

Scarcity and Abundance Revisited: A Literature Review on Natural Resources and Conflict

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Vol. 5 (1) 2011

**Focus:
Violence and Violence
Research in the
Global South**

Editorial (p. 3)

Guest Editorial Peter Imbusch / Alex Veit (pp. 4 – 12)

Violence and Violence Research in Africa South of the Sahara

Alex Veit / Vanessa Barolsky / Suren Pillay (pp. 13 – 31)

Violence Research from North Africa to South Asia: A Historical and

Structural Overview Boris Wilke / Jochen Hippler / Muhammad Zakria Zakar (pp. 32 – 54)

Violence Research in Northeast and Southeast Asia:

Main Themes and Directions Oliver Hensengerth (pp. 55 – 86)

Violence Research in Latin America and the Caribbean: A Literature

Review Peter Imbusch / Michel Misse / Fernando Carrión (pp. 87 – 154)

- **Scarcity and Abundance Revisited: A Literature Review on Natural Resources and Conflict** Stormy-Annika Mildner / Wiebke Wodni / Gitta Lauster (pp. 155 – 172)

How Does Militant Violence Diffuse in Regions? Regional Conflict Systems

in International Relations and Peace and Conflict Studies Nadine Ansorg (pp. 173 – 187)

Open Section

Difficulties Measuring and Controlling Homicide in Rio de Janeiro Steffen Zdun (pp. 188 – 199)

Affirmative Action and Ethnic Identity in Black and Indigenous Brazilian Children

Dalila Xavier de França / Marcus Eugênio Oliveira Lima (pp. 200 – 210)

Cultural Value Differences, Value Stereotypes, and Diverging Identities in Intergroup Conflicts:

The Estonian Example Henrik Dobewall / Micha Strack (pp. 211 – 223)

Perceptions of Everyday Interpersonal Discrimination among

Young Men of Turkish Background in Cologne Henrik Hartmann (pp. 224 – 233)



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Natural resources can contribute to economic growth, employment, and fiscal revenues. But many resource-rich and resource-dependent countries are, in fact, characterized by disappointing growth rates, high inequality and wide-spread impoverishment, bad governance, and an increased risk of civil violence. A vast body of literature is devoted to the issue of intrastate resource conflicts. These studies can be broadly divided into two groups: studies which focus on resource scarcity and conflict, and studies that analyse the relationship between resource abundance and conflict. While studying resources and intrastate conflict is anything but new, we show that the main findings from the literature, which are often conflicting, are difficult to compare due to a lack of adequate, general definitions and measurements of scarcity, abundance, and conflict. After overviews of research on resource scarcity and conflict and on resource abundance and conflict, we discuss the central terminology and approaches to measuring independent and dependent variables (resources and conflict).

Access to natural resources is increasingly perceived as the security risk of the twenty-first century. Natural resources are, according to the WTO, “stocks of materials that exist in the natural environment that are both scarce and economically useful in production or consumption, either in their raw state or after a minimal amount of processing” (WTO 2010).¹ They include renewable (water, land, forest, fish, etc.) and depletable resources (minerals, metals, oil, diamonds, etc.). According to the High Level Panel on Threats, Challenges and Change, which was convened by former UN Secretary General Kofi Annan in 2004, commodity shortages can help trigger social unrest and civil wars. In 2009, the UNEP’s Expert Advisory Group on Environment, Conflict and Peacebuilding found that “there is significant potential for conflicts over natural resources to intensify in the coming decades” (UNEP 2009).

As the 2010 Heidelberg Institute for International Conflict Research Conflict Barometer (HIIK 2010) shows, resource

conflicts are a serious phenomenon. Although the Conflict Barometer documents only seven cases where resources were the sole cause, overall, resources were the second-most frequent conflict item in the 363 conflicts recorded in 2010 (80 cases representing 22 percent; after system/ideology with 117 cases). Resources typically occur together with other conflict items: territory, regional predominance, system/ideology, autonomy and secession. The data also show that resources are the predominant conflict item in Sub-Saharan Africa (32 of 85, 38 percent) – far more than in other regions of the world. The HIIK also finds that in 2010 intrastate conflicts involving resources were considerably more common than interstate conflicts, with 50 cases compared to 30. Of 32 resource conflicts in Africa, 25 took place within states, while only seven were interstate conflicts. Interstate conflicts were also less violent on average: They were assigned an intensity level of 1 or 2 (where 5 equals war). In contrast, of 25 conflicts within African countries, only ten were of minor, or low intensity (level 1

¹ For a discussion of the term “scarcity,” please see section 3. “The Challenge of Definitions: Scarcity, Abundance, and Conflict.”

or 2), while twelve conflicts were of medium intensity (level 3), two were severe crises (level 4) and one conflict was a war (level 5) (HIIK 2010).

The vast body of literature devoted to analysing the relationship between resources and conflict can be broadly divided into two groups: studies which focus on resource scarcity and conflict, and studies that analyse the relationship between resource abundance and conflict. The methods applied vary from vast quantitative efforts (econometric modelling and statistical regressions, cross-country and time-series analyses) to qualitative analyses (comparative and individual case studies). We broadly follow the timeline in which the literature (journal articles and books) has evolved, but divide it according to research questions, applied methods, and results, highlighting the main findings and conflicting evidence as well as identifying remaining research gaps.

We start with an overview of studies on resource *scarcity* and conflict. Many early studies found a positive relationship between resource scarcity and conflict. They suggest that depriving people of their livelihoods leaves them no choice but to fight for survival. The relationship between resource scarcity and conflict remains highly contested, however. Critics argue that there are too many intervening non-environmental variables to establish a direct link between population growth and scarcity-induced conflicts or that real scarcity rarely occurs because technological innovation, substitution, and international trade provide remedies.

We discuss resource *abundance* and conflict in the second part of our review. Advocates of this school of thought originally identified two causes of such conflicts: similar to conflicts involving resource scarcity, “grievances”, i.e. the deprivation of basic needs, can be the cause. In addition, “greed”, i.e. opportunistic and selfish appropriation of resources, can trigger conflict. Le Billon (2008) calls the grievance mechanism “resource conflicts”: conflicts arising due to control of a resource by one group that excludes others or destroys the resources they depend on for a living. He calls the greed mechanism “conflict resources” because some resources motivate civilians, soldiers, and state officials to enrich themselves. In *The Political Economy of*

Armed Conflict: Beyond Greed and Grievance (2003), however, Karen Ballentine and Jake Sherman argue that the incentives to start or prolong a conflict are more complex than previously suggested. Not only can greed and grievance both be the causes of a conflict. Economic considerations may motivate conflicts in some cases, in others they are not the root cause, contributing instead to pre-existing causes of conflict. This section is therefore divided into two subparts. The first discusses studies that focus on rebels as the main actors; the second summarizes the literature on weak states.

The third part of our review is devoted to a discussion of central terminology and approaches to measuring independent and dependent variables (resources and conflict). In general, scarcity, abundance, and conflict are still not satisfactorily defined, and scholars frequently use diverging definitions. This reduces explanatory power to the extent that comparisons of results become quite difficult.

In view of the enormous number of studies on the issue, it is necessary to limit our focus. First of all, we concentrate on violent, intrastate conflicts. As the 2010 HIIK data show, intrastate resource conflicts were more common than international or regional conflicts. Besides, there are few studies on violent, interstate conflicts because international negotiations have – so far – been more successful at preventing violent outbreaks between states. The region most affected by resource conflicts is Sub-Saharan Africa. It does not come as a surprise that many of the studies we review also focus on this region. The focus on African intrastate conflicts explains why we selected certain resources, such as land, forests, oil, metals and diamonds, and give less attention to drug and international water conflicts, even though they also can pose significant conflict risks.

1. Resource Scarcity and Conflict

Many researchers, among them Homer-Dixon (1994), Bächler, Böge, and Klötzli (1996), Hauge and Ellingsen (1998), Raleigh and Urdal (2007), and Urdal (2008), find a positive relationship between resource scarcity and conflict. They suggest that depriving people of their livelihoods leaves them no choice apart from fighting for survival. Following a neo-Malthusian line of argument, they assume

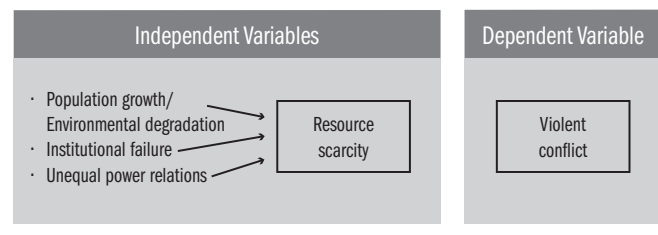
that population growth reduces the availability of natural resources because populations grow faster than food supplies. This induces competition and, ultimately, conflicts over means of existence. The research group led by Thomas Homer-Dixon (1999) is often cited as this perspective's most decisive representative. According to their research, conflicts take three forms: conflicts between states, group identity conflicts, and civil strife and insurgency. Empirical evidence from earlier studies suggests, first, that *international* conflict over scarce (mostly renewable) resources is rare. Second, scarcity can initiate migration, resulting in ethnic conflict and rivalry in the host area. Third, scarcity often causes economic deprivation and ensuing conflict, especially when institutions prove ineffective. Fourth, developing countries suffer greater harm from scarcity and conflict because they are less well-equipped to alleviate grievances.

However, this line of reasoning has been heavily challenged. Critics of the neo-Malthusian approach either argue that there are too many intervening non-environmental variables to establish a direct link between population growth and scarcity-induced conflicts (Le Billon 2001; Bates et al. 2003; Giordano, Giordano, and Wolf 2005; Theisen 2008; Brown 2010) or, as in the cornucopian tradition, that absolute scarcity rarely occurs because of, first and foremost, technological innovation, substitution, and international trade (Boserup 1965; Simon 1996; Lomborg 2001; Juul 2005; Mortimore 2005). Cornucopian scholars are convinced that people are able to substitute resources or invent new technologies, creating remedies for scarcity. The concept of social resilience – intelligent human beings are able to adapt to environmental changes – gives rise to a similar interpretation of scarcity: Scarcity is not necessarily a threat to livelihood, but an opportunity to be flexible, given adequate means. Over the last few years, the question has become salient again due to the threat of climate change-induced scarcity (Barnett and Adger 2007; Reuveny 2007; Hendrix and Glaser 2007; Raleigh and Urdal 2007; Meier, Bond, and Bond 2007).

The following figure is a schematic illustration of the mechanisms leading to scarcity and, possibly, conflict. The box on the left shows which factors, according to the literature,

induce scarcity. Once resource scarcity has been identified, studies search for a causal relationship with conflict.

Figure 1: How resource scarcity can cause conflict



1.1. Demand-Induced Scarcity and Violent Conflict: Population Growth

Does resource scarcity cause violent conflict? And if so, under which conditions? The starting point for our literature review is the Canadian Environmental Change and Acute Conflict Project led by Thomas Homer-Dixon (1994; 1999). The project approached the research question from a neo-Malthusian perspective. Homer-Dixon developed a theoretical model based on sixteen case studies, assuming scarcity to result from three factors: (1) degradation and depletion of cropland, forests, water, and fish stocks, (2) increased demand through population growth and/or rising living standards, and (3) unequal distribution of resources (1994). These factors could contribute to violent conflict in the form of ethnic clashes, insurgency, banditry or military coups. For example, a dwindling supply of renewable resources could induce powerful groups to shift resource distribution in their favour, leaving less and less for poorer and weaker groups (“resource capture”). Ensuing grievances then cause violence and conflict. Furthermore, increasing resource scarcity could trigger mass migration and, as a consequence, resource degradation or depletion in other regions. People native to the host region might feel their livelihood is threatened and use violence as a means to assert power, the consequence being ethnic clashes (“ecological marginalization”). In a case study of South Africa, Homer-Dixon and Percival (1998) tested the model and hypothesized that pre-election turmoil was caused by land degradation and fuel/wood/water scarcity in combination with high population density. Admitting that other factors, such as ethnicity, strong group identities, and the transition to democracy, contributed to the conflicts, they concluded

that grievances were exacerbated by migration, scarcities in urban black communities, poverty, and manipulation of access by warlords, leading to violence.

However, Homer-Dixon's research team was harshly criticized for its generalizations. Goldstone (2001), for example, called for specification of the independent variables *environment* and *population* and the dependent variable *conflict*. Concerning environmental factors, his empirical evidence since the 1970s showed that long-term degradation alone did not cause large-scale violence. More often, scarcity was a contributing factor in previously unstable areas. Turning to population variables, Goldstone criticizes that it is not population growth or density alone that causes violence. Instead, he finds that rapid urbanization and education, a growing proportion of youth in the population, and unequal growth of different ethnic groups, for example through migration, contribute to the onset of domestic violent conflicts. In addition, he questions the homogeneity of the dependent variable *conflict*, rightly pointing out that not all resource conflicts had to be violent. More often, they are resolved peacefully through negotiations and compromise as armed conflict is the most expensive solution.

Several studies question population as the sole driver of conflict. While Urdal (2005), for example, finds that population growth and land scarcity are significantly and positively related, he argues that armed conflict onset could be better explained with other variables, including unstable regimes, slow economic growth, and a low level of development. In the end, most quantitative cross-country regression analyses fail to establish a clear causal relationship between population-induced resource scarcity and conflict as many other variables may affect the likeliness of an outbreak. For example, Timura (2001) criticizes Homer-Dixon's macro-level model for its lack of a proper contextual analysis of social and cultural components, including history, perception, and local economies, which impede good policy solutions. Tir and Diehl (1998) indicate that population growth and density are only weakly related to conflict initiation and escalation to war. However, a third dependent variable, involvement in militarized interstate disputes, is significantly and positively related to population growth, in particular if military spending is high. Tir

and Diehl also find that not all countries are equally vulnerable to conflict risks. Countries with a high level of technological development were better equipped to reduce the effects of population growth on conflict formation.

1.2. Supply-Induced Scarcity and Violent Conflict: Environmental Degradation and Conflict

It is admittedly difficult to draw a clear line between environmental degradation and population growth as sources of scarcity. Nonetheless, some authors have shifted the focus from the variable population to environment. The most prominent of these projects is the Swiss Environments and Conflict Project of Bächler, Böge, and Klötzli (1996), who summarize their theoretical and empirical results on degradation and armed conflict in three volumes. The project concludes, first, that degradation of renewable resources contributes to violent conflicts in regions of political, economic, and social instability. Second, armed conflict related to environmental degradation only erupts if several of the following conditions occur simultaneously: degraded resources are not substitutable and people depend on them for their existence; powerful institutions to ensure sustainable use of resources are not present; environmental degradation is used by groups with special interests to construct group identities; organization and armament is possible; there are pre-existing conflicts.

As influential as Bächler's research was a project launched by the International Peace Research Institute in Oslo (PRIO), publishing its results in the institute's *Journal of Peace Research*. Hauge and Ellingsen (1998) analyse environmental variables and conflict (1980 to 1992) in a mixed cross-sectional and diachronic analysis and a pure cross-sectional analysis. Their dependent variable "incidence" is operationalized as domestic armed conflict (between two or more organized parties, of which at least one was the government, with at least 25 annual battle deaths) and civil war (at least 1,000 annual battle deaths). As a proxy for the severity of conflict they used battle deaths as a percentage of the total population. Independent variables were the annual change in forest coverage, land degradation, freshwater availability per capita, population density, and income inequality. They find that land degradation is positively related to armed conflict and civil war. The variables

deforestation and freshwater availability, on the other hand, were only significant with regard to the less severe category of armed conflict, not civil war. But their results were put into perspective by fellow PRIO researcher Theisen in 2008, who finds that land degradation did enlarge conflict risks, but economic factors were more important. Theisen emphasizes the role of poverty, state capacity, and institutional instability, questioning whether it was resource scarcity or rather unequal distribution that caused conflicts.

In the course of the recent climate change debate, the issue has regained prominence. An issue of the journal *Political Geography* in 2007 dedicated to climate change and conflict represented a first attempt to build a framework linking climate change impacts to conflict. Nordås and Gleditsch (2007) review the literature and identify a knowledge gap: the causal chains between climate change and conflict have hardly been explored. Effects of climate change, such as rising sea levels, flooding, and drought, can significantly alter the availability of natural resources, most importantly land and water, that are crucial for agricultural production. Conflict may arise either directly in the battle for livelihoods or indirectly as a consequence of migration. Barnett and Adger (2007) argue that a climate change-induced reduction in quantity and quality of natural resources increase the risk of conflict. They see the main cause of conflict in better recruitment opportunities for rebel movements, especially in those countries where a majority of the population depends on the primary sector for employment. According to Reuveny (2007), failing mitigation efforts resulting in migration were a second hazard. He argues that migration could give rise to violent conflict through four different channels: competition for resources, ethnic tension, distrust among origin and host area, and socioeconomic fault lines. The risk of conflict increased if the host area depended largely on the environment for a livelihood, experienced resource scarcity, and additionally had to deal with political instability. Gleditsch, Nordås, and Salehyan (2007) point to the link between climate change, migration, and conflict, as refugees may bring along arms, organizational structures, social networks, and ideas. Mitigating resource competition, and establishing representative institutions, economic redistribution, and state capacity are the challenges to tackle, they stress.

A quantitative study by Raleigh and Urdal (2007), covering the period between 1990 and 2004, clarifies that climate change-induced land and water scarcities only trigger armed conflict if there are medium to high scarcity levels of land and very high scarcity levels of water. The likelihood of conflict increased further when political and economic variables are included in the model. A quantitative study of temperatures between 1981 and 2002 in Sub-Saharan Africa found that warmer temperatures strongly and positively correlated with an increase in armed conflict (Burke et al. 2009). Buhaug (2010) challenges the robustness of this result. When the conflict variable was expanded to include not only civil wars with more than 1,000 annual battle deaths but also smaller conflicts, temperature was not a reliable predictor of conflict in Africa. Besides, he argues, Africa has seen rising temperatures but fewer civil wars over the last decade. Buhaug claims that ethnic marginalization, poor economic performance, and the collapse of the Cold War system offer better explanations.

There is a large body of literature that finds no significant relationship between resource scarcity and conflict. In their quantitative studies using global data from 1955 to 2002, Bates and colleagues (2003), for example, are unable to find any significant relationship between environmental variables and political instability (sustained violent conflict in revolutionary wars, ethnic wars, genocides, and politicides). Binningsbø, de Soysa, and Gleditsch (2007) choose ecological footprint, biocapacity, and ecological reserve or deficit as independent variables. Drawing on a cross-sectional dataset from the period 1961 to 1999, they fail to establish a clear relationship. Quite the contrary, increased demand for resources might predict peace as a proxy for economic and social development.

Brown (2010) measured environmental degradation in Northern and Western Darfur between 1981 and 2006 with the Normalized Difference Vegetation Index (NDVI), which is an indicator of ecological change where high values mean greater land availability. In parallel, he studied violent conflict between farmers and pastoralists, ethnic conflict, rebellion against government, and intra-community conflict in Sudan. The results speak against a relationship between land degradation and violent conflict because the resource

situation did not deteriorate immediately prior to conflicts. In Western Darfur State, vegetation actually improved.

1.3. Institutions Matter

As the discussion in section 1.2. shows, not every case of resource scarcity necessarily produces violent conflict. This may be because various institutions are able to resolve non-violent conflicts over scarce resources before they escalate. North (1990) defines institutions as incentives that guide individual behaviour, interactions with others, and society in general. Informal institutions are a set of rules or norms that are not legally stipulated and are enforced by social mechanisms instead of state agencies; formal institutions are a set of rules fixed in regulations and constitutions (North 1990). Giordano, Giordano, and Wolf (2005), for instance, do not deny that resource scarcities exist and that they could potentially cause conflict. However, they say that a discussion focusing on the supply and demand of natural resources is too narrow. Establishing a theoretical framework on the basis of this assumption leads them to claim that risk of international conflict is increased where institutions are ill-defined, do not exist, or cannot keep up with the pace of environmental change.

But failing institutions are not only a problem in international conflicts – they can also destabilize a country internally and cause violence to break out. Government institutions in Colombia, for example, have proven unable to end agrarian conflicts (Elhawary 2007). Several land reforms introduced over the course of the twentieth century failed in their aim of redistributing land and compensating groups. Because contesting claims could not be settled, violent conflicts over land control recommenced. Subsequent flows of migration caused the government to pass a law protecting displaced people's land in 1997. Enforcement of this law was impeded by a lack of capacities and coordination as well as corruption and rent-seeking. The case of tropical fisheries in Ghana, Bangladesh, and the Turks and Caicos Islands also underlines the importance of institutions. Bennett and colleagues (2001) offer valuable clues about the role of formal and informal institutions. In Bangladesh a largely corrupt government failed to support community efforts; conflict management institutions were largely absent. In Ghana decentralization did not have the desired effects

because resources for enforcement had been eliminated. In the Turks and Caicos Islands special interests in government institutions impeded proper management. Bennett and colleagues conclude that governments should support local-level conflict resolution by managing information flows. With their analysis of a gold mine in Papua New Guinea, Walton and Barnett (2008) confirm that slowness of resolution processes can trigger conflict. Here, unequal distribution of environmental impacts and compensation payments led to non-cooperation and resistance.

Institutions that regulate access to and control of natural resources do not simply appear; they evolve over time producing a certain distribution. Political ecology analyses the historical, cultural, economic, and political structures that shape power relations, which in turn influence the development of institutions. Manger (2005), for example, recognizes adverse institutions in Sudan but concentrates on the power relations leading to these outcomes: new land tenure laws were strongly influenced by colonial history and post-colonial regimes. Government agents used these laws for private interests and enabled so-called land-grabbing, which was further encouraged by current privatization tendencies. Conflicts seemed to be caused by land privatization and water monopolization; population pressure and environmental degradation made the situation more acute. In his analysis of Cameroon, Gausset (2005) argues that relative scarcity – the perceived gap between resources and needs that impairs personal well-being – is most significant. Although population density is low, violence can arise out of agropastoral conflicts due to different perceptions and uses of the same resource, different systems of management, power, and justice, and different cultural and ethical perspectives (Gausset 2005). In northern Thailand, declining forest cover and conservation policies may have had a negative effect on peace but ethnic conflicts are more likely to be the underlying cause of violence (Wittayapak 2008). Analyses of various regions come to similar conclusions: ethnic and economic inequality are the central problems, not declining resource availability (Moyo 2005, Mollett 2006, Jewitt 2008, Benjaminsen, Ba 2009).

To sum up, it is possible for quantitative studies to approximate scarcity with variables such as population

growth, but qualitative analyses show that they do not capture all aspects of scarcity. Case studies that include institutions and power relations in their analysis paint different pictures of resource scarcity. Hence, it remains unclear which factors cause relative scarcity and whether scarcity is a main driver of conflict.

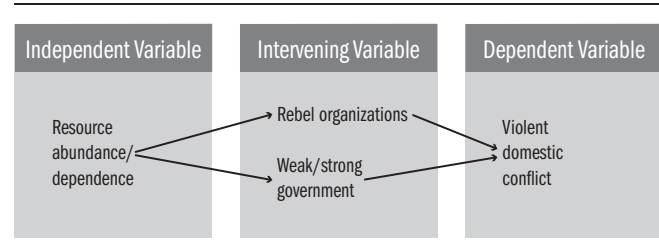
2. Resource Abundance and Conflict

While resource *scarcity* remains a contested independent variable, resource *abundance* has found stronger support among conflict scholars. Around the turn of the century, various authors highlighted a possible relationship between resource abundance and conflict, adding to the literature on the so-called resource curse (Collier and Hoeffler 1998; Le Billon 2001; de Soysa 2002a, 2002b). Abundance studies differentiate between rebel organizations and the government as actors. According to the “looting rebels model”, resource abundance can represent an opportunity to either finance a rebellion or to exploit resource wealth for personal enrichment (Collier and Hoeffler 1998, 2004). While Collier and Hoeffler consider greed the underlying motive (2004), rebel behaviour can also be motivated by poverty among the population.

In contrast, the “state capacity model” considers the government as the central actor primarily responsible for conflict (Fearon and Laitin 2003). Resource rents are an additional source of government revenue that can weaken state institutions through rent-seeking behaviour and make conflict more likely. Weakened state institutions can facilitate state capture by rebel groups. An alternative model, the “rentier state model” (Beblawi and Luciani 1987; Basedau and Lacher 2006), claims that state authorities become stronger and more repressive, exacerbating grievances among the population (see figure below). Le Billon (2008) calls state-centred mechanisms the “resource curse,” where the government plays a central role in facilitating or containing conflict. While this review separates the actors, it should be kept in mind that the conflict lines and who benefits from resources are not always that clear. In Angola, for example, resources financed conflict: Offshore oil production benefitted the government, whereas diamonds mostly sustained the rebel group (Renner 2002; Cater 2003; Le Billon 2005).

Additional mechanisms have been identified (Humphreys 2005), and resource and conflict characteristics specified (Ross 2003, 2004; Collier, Hoeffler, and Söderbom 2004; Fearon 2004; Le Billon 2005; Basedau and Lacher 2006; de Soysa and Neumayer 2007; Welsch 2008; Lujala 2009). Because some studies contest the relationship between resource abundance and conflict (Regan and Norton 2005; Brunnschweiler and Bulte 2009; Thies 2010), more research has recently been dedicated to clarifying intervening (context) variables such as socio-economic development and institutional quality (Snyder and Bhavnani 2005; Snyder 2006; Dunning 2005; Franke, Hampel-Milagrosa, and Schure 2007; Sarr and Wick 2010).

Figure 2: How resource abundance or dependence can cause conflict



Before engaging in a discussion of mechanisms and specifying resource characteristics, two recent reviews of the literature on resource abundance and conflict should be mentioned. Rosser (2006) surveys the entire literature on the resource curse, distinguishing the effect of resources on economic performance, civil war, and regime type. Our review is limited to discussing the second group. Rosser argues that there are not enough studies focusing on the political and economic contexts that shape outcomes in resource-rich countries. We present a few at the end of this section but generally agree with his finding. Samset’s review (2009) is a good introduction to the abundance literature, defining the most important terms and explaining the connections between abundance and conflict. The idea that research should examine how renewable and depletable resources interact to produce violence is an important conclusion.

2.1 Rebels – Opportunity and Feasibility

Collier and Hoeffler (1998) were at the forefront of showing that civil war has economic causes, arguing that the risk

of conflict is determined by the benefits and costs of rebellion. Originally, they claimed that rebellion was triggered by the pursuit of personal enrichment (greed). Violent insurgency occurs when there is opportunity to loot (“opportunity hypothesis”). Rebels weigh the costs of rebellion, expressed in foregone income, against the benefits, reflected in a country’s revenue flow from primary commodity exports. The analysis includes onset and duration of civil war (organized military action with at least 1,000 annual battle deaths) between 1960 and 1992 as dependent variables. In 2004, Collier and Hoeffler (2004) revised their previous assumption – post-conflict benefits to rebels have to cover the costs of rebellion – now claiming that benefits can also in themselves be a cause of conflict. In this case, a civil war erupts because of revenue flows in the form of primary commodity exports. Collier and Hoeffler (1998, 2004) confirm the hypothesis of a link between lucrative resource endowments and the risk of civil war. Further, they supposed a higher per capita income to decrease the likelihood of conflict, possibly due to recruits’ higher opportunity costs of war. Another interesting result was an inverted U-shaped relationship between conflict and abundance. This means that very high levels of resource abundance are less likely to lead to conflict than lower levels. In other analyses, this relationship has been used to explain the rentier state model (Basedau and Lay 2009).

Building on these findings – that resource rents are a motivation for rebels to start a civil war – Collier, Hoeffler, and Söderbom (2004) analyse the factors that affected the duration of civil war between 1960 and 1999, again from an economic perspective. Three different reasons for prolongation were examined: Rebellion is an investment, a business, or a mistake. Their empirical analysis supports the second and third explanations. Theoretically, rebellion could be seen as an investment. If the outcome of a conflict, such as natural resource rents, was profitable, rebels would accept higher costs of a prolonged (violent) conflict. This implies that expected revenues have to cover costs. Winning a civil war could have political payoffs (end repression) or financial ones (gain a share in primary commodity exports). Openness of political institutions and pre-conflict share of primary commodity exports had no effect on the duration of civil war in this analysis. Rebellion as a mistake or as busi-

ness have more explanatory power. In the first case, chances of victory were perceived as overly optimistic; in the second case, rebels gained from conflict because benefits during conflict were higher than costs. This also worked in reverse: A high share of primary commodities in exports and declining world market prices of these export goods reduced the duration of conflict because rebellion became less profitable. The most significant results, however, were reported for per capita income and income inequality. High inequality and low income lengthened civil wars because rebels had low opportunity costs, reducing the prospects for peace.

Recently, Collier and Hoeffler distanced themselves from the “greed” versus “grievance” debate, that is, from motivation as a cause of conflict, and reformulated their model, proposing a “feasibility hypothesis”: Rebellion will occur where it is materially feasible (financially, militarily) (Collier, Hoeffler, and Rohner 2009). The authors show with an extended dataset that rebellion occurred wherever it was feasible. Previous results are confirmed, but new variables offer more clarity with regard to the causal mechanisms. This explanation does not contradict the “opportunity hypothesis” but rather complements it. Greed can still be a motivation of conflict, but it is only one among many. Collier, Hoeffler, and Rohner (2009) explain the difference in their paper: “Our own thinking on proneness to civil war has also evolved. As implied by the title ‘greed and grievance’, our previous paper was still rooted in the traditional focus on the motivation for rebellion. Since then our work has increasingly called into question whether motivation is as important as past emphasis upon it had implied (Collier and Hoeffler 2007). Instead of the circumstances which generate a rebellion being distinctive in terms of motivation, they might be distinctive in the sheer financial and military feasibility of rebellion.”

Several case studies illustrate the importance of particular resources – especially diamonds and minerals – in financing rebellion. Sierra Leone is widely known for its high quality “blood diamonds,” but also for recurring rebellions, banditry, and coups throughout the 1990s. The Revolutionary United Front sought to control diamond production in order to finance arms purchases and for individual enrichment. Soldiers often collaborated with rebels, engaging in looting and illegal mining (Renner 2002;

Cater 2003). However, a resource's characteristics are a decisive determining factor for rebel looting to occur, in particular its lootability. Lujala, Gleditsch, and Gilmore (2005) point out that primary diamonds, which are more labour- and capital-intensive than secondary diamonds and hence more difficult to extract, make conflict less likely. Secondary, or alluvial, diamond production occurs where diamonds are found in loose soil or sediments. This does not require much capital investment as the diamonds are picked by hand or using shovels. Primary diamonds, on the other hand, are found in kimberlite and have to be mined, requiring investment in technology. While Sierra Leone is rich in secondary diamonds, Botswana has predominantly primary diamonds. Diamond production in general is associated with ethnic civil wars, but only after it has started. The discovery of diamond deposits does not affect the risk of civil war. A comprehensive discussion of the conditions for diamond conflicts is also provided by Le Billion (2008). In Côte d'Ivoire, diamonds and gold are concentrated in the rebel zone and therefore benefited above all rebel forces. Although cocoa was more profitable, in part due to its legality, the regional concentration and illegal status of these resources advantaged rebels relative to the government, which cannot engage in illegal trade (Guesnet, Müller, and Schure 2009).

Another prominent example is the DR Congo with its abundant deposits of copper, coltan, cobalt, gold, and diamonds, among others. In the two wars starting in 1996 and 1998, rebels already benefited from resource deals even though they did not control the country. Other African countries got involved and used the opportunity to plunder. As a consequence, allies were rewarded with rights to resources (Renner 2002; Cater 2003). As the case of the DR Congo shows, diamonds may be at the center of media attention, but other minerals can also be the source of intense conflict.

In contrast to Collier and Hoeffler (2004), Fearon (2005) is unable to establish a causal relationship between primary commodity exports, rebel funding, and civil war. While confirming Collier and Hoeffler's finding that income per capita correlates negatively with conflict, Fearon and Laitin (2003) interpret conflicts not as the result of opportunity costs but rather as a measure of state capacity. They con-

clude that resource rents (in this case oil) weaken state institutions, facilitating state capture by rebel groups.

2.2 States - Weak and Strong Capacity

The other major causal mechanism that links resources and conflict involves a state's financial, administrative, and political capability. Resources can weaken state capacity – in particular where institutions are already weak – or strengthen it. The literature suggests that weakened state capacity often leads to conflict whereas rulers of strong states are able to secure their position over a long period of time without being seriously contested.

Weak state capacity increases the risk of conflict through three mechanisms: incentivizing rent-seeking behaviour, causing shortages of public goods, and limiting the ability to end violent conflict. Incompetent management of resource rents and unequal treatment of a large part of the population can easily result in violent conflict, while personal enrichment is likely to prolong armed rebellion.

Resources tempt individuals to engage in rent-seeking competition rather than productive economic activities (Auty 2001, 2007, 2009; Torvik 2001; Gylfason 2004). This is the case particularly in conjunction with ill-defined property rights, imperfect or missing markets, and lax legal structures in many developing countries. Rent-seeking can breed corruption, thus distorting the allocation of resources and reducing both economic efficiency and social equity. It can also lead to a concentration of economic and political power in the hands of a few, who skew the distribution of income and wealth in their favour.

Furthermore, resource revenues tempt governments to rely on these flows instead of imposing taxes on corporate and personal incomes (Heller 2006: 25). In their quantitative study, Bornhorst, Gupta, and Thornton (2009) look for evidence of an offset between government revenues from hydrocarbon-related activities (oil and gas) and revenues from other domestic sources, using a panel of thirty hydrocarbon-producing countries. They find an offset of about 20 percent: A 1 percent increase in resource revenues reduces non-resource revenues by about 0.2 percent. While the authors do not explain this reduction, McGuirk (2010)

offers a reason. His quantitative study takes a closer look at taxes and accountability, finding that in the presence of high natural resource rents, the political elite lowers the burden of taxation on citizens in order to reduce accountability. Thus, taxation is an important tool for engaging citizens, for increasing scrutiny, and for implementing accountability (Weinthal and Luong 2006). Governments that do not depend on the population's approval (and tax income) tend to provide fewer public goods (health system, education, security, etc.).

Van Klinken (2008) offers a third reason why weak state capacity is related to conflict by analysing timber in Indonesia. This easily lootable resource was one of the main causes of pogroms against a minority in Indonesia in 1996-97 and 1999. Although the central government was never directly involved in the conflicts, it contributed indirectly due to its inability to contain ethnic violence. It was especially weak in timber-rich regions because local leaders financed their offices with illegal timber trading and retained taxes from reforestation, weakening the central government's influence. Local autonomy was both a cause and a consequence of rent-seeking. When Indonesia underwent political transition, local elites seized the opportunity to expand their power. Timber was strategically deployed to buy military and police protection in support of an ethnic group. By the time violence broke out, abundant timber resources had strengthened factions and weakened central government control.

One of the few quantitative studies to measure the impact of resource governance on conflict, with a sample of ninety-two countries between 1996 and 2006, was carried out by Franke, Hampel-Milagrosa, and Schure (2007). Democratic oversight, transparent revenue-sharing, corruption control, a stable investment environment, and the implementation of international control regimes significantly reduce the likelihood of violent conflict in resource-rich countries. Another quantitative analysis of fifty-seven countries over a period of thirty years confirms a previously developed model: the relative effectiveness of rulers and the population in appropriating resources influences whether the ruler spends resource rents on the military or public goods when faced with a possible conflict (Sarr and Wick 2010).

Not all authors confirm the weak state model. In some cases, higher government revenues reduce the risk of conflict, where governments can spend more on the provision of public goods to appease opponents or on military expenditures to deter rebellion. Thies (2010) tests the weak state mechanism with a different proxy for state capacity. Instead of income per capita, he uses government expenditure relative to overall consumption, total revenue (government income), tax ratio (tax revenue as a percentage of GDP), and relative political capacity (an index comparing states with similar levels of development and resources). With these new measures of state capacity, Thies shows that primary commodities and state capacity do not influence the onset of civil war, with oil being an important exception. Second, almost all primary commodities, including oil, strengthen states. Thies shows that rebels and rulers compete for primary commodities, the former to gain financially and the latter to sustain revenue flows. When rulers face opposition, they manipulate property rights to stay in power, effectively preventing conflict.

Thies is not alone in finding that oil abundance actually strengthens certain governments and reduces the risk of rebellion and, hence, violent conflict (Fjelde 2009; Basedau and Lay 2009; also Di John 2007). Although oil production and corruption increase conflict risks when they occur separately, conflicts (with at least 25 annual battle deaths) and civil wars (with at least 1,000 total battle deaths) are, according to Di John, less likely to occur when oil production and corruption coincide. The political elite may use economic incentives strategically to induce cooperation and loyalty. Funding by oil, either to expand military expenditure or to sustain political leaders' patronage networks or both, has been central in Côte d'Ivoire (Guesnet, Müller, and Schure 2009), Nigeria (Renner 2002; Ikelegbe 2006), and Chad (Frank and Guesnet 2009).

2.3 Resource Characteristics

Resources seem to be related to conflict in some cases but not in others. How accessible is a resource to potential rebels? Where is production located? How valuable is the primary commodity? Resource characteristics play an important role for the onset, duration and intensity of conflicts.

Resources are diffuse or point, proximate or distant. These characteristics are part of what Le Billon calls “resource accessibility” (2005). Diffuse resources are spread over wide areas and produced by a large number of small operators (alluvial diamonds, gems, minerals, timber, coffee, bananas, rubber), whereas point resources are the exact opposite – concentrated in small areas and in the hands of a few producers (oil, gas, kimberlite diamonds, copper, iron). Rebels have better access to diffuse resources because they are usually not controlled by the government. Accessibility is also influenced by geographical location. Proximate resources are located close to the center of power, distant resources in remote areas that may be politically contested and/or near porous borders. Government control is stronger for proximate resources making illegal trade more difficult. A second broad category is “resource profitability” determined by legality and value-to-weight ratio. Illegal resources are more profitable to rebels because governments cannot engage in illegal trade. Legal resources can be traded by governments, and usually yield higher prices (Le Billon 2005). In Angola, for example, government-controlled oil was more valuable than the diamonds funding the rebels, which is one reason why government forces defeated the rebels.

Another resource characteristic has been suggested. Ross (2003) refers to “lootability” to describe resources that can be extracted and transported relatively easily by small groups of unskilled workers. The loutable resources drugs, especially cocaine and opium, and diamonds are the ones that most often led to civil war between 1990 and 2000. Less significant are “obstructability” (risk of interrupted transportation) and “legality” (tradable on international markets). High value-to-weight ratio resources (drugs, diamonds, gold) can be transported by plane and are, hence, more difficult to obstruct than low value-to-weight resources transported by truck or train (many minerals). Liquid resources transported through pipelines (oil) face the highest risk of being blocked. Most resources are traded legally, with the exception of drugs. These characteristics can advantage either the government or rebel groups in civil war.

In a more recent comparative analysis (2004), Ross qualifies his previous conclusions: Oil increases the risk of conflict

onset, while loutable resources (diamonds and drugs) only influence conflict duration, not onset. A quantitative study by Welsch (2008) confirms the importance of oil in predicting conflict between 1989 and 2002. Contrary to most other studies, oil is classified here as a loutable resource, as pipelines or extraction sites can easily be tapped. Unlike Ross (2004), Welsch finds that other mineral resources (bauxite, gold, diamonds) are also significant concerning the onset of civil war. This may be due to the different proxies for resource abundance (primary commodity exports vs. stock of subsoil assets) or the different thresholds for conflict. De Soysa (2002b) uses similar proxies for abundance and conflict and comes to the same conclusion as Welsch – rising levels of mineral resources increase the risk of conflict. But when energy (oil, gas, coal) and mineral (bauxite, copper, gold, among others) rents are disaggregated and the period is extended (1970 to 1999), energy rents are more significant (de Soysa, Neumayer 2007).

The role of location is not restricted to proximity to central government. Several studies have tested whether resource location inside or outside the conflict zone influences civil war. Rebellion may be more attractive and feasible in regions with abundant resources, regardless of the resource’s loutability. Testing the effect of resource abundance on conflict onset and duration using location as variable, Lujala (2010) finds that civil wars between 1946 and 2003 were likely to occur in regions with onshore oil and secondary diamond production. In addition, secondary diamonds, other gemstones, oil, and gas inside the conflict zone prolonged civil war. A novel finding is that non-loutable resources (oil and gas) affect rebel movements and the duration of civil war, possibly because they are more loutable than previously assumed.

3. The Challenge of Definitions: Scarcity, Abundance, and Conflict

A challenge common to all studies is to define and operationalize the variables. Differences in central variables such as scarcity, abundance, and conflict reduce the comparability of the results of the studies we have presented throughout this paper.

Scarcity: Resources discussed in the literature on scarcity and conflict are generally renewable, widespread, and

require large labour inputs. Renewable resources regenerate naturally. They can be categorized into those that are subject to depletion (e.g. soil, woodland, and groundwater) and those that are infinite (solar, tidal, wind, geothermal). The scarcity literature focuses on the former. Examples include fish, wood, and land.

One central definition of scarcity can be traced back to Thomas R. Malthus's "Essay on the Principle of Population" (1798). Malthus writes that population and resources are initially in equilibrium, but while populations grow exponentially, food production increases only linearly. The consequence is increasingly intense competition for shrinking food supplies. Resource scarcity is implicitly assumed to be absolute, threatening the means of existence. The depletion of natural resources eventually results in population collapse at the point when the earth's carrying capacity is depleted. Baumgärtner and colleagues (2006) point out the difference between the Malthusian and the Ricardian understanding of scarcity. In the tradition of David Ricardo, scarcity refers to the decreasing quality of land as a natural resource.

The quantitative literature on resource scarcity has developed several variables to measure this kind of scarcity. Whether a renewable resource is scarce or not is often approximated by population growth/density or environmental degradation variables (such as forest coverage, freshwater availability). When the demand for a resource increases or when the supply decreases, scarcity becomes more likely. Demand in a region rises if the population grows or becomes denser (Homer-Dixon 1994; Tir and Diehl 1998; Urdal 2005); supply is depleted as the resource is degraded (Bächler, Böge, and Klötzli 1996; Hauge and Ellingsen 1998; Barnett and Adger 2007; Raleigh and Urdal 2007). Quantitative studies that do not use these independent variables come to different conclusions. Binningsbø, de Soysa, and Gleditsch (2007), for example, measure environmental degradation with the ecological footprint, biocapacity, ecological reserve (or deficit) and Brown (2010) uses the Normalized Difference Vegetation Index. The ecological footprint represents the consumption of land and water for consumption and production purposes in the consumer country, which, if subtracted from biocapacity, is

the ecological reserve or deficit. Biocapacity is the ecological supply. The NDVI measures the sunlight reflected by plants to determine the density of green vegetation. Both authors are unable to confirm previous results about a positive link between scarcity and conflict. A critical discussion of the term scarcity can also be found in De Soysa (2002a).

Absolute scarcity needs to be distinguished from relative scarcity. *Absolute* scarcity is often equated with Malthus's concept of scarcity: there is not enough of the resource to secure everyone's survival. According to Baumgärtner and colleagues (2006), a good is absolutely scarce if it cannot be substituted by other goods on neither the production nor on the consumption side. They refer to *relative* scarcity where a good is scarce in relation to other goods, meaning that obtaining it incurs opportunity costs. In contrast to absolutely scarce goods, relatively scarce ones are substitutable. Resources are also not absolutely scarce if access to them is denied simply because one group controls them. Access can be restricted by institutions (or lack thereof) (Giordano 2005) or historical power relations (Gausset, Whyte, and Birch-Thomson 2005).

Abundance: The literature on resource abundance and conflict generally focuses on highly profitable depletable resources such as minerals, metals, oil, and diamonds. Finite, non-renewable resources formed during the course of the earth's history, and although they are replenished in geological cycles, this does not occur within any human timeframe. Examples include oil, gas, diamonds, and metals. Measuring their domestic abundance is a challenge. Accordingly, earlier studies did not clearly differentiate between abundance, intensity, and dependence, using these terms interchangeably. Proxies used to measure the importance of resources for a country were the share of primary commodity exports in the total exports of a country and the share of primary commodity exports in GDP. As Davis explains (2009), this approach infers endowments from a country's revealed comparative advantage. But as Wright and Czelusta point out (2004), this may simply reflect an absence of other internationally competitive sectors in the economy rather than resource abundance. The WTO compiled a list of countries highly dependent on resource exports (2010): fuel makes up more than 90 percent of total

exports in Kuwait, Venezuela, Algeria, Nigeria, and Angola. While mining products generally represent a much smaller share, they still dominate exports in many countries, such as Zambia (80 percent), Chile (60 percent), Niger (58 percent), Jamaica (56 percent), and Peru (43 percent). But this tells us little about the geological availability of the resource in these countries.

Humphreys (2005) points out that primary commodity exports do not produce an exact index of the resource situation because they exclude illegal trade (for example in diamonds) and include re-export of imported resources. He therefore suggests alternative measures: level of production, proven reserves, and share of GDP. Lederman and Maloney (2008) as well as Blanco and Grier (2008) argue against using the ratio of primary commodity exports to GDP, proposing instead to measure natural resource abundance as the value of net exports of resource-intensive commodities per worker. Other authors have proposed using the location of certain resources (Lujala 2010), resource production (Humphreys 2005), or natural resource stocks per capita (de Soysa 2002b). Basedau and Lacher (2006) show that none of these indices, which measure dependence rather than abundance of resources, reflect how well a country is endowed with resources (its resource wealth). They argue that a distinct differentiation offers interesting results: Dependent, rather than resource-abundant, countries face higher risks. This is confirmed by a later quantitative analysis by Basedau and Lay (2009), who engage in a discussion about resource wealth and dependence. Brunnschweiler (2006) also makes the important distinction between resource abundance and resource dependence. In her analysis, abundance describes the amount of natural capital that a country has at its disposal: mineral deposits, oil fields, forests, land, and the like. According to the OECD, “natural capital are natural assets in their role of providing natural resource inputs and environmental services for economic production” (2005). Brunnschweiler defines dependence, on the other hand, as the extent to which a nation depends on these natural resources for its livelihood, for growth, income, and exports. Kropf (2010) also underlines the difference between resource dependence and abundance, noting that variables such as “resource exports to GDP” introduce a bias that makes less developed econ-

omies per se more resource “abundant” than developed economies. She argued for new variables that exclude information on a country’s stage of development.

Not all studies employ these definitions carefully, however. By no means are all countries characterized as resource-rich actually rich in resources, measured in terms of natural capital; they may in fact be dependent on them. The possible negative policy implications of faulty characterizations are evident: Presumed resource wealth can discourage a much needed diversification of the economy.

Distinguishing scarcity and abundance: The literature shows that it is difficult to draw a distinct line between resource scarcity and abundance as cause or accelerator of conflicts. First, most natural resources are not characterized by absolute (physical) scarcity. Many resources – apart from a few existential resources such as land and water – can be substituted, many are renewable, and many of those that are non-renewable can be recycled. What matters more than absolute scarcity is relative scarcity, here defined as the allocation of resources (and revenues from resources) and access to them. Likewise, absolute abundance does not exist. Throughout the literature, resources are, in general, considered abundant when they are plentiful in a given region, and potential sources for high profits. On the global level, however, they are often in great demand and scarce.

Conflict: The term conflict requires more specification as well. According to the Heidelberg Institute for International Conflict Research (HIIK), conflicts are “clashes of interest (differences of position) concerning national values (territory, secession, decolonization, autonomy, system/ideology, national power, regional predominance, international power, resources, other). These clashes are of a certain duration and scope, involving at least two parties (organized groups, states, groups of states, organizations of states) determined to pursue their interests and win their cases” (HIIK 2010). They can be subcategorized into: latent conflicts (non-violent of low intensity), manifest conflicts (non-violent of high intensity), crises (violent), severe crises (violent), and wars (violent). The most frequently used data set for quantitative studies is the Uppsala Conflict Data Program, which includes conflicts where at least

one party is the government of a state, and the use of armed force results in at least 25 battle-related deaths per year. Other analyses deviate from this definition, including conflicts between non-state groups or a higher threshold for battle-related deaths. This can be important for conflicts involving scarce resources, since they involve the government less than conflicts over abundant resources do. The Political Instability Task Force expands the definition of conflict by considering not only a threshold but also the intention of the combating parties.

Quantitative studies usually include a variable for violent incidents between two or more groups, one of them being the government, causing a varying number of annual battle deaths. The operationalization of the variable varies widely. Hauge and Ellingsen (1998), for example, define their “incident” variable as domestic armed conflict (between two or more organized parties at least one of which is the government, with at least 25 annual battle deaths) and civil war (at least 1,000 annual battle deaths). As a proxy for the severity of conflict they use battle deaths as a percentage of the total population. Qualitative studies dealing with resource scarcity often also consider conflicts without government involvement (intercommunal conflicts). They also employ a broader understanding of conflict ranging from demonstrations and raids to insurgency and war. This complexity makes analysis and subsequent generalization of findings more difficult.

4. Conclusion

Opinions on the explanatory power of resource scarcity for violent conflict clearly diverge. While scarcity of resources is considered an independent variable by some, others examine it as a dependent or intervening variable. Several of the reviewed studies find that scarcity has adverse effects on peace, although a few consider it to be a motor of innovation. Most of the time, when decreasing supply meets increasing demand, existing frictions in a society are

exacerbated, catalyzing conflict. Migration of a different ethnic group, for example, makes the receiving region more vulnerable to conflict. However, the empirical findings remain rather weak. A clear causal relationship cannot be established convincingly. On the contrary, there are multiple mechanisms connecting demand/supply of resources, scarcity, and conflict. Scarcity (and conflict) do not develop automatically, depending on the (political, social, and cultural) context. More recent studies incorporate short- and long-term context-specific factors, such as integration into international markets, economic development, property regimes, government interventions, composition of the community, historical inequalities, and community-specific values and norms. More research concerning the causal mechanisms is needed.

With regard to resource abundance and conflict, many scholars agree that certain – locally abundant – natural resources can under certain conditions increase the potential for conflict through several coexistent mechanisms. But quantitative studies are only meaningful if the independent and dependent variable are specified. So far, however, researchers have not agreed on a measure of resource abundance. Hence, results are mixed and statements about the relationship between abundance and conflict cannot be made with confidence. Quantitative studies investigating the role of resource characteristics are still limited. Thus, we find significant desiderata that attest an urgent need for more research in this field.

Overall we urge scholars to invest more time in operationalizing their independent and dependent variables, foremost resource scarcity, resource abundance, and conflict, but also their intervening variables such as state capacity, in order to produce convincing results. In the long run, an in-depth investigation of interstate conflict is necessary in order to uncover which resources are most prone to trigger conflict between states.

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