



SPECIAL REPORT

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ABOUT THE REPORT

This study examines links between natural resources and effective statehood, in both northern and southern Sudan, following the planned January 2011 referendum on southern Sudan's potential secession. The study draws on research and analysis of three key natural resources—petroleum, land, and water—and on commissioned reports, a detailed questionnaire, and consultations with several leading Sudan experts regarding the referendum's implications for peaceful management of these resources. Using this information, the circumstances most likely to trigger violent conflict can be pinpointed. These findings are used to develop recommendations aimed at improving the management of these three resources and reducing the likelihood that competition over them will lead to violence in 2011. Dr. Paul J. Sullivan teaches at National Defense University and Georgetown University.¹ Natalie Nasrallah, a consultant for the United States Institute of Peace on this study, has an MS in violence, conflict, and development.

Paul J. Sullivan and Natalie Nasrallah

Improving Natural Resource Management in Sudan

A Strategy for Effective State Building and Conflict Resolution

Summary

- Most experts view secession as the most likely outcome of the 2011 referendum on southern Sudan's potential secession. While this scenario may lead to some stability in the long run, effective secession immediately after the referendum may prove difficult.
- There is significant concern about preparedness for the referendum at the national, regional, and community levels. While postponing the vote may provide some breathing room, it heightens the risk of uncertainty and instability.
- Each plausible scenario—unity, secession, or a delay to the referendum—holds great uncertainty and risk regarding the potential impacts on oil, land, and water. The effects of each scenario could drastically change if the political and economic situations on the ground become more fragile.
- Management of petroleum resources is one of the most serious challenges facing Sudan's leaders. Petroleum is the largest foreign exchange earner and the biggest contributor to fiscal revenues for both north and south. Potential flash points include revenue transparency and equitable sharing formulas, as well as financing for exploration, production, new infrastructure development, and maintenance of existing infrastructure.
- There are insufficient data on, and attention to, use and potential of land and water. The management of both resources poses serious challenges that could derail statehood and precipitate violence.
- If oil, water, and land are not managed and developed properly and sustainably, both north and south Sudan could be facing a much more uncertain and violent future.

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Introduction

If resource management—particularly of oil, water, and land—in Sudan does not significantly improve, post-2011 Sudan will likely be a more uncertain and violent place. Mistrust between north and south continues, and both sides seem unprepared for the consequences. With so much at stake, it is crucial that north and south, given their symbiotic relationship, work together. Violent conflict is quite probable, but it is not inevitable, and proper joint resource management and cooperation could help lead to better outcomes for both sides.

While much of the existing violence in Sudan centers on political and ethnic factors, natural resource issues are also significant contributors. The Comprehensive Peace Agreement (CPA)² offers compromises and methods of resolution to settle many of these root conflicts, but implementation has been slow and insufficient to resolve the many complex problems Sudan faces.

Lack of transparency in wealth sharing and unsustainable natural resource management persist, threatening a recurrence of the types of conflict seen during the brutal civil war that broke out between north and south in 1983. Millions died or were displaced, and although hostilities formally ended in 2005 with the signing of the CPA, the animosities building since the 1946 merger of north and south have hardly been assuaged.³

Natural resources may not be immediate game changers, but their use (and misuse) will continue to influence the likelihood of friction among central, regional, and local parties, as well as the economic success of the future Sudanese state(s). With less than a year left before the referendum, it is crucial to the stability and security of the state and region that, whatever the outcome, the transition be smooth. This requires judicious use of Sudan's natural resources. Although petroleum, water, and land are not all-inclusive, they are vital elements in promoting peace and determining the success of political and economic development.

Importance of Resource Management

As Sudan's main source of wealth, its natural resources are a focal point for competition and conflict. Resource conflicts are often the result of a growing population, climate change, and poor management of the environment, but the constantly shifting power struggles of national politics also have intervened at a local level, turning groups that coexisted peacefully into rivals. Decades of neglect and heavy-handed control by the central government have left many Sudanese communities on the periphery without access to land and water and cut off from the financial and developmental benefits of resource wealth, particularly from oil and agriculture. The central government is known to have sent land-raiding parties into the south. There is no refinery in, or oil pipeline to, the southern capital, Juba. Electrical networks are almost exclusively in the north, and all hydropower and the best irrigation systems are in the north. Investment for development in the north far outstrips that for the south.

Sudan's resource management is often opaque and not directed at sustainability and human development. For example, agreements between the central government and oil companies are undisclosed, and production numbers are not independently verified. Policies on managing oil, land, and water resources are not clear. Laws governing the oil industry and land administration are both outdated and poorly enforced, and environmental impact assessments, particularly in the oil industry, are largely absent. Environmental damage has led to bad blood between local communities and the oil industry.

Also, effective use of one natural resource hinges on the management of the others. Petroleum production needs water. Petroleum exploration will likely not be as successful

without the security of defined borders; clear land administration; and developed roads, pipelines, and petroleum-refining infrastructure. Electricity in Sudan comes mostly from oil-fired generating plants, which require water both to produce steam and to cool the generators. The hydroelectric plants in the north also require a lot of water control, which can affect land use and the recharging of aquifers north of the dams. Refineries, too, require water. Agricultural development depends on access to water resources with reliable flows and distribution. Similarly, proper management of water infrastructure depends on how land policies are defined and implemented.

Since natural resources such as water and oil are not always confined by boundaries, any efforts to improve resource management will require cooperation among all stakeholders. Complicating the situation, the lack of diversification in the Sudanese economy limits its ability to offset potential losses in the oil sector. Hence, better use of water and land may be the only short- to medium-term way to offset these losses.

The following discussion analyzes the probability of violence breaking out over Sudan's oil, land, and water resources in post-CPA outcomes, whether forced (i.e., not the result of a peaceful referendum) or according to CPA provisions. It also provides a glimpse at how these three resources offer opportunities for political and economic security and cooperation through the exploitation of shared interests at local, state, and regional levels.

Petroleum

Sudan has between 5 billion and 6.7 billion barrels of proven oil reserves, the fifth largest endowment in Africa.⁴ Most of these reserves lie in the Muglad and Melut basins in the south, and production hovers around 480,000 barrels per day.⁵ Oil is vital to Sudan's economy, to a destabilizing degree. It accounted for 60 percent of government revenues and 95 percent of exports in 2008, and it accounts for 98 percent of southern Sudan's revenues.⁶ Unless Sudan begins to diversify its economy, its fortunes will be held hostage to the oil market.⁷

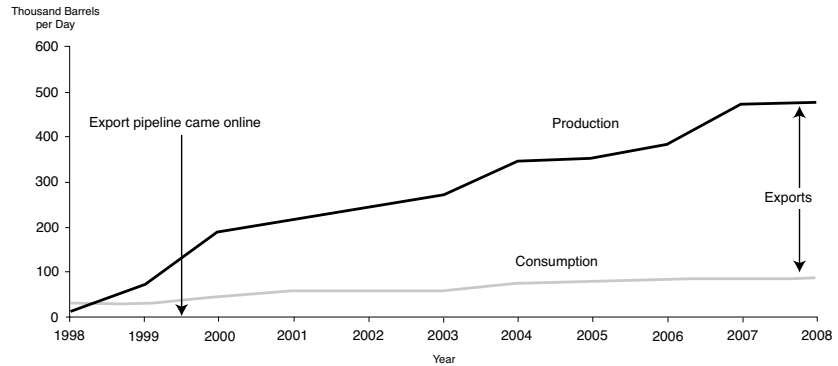
Figure 1 shows that oil consumption has not risen at nearly the same rate as oil production; that is, the Sudanese are not reaping the benefits of increased production. An important question is, how will the costs and revenues of production be split between north and south, and how will the benefits from oil be split between the two in the future?

Whatever the outcome of the referendum, the mutual economic survival of north and south depends on continued cooperation over oil. Whereas most of the reserves are in the south, the processing and distribution infrastructure, including most of the pipelines, is in the north. About 70 percent of current oil revenue comes from the south, but oil from the south and the three contested areas of Abyei, Southern Kordofan, and Blue Nile is pumped northward to two export terminals in Port Sudan. Similarly, all of Sudan's refining capacity is located in the north.

The task of demarcating Abyei will be a major issue. Containing up to 15 percent of Sudan's known oil reserves, the region is vital to the national economy. The decision by the Permanent Court of Arbitration in The Hague to shrink the boundaries of the region, leaving Heglig, one of the largest oil fields, in the north, may help mitigate the economic blow to the north if the south secedes. Production from the already peaked Heglig field accounts for 37 percent of Sudan's oil revenues.⁸ Some leaders from both north and south agreed with the CPA ruling initially, but over time that agreement has become a lot less certain in the south. Some leaders say that Heglig is up for grabs and that its ownership will be defined by future border demarcations. Their argument is based on the fact that most of Abyei is inhabited by the Ndok Dinka, who will want to be part of the south. Hence, Heglig would be part of the south despite the CPA agreement. Meanwhile, the north has stopped paying

The mutual economic survival of north and south depends on continued cooperation over oil.

Figure 1. Sudan's Oil Production and Consumption, 1998–2008



Source: Energy Information Administration

the south for oil from Heglig. The political conflicts over the Heglig field could turn violent if this issue is not more clearly agreed to by all sides.

The future sharing of oil revenue is perhaps the most contentious issue. The CPA currently provides for the division of Sudan's oil wealth among its states. It stipulates that oil revenues from the north go directly to the Government of National Unity (GoNU), and those from the south be split evenly between the GoNU and the Government of Southern Sudan (GoSS). Although the arrangement has held, tensions are never far below the surface. The south would prefer a deal that better reflects its possession of most of the petroleum reserves. Compounding its unhappiness, a lack of transparency in the National Congress Party (NCP)-dominated finance and energy ministries means that the south cannot verify whether it is getting even the smaller-than-desired share stipulated in the CPA. A recent report by Global Witness reveals discrepancies of 9 to 26 percent.⁹ This means that even at 9 percent—the low end of the discrepancy range—the GoSS is owed another \$162 million for 2007 alone.¹⁰ Unless the oil revenue books are opened up to the experts in both north and south, disputes on these issues could exacerbate potential violence over many other issues. For example, if simmering land or water disputes escalate, any reports alleging falsified oil revenue data could be a trigger.

Although the time frame for peak oil production hovers around 2010, reserves could hold out for another forty years given reasonably expected production and the potentials for better production methods.¹¹ If peace is finally reached in Sudan, exploration will likely accelerate, and then known reserves may increase. Both sides would benefit from serious exploration activities in both northern and southern oil blocks, which could postpone the difficulties that occur when oil production peaks and then begins to decline.

Another problem with Sudan's current oil management is the lack of environmental regulation. Communities have been alienated by intrusive surveys, seismic studies, well construction and drilling, and soil and water contamination. Contaminated water from wells is sometimes poured onto local land, and managing these resentments may be one of the bigger future issues. Existing oil infrastructure is poorly maintained, with some pumping stations working at far below optimal capacity, sections of pipeline in need of repair, and equipment at the wells not up to international norms.

Also, wells are becoming degraded. As a well ages, the negative pressure caused by oil extraction brings water seeping in from local aquifers. Often, oil fields are damaged by overproduction at far too fast a rate, which brings in water sooner and faster. Aggravating the problem, the poorly maintained infrastructure of many Sudanese oil fields makes leaks and blowouts more likely.

As the referendum approaches, U.S. economic sanctions imposed on Sudan have become an important factor by inadvertently providing an incentive for the south to secede. Although southern Sudan is technically exempt from U.S. sanctions, the exemption does not apply to the oil industry. As a result, the south struggles to gain revenues from its highly acidic Dar blend of petroleum, which has plummeted in value because it requires extra processing in most refineries.

The south also has Nile blend, a medium, sweeter variety compared with the fairly heavy, sour Dar blends. The Nile blend contains a lot of paraffin (wax), so that it sometimes requires heating to move it properly in the pipelines. Both Dar and Nile blends sell at discounts on the world markets due to the extra costs that most refineries would incur, especially in Asia, where most of Sudan's oil goes. If sanctions were lifted from the south's oil industry, it could import superior American oil technology and bring in American experts to help develop and maintain the fields better. It could also export its Dar and Nile blends to the United States, which has large refining capacity for such oils, thus opening up potentially more profitable markets.

Irrespective of the political outcomes, overdependence on oil revenues to maintain the Sudanese economy points to the need for more diversified exports. Revenue sharing needs to be not merely equitable between north and south—it should also deliver services and security effectively to the people in all parts of Sudan. New oil infrastructure, such as a southern pipeline, may be inevitable, but for such changes to be peaceful, effective state building, good governance, and strategic planning are needed so that both north and south derive benefits from any future oil development. Also, production is forecast to slow over the coming years, and many established oil fields are already in decline. This slowdown may lead to economic difficulties, but it may also help take the heat out of one of the most divisive issues between north and south.

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Potential Events and Flash Points

Experts consulted in this research identified the following potential events and flash points for violence linked to petroleum management:

- Regardless of the referendum's outcome, revenue-sharing arrangements will be renegotiated, highlighting the need for more transparency and balance. Most experts predict that the south is likely to get a bigger share in any outcome.
- In the case of secession, the north will make up for some of its revenue losses by imposing fees directly on the south for use of the pipelines, which are located within the north's borders. A sizable majority of experts believes the south will overcome the pipeline fee arrangement by planning to build a southern pipeline and perhaps a refinery and by seeking out its own oil contracts.
- If southerners vote in favor of secession, foreign investors are likely to reevaluate their oil agreements with the north and start dealing directly with the south.
- A unity outcome may cause the most violence between north and south, because southern grievances against the central government over division of power and oil wealth would likely remain unresolved and, once again, erupt into violent retaliations. Unity would dash the hopes of most southerners, who have long hoped for their own separate country.
- Any delay in the referendum will amplify existing tensions and mistrust over oil contracts, revenue distribution, and management of production schedules, risking outbursts of primarily north-south violence.

- Secession may cause north-south violence over border demarcation, which could affect the placement and boundaries of some of the most important oil fields and oil exploration blocks as well as infrastructure needed to exploit and move the oil.
- There will likely be flash points over plans to build a southern pipeline or refinery, reflecting northern worries about being completely cut off from southern oil.
- Any new revenue-sharing arrangements are likely to lead to both north-south and south-south problems. Stakeholders on both sides will try to extract as much revenue as possible. Those in the north who have benefited from oil revenues may find themselves battling over a smaller piece of the pie, whereas some in the south may be battling over a larger pie—that is, until oil production peaks or until the next significant drop in oil prices.¹²

Opportunities and Challenges

Sudan has struggled to use oil revenues to ensure macroeconomic stability, replenish foreign exchange reserves, and boost development and reduce poverty. Plunging oil prices at the end of 2008 wreaked havoc with Sudan's finances. According to International Monetary Fund projections, annual oil revenues in 2009–12 will be 6 percentage points of GDP lower than in 2005–08.¹³ Regardless of the referendum's outcome, Sudan (north and south) needs to promote the nonoil sector of its economy, which demonstrated its considerable potential by growing at 8.5 percent in 2008. Such growth will also increase tax revenue.

An independent southern Sudan would face major economic challenges in managing its oil supply. Its first task would be to reduce its dependence on the north. The most ambitious response would be to build its own oil infrastructure: a pipeline to the Kenyan coast and, possibly, a refinery. These ideas have already been floated, and the Japanese and Chinese governments have shown interest.

A plan proposed in 2005 envisaged a 600-mile pipeline capable of moving 400,000 barrels of crude oil per day from southern Sudan to the Kenyan deepwater port of Lamu. If the project moves forward, the pipeline, including ten pumping stations and terminal facilities at each end, will take at least two years to build, at a cost of about \$725 million.¹⁴ This expense may be partially offset by savings in travel costs (because most of Sudan's petroleum exports go to Asia and, therefore, travel east rather than north through the Suez Canal), with the additional benefit of bypassing the highly trafficked and pirate-plagued Gulf of Aden. Rough estimates suggest that insurance costs on transport ships for a single company would decrease by around \$5 million per year as a result of avoiding the coast of Somalia and the Gulf of Aden.¹⁵ Petroleum traffic through the Bab el Mandab—the strait at the northern end of the Gulf of Aden—currently totals 3.3 million barrels per day (of about 80 million barrels per day worldwide).¹⁶ Some ships have been attacked off the Kenyan coast, but the risks off Kenya seem much less than in the Bab al Mandab, the Gulf of Aden, and Somali waters.¹⁷ Whether such an expensive scheme would be feasible, given the dismal revenue stream the south is currently realizing from its Dar blend, remains to be seen. There is also the risk of antagonizing the government in Khartoum.

Another way of increasing profit margins on the Dar blend would be to refine it locally into products for the domestic and regional market. This would involve building a new refinery, either in southern Sudan or across the border in Uganda or Kenya. The potentially more profitable Nile blend could be exported directly to the international market. Aside from infrastructure improvements, an independent southern Sudan could also try to renegotiate existing oil contracts signed by the government in Khartoum. In principle, this approach would hold out the prospect of gaining more favorable terms, although it would carry significant risks of provoking the north.

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Southern Sudan's infrastructural dependence on the north is not limited to pipelines but extends to the banking sector as well. Juba relies on the Central Bank of Sudan in Khartoum to provide its share of the oil revenue. Routing these funds directly through the Bank of Southern Sudan is currently impossible, because it does not have the capacity to complete electronic transfers. Major investments in the banking sector would therefore be necessary for an independent southern Sudan to achieve financial independence.

Although southern Sudan would pay a high cost for secession, it could also benefit economically. An independent government in Juba could likely persuade the United States to lift sanctions against its oil industry. It then might expect the markets for its oil to expand. The south may also gain from finding more direct channels to its markets and, for example, going around the north's in-kind sales of oil to the Chinese and others in return for such things as military equipment.

Turning briefly to examine secession's potential costs to the north, the central issue would be the renewal or renegotiation of oil revenue-sharing agreements. Although the Abyei arbitration decision placed the Heglig field in the north, Khartoum could still expect to lose 60 to 75 percent of its revenue and would have to find a way to cover this enormous shortfall. In the short term, it might look to wealthy foreign allies, such as Saudi Arabia or China, to provide remedial assistance. But this would be a stopgap measure. Its best resource could turn out to be possession of the oil industry infrastructure. The south would not be able to construct its own pipeline in the short term. Therefore, the north could try to claw back some of its lost revenue by increasing the fees for using its infrastructure. Currently, the Khartoum government retains a 3 percent management fee from revenues shared with the GoSS and charges a toll for using the pipeline to transfer crude oil from the field to Port Sudan, amounting to about four to six dollars per barrel. Actual movement costs range from one to three dollars per barrel, or 3 to 8 percent of the value of both governments' combined share of oil revenues in 2008.¹⁸ Actual costs to the south could be much higher given the opacity in monitoring the oil's transport and sale, and the amount of "disappeared oil" that is used in barter and other shady transactions by the north. If the GoSS insists on keeping all or most of its revenues, it will likely have to pay similar or additional transport costs for using the pipeline.

Luka Biong Deng, minister of presidential affairs in the government of southern Sudan, has recently said that the current agreement on division of oil revenues could continue for some time after the referendum. In the short term, Biong said, oil could be a "soft landing" for cooperation with the north and for economic stability.¹⁹

If north and south are to avoid conflict over oil in the event of secession, they both need to avoid making sudden changes to the current revenue-sharing mechanism. They would need to reach an interim agreement protecting the north's share of oil revenues, at least for the short term. The money could be placed in a transparent, jointly managed trust fund.

Even if Sudan should remain united, preserving the even north-south split in oil revenue sharing would prove increasingly difficult. The south would demand a greater share in return for its affirmation of faith in a united Sudan. It would also want a more transparent system for distributing the revenue. Yet at the same time, with oil production possibly peaking in the near future, Khartoum would not be in a position to offer terms satisfactory to the south.²⁰ Much would depend on the steepness of the revenue slowdown. If revenue should drop off quickly, disagreements between north and south might quickly spiral out of control, leading to potential disruptions in oil production, with associated damage to the economy. Given the pessimistic outlook for the oil revenue stream, finding new oil fields will be a priority. However, exploration costs are high, and the current batch of concessions has yet to yield any major discoveries.

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Land

In Sudan, local tensions over land use, ownership, and access are historic sources of grievance that can lead to violent conflict unless carefully managed. Historically, development policy has marginalized those communities in the southern, eastern, and western parts of the country. Regulation of land use has largely been overlooked, and the customary systems for land ownership ignored. This situation has resulted in conflicting and inefficient uses of land, and intensified scarcity. Land issues are central to understanding the conflict in Darfur, and they provide a common backdrop to smaller-scale conflicts across the country.

Sudan's land is under more pressure than ever before. An increasing human and livestock population has intensified competition for resources and speeded up the process of land degradation. The population is growing by more than 2.5 percent per year, while livestock numbers have jumped 400 percent from 1961 to 2004.²¹ Also, the effects of climate change have led to reduced rainfall, and poor livestock, farming, and arboricultural techniques have increased desertification, reducing the areas suitable for farming and grazing. Years of warfare have left vast tracts unfit for use and have led to huge population displacements.

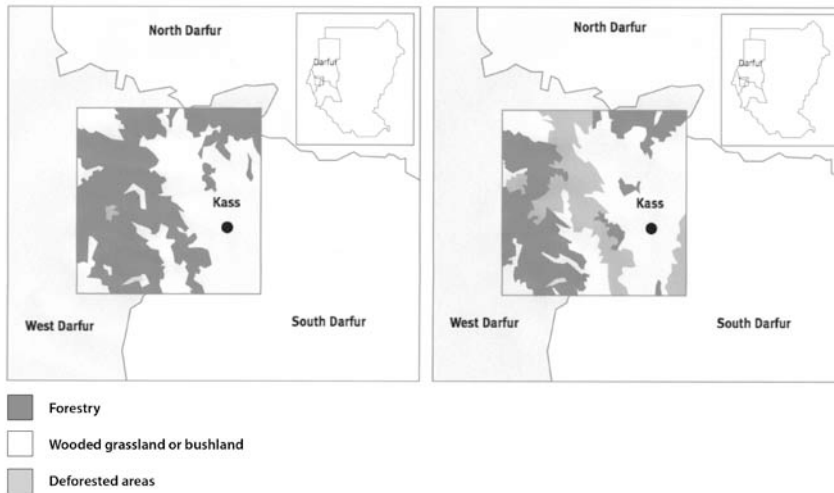
Agriculture is another source of strain on the land. More than 70 percent of Sudanese depend on agriculture for their livelihood. Most agricultural production comes from rain-fed farming, characterized by small farms, labor-intensive cultivation techniques, low input levels, and poor and un dependable crop yields. Sudan's agriculture follows a low-input, low-productivity model of production. According to Sudan's Federal Agricultural Commissioner at the Ministry of Investment, only 20 percent of the 7.2 million hectares of cultivated land is farmed using modern technology, most of which comes from foreign investment.²² Inadequate budgetary resources and lack of coordination between farmers and government worsen constraints in the agricultural sector.

Rangelands are being overgrazed and increasingly overlap farming activities.²³ The decrease in land available for traditional agriculture leaves farmers little choice but to continue farming the same land, thereby impoverishing the soil.²⁴ When the soil gets increasingly degraded, more fertilizer is needed. At the same time, pesticides are being used in a lax legal and regulatory environment, and fertilizers and pesticides are increasingly contaminating the water. Moreover, mechanized farming, which requires large amounts of land, is consuming traditional pastoral corridors and smaller agricultural endeavors in some areas, and its organized crop rotation, or fallow systems, requires constant expansion to maintain output. Mechanized agriculture without fertilizers, organized crop rotation, or fallow periods has contributed to soil depletion, yield collapse, desertification, and subsequent land abandonment.²⁵

New migration routes and settlements, especially of internally displaced persons (IDPs), including those displaced by climate and weather shifts, are clashing with established local communities, adding to tensions over land access and setting the stage for future border disputes. At the same time, population pressures have encouraged more destructive forms of agriculture. For example, in southern Sudan, one especially unsustainable way for traditional farmers to ensure a short-term food supply has been to burn and clear forests and produce a few crops of low-intensity maize instead of developing higher-value agroforestry plantations.²⁶ Repeated monoculture of wheat, sorghum, millet, barley, or corn, without crop rotation and adequate fallow periods, has led to a decline in soil fertility in drier areas of the country. This, in turn, increases runoff and topsoil erosion and inhibits possible restoration of wildlife habitats and native vegetation.²⁷

Figure 2 shows the impact of deforestation in Darfur. As time passed, the tree cover disappeared, water retention became more difficult, and topsoils were either washed or blown away.

Figure 2. Changing Land Use around Kass (1973–2006)



Source: Brendan Bromwich, "Environmental Degradation and Conflict in Darfur: Implications for Peace and Recovery," Humanitarian Exchange, July 2008, www.odihpn.org/report.asp?id=2927 (accessed Apr. 23, 2010).

Sudan's northern desert boundary has shifted 50 to 200 kilometers south since the 1930s, and average precipitation levels have dropped 40 percent since the early 1980s, resulting in less pasturage and reduced agricultural productivity.²⁸

With these pressures, competition for diminished resources has intensified. Dwindling rangeland is a particular problem, exacerbating tensions between pastoralists and agriculturalists and leading to fights over land. Pastoralists are increasingly being denied grazing rights and finding their traditional migration routes blocked by agricultural land. Long ago, these tensions were more controllable through traditional dispute resolution, but over the past few decades, the influx of arms, combined with increasing competition for diminishing resources, has exacerbated this conflict in many areas. Clashes over grazing rights between the Ngok Dinka people of Abyei and the Misseriya cattle people are just one example of the way these stresses can boil over. Khartoum has been accused of inflaming these disputes for political gain, in this case arming the Misseriya and using them to fight proxy wars against its perceived opponents, the Ngok Dinka. Under the terms of the CPA, the traditional rights of the nomadic Misseriya people to graze cattle in Abyei were guaranteed, but in the event of secession, the establishment of a new international border would cut across migratory routes, making it necessary to renegotiate many of these local agreements.

Many of Sudan's land disputes prove intractable because there is no unified legal system of land tenure. Also, rule of law is weak. Disputes were traditionally settled at a local level, but ill-conceived reforms introduced by Khartoum in the 1970s undermined this informal system and effectively made untitled land the property of the state.

The CPA does not provide solutions to issues of land and resource tenure and defers any definite resolution until the postagreement phase. Instead, to resolve land questions, it has created a National Land Commission (NLC) and its counterpart, the Southern Sudan Land Commission (SSLC). But the NLC has yet to become operational, and without it, the SSLC can do little on a national level. Also, while the north relies on statutory law rooted in colonial legislation, the south bases its land regulation and dispute resolution on customary law.²⁹ Land disputes and access issues in both north and south will require an overall legal framework, including a coherent policy, functioning institutions (i.e., ministries and land commissions), law enforcement capacity, and supporting administrative services. Otherwise, land tensions may increase over time and degenerate into more violent clashes. Historically, land conflicts in Sudan tend to spread into group or tribal conflicts and are often used for

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political manipulation. If left unresolved, land disputes are likely to undermine broader peace efforts.

Potential Events and Flash Points

- Inattention to land policy, with the resulting lack of data, makes the referendum's potential impact on land issues hard to gauge.
- Even in unity, there is a high likelihood that the NCP will continue to use government-backed armed militias, or *murahaleen*, to evict or kill the traditional occupants of land it wants, causing more displacement and more confusion over land administration.
- A unity scenario may not lead to resolution of land claims in the most disputed areas, possibly leading to significant violence.
- In the case of secession, north and south could possibly work together to agree on border rights for pastoralists, who follow an important, time-honored livelihood.
- The GoSS is expected to boost its agricultural investments, including improvements to land and irrigation systems, and improved road systems to transport farming materials, equipment, and products. It would also, hopefully, enact legislation to help make the land more sustainable and strengthen law enforcement capacity to deal with land crimes such as stealing or burning land and killing herds. Such crimes are rampant in many parts of the south.
- Although the GoSS is likely to clarify land claims and IDP resettlement issues, most southern IDPs in the north are not likely to return to an independent south. If they are forced to move to the south, the problems of land scarcity could worsen, with violence a likely result.
- Land grabbing to force changes in the border demarcation could be the worst form of north-south violence in the event of secession.
- Investment in public infrastructure and agricultural development represents a potential area for cooperation. For example, with farms in the south connected to food processing in the north via good road networks, economic relations can improve. Irrigation canals cutting across borders and developed and managed by joint north-south committees also could foster increased cooperation. But each of these examples is also a potential source of tension and violence.
- Sudan has much unused arable land, with enormous potential for agricultural development, but this will require peace and stability, better management, and proper rule of law.

Opportunities and Challenges

The south will likely face problems related to weak governance, lack of public infrastructure, returning IDPs, and changes in migration routes. However, the south has great potential for agriculture and forestry. Feasible crops include mango and other fruit trees, acacia, mesquite, gum arabic, and even high-quality lumber trees for export. *Jatropha* and other biofuel plants could be grown in marginal lands and also help reduce desertification. Potential income from forestry is estimated at \$100 million per year, with teak alone generating up to \$50 million per year in export revenue.³⁰

This industry could be sustainable if the GoSS Ministry of Agriculture and Forestry can put in place policies to manage and protect its forest and land resources. Some 34 to 42 percent of land in Sudan is cultivable, but only 15 to 16 percent is actually farmed in any given year, depending on rainfall.³¹ Most of the fertile land is in the south. Thus, the agricultural sector has enormous potential for sustainable economic growth. But this cannot be realized without large-scale investments in infrastructure. The GoSS is aware of this and is setting

aside almost a quarter of its 2008–11 budget for building infrastructure. Road needs alone will cost \$1.799 billion.³²

One potential strategy that both north and south have begun to explore is the leasing of large parcels of land to overseas investors, particularly from the Middle East. In 2008, the Saudi Arabian Al-Rajhi Group was granted a forty-year lease for 40,000 hectares for agribusiness, paying \$70 million up front. Arab countries have focused mainly on growing wheat and maize, but such plantation farms could also grow nuts, fruits, cotton, and other crops. In southern Sudan, Al Ain National Wildlife, a company based in the United Arab Emirates, bought a 6,180-square-mile tract in the Boma Plateau, presumably to build a resort.³³ Although such deals have implications for national sovereignty, they provide Sudan's best hope for developing the infrastructure it needs. Also, if the offsets are set up properly, many Sudanese could be trained in more modern, effective, and sustainable agricultural methods. When the large investors leave, roads, electrical networks, irrigation networks, and other improvements will remain. But all this has to be done properly and sustainably; it is fraught with potential friction and violence if local populations continue to feel neglected. The reality is that without large-scale investment, southern Sudan is unlikely to extract much revenue from its land.

North-south cooperation could prove vital to the development of land and agriculture. Tentative steps have already been made in the direction of cooperation. The GoNU is well aware of the potential for agriculture in reducing Sudan's dependence on oil revenue. More public spending should go toward agricultural services, livestock, rural roads, and traditional rain-fed agricultural projects, which received only 1.5 percent of spending in 2005–07.³⁴ Considering that only 15 percent of Sudan's total land is farmed (of the 34 to 42 percent that is cultivable), contributing 40 percent to GDP and 80 to 90 percent of nonoil export earnings, farming or grazing the huge tracts of unused cultivable land could increase agriculture's contribution to GDP considerably.³⁵

A national agricultural development plan has been drawn up that advocates infrastructure improvements and better global marketing strategies for agricultural products.³⁶ Also, efforts to reduce the environmental cost of intensive land use have gotten legal backing with the Desertification Control Act, the first such law passed in Africa. One priority would be to tackle the problem of land contamination caused by pesticides—a project that UN Environment Programme (UNEP) estimates would cost about \$50 million.³⁷

If properly developed and managed alongside water resources, Sudan's land could prove more valuable than oil. If peace prevails, this country could be an agricultural power, but if violence and instability persist, poverty and starvation may worsen.

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Water

Sudan is a semidesert country, and water is a precious resource. Almost two-thirds of the Nile basin lies within Sudan's borders, and groundwater reserves are considerable. And yet, most of the population suffers from a shortage of clean drinking water and reliable water sources for agricultural livelihoods. This scarcity affects the country's economic stability. The opportunity for water development is enormous. But the current mismanagement of water resources aggravates the imbalance in regional availability of water, and yearly and seasonal fluctuations create uncertainty for many Sudanese communities in sustaining their livelihoods.³⁸

Although only 11 percent of the total cultivated land in Sudan is irrigated, this still represents the second largest irrigated area in all Africa, after Egypt. More than half the country's total agricultural production derives from this irrigated land, which is crucial to the country's economic security in the event of drought and unpredictable rainfall. Sudan's

Table 1. Key Aspects of Sudan's Major Dams

Dam	Location	Purpose	Design Capacity	Current Capacity	Capacity Loss
Sennar	Blue Nile	Irrigation, flood control	0.93 km ³	0.37 km ³	60 percent
Roseires	Blue Nile	Flood control, hydropower	3.35 km ³	2.2 km ³	34 percent
Jebel Aulia	White Nile	Hydropower	3.0 km ³	3.0 km ³	-
Khashm El Girba	Atbara River	Irrigation, flood control	1.3 km ³	0.6 km ³	54 percent
Total Sudan storage capacity			8.58 km ³	6.17 km ³	28 percent
Percentage of Sudan's share of Nile (per Nile Basin Agreement) that is used in storage			46	33	13

Sources: UNEP, "Sudan, Post-Conflict Environmental Assessment," 225, http://postconflict.unep.ch/publications/UNEP_Sudan.pdf; FAO, "AQUASTAT Survey: Sudan."

Note: Data are from before completion of the Merowe Dam.

irrigation potential is estimated to be about 2.78 million hectares, but only 43 percent was actually irrigated in 2000, due to deterioration of irrigation and drainage infrastructures.³⁹ The constraints to effective irrigation center on ineffective maintenance of civil works, increasing development costs, and lack of farmer involvement in planning and operating irrigation schemes.⁴⁰

Southern Sudan has vast untapped potential for irrigated agriculture, but the lack of water infrastructure is a major impediment. For example, huge amounts of Nile water are lost in the Sudd marshlands through evaporation. Yet previous attempts by the government in Khartoum to address this problem have led to confrontation. The Jonglei Canal, which began construction in 1977, was meant to prevent seepage into the Sudd but instead provoked demonstrations and violence by southerners and was abandoned. It is unclear whether the project will be resurrected. Even if construction should resume, Juba would at the very least require outside technical assistance and a large capital injection. It would also need to develop considerable management and maintenance expertise to keep the canal in working order for the future.

Sudan's most ambitious hydroelectric project is the Merowe Dam in the north, which may be capable of generating 1,250 megawatts. But such projects have displaced entire Sudanese communities and shown a casual disregard for the environment, causing a raft of problems, including soil salination and waterlogging and sedimentation of canals and reservoirs. They have also reduced natural silt flows that helped fertilize the land. The estimated loss of production due to siltation of Sudan's irrigation canals is 40 percent.⁴¹

The storage capacity of Sudan's dams amounts to 8.58 km³, with a potential nameplate hydroelectric production capacity of 335 megawatts. However, sedimentation and debris reduce the actual annual storage capacity to about 6.17 km³.⁴² Actual hydropower capacity is likely much less than the nameplate capacity. In the Gezira scheme alone, the loss of production from siltation is 15 percent. Table 1 summarizes key aspects, including storage capacity, of Sudan's major dams.

The Nile Basin Initiative is a regional body that seeks to resolve conflicts over water and divide resources amicably. But it is under serious strain because of the historic rights guaranteed to Egypt, the most powerful of its nine member nations. An agreement negotiated by the British in 1929 gives Egypt the right to veto any upstream project that affects its guaranteed share of 55.5 billion cubic meters (bcm) of the Nile's annual flow of 84 bcm. Sudan's annual share is 18.5 bcm. If the south secedes in 2011, the arrival of a new international player will likely complicate these agreements. An independent southern Sudan

would be expected to ally with its southern neighbors, Uganda and Kenya, to challenge the primacy of the Arab north. The recent agreement among some Nile Basin Initiative members to sign a water treaty without Sudan and Egypt will complicate matters and may add to the discord over water in the region.⁴³

Despite increasing demands for water for agricultural, domestic, and industrial uses, Sudan does not suffer an overall water deficit. Some communities suffer water shortages, but with improved water management, water can flow to those areas in an economically efficient way. The country has 149 km³ of natural renewable water and uses only 37 km³ per year.⁴⁴ It has an excess of about 5 bcm, which Egypt uses. Also, Sudan uses only a tiny percentage of its groundwater. Although reliable data are unavailable, groundwater reserves appear to be vast. If managed properly in basins that allow rain and river water to percolate into the aquifers, groundwater can be constantly replenished by surface water. Sudan's groundwater will be most useful during drought periods, and the low use compared with availability indicates tremendous potential for easing water shortages in dry seasons and in desert areas. One of the most immediate tasks facing water authorities in both north and south is to see how much groundwater is really there and to plan how to use this potentially vast resource sustainably.

Potential Events and Flash Points

- Most of the experts consulted believe that water will not be effectively managed anytime soon after 2011. There is little confidence in the GoSS and the GoNU to ensure the quality and quantity of water flow, and the maintenance of watersheds and irrigation systems, throughout Sudan.
- With secession, the GoSS may increase investment in water infrastructure, which has historically been neglected by the central government. More funding may go toward new irrigation schemes, dams, and water systems in rural areas.
- In all scenarios, it is unlikely that construction of the Jonglei Canal will resume anytime soon, despite media reports that southern officials are open to reversing their views on the project. The argument that the project will benefit mostly Egypt and northern Sudan at the expense of local communities still resonates heavily with southerners. Also, decades have passed since the project was halted, and the current costs and environmental impacts require much scrutiny.
- While speculation surrounds Egypt's reluctance to further negotiate Nile River use and allocations, Egypt cannot ignore a new actor. However, the new treaty signed by Ethiopia, Rwanda, Uganda, and Tanzania will further complicate matters and may increase regional tensions over water.
- In all scenarios, there is low expectation of violence directly over water resources. Most believe that this resource can be managed amicably between north and south. (But such a prediction may reflect how water, as a "forgotten" resource, is often overlooked in the development and peacebuilding process.)
- In both north and south, declines in local rainfall and water tables could spark violent disputes.

Opportunities and Challenges

The management of water supplies in the event of secession poses a series of economic challenges. The south would need to spend heavily on water infrastructure. Most of southern Sudan's population does not have access to clean drinking water. Even Juba, the capital, does not have a functioning water or sewage system. The GoSS estimates that 15,000 to

20,000 wells are needed, and it has identified rural water projects as one of its top six priorities in the 2008–11 budget, assigning \$138 million for the purpose.⁴⁵ It is unclear where the investment for meeting these serious challenges might come from or, even if it were forthcoming, how the government in Juba could afford to maintain new infrastructure.

The presence of a new independent state of southern Sudan would mean new negotiations on water allocations, notably the 1959 Nile Basin Agreement. Southern Sudan would have to make its own claim. Also, the occasion to renegotiate might encourage other nations, such as Ethiopia, to come forward and demand a percentage. Egypt has repeatedly voiced its opposition to any reduction in its water quota.⁴⁶

An independent north would have a comparatively well-developed water infrastructure—although quite backward by international norms—to fall back on. Three hydroelectric dam projects, at Merowe, Kajbar, and Dal, have become the centerpiece for developing much of the north. Some northern Sudanese leaders are looking to Dongola, Sinar, and Kordofan as part of a stable economic and social core of Sudan. Some believe that with a strong and stable economic core in place, Sudan could withstand the loss of Darfur and even the south. These ideas, combined with the fact that dam construction has tended to displace already marginalized communities such as the Nubians, have led to suspicions that political rather than economic motives are driving NCP policy on water management. Others have pointed out that the NCP's dam policy would help reduce the problem of sedimentation at the Aswan High Dam and could therefore be a sop to Egypt in return for diplomatic support.⁴⁷

A united Sudan would, in theory, make it easier to improve water infrastructure and alleviate the problems many Sudanese have in getting clean water. While spending on water projects has increased since 2000, the figure amounts to less than 1 percent of the 2005–07 federal budget. The GoNU has tended to focus on grand dam projects, eschewing smaller-scale water management schemes. Indeed, land and water investments have often focused on the large projects to the detriment of smaller ones that may have more immediate and sustainable positive impacts for the population, especially those on the periphery, who frequently miss out on many benefits from these megaprojects.

A vote for unity in 2011 would seem to offer the best (though still very slim) chance of reviving the Jonglei Canal project. In terms of water management, the project has its merits. It is estimated that by cutting evaporation levels from the Sudd, the canal would increase the volume of water flowing through Sudan by 4 km³ per year. But whether it makes sense politically or environmentally is debatable. Many southern leaders would be unlikely to let “their” water flow north more easily.

Not much of the water percolating back into groundwater from rains and other surface water sources is used in Sudan, indicating the great potential that groundwater aquifers have for developing irrigation, other domestic uses, such as for industry, mining, and residential use, and possibly even a water export industry. Developing this potential could improve agricultural yields and support domestic and industrial demands while requiring little treatment. But such developments would require clear economic policies, technical expertise, good data, and new technology and investment. Also, benefits would depend on how the water industry is developed, how it is protected against degradation, and how agriculture, industry, and service systems are developed alongside water infrastructure. In the long run, the water in southern Sudan has the potential to be extraordinarily valuable.

But water management presents a number of pitfalls as well as opportunities. Shortages cause friction both within Sudan and between it and its neighbors, creaking infrastructure wastes scarce supplies, and poorly implemented dam projects displace communities and wreak environmental havoc. Sudan's water is a largely neglected resource with enormous potential to help development in other sectors, namely agriculture, industry, and energy.

Sudan's water is a largely neglected resource with enormous potential to help development in other sectors, namely agriculture, industry, and energy.

Significant investment in, and effective management, development, and use of, water resources can vastly improve the productivity and welfare of the Sudanese people.

Conclusion and Recommendations

Natural resource management is often overlooked in the peacebuilding process, yet it has enormous potential to serve as an entry point for rebuilding trust, confidence, and cooperation between affected parties, especially between Sudan's north and south. Responding to the resource needs of the population can foster peace and stability while addressing the poverty and vulnerability that derive from poor governance, environmental stress, and overuse of assets. Thus, it is vital that good management structures be established, ensuring accountability and transparency.⁴⁸ Responsibility for these structures lies with the country's ruling parties as well as with international and regional stakeholders. Petroleum, land, and water offer several opportunities for political and economic security and for encouraging cooperation through exploitation of shared interests at local, state, and regional levels. The needed reforms for improved resource management will be costly, but it is crucial to understand that the protection, development, and management of all three key resources go hand in hand. Their success is interdependent, and their combined value is enormous.

Petroleum

- Whether the referendum results in unity or secession, the north should publish audited data on revenue sharing, reach an agreement on pipeline and port fees with the south, initiate discussions on a comprehensive petroleum-sector strategy, and lay the groundwork for requisite regulatory and institutional reform.
- Both north and south should join the Extractive Industries Transparency Initiative (EITI) and, possibly, establish a domestic EITI.
- The south should empower its anticorruption bureau to investigate and publish a report on the use of oil revenues received since 2005, start a capacity-building initiative for sector managers, make a decision on the viability of alternative infrastructure arrangements (i.e., a southern pipeline and refinery), and start work on a comprehensive industry strategy.
- The international community could help both north and south in their negotiations and discussions, leading to an equitable apportionment of the oil industry and its financial and physical infrastructure in the event of secession. The international community can support Sudan's efforts to improve oil management by (a) providing technical support for facilitated negotiations involving all parties; (b) providing mediation support; (c) facilitating technical training and expertise; (d) helping strengthen key anticorruption institutions; (e) supporting the regular publication of audit reports; (f) helping develop a comprehensive sector strategy; and (g) facilitating the participation of U.S. corporations in Sudan's oil sector.
- Both north and south should make a priority of ending corruption in revenue management and setting up transparent frameworks for (a) contracting, (b) capacity building, (c) environmental impact assessments, and (d) regional coordination.

Land and Water

- Both north and south should engage community and regional leaders in resolving some of the many difficult and tension-filled issues likely to arise over land and water. Needed steps include developing national land and water policies that better enforce oil, land, and water management laws; investing in research to improve water delivery systems and environmental management; making commitments not to instigate or support proxy land

grabbing; initiating land demarcation processes as a confidence-building measure; articulating policies on the rights of IDPs; and preparing draft proposals for modifications to the Nile Basin Agreement.

- The south should develop national land and water policies that include proposals on the future of the Jonglei Canal, policies on the rights of IDPs, work on a cadastral system, and building capacity in land and water administration.
- The international community can support Sudan's efforts to improve land and water management by (a) supporting facilitated negotiations on the Nile Basin Agreement and the Jonglei Canal; (b) assisting with water infrastructure investment; (c) facilitating technical support from U.S. institutions in water and land management; (d) providing technical and material support for programs to resettle IDPs; (e) facilitating the participation of relevant U.S. institutions in economic and environmental impact assessments; (f) facilitating training of government workers and local communities in land and water use management and agricultural extension; and (g) supporting local, national, and regional efforts to ensure security in contentious areas.

Any attempt to predict the future in a place as unstable and complex as Sudan is fraught with difficulty. Even though the referendum date of 2011 is fast approaching, so many fundamental political, economic, and social issues remain unresolved that it is impossible to state with any certainty what might happen. At the heart of many of the country's disputes is a desire to control resource wealth or guarantee access to finite resources such as land and water. This report has attempted to identify the fault lines of these struggles and find ways to prevent their tearing Sudan apart as the political contest intensifies in the run-up to 2011. Thus, as the referendum date approaches, the management of oil, land, and water will require particular attention because of their central position in determining the health of Sudan's economy. And if secession is to be the outcome, the onus is on the NCP and the GoSS to begin immediately the serious negotiations on how to divide their natural resources fairly.

Notes

1. All opinions expressed by Dr. Sullivan are his alone. We appreciate the feedback, suggestions, and other efforts of the Sudan team at USIP, especially the contributions of Raymond Gilpin and Jon Temin.
2. See United Nations, Comprehensive Peace Agreement, 2005, <http://unmis.unmissions.org/Portals/UNMIS/Documents/General/cpa-en.pdf> (accessed Mar. 24, 2010). For specific reference to natural resources, see chapter 3, "The Protocol on Wealth-Sharing."
3. Douglas Johnson, *The Root Causes of Sudan's Civil Wars* (Bloomington IN: Indiana University Press, 2003).
4. The lower, more conservative figure is from the U.S. Energy Information Administration (EIA), "Country Analysis Briefs," Sept. 2009, www.eia.doe.gov/cabs/Sudan/Oil.html (accessed May 20, 2010). The higher figure is cited in BP, "BP Statistical Review of World Energy," June 2009, www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2008/STAGING/local_assets/2009_downloads/statistical_review_of_world_energy_full_report_2009.pdf (accessed May 20, 2010). Given the opacity of the situation, and contradicting data from many other sources, figures are far from certain. Actual reserves are likely to prove greater if exploration continues.
5. These are 2008 figures from EIA, "Country Analysis Briefs: Sudan," Sept. 2009, www.eia.doe.gov/cabs/Sudan/pdf (accessed May 20, 2010).
6. International Monetary Fund (IMF), "Sudan: Staff-Monitored Program for 2009–10," July 2009, 4, www.imf.org/external/pubs/ft/scr/2009/cr09218.pdf (accessed May 18, 2010).
7. The fall of world oil prices since summer 2008 led to major budgetary shortfalls, particularly in the Government of Southern Sudan (GoSS). According to the EIA, GoSS oil revenue fell from \$272 million in October 2008 to \$54.5 million in February 2009.
8. Fatal Transactions Campaign and European Coalition on Oil in Sudan, "Sudan: Whose Oil?" April 2008, www.ecosonline.org/reports/2008/dossier%20final%20groot%20web.pdf (accessed May 20, 2010).
9. For example, the revenues from certain production levels from the fields entirely in the north are quite different from those for similar fields in the south. Also, the Chinese company exploiting some of these fields provided much different production numbers from those released by the government in Khartoum.
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11. According to Eric Smith, the oil industry is constantly innovating new technologies to refine lower-grade crudes, which should help stabilize production and give Sudan more time to adjust its economy to a postpetroleum age. Once new reserves are discovered, depending on their proximity to existing infrastructure, it could take many months to years to get the field running, and even longer to make it profitable.
12. These predictions, along with those under the land and water sections, are based on the findings of an unpublished USIP economic questionnaire.
13. IMF, "Sudan: Staff-Monitored Program for 2009–10," 8.
14. Eric Smith, "Using Petroleum Resources to Promote Political Stability and Economic Development in South Sudan" (unpublished report, Tulane Energy Institute, prepared for USIP, 2009).
15. Interview with Eric Smith, Tulane University, August 27, 2009.
16. Smith, "Using Petroleum Resources."
17. Interview with Eric Smith, Tulane University, August 27, 2009.
18. Smith, "Using Petroleum Resources"; Global Witness, "Fueling Mistrust," 44.
19. Barney Jopson, "South Sudan Uses Oil to Ease Secession Fears," *Financial Times*, Feb. 9, 2010, www.ft.com/cms/s/0/9bf5a100-1590-11df-8f05-00144feab49a.html (accessed Apr. 8, 2010).
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21. UN Environment Programme (UNEP), "Sudan Post-Conflict Environment Assessment," 2007, 85, http://postconflict.unep.ch/publications/UNEP_Sudan.pdf (accessed May 18, 2010).
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23. UNEP estimates that rangelands have shrunk 20 to 50 percent within the past generation.
24. This is particularly troublesome in the Nuba Mountains of Southern Kordofan.
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26. *Ibid.*, 169.
27. *Ibid.*
28. Christian Webersik, "Sudan Climate Change and Security Factsheet," 2008, United Nations University, Institute of Advanced Studies, www.ias.unu.edu/resource_centre/Sudan_Climate%20Change%20Facts%20Sheets%20Series_2008_2_lowres.pdf (accessed May 26, 2010).
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31. UNEP, "Sudan Post-Conflict Environment Assessment: Agriculture and the Environment," 2008, 161, http://postconflict.unep.ch/publications/sudan/08_agriculture.pdf (accessed May 20, 2010).
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36. Sudan Vision, "Parliament Committee Recommends Emphasis on Non-Oil Export," Aug. 9, 2009, (accessed May 19, 2010).
37. UNEP, "Sudan Post-Conflict Environment Assessment," 175.
38. "Availability of water" refers not only to the quantity but also to the quality of water available for drinking and other uses.
39. FAO, "AQUASTAT Survey: Sudan," 2005, www.fao.org/nr/water/aquastat/countries/sudan/index.stm (accessed May 18, 2010).
40. Ibid.
41. Ibid.
42. UNEP, "Sudan Post-Conflict Environment Assessment," 225.
43. See France 24, "African Countries Sign Nile Water-Sharing Treaty," May 14, 2010, www.france24.com/en/20100514-african-countries-sign-water-sharing-treaty-river-nile-Egypt-Sudan (accessed May 19, 2010).
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