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Abstract

The rationale is straightforward and persuasive: intrastate conflicts are by definition subnational phenomena. If we want to understand them fully, it may be wise to refocus our attention from the country level to the subnational level. Where violence is located might inform us as to why it erupts and how it is linked to various political, economic or social factors. The number of statistical geospatial analyses undertaken at the subnational level has been increasing constantly in recent years. Even though such studies have contributed greatly to peace and conflict research, they have come with their own challenges. Most importantly, they often do not adequately consider the theoretical and conceptual implications of switching from conventional cross-country to subnational analysis; this has led to dubious theoretical arguments and conclusions. Moreover, operationalization and measurement issues often limit these analyses' explanatory power. The paper reviews several geospatial analyses of violent conflict, points out the limitations of the previous research and proposes some potential avenues for improvement.

Keywords: civil war, political violence, geospatial analysis, subnational analysis, causality

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Mapping Political Violence – The Approaches and Conceptual Challenges of Subnational Geospatial Analyses of Intrastate Conflict

Alexander De Juan

Article Outline

1 Introduction

Violent conflicts do not engulf countries uniformly. Rather, the occurrence and intensity of violence vary across subnational regions. The same holds true for many of the variables that are regularly associated with the risk of political violence – such as poverty rates, ethnic differences or resource abundance. Thus, as part of a more general trend towards the disaggregation of civil war research, quantitative geospatial analyses of the subnational level have been gaining in importance (e.g. Buhaug and Gates 2002; Kalyvas 2008; Raleigh et al. 2010a).

The number of statistical studies that consider or actively investigate the geographical patterns of intrastate conflict has been increasing constantly. Such studies share a common interest in geospatial patterns, but they are far from uniform. They differ in the data they use, the units of analyses they focus on, and the technical methods they apply. Most importantly, they differ in terms of the specific research questions they ask, the way they consider and handle geographical factors, and the kinds of causal claims they make. The growing diversity of studies has enriched the analysis of political violence but has made it increasingly difficult to grasp the actual essence, as well as the potential and limits, of this specific research agenda. This paper aims to provide a systematic overview of this research strand, illustrating its weaknesses and proposing some avenues for improvement.

Peace and conflict studies have been strongly shaped by a specific type of research: large-N cross-national analyses that examine covariations between country-specific social, political and economic features and the onset, intensity or duration of conflicts. The approach of such analyses has become second nature to many researchers. So it comes as no surprise that this specific perspective has shaped the way that subnational geospatial analyses have been performed and interpreted. However, switching from the country level to the subnational level is about more than just studying a more fine-grained unit of analysis (Raleigh 2011). Firstly, what is being analyzed in most studies is no longer the intrastate conflict as such, but the geographical variance of violent events within conflicts. Secondly, whereas most cross-national analyses focus on conflict onset, subnational studies concentrate on incidence or intensity measures. Finally, contrary to the case with "conventional" cross-country studies, in the case of subnational studies one cannot necessarily assume that the features of a conflict within a specific unit of analysis are primarily shaped by features of that unit: cause and effect might not be found within the same unit.

These differences pose challenges for those who want to conduct or interpret quantitative geospatial analyses: What kinds of questions can be answered with such analyses? How can causal inference be drawn from geospatial observations? How can and should theoretical concepts be operationalized at the subnational level? While the challenges of subnational geospatial analyses have been emphasized previously (e.g. Gleditsch and Weidmann 2012; Kalyvas 2008), no systematic reviews of the existing research or analyses of potential pitfalls with respect to matters of research design, inference and operationalization have been undertaken. Rather, previous reviews have focused on the challenges related to event databases and their respective sources (e.g. Eck 2012; Schrodt 2012), the scaling and selection of units of analysis (e.g. Buhaug and Lujala 2005; Raleigh 2011), and statistical techniques (e.g. Gleditsch and Weidmann 2012; Raleigh et al. 2010b; Stephenne et al. 2009). This paper aims to fill this gap. It focuses on the research agendas, conceptualizations and causal claims of quantitative subnational analyses of political violence.

The paper is structured as follows: I first outline some major arguments in favor of such analyses. In the subsequent section I illustrate the variations among previous geospatial

analyses. The aim is purely descriptive: what research interests and conceptual approaches have these studies demonstrated? This review provides the basis for the discussion of some essential challenges of this type of analysis in the subsequent section. The final section summarizes the paper's central arguments.

2 The Case For Subnational Geospatial Analysis

Countries constitute the prime unit of analysis in peace and conflict studies. Indeed, various factors relevant to peace and conflict are better analyzed at the country than at the subnational level – either because they do not display substantial subnational variations (for example, regime type) or because one may argue that aggregate country-level features are more important for conflict than potential local-level variations (for example, dependence of the economy on primary commodity exports). However, other aspects may be better analyzed within, rather than across, countries. In the following discussion I briefly summarize some arguments in favor of such subnational analyses.

Mitigating the ecological inference fallacy: The ecological inference fallacy can occur when aggregated data is used to draw conclusions about individual characteristics or relationships (King 1997; Robinson 1950). Most violent conflicts do not cover entire state territories. They are geographically limited to specific substate regions. The same holds true for factors that are said to influence the risk of political violence, such as ethnic identity, terrain or economic well-being. More specifically, Buhaug and Lujala demonstrate that many conflict zones differ from other regions in important respects, thus making the application of inferences based on country-level indicators to subnational characteristics and phenomena spurious (e.g. Buhaug and Lujala 2005). For example, a comparably high national GDP may indicate a high degree of welfare at the national level. However, national-level numbers may obscure the strong concentration of economic power in specific regions, which in turn may enhance regional, ethnic or religious cleavages and increase rather than reduce the risk of violence. Without analyzing whether subnational patterns of violence match the subnational patterns of the independent variables, it is difficult to draw reliable conclusions on the actual effects of the factors under investigation (e.g. Raleigh et al. 2010a; Raleigh 2011). Thus, recent subnational analyses have questioned some of the findings that seemed to have been consolidated by cross-country studies. Grievance-based explanations of political violence, for example, had largely been dismissed in previous country-level analyses. More fine-grained analyses have, however, brought them back to the fore. Disaggregated studies that have incorporated measures of inequality across groups and subnational regions support the argument that grievances matter for political violence (e.g. Cederman et al. 2009, 2011).

Understanding other aspects of violent conflicts: Subnational geospatial analyses allow not only for new ways of analyzing conventional questions related to political violence, but also for the analysis of new questions. National-level studies have focused on a rather limited

number of dependent variables, notably the onset, duration and intensity of violent conflicts. Spatial disaggregation and subnational analyses permit the consideration of other characteristics of political violence. For example, such studies may investigate the actual location of violence or violent conflict onset (e.g. Buhaug and Gates 2002). Similarly, they may study how violence diffuses across geographical territories (e.g. Schutte and Weidmann 2011). The subnational approach also allows for the consideration of other independent variables that are inherently geographical: economic and political disparities across regions (Fjelde and Østby 2012), peripheral locations (e.g. Rustad et al. 2011), or the accessibility of regions (Raleigh and Hegre 2009). This diversification of dependent variables and independent variables may help us to understand political violence more comprehensively and to scrutinize aspects that have previously been underinvestigated. Thus, for example, the analysis performed by Hegre and Raleigh (2009) indicates that – contrary to intuitive expectations – violence does not necessarily take place more often in peripheral and inaccessible regions of countries. Rather, as other studies also show, the greater accessibility of certain subnational regions may increase the risk of violence occurring there (Zhukov 2012).

Reducing the gap between indicators and concepts: Civil wars are fought by individuals. Thus, all causal theories on conflict onset, intensity or duration entail explicit or implicit assumptions regarding the respective explanatory factors' effect on individual-level perceptions, decisions and actions. Using macro-level (for example, state-level) indicators to explain political violence requires auxiliary assumptions that link the indicator to local, micro-level dynamics. These assumptions may introduce additional uncertainties into empirical analyses. We assume, for example, that the state's security budget reflects its actual coercive capacity on the ground or that decentralization laws mirror individuals' access to decentralized decision-making. Geographical disaggregation permits the utilization of indicators that are closer to the local and individual levels: the number of police stations per district or spending by decentralized administrative bodies. Thus, using such subnational indicators is one way of reducing the uncertainties that come with the assumptions used to bridge the gap between state-level proxy indicators and the respective theoretical concepts. Recent subnational analyses have, for instance, used information on households' durable assets per administrative unit as an indicator for subnational poverty and economic inequality rates (e.g. Fjelde and Østby 2012; Hegre et al. 2009; Østby et al. 2011). Such operationalization can doubtless capture concepts and hypotheses related to the role of poverty in political violence more adequately than nationally aggregated measures such as GDP levels.

3 Research Questions and Variables

The potential benefits of geospatial analyses have made them increasingly popular. More and more studies are incorporating spatial characteristics into analyses of violent conflict in one way or the other (Gleditsch and Weidmann 2012; Kalyvas 2008). The various studies

have in common that they use information on location or geographical variation to undertake causal analyses of political violence. However, they differ greatly in the specific questions they ask and how they use subnational geographical information to answer these questions. The following section categorizes previous analyses according to their research interests and the dependent variables they use. It aims to provide a structured overview of the different approaches, to display their diversity and to outline their theoretical focuses. It is not meant as a comprehensive review. Rather, I present examples as illustration and to lay the groundwork for the subsequent discussion of some potential weaknesses and avenues for improvement in such studies. The section presents three types of studies:

1) analyses that focus on the location of *conflicts*,
2) analyses that focus on the location of *violence within conflicts*, and
3) analyses of the *diffusion of violence*.

3.1 Where Do Conflicts Take Place?

The first area of research focuses on the location of conflicts within countries. More specifically, it analyses how the specific socioeconomic characteristics of subnational regions influence the onset, occurrence, duration and intensity of conflicts in these regions. The rationale follows directly from what has been said with regard to the potential shortcomings of studies that consider country-level explanatory variables only. The location-level specifics may thus contribute to a better understanding of conflict: if poverty matters for conflict, conflicts should actually be found more often in economically weak subnational regions; if rough terrain can increase the duration of violent conflict, wars that are fought in forested areas or mountains should actually last longer than other conflicts. Such studies focus on entire conflicts rather than conflict events. They are performed at the subnational level across various countries and conflicts rather than within single countries. Two types of such studies can be distinguished: those that focus on conflict onset or incidence and those that are primarily interested in intensity or duration.

Buhaug and Rod (2006), for example, analyze polygons of violent conflict – geographical areas that encompass all relevant battlefields for each conflict-year. They find that territorial civil wars are more likely to occur in remote and sparsely populated areas, whereas conflicts about control over government mainly take place in populated urban areas (see also Buhaug et al. 2011). Theisen et al. (2012) analyze conflict onset rather than occurrence. For each conflict recorded in the UCDP/PRIO Armed Conflict Dataset, they code the location of fighting on the first day of the conflict to determine the onset location. Georeferenced precipitation data is the basis of their central independent variable. Their empirical analyses do not support the thesis that conflicts are more likely to break out in areas affected by drought and water scarcity.

Other studies are based on a similar approach but focus on the specific characteristics of violent conflicts, rather than on their occurrence or onset. Lujala (2009) considers the effects of geographical overlaps between conflict zones and abundant natural resources on the intensity of conflicts. She finds that conflicts fought in resource-rich areas are significantly more severe than others. Rustad et al. (2008) investigate how geographical overlaps between conflict zones and forested terrain influence the duration of violence in such zones. They do not find consistent evidence that such overlaps lead to increased conflict duration (see also Buhaug et al. 2009).

3.2 Where Does Violence Take Place?

The most widely applied type of subnational geospatial analysis focuses on the location of violent events within conflicts. In contrast to the previous strand of research outlined, such studies are not interested in the location of conflicts per se but rather in how violence is distributed geographically. More specifically, they focus on geospatial associations between violent events and the social, economic, political or geographical characteristics of subnational regions (subnational administrative regions or grid cells[1]). Given the comparably large number of such studies, I further differentiate them according to the way they conceptualize their dependent variable:

1) whether they focus on organized forms of violence such as armed conflict and civil war or on more decentralized violence such as riots or violent protest,
2) whether they focus on the general occurrence of violence or on the intensity of violence,
3) whether they analyze aggregated indicators of violence or specific forms of violence, and
4) whether they are performed within single or across various countries.

(1) Type of Violence: Civil War versus Other Forms of Violence

Subnational geostatistical analyses have been performed in various countries and contexts. Most of them focus on the geographical distribution of violent events in the context of organized collective action such as armed conflicts or full-fledged civil wars. They analyze how and why violent events are dispersed across the respective countries during the period of war. Other studies perform similar analyses but focus on violence that may be considered more decentralized and spontaneous and thus less guided by central organization and planning. Examples of both kinds of studies are presented below.

In their study of the civil war in Nepal, Do and Iyer (2010) are interested in the geographical variation of conflict intensity as measured by the number of conflict-related deaths per district They juxtapose the number of deaths with socioeconomic factors in the respective

1 The selection of subnational units of analysis as well as the potential advantages and disadvantages of using artificial grid cells or actual subnational administrative units has been discussed in various studies (e.g. Buhaug and Lujala 2005; Rustad et al. 2011).

units to analyze the determinants of violence. Their findings stress the role of poverty and inequality. Costalli and Moro (2011) follow a similar approach. They aim to explain how ethnic settlement patterns influenced the severity of fighting during the civil war in Bosnia-Herzegovina between 1992 and 1995. They find that ethnic fractionalization and polarization matter for violence at the municipality level, with the former appearing to impact the general occurrence of violence and the latter resulting in higher numbers of victims.

Fewer studies consider other types of violence such as riots, communal violence or violent protests. A contribution by Tadjoeddin and Murshed (2007) is among the exceptions. These authors concentrate on routine violence (mainly vigilante violence and interneighborhood/intervillage/intergroup brawls) in Indonesia. Focusing on geographical variations in economic development, they find an inverted-U-shaped relationship between levels of education and income on the one hand and the number of deaths per district on the other. The second example uses data from Indonesia as well. Østby et al. (2011) investigate the role of resource scarcity and population pressure in political violence. Their estimations consider two different kinds of dependent variables: the occurrence of lethal episodic violence and the occurrence of routine violence. The former refers to group-based vigilante violence or intergroup brawls, the latter to ethnocommunal or separatist violence. Among other things, they find the risk of violence to be higher in provinces that are segmented and have a high degree of population pressure.

(2) Measurement and Operationalization: Occurrence versus Intensity

Three different conceptualizations of the dependent variable are usually used in subnational analyses of political violence: the occurrence of violent events, the number of violent events and the number of fatalities per subnational administrative unit or grid cell. The first is employed to explore which subnational units have higher or lower risks of experiencing violence at all. The latter two types of operationalization are geared towards analyses that ask which subnational units have a higher probability of experiencing higher or lower levels of violence than others.

In their investigation of 14 African countries, Hegre and Raleigh (2009) examine how factors such as population size as well as the distance to capitals, borders and road networks influence the probability that subnational regions will experience violent events. They find that population concentration and distance measures impact the risk of event occurrence. Theisen (2012) employs a similar approach. He analyzes whether areas with low levels of land per capita display higher risks of experiencing violence than other areas in Kenya. Among other dependent variables, he considers a dichotomous variable that captures whether a cell experienced any violent event during a conflict that caused more than 25 deaths per year. He does not find consistent evidence that resource scarcity leads to violence.

Other articles focus not on the occurrence or nonoccurrence of violence but rather on its intensity, as measured by the number of violent events within specific subnational regions.

Hoelscher et al. (2012) recently studied violent events related to the Maoist insurgency in India. They analyze the total number of events at the district level and find violence to be associated with a high percentage of scheduled caste/tribes within the respective district. Socioeconomic factors do not seem to play a primary role in the occurrence of violence. Similarly, counts of fatalities have also been used as an indicator of conflict intensity. Murshed and Gates (2005) analyze the civil war in Nepal. They ask how the number of people killed per district is related to various district-level socioeconomic characteristics and find that poverty and inequality matter.

(3) Types of Violent Events: Aggregated or Disaggregated Analyses

Most subnational geospatial analyses concentrate on the geographical patterns of violence as such. No further disaggregation is considered. Rather, various events are subsumed into more general event or fatality counts. Other analyses either consider different forms of violence or concentrate on specific perpetrators or types of violence, thus allowing for more differentiated or more focused analyses. The latter type consists mostly of analyses of the hypothesis put forward by Kalyvas (2006) regarding the role of territorial control in civil wars. Examples of both approaches are presented below.

A recent study by De Luca et al. (2012) serves as an example of the predominant type of study. The authors are interested in the role of mineral resources in the violent conflict in Democratic Republic of Congo (DRC). They find that a larger number of mining sites increases the number of total events and simultaneously leads to the displacement of conflict to surrounding areas, which may be the result of entrepreneurs' attempts to secure their mining sites. Bohara et al. (2006) use a similarly aggregated dependent variable. They analyze the geographical variation of violence intensity across Nepalese districts during the civil war. District-level causality aggregates form their right-hand variable. They find that areas with rugged hills were more likely to experience high-intensity violence. Citizen engagement in political activities (elections) and social organizations lowered the risk of government and rebel violence.

Other studies are interested in the location of specific types of violence. Kalyvas and Kocher (2009), for example, analyze the location of insurgent selective violence and incumbent indiscriminate violence (shelling or air strikes) during the Vietnam War. They find that selective violence was most frequent in areas that were predominantly controlled by the insurgents. Bhavnani et al. (2011) perform similar analyses of selective and indiscriminate violence in Israel, the West Bank and Gaza in the period from 2006 to 2008. They classify localities according to the degree of Israeli and Palestinian (Hamas and Fatah) control and analyze whether geographical patterns of violence correspond to the prediction of Kalyvas's (2006) theoretical argument. Their findings suggest that control matters, albeit in a different way than Kalyvas predicted: Israel has employed selective violence primarily in regions controlled by Palestinians, whereas contested zones were less prone to this form of violence.

(4) Scope: Within- or Cross-Country Analyses

The bulk of subnational analyses of violence focus on single countries. One major reason for this may be the limited availability of data. It can be difficult to obtain relevant geographically disaggregated information for single countries. It is, however, even more difficult to get hold of such data for multiple countries. Subnational studies that have been performed across more than one country focus on specific explanatory variables for which the required data is available on a global scale (for example, precipitation, resource abundance) or has been collated in large database projects (e.g. Wucherpfennig et al. 2011). Some examples of subnational single- and cross-country analyses are outlined below.

Weidmann (2011) presents an interesting analysis of the Bosnian war. He asks whether violence was driven by the micro-level dynamics of individual "ethnic-religious hatred" or by a macro rationale of groups striving for ethnically homogenous homelands. He differentiates between contested[2] and ethnically polarized municipalities. The strong empirical association between violence intensity and contested municipalities indicates that macro explanations apply to the violence that occurred in most parts of Bosnia. O'Loughlin and Witmer (2011) concentrate on a specific region of Russia: the North Caucasus. They find that the rate of violent events is highest in those regions close to the highway, with a low share of Russians, and with forest cover.

Fewer studies are done across various countries. Raleigh (2012) recently performed an interesting analysis. Using global geocoded event data he investigated the determinants of violence against civilians. In doing so, he considered two competing claims: The first was that violence against civilians is primarily a consequence of armed actors' aim to punish areas supportive of their opponents. The second was that violence is a result of various violent groups competing for supremacy in local areas. He found the spatiotemporal patterns of violence to be consistent with the latter rather than the first proposition. Another subnational cross-country study was recently presented by Raleigh and Kniveton (2012). They analyzed the influence of rainfall variation on rebel conflict and communal violence, focusing on locations in Uganda, Kenya and Ethiopia where conflict had actually occurred. Their statistical analyses show that the number of events increases in periods of strong variation, regardless of whether rainfall increases or decreases.

3.3 How Does Violence Diffuse?

A final research strand focuses not on the onset, prevalence or intensity of conflict but on its geographical diffusion. How do violent events spread geographically once that violence has erupted? Various more recent studies have attempted to answer this question. One approach

2 A municipality is considered "contested" if it is of strategic importance to more than one ethnic group because it hosts significant numbers of the respective groups and because it is near regions with significant numbers of the groups (Weidmann 2011).

focuses on the temporal and spatial autocorrelation of violence: how do violent events in one location and at a specific point in time influence violence in other areas and subsequent periods? Other studies have a similar interest; however, they incorporate further factors that may influence the transmission of violence from one area to another and that may thus shape diffusion patterns.

Schutte and Weidmann (2011) analyze diffusion patterns in Bosnia, Kosovo, Burundi and Rwanda. More specifically, they ask if diffusion in civil wars is characterized by escalation (violence expands to new locations while the original location remains affected) or by relocation (violence expands to new locations whereas violence in the original location ends). They find the former to be the predominant mode of diffusion. O'Loughlin and Witmer (2012) have a similar research interest. However, they focus on interactions between the warring parties. In analyzing violent events in Russia's North Caucasus and differentiating between rebel and government (military and police) events, they find evidence of tit-for-tat dynamics characterized by strong temporal and spatial dependencies between violent events of both types (see also Linke et al. 2012).

Other theoretical models are not based on autocorrelations of violence alone but consider other factors that influence the likelihood of spatial diffusion to specific locations. Zhukov (2012), for example, focuses on the logistical side of diffusion. In his analysis of the conflict in Russia's North Caucasus he finds that accessibility reduces the risk that violence recurs: qualifying the findings of Schutte and Weidmann (2011), Zhukov finds that road networks increase the likelihood that violence relocates rather than escalates to other areas (see also Toft and Zhukov 2012). Braun (2011) has undertaken one of the few studies that focus on an OECD country, analyzing the diffusion of racist violence in the Netherlands. He argues that the occurrence of violence in one location may strengthen people's perceptions that violence is legitimate in other locations and finds that incidents of racist violence have indeed diffused from the locations where they first originated to nearby locations. Media coverage then spreads information on violent events nationally and may trigger subsequent violent events in more distant locations.

4 Conceptual Challenges

The bulk of the studies presented above follow a specific approach: using information on the geographical associations between socioeconomic factors and violence to answer questions related to the causes of conflicts, the motives of combatants, and opportunities for rebellion. Put differently, they use information on "Where" to answer questions related to the "Why" of armed conflicts: Why do people take up arms? Why do people support violent action? Why are rebels able to stage armed uprisings? Thus, geographical variations are not the actual research interest but rather an instrument for causal inference.

As argued above, such an approach can contribute greatly to our understanding of violent conflict. However, it also has its weaknesses. The following discussion highlights some of the challenges. It focuses primarily on the second type of study described above: subnational analyses of the geographical variations of violent events. This is the approach that is the most widely applied and the most prone to the potential conceptual problems this paper is focused on. The following sections are organized according to the essential elements of the research process in which these challenges may occur:

1) the definition of the theoretical argument,
2) the logic of causal inference,
3) the conceptualization of the dependent variable, and
4) measurement.

The aim is not so much to point out the problems of previous studies as to highlight some potential issues that should be taken into consideration in future geospatial analyses undertaken at the subnational level.

4.1 The Theoretical Framework – Getting the Argument Right

Subnational geospatial analyses differ from "conventional" cross-country analyses in three essential respects: First, the unit of analysis is no longer the country but the grid cell or the subnational administrative unit. Second, the phenomenon of interest is no longer the intrastate conflict as such, but rather the geographical variances of violent events within conflicts. Third, whereas most cross-national analyses focus on conflict onset, most subnational studies analyze the incidence or intensity of violence. Thus, blunt transfers of national-level arguments to subnational studies might be inappropriate.

(1) Switching from the country level to the subnational level: The country level differs from subnational levels of analysis. The main difference between the two levels is related to the specificity of the state. Here, two characteristics stand out: First, the state in itself constitutes the central bone of contention of many violent conflicts. Warring parties fight for control over central government. This is not the case for subnational regions, which do not each dispose of such a center of power. Second, the state is a rather closed unit and dynamics occurring within states do not necessarily spill over to adjacent units. People move less freely between countries and tend to express their grievances within their home country rather than within neighboring ones. This does not necessarily hold true for grid cells or subnational administrative units. Thus, applying national-level causal assumptions to subnational analyses without adapting them to these differences may result in dubious theoretical arguments. The potential effects of religious polarization provide an example (e.g. in Costalli and Moro 2011; Østby et al. 2011). At the national level, one can argue that specific identity constellations may lead to violence because identity groups compete for control over central government. However, this argument cannot be made directly for polarization at the subnational level.

Certainly, one may argue that local-level polarization matters; however, the underlying causal claim may be different (for example, religious intolerance rather than power struggles), and one will have to make a strong argument as to why polarization should matter within one specific administrative unit (for example, municipality, district or province) rather than across neighboring ones. As another example, it has often been argued that poor economic conditions result in a lack of economic opportunities for people, which makes engagement as rebels attractive and increases the risk of violent conflict. This argument has also been applied in subnational analyses (e.g. Bohara et al. 2006; Murshed and Gates 2005). However, why exactly should a high potential for recruitment in a district increase the number of killings by government and rebels in the same district? People may instead move to other regions to search for jobs. Or people in economically stronger regions may be targeted by rebels from poor subnational regions (e.g. Hegre et al. 2009). Again, this is not say that the basic argument may not be valid for subnational analyses. However, it requires further specification that is often not provided. This can lead to blurry theoretical arguments and conclusions.

(2) Switching from conflicts to violence: Similarly, there is a conceptual difference between analyzing conflicts and investigating violence within conflicts. The factors that cause civil wars and determine their duration or overall intensity do not necessarily influence the location of violent events or the location of particularly long-lasting or intense fighting – and vice versa. It may thus be premature to apply insights from one phenomenon to the other without having a closer look at the transferability of the underlying theoretical arguments and concrete hypotheses. A blunt example illustrates this argument: Subnational analyses may reveal that civil war violence is particularly intense near military bases or government facilities. The explanation is straightforward: challengers of state authority act strategically and target the resources of their enemies. The location of violence thus informs us about the strategic aims of the rebels but not about their actual motives or the causes of the overall conflict. Similarly, it is clear that the association between violent events and military bases cannot be transferred to the conflict level. We cannot infer from our finding that government buildings matter as conflict causes and that conflicts will more likely be observed in countries with a high density of military facilities. The same holds true the other way around: theoretical arguments and findings regarding the conflict level cannot directly be transferred to the event or violence level. It has been argued that conflicts tend to take place in countries with rough terrain as this increases opportunities for rebellion (Fearon and Laitin 2003; Hendrix 2010). This argument cannot simply be shifted to the level of violent events at the subnational level. Nonetheless, this is often done without further qualification (e.g. Bohara et al. 2006). Should violence actually occur more often or be particularly intense in areas with rough terrain? Not necessarily: if rebels actually use rough terrain to hide from government military forces, we should see less violence in areas with rough terrain and more violence at its borders (Rustad et al. 2008). Thus, the theoretical argument on opportunities for rebellion needs to be framed differently at the event level of analysis than it is at the conflict level of analysis.

(3) Switching from onset to occurrence and intensity: Peace and conflict studies have analyzed different elements of violent conflicts, notably their onset, incidence, duration or intensity. Even though these are facets and traits of the same social phenomenon, they should be understood as distinct concepts (Montalvo and Reynal-Querol 2007). While the determinants of all three elements might overlap, they are not necessarily the same. Thus, they should be treated separately and analyzed based on tailored theoretical arguments. However, this differentiation is often blurred in current geospatial analyses. Theoretical arguments that have been put forward for analyses of conflict onset in cross-country analyses are being used in subnational analyses of conflict intensity – particularly in discussions relating to opportunity, greed and grievance (Do and Iyer 2010; Murshed and Gates 2005). However, the factors that motivate people to take up arms or that influence their ability to stage a rebellion may be different from those factors that influence the intensity of fighting and the severity of violence against civilians. A high number of fatalities or events in a specific area may be traced back to a spiral of attacks and reprisals within a given territory (e.g. Raleigh 2012). It may also be influenced by a military scorched-earth strategy aimed at weakening the particular adversary. In neither case are the factors that increase the intensity of the conflict within a specific area necessarily related to the causes of the conflict.

The same argument can be made the other way around. In line with the cross-national findings of onset analyses, high levels of poverty in a subnational region may be associated with a higher risk of conflict onset or incidence within the region (Buhaug et al. 2011). However, it is not theoretically evident why high levels of poverty should actually increase the intensity of fighting within the region – more reasons to fight do not necessarily lead to more zealous and more aggressive fighting (e.g. Costalli and Moro 2011). Finally, analyses that have included measures of the incidence and intensity of conflict confirm the differences between these concepts. Estimation results differ across both measures (e.g. Costalli and Moro 2011; Tadjoeddin and Murshed 2007). This underscores the necessity of analyzing them distinctively based on theoretical arguments that are clearly geared towards the concept of interest.

The review and the examples presented above indicate that transferring arguments and findings from cross-national research to subnational analyses (and the other way around) may be problematic if these concepts are not adequately adapted to the respective analytical context. The "lending" of theoretical arguments needs to be accompanied by explicit reasoning as to whether and how causal assumptions might need to be adapted in order to match the designated type of analysis. This reasoning entails making statements about how essential differences between the state and subnational units of analysis (grid cells or administrative units) may affect the validity of the respective causal assumptions – particularly with respect to forms of governance and permeability across units. Furthermore, the theoretical arguments used in subnational analyses of violent events should concentrate on factors that may explain why battles or killings take place in specific areas (origin of events) rather than trying to explain why they take place at all (origin of the conflict). Results from the former

may be used to make inferences regarding the latter; however, such conclusions need to based on explicit theoretical arguments that link the location of violence to the causes of conflicts. Finally, hypotheses should be aligned with the actual dependent variable and focus on factors that may account for the intensity or occurrence rather than the onset of violence. Similarly, these differences should be taken into account when results from subnational analyses are fed back into national-level analyses of conflict onset.

Another way of avoiding some of the conceptual problems highlighted above is to make use of geospatial techniques to actually investigate the geographical dimension of political violence. Rather than using "where" data to answer "why" questions, one may use it to answer actual "where" questions. Thus, one may concentrate on analyzing locations and developing hypotheses that are geared towards explaining geospatial patterns of violence. Previous studies have demonstrated what such research might look like. For example, Buhaug (2010) has argued that the location of violent conflicts is influenced by power distribution between rebels and the state. His analyses indicate that conflicts tend to occur in peripheral regions when states are strong and face militarily weak insurgents (see also Buhaug and Gates 2002). A myriad of further research questions related to diffusion, termination or recurrence patterns can be asked: How do different kinds of conflicts (for example, territorial or governmental) diffuse? How do violent conflicts end? Are geographical termination patterns characterized by uniform pacification from the periphery to one center or by decentralized cessation of fighting? Where do violent conflicts recur? Do they tend to recur in areas where the initial conflict began or where violence ended last? Empirical analyses based on such questions speak more directly to the potential and the limits of subnational geospatial analyses and are less prone to the weaknesses described above.

4.2 Causal Inference – The Link between the Location of Violence and Independent Variables

The second challenge I want to raise is related to causal inference. Most cross-country analyses rely on the assumption that the features of violent conflicts (for example, incidence or intensity) can be traced back to the characteristics of the countries in which they are fought. Thus, they draw causal inferences from analyses of the covariation of such characteristics. However, geospatial analyses differ from country-level studies in one central respect: whereas it can reasonably be assumed that the factors that cause, perpetuate and end violent conflict are associated with structures, actors and processes that are observable within the respective country, this cannot be assumed in the case of geospatial subnational analyses (Kalyvas 2008). To put it simply: people do not necessarily fight in the same subnational region in which grievances or personal political or economic aspirations made them take up arms. Thus, drawing causal inferences from the observable covariation of the "classic" de-

pendent (for example, onset or intensity) and independent (for example, poverty) variables at the subnational level may be flawed.

The presence of violence within an administrative unit or grid cell may reflect the eruption of violence within that unit or cell. In many cases, however, violence within a subnational region may be a consequence of diffusion from neighboring regions (Schutte and Weidmann 2011). Rebellions erupt in one region and may with time engulf other parts of a country. Some previous studies have not adequately accounted for this specificity. Their analyses are based on the underlying assumption that features of violence within a specific subnational unit of analysis (for example, district or grid cell) can more or less be fully explained with reference to other characteristics of that unit. Violence within the respective administrative regions or grid cells is conceptualized as "homegrown" (e.g. Hoelscher et al. 2012; Murshed and Gates 2005). This conception, however, neglects the findings of previous analyses on the role of processes endogenous to violence as well as on the diffusion of violence (e.g. Kalyvas and Kocher 2009; Raleigh 2012). Such estimations may thus be considered as oversimplified and based on a logic of inference used in cross-national research that is not readily applicable to subnational geospatial analyses.

This is not to say that the features of administrative units or cells may not be important in explaining why violence diffuses into certain regions and not into others. Structural characteristics such as poverty rates, ethnic constellations or features of terrain may play an important role in determining the location of violence in that they influence decision-making and action on the part of the military and rebel groups. However, further causal assumptions are needed to account for such dynamics. Arguments related to military strategy (for example, the location of military targets) may play a more prominent role in particular theoretical models than variables related to the causes of violence (for example, local grievances). Many studies, however, don't incorporate such factors or do not make such assumptions explicit. This makes causal inference based on empirical observations particularly challenging.

Subnational geospatial analyses would benefit from the more rigorous development of auxiliary theories that link the location of specific explanatory variables to the location of violence. For example, Hegre et al. (2009) analyze the geospatial associations between poverty and political violence in the Liberian civil war. Their hypotheses are derived from Boulding's "Loss of Strength Gradient" model, which assumes that violence will likely take place in locations where there is a high level of support for the weaker party as the stronger party is able to target its opponent in the latter's home base. Hegre et al. theorize that poor people will be more inclined to support the rebels, whereas people who are better off will tend to support the government. As the rebels in Liberia are considered to have been particularly strong relative to the central government – and thus better able to target the government's support base than the government could target theirs – they hypothesize that one should observe more violence in wealthier regions. Using such clearly defined auxiliary theories and making them explicit is an important step towards more convincing causal inference in sub-

national geospatial analyses. In the future more effort might also be put into actually testing such auxiliary assumptions themselves. In the case of the Liberian example presented above, this would mean analyzing whether the stronger parties in a conflict actually target weaker parties in their home regions or whether wealthier people actually tend to be more pro-government and pro-status quo than economically weaker members of the population. If such auxiliary assumptions are not empirically tested, they may merely introduce more uncertainty into the studies that make use of them.

Furthermore, other, more decentralized types of violence may generally be better suited as dependent variables for subnational analyses of political violence. Violent protests, riots or communal violence have increasingly been included in peace and conflict research with the aim of understanding violent conflicts in more general terms. The underlying assumption is that phenomena such as civil war, protests, riots or communal violence might actually derive from the same underlying factors (Tilly 2003; Cunningham and Lemke 2011). However, from a methodological point of view the latter are easier to handle in geospatial analyses. Central planning, organization and military strategy matter less for the location of riots and demonstrations, as such events tend to erupt in a more spontaneous and decentralized manner (Østby et al. 2011). Thus, the location of violence can be associated more directly with features of the respective subnational unit (e.g. Gurr 1970; McAdam et al. 2001), making inferences based on the relationship between the location of violence and the causes of violence less challenging. If one wants to analyze the causes of violence through subnational geospatial analyses, it makes sense to focus on riots or violent protests or to include different kinds of violence in the same analysis (see for example Urdal 2008).

4.3 Conceptualizing the Dependent Variable – Further Disaggregation

Disaggregation is easier said than done. One may also be inclined to argue that geographical disaggregation is a laudable step that should not trigger calls for further disaggregation according to other dimensions. I nonetheless want to point out some potential challenges for causal inference that result from the inadequate consideration of temporal dynamics and of different types of violence. In particular, aggregated dependent variables may obscure the divergent effects of various explanatory factors, potentially increasing the risk of false conclusions.

Many subnational studies rely on analyses of geographical patterns of violence without temporal disaggregation. The number of events or the number of fatalities are cumulated per subnational region over the entire period of the particular conflict. The sum is then used as the dependent variable (e.g. Do and Iyer 2010; Hoelscher et al. 2012; Murshed and Gates 2005). In many cases, the reason temporal variation is not considered is the lack of information available to measure the independent and control variables. Whereas most geographically disaggregated event data sets contain information on the exact dates of violent events,

information on temporal variations in economic, political and social factors is much harder to obtain. Many developing countries may dispose of reliable data on poverty or ethnic identities at a specific point in time; however, hardly any country has sufficient data to allow for panel-style data analyses. Thus, most geospatial analyses are cross-sectional only. Not considering different phases of violent conflict may, however, lead to inference problems. As Buhaug et al. (2011) convincingly argue, the location of early phase violence may exhibit different patterns than violence in later stages of insurgency. Specific factors may play essential roles in either the onset or the diffusion of violence. For example, rough terrain may not be relevant when violent conflicts break out. However, it may correlate with high intensity levels during later stages of violence, when organized rebels seek refuge from counterinsurgency campaigns. Similarly, ethnic identities and differences may increase in importance over the course of violent conflicts. Thus, the constellations of ethnic identity groups might not impact the location of violent events at the beginning of a conflict but may shape geographical patterns of violence in subsequent conflict phases. Temporally aggregated analyses obscure such developments and thus may lead to misinterpretations of the relevance of such factors.

It has also been argued that, in addition to undertaking temporal disaggregation, different forms of violence need to be singled out and potentially analyzed separately (e.g. Kalyvas 2006). Events or fatalities may be disaggregated according to the perpetrators, acts and targets of violence. Subsuming various types of violence into a single intensity variable may obscure the divergent effects of these different kinds of violence. For example, hiding places for rebel groups such as forests or mountains may mean reduced killings of rebels in the area but increased civilian deaths as a result of government counterinsurgency activities. High levels of violence in such areas, measured on the basis of aggregated fatality data, would be hard to interpret adequately. Similarly, one may find that subnational administrative units that display high levels of poverty exhibit higher levels of violence. One explanation may be that poverty leads to more recruitment by and tacit support for rebels in the particular unit, thus increasing rebel presence in the area and leading to more combatant deaths (e.g. Bohara et al. 2006). It may, however, also be the case that poor people tend to side with the government, which may lead to more violence against civilians by rebel groups. One might assume that the first explanation is more likely; however, without disaggregated data on the background of the killings it will not be possible to confirm this assumption.

Accounting for problems that may arise from time-invariant analyses is not straightforward. Most notably, it is not always possible to introduce temporal elements into an analysis due to the absence of the necessary data. However, another suitable approach would be to focus on a specific period of the conflict only. Such a concentration would help avoid the risks that come with merging different time periods that may have been influenced by divergent dynamics. In a recent article, Zuckerman Daly (2012) presents the findings of her analysis of geographical patterns of violence in Colombia. She examines the period from 1964 to 1984, the time before the conflict is coded as an actual "civil war" by conflict databases. Thus,

she focuses on violence in the early stages of the armed conflict. She finds that many factors that have been emphasized in cross-country analyses, such as poverty, road density or terrain characteristics, have little explanatory power in terms of her research question. Rather, what seems to have determined the location of violence were the legacies of previous periods of violence: violent events were particularly likely in areas affected by guerilla groups in the period between 1948 and 1958.

Data paucity may also inhibit disaggregation of the dependent variable by type of violence. However, most of the event or fatality databases contain disaggregated information that allows for more specific analyses of various forms of violence, such as violence against civilians or events that did or did not lead to fatalities. Concentrating on one of these aspects may help researchers to draw more concise conclusions from empirical findings, as it is less likely that the results will be affected by the divergent patterns of different types of violence aggregated into one single variable (see for example Raleigh 2012 on violence against civilians). Whether potential reductions in the statistical power that result from concentrating on a subset of events outweigh the benefits of more concise analyses must be decided on a case-by-case basis. Such a decision may be based on the degree to which different forms of violence diverge temporally or are clustered geographically, both of which may indicate the necessity of differentiated analyses. In addition, the disaggregation of different forms of violence may not only be helpful in avoiding distortions but may also in itself be a useful instrument for causal inference. Analyses of theoretical assumptions based on different conceptualizations of the dependent variables may allow for effective robustness checks of the empirical findings and for nuanced interpretations across different types of violence.

4.4 Measurement – Identifying Less Ambiguous Indicators

Identifying valid and reliable indicators is often not an easy task – no matter what a study's level of analysis. However, a lack of data might make persuasive operationalization in subnational analyses even more difficult, especially in conflict-affected countries. Whereas information about the national-level GDP may be available, information on income levels at the subnational level is often not obtainable. The same often holds true for data about ethnic identities or various development indicators. Paucity of data increases the need to rely on proxy indicators that may or may not adequately reflect the concepts at hand. Thus, geospatial analyses have, for example, attempted to capture state capacity using the distance from the capital, the type of terrain (for example, mountainous) and the density of road networks (Buhaug 2010; Cederman et al. 2009). The validity of these indicators can be questioned: can we reasonably assume that the state's ability to repress or to coopt potential rebellion is mirrored by the number of roads in a given grid cell or administrative unit?

Another problem is that the same indicators have often been used as proxies for various variables, thus making interpretation of the empirical results somewhat discretionary. In

general terms, Kalyvas (2008) has emphasized the problem of observational equivalence: The same factors may lead to the same outcome through different causal pathways. Poverty may foster violence through grievance mechanisms (people fight for justice and equality) or greed/opportunity mechanisms (people fight because they don't have other income-generating opportunities). Thus, finding poverty to be related to violence does not allow for any conclusions as to how exactly poverty impacts the occurrence of violence. This problem is exacerbated in those subnational analyses that use ambiguous indicators for operationalization (see also Raleigh et al. 2010b). The problem of ambiguity can be exemplified with respect to road networks: besides state capacity (Cederman et al. 2009), they might be used as an indicator for overall levels of development (Buhaug and Rød 2006), or they may be understood as strategic targets of rebel groups (Raleigh and Hegre 2009) or as potentially enhancing rebels' logistics capacities (Zhukov 2012). If dense road networks are found to be negatively or positively associated with political violence, what conclusions can be drawn from these findings?

The challenge of measurement is primarily an issue of data unavailability that is not easily solved. Already, case selection for geospatial analyses is strongly driven by data availability rather than by more theoretical considerations. Studies tend to be concentrated on specific countries for which relevant data is available. Thus, it comes as no surprise that there are many analyses of Nepal (Bohara et al. 2006; Do and Iyer 2010; Murshed and Gates 2005), Indonesia (Østby et al. 2011; Rustad et al. 2011; Tadjoeddin and Murshed 2007) and India (Hoelscher et al. 2012; Urdal 2008), and (to the best of my knowledge) none on Chad or Yemen. Thus, arguing in favor of raising the bar for operationalization and measurement with respect to reducing ambiguities would amount to arguing in favor of further concentration on data-rich countries. I think three other potential avenues would be more promising:

Qualitative analyses of violent conflicts have traditionally focused on the subnational processes of violent conflicts. They rely less on hard numbers for persuasive causal inference. Thus a method mix combining geostatistical analyses with in-depth qualitative analyses may be particularly well suited for subnational analyses of political violence (Raleigh et al. 2010b). In such a setting, qualitative analyses may be used to scrutinize the findings of quantitative analyses and to allow for informed judgments as to whether the latter actually reflect the underlying theoretical assumptions and causal reasoning. Besides mere triangulation, such a multi-method design may be set up as an actual nested analysis, something that has been advocated for with respect to cross-country analyses (Lieberman 2005). To date, only a few studies have actually pursued multi-method strategies. A recent paper by Koos and Basedau (2012) is a notable exception.

Another approach would consist of trying to break down some of the causal assumptions that are regularly put forward in analyses of violent conflict. The larger the number of logical steps required to move from the independent variable to the dependent one, the more uncertainty will be introduced into the analysis in question and the harder the respective findings

will be to interpret – particularly with respect to the validity of the assumption regarding the actual causal effect of the independent on the dependent variable. Thus, it may make sense to focus on some specific elements of these causal assumptions only. This would not only reduce this uncertainty but also introduce other dependent variables into analyses of political violence for which more plausible indicators would be available. For example, many studies assume that poverty leads to grievances and that grievances increase the risk of violence. They analyze covariations between poverty rates and levels of violence. Instead, one may focus on analyzing the first causal step only: does poverty lead to grievances? Such analyses could rely on survey data that is available for many relevant countries (for example, data from the Barometer project or the World Values Survey).

Finally, potential data sources should be explored more rigorously with the aim of identifying more plausible ways of operationalizing relevant independent and control variables. There are various data sets that contain information that is disaggregated at the geographical level, such as USAID's Demographic and Health Surveys (DHS) and EdData (Education Data), the World Health Organization's World Health Survey (WHS), or the World Bank's Living Standard Measurement Surveys (LSMS). Moreover, detailed country-level information, such as census or household survey data, can be obtained from national statistical authorities. These data feature information on identities and attitudes, as well as on the social and economic conditions of households and individuals in various countries. They constitute a valuable source of information that can be used for subnational geospatial analyses of political violence.

5 Conclusion

Geospatial analyses undertaken at the subnational level contribute significantly to research on political violence: they shed new light on hypotheses that have been tested in country-level analyses and allow for the consideration of aspects of violence that have thus far been widely neglected. In this paper I have presented and differentiated between various types of such analyses in order to provide a systematic overview of existing approaches – particularly with respect to the way they make use of geographical information, their specific research questions, and the actual dependent variables they analyze.

The overview has highlighted the fact that geospatial analyses of the subnational level come with their own specific challenges. Many of these challenges are related not so much to the actual technique itself but rather to the fact that the theoretical arguments and reasoning of causal inference are often directly adopted from large-N cross-country analyses of civil war onset. However, geospatial analyses of the subnational level are different from cross-country studies. They focus on another level of analysis, they investigate features of violence within rather than across conflicts and they tend to concentrate on the intensity and occurrence of violence rather than its onset. Negligence of these differences may not only prevent

us from making use of the specific value-added of geospatial analyses but may also lead to potentially erroneous conclusions.

Given these challenges, I have presented a sort of wish list: Firstly, analyses of political violence should, in general, be careful about transferring theoretical arguments and empirical findings from the cross-country to the geospatial level – and vice versa. It may be more promising to use geospatial analysis for particular research questions that are more specifically geared towards the actual geographical characteristics of violent conflict. Secondly, studies should be more careful about the plausibility of implicit or explicit assumptions relating observable violence in one subnational region to specific features of that region. The underlying assumptions should either be abandoned or thoroughly justified on theoretical grounds. Thirdly, challenges stemming from the use of aggregated dependent variables may be mitigated either by incorporating different kinds of operationalization into the same analysis or by focusing on single types or phases of violence and thereby allowing for less ambiguous interpretations of empirical findings. Finally, to reduce uncertainty resulting from potentially ambiguous indicators, the potential of nested analyses combining quantitative and qualitative analyses should be considered more regularly. Moreover, existing data sources should be explored more systematically for information that may be used for the more persuasive operationalization of independent and control variables. Where the required information is not readily available, data collection projects may make valuable contributions.

The last recommendation leads me to the conclusion of the paper: geospatial analysis is best understood as one among many research approaches and techniques, all of which come with specific advantages and disadvantages. Rather than trying to overcome these disadvantages in the case of geospatial analysis, it would be more promising to make use of it in a multi-method setting. Such an approach would allow subnational geospatial analyses to contribute their specific value-added, while their potential weaknesses would be balanced by other approaches such as cross-national statistical analyses or qualitative analyses of the local level. Although some studies have worked in this direction, the full potential of such an approach has yet to be realized.

Bibliography

Bhavnani, Ravi, Dan Miodownik, and Hyun Jin Choi (2011), Three Two Tango: Territorial Control and Selective Violence in Israel, the West Bank, and Gaza, in: *Journal of Conflict Resolution*, 551, 133–158.

Bohara, Alok K., Neil J. Mitchell, and Mani Nepal (2006), Opportunity, Democracy, and the Exchange of Political Violence A Subnational Analysis of Conflict in Nepal, in: *Journal of Conflict Resolution*, 501, 108–128.

Braun, Robert (2011), The Diffusion of Racist Violence in the Netherlands: Discourse and Distance, in: *Journal of Peace Research*, 486, 753–766.

Buhaug, H. (2010), Dude, Where's My Conflict?: LSG, Relative Strength, and the Location of Civil War, in: *Conflict Management and Peace Science*, 272, 107–128.

Buhaug, Halvard, Scott Gates, and Päivi Lujala (2009), Geography, Rebel Capability, and the Duration of Civil Conflict, in: *Journal of Conflict Resolution*, 534, 544–569.

Buhaug, Halvard, and Scott Gates (2002), The Geography of Civil War, in: *Journal of Peace Research*, 394, 417–433.

Buhaug, Halvard, Kristian Skrede Gleditsch, Helge Holtermann, Gudrun Østby, and Andreas Forø Tollefsen (2011), It's the Local Economy, Stupid! Geographic Wealth Dispersion and Conflict Outbreak Location, in: *Journal of Conflict Resolution*, 555, 814–840.

Buhaug, Halvard, and Päivi Lujala (2005), Accounting for Scale: Measuring Geography in Quantitative Studies of Civil War, in: *Political Geography*, 244, 399–418.

Buhaug, Halvard, and Jan Ketil Rød (2006), Local Determinants of African Civil Wars, 1970–2001, in: *Political Geography*, 253, 315–335.

Cederman, Lars-Erik, Halvard Buhaug, and Jan Ketil Rød (2009), Ethno-Nationalist Dyads and Civil War A GIS-Based Analysis, in: *Journal of Conflict Resolution*, 534, 496–525.

Cederman, Lars-Erik, Nils B. Weidmann, and Kristian Skrede Gleditsch (2011), Horizontal Inequalities and Ethnonationalist Civil War: A Global Comparison, in: *American Political Science Review*, 10503, 478–495.

Costalli, Stefano, and Francesco N. Moro (2011), The Patterns of Ethnic Settlement and Violence: A Local-Level Quantitative Analysis of the Bosnian War, in: *Ethnic and Racial Studies*, 3412, 2096–2114.

Daly, Sarah Zukerman (2012), Organizational Legacies of Violence: Conditions Favoring Insurgency Onset in Colombia, 1964–1984, in: *Journal of Peace Research*, 493, 473–491.

Do, Quy-Toan, and Lakshmi Iyer (2010), Geography, Poverty and Conflict in Nepal, in: *Journal of Peace Research*, 476, 735–748.

Eck, Kristine (2012), In Data We Trust? A Comparison of UCDP GED and ACLED Conflict Events Datasets, in: *Cooperation and Conflict*, 471, 124–141.

Fearon, James D., and David D. Laitin (2003), Ethnicity, Insurgency, and Civil War, in: *American Political Science Review*, 9701, 75–90.

Fjelde, Hanne, and Gudrun Østby (2012), *Economic Inequality and Inter-group Conflicts in Africa*, Paper prepared for presentation at the Democracy as Idea and Practice conference, January 12–13.

Gleditsch, Kristian Skrede, and Nils B. Weidmann (2012), Richardson in the Information Age: Geographic Information Systems and Spatial Data in International Studies, in: *Annual Review of Political Science*, 151, 461–481.

Hegre, Håvard, Gudrun Østby, and Clionadh Raleigh (2009), Poverty and Civil War Events: A Disaggregated Study of Liberia, in: *Journal of Conflict Resolution*, online: <http://jcr.sagepub.com/content/early/2009/06/08/0022002709336459> (14. December 2012).

Hendrix, Cullen S. (2010), Measuring State Capacity: Theoretical and Empirical Implications for the Study of Civil Conflict, in: *Journal of Peace Research*, 473, 273–285.

Hoelscher, Kristian, Jason Miklian, and Krishna Chaitanya Vadlamannati (2012), Hearts and Mines: A District-Level Analysis of the Maoist Conflict in India, in: *International Area Studies Review*, 152, 141–160.

Kalyvas, Stathis N., and Matthew Adam Kocher (2009), The Dynamics of Violence in Vietnam: An Analysis of the Hamlet Evaluation System (HES), in: *Journal of Peace Research*, 463, 335–355.

Kalyvas, Stathis N. (2006), *The Logic of Violence in Civil War*, Cambridge: Cambridge University Press.

Kalyvas, Stathis N. (2008), Promises and Pitfalls of an Emerging Research Program: The Microdynamics of Civil War, in: Stathis N. Kalyvas, Ian Shapiro, and Tarek Masoud (eds), *Order, Conflict, Violenc*e, Cambridge: Cambridge University Press, 397–420.

King, Gary (1997), *A Solution to the Ecological Inference Problem: Reconstructing Individual Behavior from Aggregate Data*, Princeton: Princeton University Press.

Koos, Carlo, and Matthias Basedau (2012), *Does Uranium Mining Increase Civil Conflict Risk? Evidence from a Spatiotemporal Analysis of Africa from 1945 to 2010*, GIGA Working Papers, 205, online: <www.giga-hamburg.de/workingpapers> (14. December 2012).

Lieberman, Evan S. (2005), Nested Analysis as a Mixed-Method Strategy for Comparative Research, in: *American Political Science Review*, 9903, 435–452.

Linke, Andrew M., Frank D. W. Witmer, and John O'Loughlin (2012), Space-Time Granger Analysis of the War in Iraq: A Study of Coalition and Insurgent Action-Reaction, in: *International Interactions*, 384, 402–425.

Luca, Giacomo De, Jean-Francois Maystadt, Petros G. Sekeris, and John Ulimwengu (2012), *Mineral Resources and Conflicts in DRC: A Case of Ecological Fallacy*, CRED Working Papers, 7.

Lujala, Paivi (2009), Deadly Combat over Natural Resources Gems, Petroleum, Drugs, and the Severity of Armed Civil Conflict, in: *Journal of Conflict Resolution*, 531, 50–71.

Montalvo, Jose G., and Marta Reynal-Querol (2007), *Ethnic Polarization and the Duration of Civil Wars*, Post-Conflict Transitions Working Paper.

Murshed, S. Mansoob, and Scott Gates (2005), Spatial-Horizontal Inequality and the Maoist Insurgency in Nepal, in: *Review of Development Economics*, 91, 121–134.

O'Loughlin, John, and Frank D. W. Witmer (2011), The Localized Geographies of Violence in the North Caucasus of Russia, 1999–2007, in: *Annals of the Association of American Geographers*, 1011, 178–201.

Østby, Gudrun, Henrik Urdal, Mohammad Zulfan Tadjoeddin, S. Mansoob Murshed, and Håvard Strand (2011), Population Pressure, Horizontal Inequality and Political Violence: A Disaggregated Study of Indonesian Provinces, 1990–2003, in: *Journal of Development Studies*, 473, 377–398.

Raleigh, Clionadh, and Håvard Hegre (2009), Population Size, Concentration, and Civil war. A Geographically Disaggregated Analysis, in: *Political Geography*, 284, 224–238.

Raleigh, Clionadh, and Dominic Kniveton (2012), Come Rain or Shine: An Analysis of Conflict and Climate Variability in East Africa, in: *Journal of Peace Research*, 491, 51–64.

Raleigh, Clionadh, Andrew Linke, Håvard Hegre, and Joakim Karlsen (2010a), Introducing ACLED: An Armed Conflict Location and Event Dataset Special Data Feature, in: *Journal of Peace Research*, 475, 651–660.

Raleigh, Clionadh, Frank D. W. Witmer, John O'Loughlin, and Robert Allen Denemark (2010b), A Review and Assessment of Spatial Analysis and Conflict: The Geography of War, in: *The International Studies Encyclopedia, Vol X*, Oxford: Wiley-Blackwell, 6534–6553.

Raleigh, Clionadh (2011), Scales of Conflict Research, in: *International Interactions*, 374, 469–481.

Raleigh, Clionadh (2012), Violence Against Civilians: A Disaggregated Analysis, in: *International Interactions*, 384, 462–481.

Robinson, William Sydney (1950), Ecological Correlations and the Behavior of Individuals, in: *American Sociological Review*, 153, 351.

Rustad, Siri Camilla Aas, Halvard Buhaug, Åshild Falch, and Scott Gates (2011), All Conflict is Local: Modeling Sub-National Variation in Civil Conflict Risk, in: *Conflict Management and Peace Science*, 281, 15–40.

Rustad, Siri Camilla Aas, Jan Ketil Rød, Wenche Larsen, and Nils Petter Gleditsch (2008), Foliage and Fighting: Forest Resources and the Onset, Duration, and Location of Civil War, in: *Political Geography*, 277, 761–782.

Schrodt, Philip A. (2012), Precedents, Progress, and Prospects in Political Event Data, in: *International Interactions*, 384, 546–569.

Schutte, Sebastian, and Nils B. Weidmann (2011), Diffusion Patterns of Violence in Civil Wars, in: *Political Geography*, 303, 143–152.

Stephenne, Nathalie, Clementine Burnley, and Daniele Ehrlich (2009), Analyzing Spatial Drivers in Quantitative Conflict Studies: The Potential and Challenges of Geographic Information Systems, in: *International Studies Review*, 113, 502–522.

Tadjoeddin, Mohammad Zulfan, and Syed Mansoob Murshed (2007), Socio-Economic Determinants of Everyday Violence in Indonesia: An Empirical Investigation of Javanese Districts, 1994–2003, in: *Journal of Peace Research*, 446, 689–709.

Theisen, Ole Magnus, Helge Holtermann, and Halvard Buhaug (2012), Climate Wars?: Assessing the Claim That Drought Breeds Conflict, in: *International Security*, 363, 79–106.

Theisen, Ole Magnus (2012), Climate Clashes? Weather Variability, Land Pressure, and Organized Violence in Kenya, 1989–2004, in: *Journal of Peace Research*, 491, 81–96.

Urdal, Henrik (2008), Population, Resources, and Political Violence: A Subnational Study of India, 1956–2002, in: *Journal of Conflict Resolution*, online: <http://jcr.sagepub.com/content/early/2008/05/13/0022002708316741> (14. December 2012).

Weidmann, Nils B. (2011), Violence "from Above" or "from Below"? The Role of Ethnicity in Bosnia's Civil War, in: *The Journal of Politics*, 7304, 1178–1190.

Wucherpfennig, Julian, Nils B. Weidmann, Luc Girardin, Lars-Erik Cederman, and Andreas Wimmer (2011), Politically Relevant Ethnic Groups across Space and Time: Introducing the GeoEPR Dataset, in: *Conflict Management and Peace Science*, 285, 423–437.

Zhukov, Yuri M. (2012), Roads and the Diffusion of Insurgent Violence: The Logistics of Conflict in Russia's North Caucasus, in: *Political Geography*, 313, 144–156.

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