-stats for the residuals. A similar pattern to the dependent variable G-stats emerged, bolstering our assessment that the most intense diffusion occurred in the Candéias, Porto Velho, Nova Mamoré, Guajará-Mirim corridor. Within that hotspot, Guajará-Mirim and Nova Mamoré were significant to the .05-level.

however, may have activated community organizations as they came into contact with new ideas and forms of organizing fostered by Planafloro and the intermediate NGOs.

The relationship between Porto Velho and Candéias, however, implies a slightly different dynamic with respect to hierarchical diffusion. While it is possible that the same processes occurred between intermediate NGOs in Porto Velho and grassroots NGOs in Candéias, information gathered during our field work suggests an alternative explanation. Pedro Beber, then-director of Planafloro, received help from farmer group recipients of Planafloro funds in his campaign for a seat on Candéias's city council in the 1998 election. The relationship that developed between Beber and the farmer groups in Candéias created a disproportionate amount of associative activity within and among groups in Candéias as they organized to get Beber elected. This higher amount of clientelistically generated associative activity could have easily involved neighboring groups in Porto Velho, given its extreme proximity and the likelihood that politicians in the two municipalities coordinate campaigns. The increased associative activity, though spurred by a clientelist project, may still affect political change when people discuss and act on politics at the national level. Interviews with Candéias's NGO leaders confirmed that discussions in local NGO meetings often turned to presidential politics in which Luiz Inácio Lula da Silva, the main leftist who would eventually win the presidency in 2002, was a favored candidate.

Conclusion

The spatial analysis of the political effects of the Planafloro program confirms that actions taken as a result of the Planafloro money spilled over into adjacent municipalities. Indeed, Planafloro's goal of creating a network of groups to encourage new associative activity seems to have worked. We also confirmed, as one would expect, that such diffusion occurs along communication/transportation routes and is impeded by the physical geographic constraints of this region of humid tropical forest. Any research involving spatial statistics in developing regions must be well-informed with respect to the selection of contiguity criteria.

Our research may remind readers of earlier spatial analytic work related to infrastructure and issues of Third-World development, especially in Africa (Altschul, 1980; Gould, 1961, 1963, 1969; Riddell, 1970; Soja, 1968; Taaffe, Morrill, & Gould, 1963). The policy recommendations coming from this previous line of inquiry emphasized the importance of infrastructure in modernization and economic development. While our findings give support for spatial analytic approaches to understanding patterns of human interaction, the same social theory critiques leveled against spatial analysis in general should not be disregarded: social processes cause political change, not roads that merely link one geographic unit to another (Cox, 1995; Riddell, 1981, 1989; Sheppard, 1995). However, if one accepts that transportation routes can shape human interaction, our spatial analytic approach helps draw attention to important social processes that could be the subject of future research. Our goal was to test whether diffusion was occurring. There was evidence of diffusion along highways, and spatial analysis helped us determine where it was concentrated. Our knowledge of the area's political context then allowed us to hypothesize specific processes that produced political change. Clearly, new and better roads/connectivity alone do not lead to political developments in Rondonia, nor do they determine the social processes that may take place as new connections are made between geographic units. What appears clear, however, is that connectivity—established through social processes—plays a major role in the diffusion of political change in developing areas.

In sum, diffusion—one of the goals of decentralized development—was most concentrated in areas already well-linked to centers of power and influence in Rondonia. Political change did not spread to the far reaches of the state, because diffusion was strongly constrained by physical geography and infrastructure. It is a tragic irony, though not completely surprising, that the most isolated and impoverished communities are also the least likely to be touched by the diffusion of economic, environmental, and social change. Investments in community development are paving the way for significant change, but the added benefits of diffusion stop where the blacktop ends.

Acknowledgements

We wish to recognize NSF Grant SES 00-99097 for supporting this research. Thanks as well to John O'Loughlin and three anonymous reviewers for their helpful comments. Tom Dickinson and Jani Little at the Institute of Behavioral Science at the University of Colorado provided assistance with the spatial analysis. Matthew Koeppe, Darin Grauberger and student assistants at University of Kansas Cartography and GIS services helped assemble the maps. Any errors remain ours.

References

Abler, R., Adams, J. S., & Gould, P. R. (1971). *Spatial organization; the geographer's view of the world.* Englewood Cliffs, NJ: Prentice-Hall.

Altschul, D. R. (1980). Transportation in African development. *Journal of Geography in Higher Education, 79*(2), 44–56.

Anselin, L. (1988). Model validation in spatial econometrics: a review and evaluation of alternative approaches. *International Regional Science Review, 11*(3), 279–316.

Anselin, L., & Rey, S. (1991a). Properties of tests for spatial dependence in linear regression models. *Geographical Analysis, 23*, 112–131.

Anselin, L., & Rey, S. (1991b). *The performance of tests for spatial dependence in a linear regression*. Santa Barbara, Calif: National Center for Geographic Information and Analysis.

Bodley, J. H. (1982). *Victims of progress*. Palo Alto: Mayfield.

Brohman, J. (1990). *Popular development*. Cambridge, MA: Blackwell.

Brown, D. S., Brown, J. C., & Desposato, S. W. (2002). Left turn on green? The unintended consequences of international funding for sustainable development in Brazil. *Comparative Political Studies, 35*(7), 814–839.

Cliff, A. D., & Ord, J. K. (1981). *Spatial processes, models and applications*. London: Pion.

Cox, K. (1995). Concepts of space, understanding in human geography, and spatial analysis. *Urban Geography, 16*(4), 304–326.

Diaz-Polanco, H. (1997). *Indigenous peoples in Latin America: the quest for self-determination*. Boulder, CO: Westview Press.

Friedmann, J., & Rangan, H. (Eds.), (1993). *Defense of livelihood: comparative studies on environmental action*. West Hartford, CT: Kumarian Press.

Gould, P. R. (1961). *The development of the transportation pattern in Ghana*, *Vol. 5*. Evanston: Northwestern University Studies in Geography.

Gould, P. R. (1963). Man against his environment: a game theoretic framework. *Annals of the Association of American Geographers, 53*(3), 290–297.

Gould, P. R. (1969). *Spatial diffusion, resource paper (Association of American Geographers. Commission on College Geography)*, Vol. 4. Washington, DC: Association of American Geographers.

IBGE. (1996). *Contagem da População* [Count of Population]. IBGE.

Keck, M., & Sikkink, K. (1998). *Activists beyond borders*. Ithaca and London: Cornell University Press.

Mahar, D. J. (1989). *Government policies and deforestation in Brazil's Amazon region*. Washington, DC: World Bank.

O'Loughlin, J. (2003). Spatial analysis in political geography. In J. Agnew, K. Mitchell, & G. O. Tuathail (Eds.), *A companion to political geography*. Oxford: Basil Blackwell.

O'Loughlin, J. (2002). The electoral geography of Weimar Germany: exploratory spatial data analyses (ESDA) of protestant support for the Nazi Party. *Political Analysis, 10*(3), 217–243.

O'Loughlin, J., & Anselin, L. (1991). Bringing geography back to the study of international relations: spatial dependence and regional context in Africa, 1966–1978. *International Interactions, 17*(1), 29–61.

Osei-Kwame, P., & Achola, P. P. W. (1981). A new conceptual model for the study of political integration in Africa. *The Journal of Developing Areas, 15*, 585–604.

Planafloro. (1996). *Quadro demonstrativo de metas e benficiários de Projetos de Iniciativa Communitária conveniados em 1996* [Chart of goals and beneficiaries of the Community Initiative Projects approved in 1996]. Porto Velho, Brasil: Planafloro (in Portuguese).

Planafloro. (1997). *Progama de apoio às iniciativas comunitárias PAIC: cartilha informativa* [Program of Support for Community Initiatives (PAIC): Information Booklet]. Porto Velho, Brasil: Planafloro (in Portuguese).

Planafloro. (1998). *Relatório No 01 de acompanhamento da execução orçamentária/financeira dos Programas de Apoio ás Iniciativas Communitárias—PAIC's—1997* [Budget/financial execution report no. 01 of the Programs of Support for Community Initiatives—PAIC's—1997]. Porto Velho, Brazil: Planafloro (in Portuguese).

Porter, G., & Brown, J. W. (1996). *Global environmental politics*. Boulder, CO: Westview Press.

Riddell, J. B. (1970). *The spatial dynamics of modernization in Sierra Leone: structure, diffusion, and response*. Evanston: Northwestern University Press.

Riddell, J. B. (1981). The geography of modernization in Africa: a re-examination. *Canadian Geographer, 25*, 290–299.

Riddell, J. B. (1989). Geography and the study of third-world underdevelopment revisited. *Progress in Human Geography, 13*(2), 267–276.

Rondonia, State Government of (2003). *PLANAFLORO—Plano Agropecuário Florestal de Rondônia PAIC–Programa de Ação à Inciativa Comunitária* 2003 [PLANAFLORO—Rondonia Natural Resources Development Project PAIC—Programs of Support for Community Initiatives]. Available: http://www.planafloro.ro.gov.br/, March 14 (in Portuguese).

Schwartzman, S. (1986a). World bank holds funds for development project in Brazil. *Cultural Survival Quarterly, 10*(1), 25–27.

Schwartzman, S. (1986b). *Bankrolling disasters: a citizens' environmental guide to the world bank and the regional multilateral development banks*. San Francisco: Sierra Club.

Scott, J. (1997). *Seeing like a state*. New Haven: Yale University Press.

Sheppard, E. (1995). Dissenting from spatial analysis. *Urban Geography, 16*(4), 283–303.

Smith, N. (1993). Homeless/global: scaling places. In J. Bird (Ed.), *Mapping the futures: local cultures global change*. New York: Routledge.

Soja, E. W. (1968). *The geography of modernization in Kenya; a spatial analysis of social, economic, and political change*. Syracuse, NY: Syracuse University Press.

Stiefel, M., & Wolfe, M. (1994). *A voice for the excluded: popular participation in development*. London: Zed Books and the United Nations Research Institute for Social Development (UNRISD).

Swyngedouw, E. (1997). Neither global nor local: ''glocalization'' and the politics of scale. In K. Cox (Ed.), *Spaces of globalization*. New York: Guilford Press.

Taaffe, E. J., Morrill, R. L., & Gould, P. R. (1963). Transport expansion in underdeveloped countries: a comparative analysis. *Geographical Review, 53*(4), 503–529.

WCED (1987). *Our common future*. Oxford: Oxford University Press.