

The Nubian Sandstone Aquifer System: Thoughts on a Multilateral Treaty in Light of the 2008 UN Resolution on the Law of Transboundary Aquifers

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SUMMARY

INTRODUCTION	379
I. THE NUBIAN SANDSTONE AQUIFER SYSTEM'S VULNERABILITIES	382
A. <i>Geological Vulnerabilities</i>	382
B. <i>Climatic Vulnerabilities</i>	384
C. <i>Political Vulnerabilities</i>	384
D. <i>Economic Vulnerabilities</i>	386
II. SOURCES OF INFORMATION.....	386
A. <i>1997 Convention on the Law of the Non-navigational Uses of International Watercourses</i>	387
B. <i>2008 Resolution on the Law of Transboundary Aquifers</i>	388
III. TASKS THE NUBIAN STATES MUST COMPLETE.....	389
A. <i>Define Equitable and Reasonable Use</i>	389
B. <i>Address the Economic Gap Between the Nubian States</i>	393
C. <i>Endorse the Principle of Sovereignty over Shared Natural Resources</i> ...	396
D. <i>Craft a Flexible Jurisdictional Clause</i>	398
E. <i>Encourage Pairs of Nubian States to Enter Bilateral Agreements</i>	403
IV. CONCLUSION	408

INTRODUCTION

The Nubian Sandstone Aquifer System (NSAS), underlying 2.2 million square kilometers of North African desert,¹ is vital to the survival of the Egyptians, Libyans,

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Sudanese, and Chadians living above it. Millions of people, though they do not drink Nubian water on a daily basis, also benefit from it.² The NSAS's "virtual water"—the water used by farmers to grow crops and produce other goods³—reaches beyond the region.⁴ At 375,000 cubic kilometers in volume, the NSAS is one of the largest aquifers in the world.⁵ Despite its importance, however, no binding multilateral treaty governs usage of the NSAS.⁶

Demand for NSAS water has grown rapidly over the past 30–40 years.⁷ Libya's current usage is illustrative: following the takeover by Colonel Muammar al-Gaddafi in 1969, new industrialization put stress on Libya's minimal freshwater resources.⁸ As water levels dropped in the small coastal aquifers near Libya's population centers on the Mediterranean coast, salt water from the Mediterranean flowed into the aquifers.⁹ Soon, the water from these aquifers was too salty to use for irrigation,¹⁰ much less to drink.¹¹ Libya's coastal areas, which make up 1.5% of the area of the country but are home to 75% of its people,¹² turned to the NSAS.¹³ The Great Man-made River Project (GMRP), a decades-long project funded by the Libyan government, has been piping hundreds of millions of gallons of water from the NSAS north to the coast every day since the first pipeline was completed in 1993.¹⁴ By the

Gabriel Eckstein of Texas Wesleyan University School of Law and Professor Jane Maslow Cohen of the University of Texas School of Law for their valuable assistance throughout the writing process.

1. Marianne Alker, *The Nubian Sandstone Aquifer System: A Case Study for the Research Project "Transboundary Groundwater Management in Africa,"* in CONCEPTUALIZING COOPERATION ON AFRICA'S TRANSBOUNDARY GROUNDWATER RESOURCES 231, 238 (Waltina Scheumann & Elke Herrfahrdt-Pahle eds., 2008), available at [http://www.die-gdi.de/CMS-Homepage/openwebcms3.nsf/\(ynDK_contentByKey\)/ANES-7FJFVT/\\$FILE/Studie%2032.pdf](http://www.die-gdi.de/CMS-Homepage/openwebcms3.nsf/(ynDK_contentByKey)/ANES-7FJFVT/$FILE/Studie%2032.pdf).

2. See *id.* at 245–49 (detailing agricultural use of groundwater in Libya, Egypt, Chad, and Sudan generally and use of the NSAS specifically).

3. See *The Concept of "Virtual Water"—A Critical Review*, FRONTIER ECONOMICS 2 (Jan. 2008), http://www.frontier-economics.com/_library/publications/Frontier%20Australia%20-%20paper-%20%20Virtual%20water.pdf (defining virtual water as the "measure of total water used in producing a good or service").

4. See, e.g., Int'l Atomic Energy Agency [IAEA], *Irrational Use*, THE NUBIAN AQUIFER PROJECT, http://www-naweb.iaea.org/napc/ih/IHS_projects_nubian_irrational.html (last updated Mar. 15, 2010) (noting that NSAS "virtual water" ends up in Austria via exports of Egyptian olives).

5. IAEA/UNITED NATIONS DEVELOPMENT PROGRAMME [UNDP]/GLOBAL ENVIRONMENT FACILITY [GEF], MEDIUM-SIZED PROJECT PROPOSAL: REQUEST FOR GEF FUNDING 3 [hereinafter MEDIUM-SIZED PROPOSAL], available at http://www-naweb.iaea.org/napc/ih/documents/Nubian/Nubian_final_MSP_Sandstone.pdf (last visited Feb. 3, 2010).

6. The NSAS is governed by a multilateral agreement requiring all overlying nations to regularly exchange scientific information about the aquifer, but it has no usage component and therefore it will not be discussed in this paper. See STEFANO BURCHI & KERSTIN MECHLEM, FOOD AND AGRIC. ORG. [FAO] LEGAL OFFICE, FAO LEGISLATIVE STUDY 86, GROUNDWATER IN INTERNATIONAL LAW 4–6 (2005) (describing the Programme for the Development of a Regional Strategy for the Utilisation of the Nubian Sandstone Aquifer System in a survey of legal instruments regulating groundwater in international law).

7. Mohamed Bakhbakhi, *Nubian Sandstone Aquifer System*, in NON-RENEWABLE GROUNDWATER RESOURCES: A GUIDEBOOK ON SOCIALLY-SUSTAINABLE MANAGEMENT FOR WATER-POLICY MAKERS 75, 75 (Stephen Foster & Daniel P. Loucks eds., 2006).

8. John Watkins, *Libya's Thirst for "Fossil Water,"* BBC NEWS, Mar. 18, 2006, <http://news.bbc.co.uk/2/hi/science/nature/4814988.stm>.

9. Alker, *supra* note 1, at 246 box1.

10. FRED PEARCE, WHEN THE RIVERS RUN DRY 48 (2006).

11. Alker, *supra* note 1, at 246 box1.

12. FAO LAND & WATER DEV. DIV., FAO WATER REPORTS 29, IRRIGATION IN AFRICA IN FIGURES 316 (Karen Frenken ed., 2005), ftp://ftp.fao.org/agl/aglw/docs/wr29_eng_including_countries.pdf.

13. Alker, *supra* note 1, at 245–46 (including box1).

14. Watkins, *supra* note 8; IAEA, *More People, More Development*, THE NUBIAN AQUIFER PROJECT, http://www-naweb.iaea.org/napc/ih/IHS_projects_nubian_development.html (last visited Feb. 4,

time the GMRP is finished, it will move 6 million cubic meters of water per day¹⁵ across 600 miles¹⁶ of desert to booming coastal cities like Tripoli and Benghazi. Libya already has spent \$27 billion on the project.¹⁷ The largest of the four basins serving the GMRP is the Kufra Basin,¹⁸ which is home to much of the northwestern NSAS.¹⁹

As surprising as it initially seems, the fact that Egypt, Libya, Sudan, and Chad (the Nubian states) have not signed a binding agreement for such an important natural resource is typical of international water law.²⁰ There is no international United Nations Convention in force to govern usage of shared international surface water or groundwater.²¹ Ninety-nine percent of the Earth's accessible freshwater is stored in aquifers, and nearly two billion people depend exclusively on aquifers for their water needs.²² Water experts have recognized the importance of legal structures

2011).

15. Great Man Made River Auth., THE GREAT MAN MADE RIVER PROJECT, <http://www.gmmra.org/en/> (last visited Feb. 4, 2011).

16. PEARCE, *supra* note 10, at 46.

17. *Id.* at 48.

18. See Great Man Made River Auth., *The Vision, THE GREAT MAN MADE RIVER PROJECT*, http://www.gmmra.org/en/index.php?option=com_content&view=article&id=73&Itemid=2 (last visited May 17, 2010) (comparing the groundwater storage capacities of the different Libyan basins being exploited by the GMRP).

19. W. Gossel et al., *A Very Large Scale GIS-based Groundwater Flow Model for the Nubian Sandstone Aquifer in Eastern Sahara (Egypt, Northern Sudan, and Eastern Libya)*, 12 *HYDROGEOLOGY J.* 698, 700 fig.1 (2004).

20. Of some 275 currently identified transboundary aquifers, only two are governed by treaties. See Convention relative à la protection, à l'utilisation, à la réalimentation et au suivi de la Nappe Souterraine Franco-Suisse du Genevois, Fr.-Switz., Dec. 18, 2007, available at http://www.unece.org/env/water/meetings/legal_board/2010/annexes_groundwater_paper/Arrangement_French_Swiss.pdf (unofficial English translation available at <http://internationalwaterlaw.org/documents/regionaldocs/2008Franko-Swiss-Aquifer-English.pdf>) [hereinafter Genevese Aquifer Treaty]; Acordo sobre o Aquífero Guarani, Aug. 2, 2010, available at <http://www.itamaraty.gov.br/sala-de-imprensa/notas-a-imprensa/acordo-sobre-o-aquifero-guarani> [hereinafter Guarani Treaty]; see also INT'L SHARED AQUIFER RES. MGMT. PROGRAMME, UNITED NATIONS EDUC., SCIENTIFIC AND CULTURAL ORG., ATLAS OF TRANSBOUNDARY AQUIFERS 61 (Shaminder Puri & Alice Aureli eds., 2009) [hereinafter ISARM Report] (noting that about 275 transboundary aquifers have been identified); Yoram Eckstein & Gabriel E. Eckstein, *A Hydrogeological Approach to Transboundary Groundwater Resources and International Law*, 19 AM. U. INT'L L. REV. 201, 227 (2003) (identifying, in 2003, the Genevese Aquifer Treaty's predecessor agreement as "the only international agreement that directly addresses a transboundary aquifer"); *Hydraulic Harmony or Water Whimsy? Guarani Aquifer Countries Sign Agreement*, INT'L WATER LAW PROJECT BLOG (Aug. 5, 2010, 11:08 PM), <http://www.internationalwaterlaw.org/blog/?p=290> (announcing signing of the Guarani Treaty and critiquing it as merely a "bare-bones agreement that contains less than ideal cooperative mechanisms").

21. See Salman M.A. Salman, *The Helsinki Rules, the UN Watercourses Convention and the Berlin Rules: Perspectives on International Water Law*, 23 INT'L J. WATER RESOURCES DEV. 625, 625 (2007) (noting that no universal treaty regulates "non-navigational uses of international watercourses"). Ground water "generally refers to subsurface water that is below the ground water table, *i.e.*, where the porous geologic formations are saturated completely with water, or where water occupies the entire porous space within a porous geologic formation." Eckstein & Eckstein, *supra* note 20, at 209–10. Surface water refers to "a surface body of water, such as river, stream, or lake, and other defined bodies of water on the Earth's surface" and does not include "surface runoff, water percolating into the ground, and other diffused or unchanneled waters." Gabriel Eckstein, *A Hydrogeological Perspective of the Status of Ground Water Resources Under the UN Watercourse Convention*, 20 COLUM. J. ENVTL. L. 525, 547 n.96 (2005).

22. ISARM Report, *supra* note 20, at 16.

to manage transboundary aquifers (TBAs).²³ Nonetheless, groundwater is “out of sight and, unfortunately, all too often out of mind” to attract the attention of lawmakers.²⁴

This paper argues that the Nubian states can and must enact a binding agreement to govern NSAS usage. Fortunately, change has begun to stir, in the form of the U.N. General Assembly’s 2008 Resolution on the Law of Transboundary Aquifers.²⁵ Additionally, several NGO-funded projects on TBAs are underway or recently have been completed.²⁶ Of particular relevance is the Nubian Aquifer Project (NAP), which was initiated in 2006²⁷ to “establish a rational and equitable management of the NSAS for sustainable socio-economic development and the protection of biodiversity and land resources.”²⁸ One of the NAP’s five components is to create a legal and institutional framework for NSAS management.²⁹ The Nubian states must build on this momentum at the international and regional level to make the NSAS the first of the vast, politically charged TBAs to be governed by a multilateral treaty.

Section I of this paper catalogs the NSAS’s vulnerabilities—geological, climatic, political, and economic—to show that in comparison with other TBAs, the NSAS is in particular need of a treaty. Section II briefly discusses two key sources upon which the Nubian states should draw during the treaty drafting process. Section III offers in-depth advice about several components an NSAS treaty must contain in order to be successful. Finally, Section IV offers a brief conclusion.

I. THE NUBIAN SANDSTONE AQUIFER SYSTEM’S VULNERABILITIES

A. *Geological Vulnerabilities*

While much of what makes the NSAS vulnerable comes from outside the aquifer itself, it is one defining geological feature—that the NSAS is for all intents and purposes a non-recharging aquifer—that most clearly demonstrates the need for a comprehensive treaty.³⁰ Non-recharging aquifers are non-renewable resources and

23. INT’L SHARED AQUIFER RES. MGMT. PROGRAMME, UNITED NATIONS EDUC., SCIENTIFIC AND CULTURAL ORG. [UNESCO], TRANSBOUNDARY AQUIFERS, MANAGING A VITAL RESOURCE 14 (Raya Marina Stephan ed., 2009), available at <http://unesdoc.unesco.org/images/0018/001824/182431e.pdf>.

24. Theresa Grant-Peterkin, *Groundwater Contamination: Approaches to the Regulation and Clean-Up in the UK and EC, in WATER POLLUTION: LAW AND LIABILITY* 335, 337 (Patricia Thomas ed., 1993).

25. G.A. Res. 63/124, U.N. GAOR, 63rd Sess., U.N. Doc. A/RES/63/124 (Dec. 11, 2008) [hereinafter 2008 Resolution].

26. See, e.g., OFFICE FOR SUSTAINABLE DEV. & ENV’T, ORG. OF AMERICAN STATES, WATER PROJECT SERIES NO. 7, GUARANI AQUIFER SYSTEM (2005), available at http://www.oas.org/dsd/Events/english/Documents/OSDE_7Guarani.pdf (providing overview of the Environmental Protection and Sustainable Development of the Guarani Aquifer System Project); *Introduction*, MANAGING HYDROLOGICAL RISK IN THE IULLEMEDEN AQUIFER SYSTEM, <http://iullemeden.iwlearn.org/> (last visited May 17, 2010) (outlining completed project on the Iullemeden Aquifer in West Africa).

27. IAEA/UNDP/GEF NUBIAN SANDSTONE AQUIFER SYSTEM MEDIUM SIZED PROJECT: PROJECT IMPLEMENTATION PLAN 2 (2006) [hereinafter PROJECT IMPLEMENTATION PLAN], available at <http://www-naweb.iaea.org/napc/ih/documents/Nubian/Nubian%20PIP%20-%20may1107.pdf>.

28. IAEA, *About the Project*, THE NUBIAN AQUIFER PROJECT, http://www-naweb.iaea.org/napc/ih/IHS_projects_nubian.html (last visited May 17, 2010). The NAP is still underway at the time of writing. *Id.* The project is funded by the GEF, IAEA, UNESCO, and the four Nubian states. PROJECT IMPLEMENTATION PLAN, *supra* note 27, at 20–26.

29. PROJECT IMPLEMENTATION PLAN, *supra* note 27, at 20.

30. Hydrogeologists and other scholars often make reference to the NSAS receiving recharge, which

thus can be completely depleted through artificial consumption.³¹ On the other hand, recharging aquifers are recharged to varying extents by rainwater or seepage from overlying rivers and lakes.³²

An aquifer is “a relatively permeable geologic formation (such as sand or gravel)” through which water can flow.³³ For the NSAS, the permeable geologic formation is mainly sandstone laid down during the Paleozoic and Mesozoic eras.³⁴ The NSAS was likely filled with water at the end of a more recent geological era when the Sahara was lush and wet.³⁵ According to recent dating attempts, some Nubian water is 200,000 to 1.5 million years old.³⁶

Non-recharging aquifers also have limited flow, the geological process by which water moves laterally from one part of the aquifer to another, caused in recharging aquifers by recharge from surface water sources.³⁷ However, flow speeds up near artificial extraction points like wells and pipelines.³⁸ This extraction creates a cone of depression, which causes water from elsewhere to shift toward the extraction point as a result of gravity.³⁹ As the water flows toward the point of extraction, the ground water table within the “radius of influence” of the cone of depression drops.⁴⁰

Desert lakes in Libya linked to Kufra Basin oases have begun drying up because of groundwater pumping.⁴¹ Scientists hypothesize that Egyptian extraction will soon begin lowering the Sudanese water table.⁴² Eastern Sudan’s section of the NSAS

if true would suggest that it is not a non-recharging aquifer. See Gossel et al., *supra* note 19 (mentioning recharge that occurs in Sudan and Chad). However, the recharge is so negligible and localized that for purposes of crafting a treaty, the NSAS should be considered a non-recharging aquifer. See A.M. Ebraheem et al., *Simulation of Impact of Present and Future Groundwater Extraction from the Non-replenished Nubian Sandstone Aquifer in Southwest Egypt*, 43 ENVTL. GEOLOGY 188, 192 (2002) (explaining that there has been no recharge in southwest Egypt specifically for the last 9,000 years); Alker, *supra* note 1, at 241 (explaining that recharge is so low that NSAS is considered non-renewable).

31. Aquifers receiving little recharge also are often described as “confined” or “fossil.” However, there has been an effort of late to avoid using these less exact terms. See Int’l Law Comm’n., *Second Report on Shared Natural Resources: Transboundary Groundwaters*, paras. 11–14, U.N. Doc. A/CN.4/539 (Mar. 9, 2004) (citing the NSAS as a demonstration of the confusion that arises from careless use of hydrogeological terms in legal context). For purposes of this article, the distinction between “non-recharging” and “recharging” provides sufficient detail.

32. See Eckstein & Eckstein, *supra* note 20, at 214 (describing influent bodies of water).

33. *Id.* at 210.

34. Alker, *supra* note 1, at 239. The Paleozoic era was 570–244 million years ago; the Mesozoic era was 245–65 million years ago. *Id.* at 239 n.48–49.

35. PEARCE, *supra* note 10, at 45.

36. P. Gremillion, *New Light Shed on the Nubian Aquifer*, WATER & ENV’T NEWS (IAEA Isotope Hydrology Section, Vienna Austria), Feb. 2010, at 4, available at http://www-naweb.iaea.org/napc/ih/documents/Newsletter/issue_26.pdf.

37. Eckstein & Eckstein, *supra* note 20, at 216–17, 220.

38. See *id.* at 219 (describing the increase in flow around a pumping well).

39. *Id.*

40. *Id.*

41. Alker, *supra* note 1, at 250.

42. Waltina Scheumann & Marianne Alker, *Cooperation on Africa’s Transboundary Aquifers—Conceptual Ideas*, 54 HYDROLOGICAL SCI. J. 793, 795 (2009); see also Alker, *supra* note 1, at 266 (predicting Egyptian groundwater development projects will negatively impact Sudan).

already contains little water in comparison with most other areas of the NSAS.⁴³ In addition to having no natural recharge, the NSAS loses water independent of human extraction. In the 5,800 square kilometer Qattara Depression in Egypt water from the NSAS is continually surfacing and evaporating in small but not negligible amounts.⁴⁴ Drought and climate change have lowered the water table in Chad, forcing some Chadians to move in order to find sufficient water.⁴⁵

B. Climatic Vulnerabilities

The NSAS underlies the extremely arid Sahara Desert. The land above it is largely uninhabited desert.⁴⁶ Naturally, surface water above the NSAS is scarce. Libya, for example, has no permanent rivers.⁴⁷ Refugees in Chad and Sudan are regularly forced to endure potentially fatal water shortages.⁴⁸ Other large TBA regions are not in such dire need of water: the massive Guarani in South America, for example, though important to the people living above it, lies under an area that receives substantial rainfall.⁴⁹ The lack of surface water above the NSAS makes the need for a reliable, binding treaty even clearer.

C. Political Vulnerabilities

One cannot overstate the political volatility of the NSAS region. After eighteen days of largely peaceful protests in early 2011, Egyptians forced the end of president Hosni Mubarak's thirty-year reign, signaling the end of "the Arab world's original secular dictatorship."⁵⁰ Less than a week later, challenges to the "mercurial" forty-one-year reign of Libyan leader Muammar al-Gaddafi were in full swing.⁵¹ The upheaval may prove to be the most decisive moment in the Middle East since the Six

43. Itzhak E. Kornfeld, *Parched Ground: After the War, Can Sudan Sustainably Develop and Preserve Its Groundwater Resources*, 14 PENN ST. ENVTL. L. REV. 655, 663 (2006).

44. G.W. Murray, *The Water Beneath the Egyptian Western Desert*, 118 GEOGRAPHICAL J. 443, 449–50 (1952).

45. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 7.

46. Elizabeth Burleson, *Middle Eastern and North African Hydropolitics: From Eddies of Indecision to Emerging International Law*, 18 GEO. INT'L ENVTL. L. REV. 385, 421 (2006).

47. *Id.*

48. Martin Plaut, *Chad Refugees Face Water Shortage*, BBC NEWS, Apr. 23, 2005, <http://news.bbc.co.uk/2/hi/africa/4477653.stm>; Press Release, UNICEF, Darfur Refugees Fueling Tension in Chad (Feb. 1, 2005), available at http://www.unicef.org/infobycountry/sudan_25018.html.

49. See, e.g., CENT. INTEL. AGENCY [CIA], *Paraguay, Geography*, THE WORLD FACTBOOK, <https://www.cia.gov/library/publications/the-world-factbook/geos/pa.html> (last visited Feb. 4, 2011) (stating that eastern Paraguay—the portion of Paraguay under which the Guarani lies—receives “substantial rainfall”); CIA, *Brazil, Geography*, THE WORLD FACTBOOK, <https://www.cia.gov/library/publications/the-world-factbook/geos/br.html> (last visited Feb. 4, 2011) (stating that Brazil’s climate is “mostly tropical”). Despite less immediate need for groundwater in this region, the Guarani states recently passed a binding agreement governing usage of the Guarani. See generally Guarani Treaty, *supra* note 20; INT'L WATER LAW PROJECT BLOG, *supra* note 20. Although the new Guarani Treaty is skeletal, the fact that the Guarani states see it as necessary to begin managing the Guarani reinforces the urgent need for a binding management agreement over the vital NSAS.

50. David D. Kirkpatrick, *Egypt Erupts in Jubilation as Mubarak Steps Down*, N.Y. TIMES, Feb. 12, 2011, at A1, available at http://www.nytimes.com/2011/02/12/world/middleeast/12egypt.html?_r=2&scp=8&sq=egypt%20revolution&st=cse.

51. Anthony Shadid, *Clashes in Libya Worsen as Army Crushes Dissent*, N.Y. TIMES, Feb. 18, 2011, at A1, available at <http://www.nytimes.com/2011/02/19/world/africa/19libya.html?scp=2&sq=libya%20protest%20unprecedented&st=cse>.

Day War in 1967.⁵² Commentators tracking the revolutionary upheaval in the Arab world have begun speculating on the future impact of the regional upheaval on water sources.⁵³

With constant political instability, water scarcity issues become even more important. For example, the current fighting in Darfur is largely attributable to water access issues.⁵⁴ Armed conflict threatens the rest of Sudan as well. Southern Sudanese overwhelmingly supported secession in a January 2011 referendum.⁵⁵ Although the Sudanese government has accepted the results of the referendum,⁵⁶ fighting continues in the south.⁵⁷

Another conflict in the region is particularly relevant to the NSAS. Throughout the 1970s and 1980s, Chad and Libya feuded over the Aouzou Strip, a 100 kilometer-wide strip of land running across the northern border of Chad that is said to contain valuable mineral resources.⁵⁸ The Aouzou Strip contains another valuable resource as well: groundwater. Chad's portion of the NSAS lies directly under the Aouzou Strip.⁵⁹ Section III, *infra*, discusses the importance of the Aouzou Strip to a potential NSAS treaty.⁶⁰

Several hundred miles east of the Aouzou Strip, at the NSAS's eastern edge, there is more evidence of water-related feuding. Egypt and Sudan have had a tense but effective relationship with regard to the Nile River, the primary water source for both countries. Egypt has multiple times threatened to use military force against

52. Anthony Shadid, *Uncharted Ground After End of Egypt's Regime*, N.Y. TIMES, Feb. 11, 2011, <http://www.nytimes.com/2011/02/12/world/middleeast/12revolution.html?scp=14&sq=egypt%20revolution&st=cse>.

53. See, e.g., Maurice Picow, *Libyan Revolution Will End Gaddafi's Green Visions*, GREEN PROPHET (Feb. 25, 2011), <http://www.greenprophet.com/2011/02/libya-gaddafi-green> (suggesting that if Gaddafi falls, funding for the Great Man-made River Project, one of Gaddafi's passions, may be in jeopardy); John Vidal, *What Does the Arab World Do When Its Water Runs Out?*, OBSERVER (Feb. 20, 2011), <http://www.guardian.co.uk/environment/2011/feb/20/arab-nations-water-running-out#history-link-box> (citing rising food prices linked to a regional water crisis as a "less recognised reason" for the protests in Egypt and throughout the Middle East); Solomon Bekele, *The Egyptian Revolution*, CAPITAL (Feb. 14, 2011), http://www.capitalethiopia.com/index.php?option=com_content&view=article&id=14159:theegyptianrevolution&Itemid=9 (predicting that the regime change in Egypt will not change Egypt's approach to Nile usage).

54. *Water Find May End Darfur War*, BBC NEWS, July 18, 2007, <http://news.bbc.co.uk/2/hi/6904318.stm>.

55. Josh Kron & Jeffrey Gettleman, *South Sudanese Vote Overwhelmingly for Secession*, N.Y. TIMES, Jan. 21, 2011, http://www.nytimes.com/2011/01/22/world/africa/22sudan.html?_r=1&ref=sudan; *Results for the Referendum of Southern Sudan*, SOUTHERN SUDAN REFERENDUM 2011, <http://southernsudan2011.com/> (last visited Mar. 1, 2011).

56. Josh Kron, *Sudan Leader to Accept Secession of South*, N.Y. TIMES, Feb. 7, 2011, <http://www.nytimes.com/2011/02/08/world/africa/08sudan.html?ref=sudan>.

57. See, e.g., Josh Kron, *Southern Sudan Suffers a Blow as Fighting Ends a Truce*, N.Y. TIMES, Feb. 11, 2011, <http://www.nytimes.com/2011/02/12/world/africa/12sudan.html?ref=sudan> (describing several clashes between the southern Sudanese military and rebel forces).

58. Clyde R. Mark, CONG. RES. SERV. [CRS], CRS ISSUE BRIEF FOR CONGRESS, LIBYA 8 (2002), available at <http://fpc.state.gov/documents/organization/9577.pdf>.

59. See *infra* note 224 and accompanying text.

60. See *infra* text accompanying notes 217–226.

Sudan, its upstream riparian, over perceived injustices in Sudan's usage of the Nile.⁶¹ Even experts who believe the risk of military conflict over water is exaggerated admit that the Sudan-Egypt relationship has all the variables needed for a water war.⁶² As Egypt's population moves westward beyond the edge of the Nile Valley, the NSAS likely will become a pawn in this chess game. As discussed *infra*, recent developments could leave Egypt and Sudan particularly vulnerable to their upstream Nile riparians.⁶³

The above is just a sampling of past and present conflicts within and among the Nubian states. Few other TBAs underlie such a politically volatile landscape.⁶⁴ Such instability makes a binding treaty governing usage of the NSAS even more important.

D. Economic Vulnerabilities

One of the many catalysts of conflict in the NSAS region is the disparity in economic power between the four nations. For example, the gross domestic product (GDP) per capita of Chad is 13% of the GDP per capita of Libya.⁶⁵ Though wealthier than Chad, Sudan is quite poor as well: its GDP per capita is 16% of Libya's.⁶⁶ This wealth disparity has the potential to directly influence the stability of the NSAS.

Economic disparities between the four Nubian states, when considered alongside deep-seated political instability and disadvantageous natural attributes of the NSAS, demonstrate the pressing need for a multilateral treaty. Usage will only increase, and until the Nubian states have an agreement in place, the likelihood of conflict will increase as well.

II. SOURCES OF INFORMATION

The Nubian states must cast a wide net in their search for relevant treaty-building precedents and principles of international law. Two particularly relevant sources of information are readily apparent.

61. Biong Kuol Deng, *Cooperation between Egypt and Sudan over the Nile River Waters: The Challenges of Duality*, 11 AFR. SOC. REV. 38, 39–40 (2007).

62. See Thomas Homer-Dixon, *The Myth of Global Water Wars*, in FORUM: WAR AND WATER 10, 13 (Sarah Fleming ed., 1998) (explaining that several factors—Egypt's dependence on the Nile, its "historically turbulent" relationship with Sudan, and its significantly greater power—make the Nile River basin one of the few places where concerns regarding a water war are not unfounded).

63. See *infra* text accompanying notes 249–260.

64. The most notable exception to this is the Mountain Aquifer, shared by Israel and Palestine. For details on the political tension engendered by usage of the Mountain Aquifer, see Bursleson, *supra* note 46, at 400.

65. Compare CIA, *Chad, Economy*, THE WORLD FACTBOOK, <https://www.cia.gov/library/publications/the-world-factbook/geos/cd.html> (last visited Feb. 5, 2011) (listing Chad's most recent GDP per capita as \$1,800), with CIA, *Libya, Economy*, THE WORLD FACTBOOK, <https://www.cia.gov/library/publications/the-world-factbook/geos/ly.html> (last visited Feb. 5, 2011) (listing Libya's most recent GDP per capita as \$13,800).

66. Compare CIA, *Sudan, Economy*, THE WORLD FACTBOOK, <https://www.cia.gov/library/publications/the-world-factbook/geos/su.html> (last visited Feb. 5, 2011) (listing Sudan's most recent GDP per capita as \$2,200), with CIA, *Libya, Economy*, THE WORLD FACTBOOK, *supra* note 65 (listing Libya's most recent GDP per capita as \$13,800).

A. *1997 Convention on the Law of the Non-navigational Uses of International Watercourses*

In 1970, the United Nations General Assembly (UNGA) commissioned the International Law Commission (ILC), a UN body, to study the law of international watercourses.⁶⁷ Citing “the increasing and multiplying . . . demands of mankind” for freshwater, the UNGA called for further study of legal problems associated with international freshwater management.⁶⁸ After more than two decades of work, the ILC presented the UNGA with a set of 33 Draft Articles in 1994.⁶⁹ Three years later, the UNGA converted the Draft Articles into the Convention on the Law of the Non-navigational Uses of International Watercourses (1997 Convention) and opened it for ratification by UN member states.⁷⁰

Groundwater is within the purview of the 1997 Convention only if it is part of “a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole.”⁷¹ In other words, only those aquifers hydrologically connected to surface waters,⁷² unlike the NSAS, are covered. Prior to the 1997 Convention being enacted, many countries commented that including non-recharging aquifers would be too ambitious, as it would require further study and the incorporation of additional complicating articles.⁷³ Thus, the ILC left non-recharging aquifers out of the Draft Articles, instead appending a resolution suggesting that the Draft Articles apply equally to non-recharging aquifers.⁷⁴ In the process of converting the Draft Articles into the 1997 Convention, the UNGA was “silent on the matter” of non-recharging aquifers and the ILC Resolution was dropped entirely.⁷⁵

More than a decade after being finalized, the 1997 Convention has not attracted enough signatures to come into force.⁷⁶ Nonetheless, it represents an important progression in the emerging world of international water law.⁷⁷ Some of its

67. Salman, *supra* note 21, at 631.

68. G.A. Res. 2669 (XXV), U.N. GAOR, 25th Sess., U.N. Doc. A/RES/2669 (Dec. 8, 1970).

69. Int'l L. Comm'n, *Draft Articles on the Law of the Non-Navigational Uses of International Watercourses and Commentaries Thereto*, U.N. Doc. A/CN.4/L.493 (Jul. 12, 1994).

70. G.A. Res. 51/229, U.N. GAOR, 51st Sess., U.N. Doc. A/RES/51/229 (May 21, 1997) [hereinafter 1997 Convention].

71. *Id.* art. 2(a).

72. In the ILC's report, *infra* note 73, and its appended resolution to the Draft Articles, *infra* note 74, recharging aquifers are referred to as “confined” aquifers.

73. See, e.g., Int'l L. Comm'n, *Report of the International Law Commission on the Work of its Forty-Sixth Session*, paras. 6, 15, 17, 43, U.N. Doc. A/C.6/49/SR.24 (Nov. 29, 1994) (the views of representatives from Gabon, Mexico, France, and Venezuela respectively).

74. *Resolution on Confined Transboundary Groundwater*, [1994] 2 Y.B. Int'l L. Comm'n 135., U.N. Doc. A/CN.4/459.

75. Stephen C. McCaffrey, *An Overview of the U.N. Convention on the Law of the Non-Navigational Uses of International Watercourses*, 20 J. LAND RESOURCES & ENVTL. L. 57, 59 (2000).

76. *Status of the Watercourse Convention*, THE INT'L WATER LAW PROJECT, http://internationalwaterlaw.org/documents/intldocs/watercourse_status.html (last visited Feb. 6, 2011) (showing that as of January 1, 2011, only 21 of the required 35 countries had become parties to the convention).

77. McCaffrey, *supra* note 75, at 70–73.

fundamental principles are applicable to non-recharging aquifers.⁷⁸ Therefore, the 1997 Convention will be helpful to the Nubian states as they begin to craft an NSAS treaty.

B. 2008 Resolution on the Law of Transboundary Aquifers

In 2002, the ILC acknowledged the need to address shared natural resources, specifically confined groundwater⁷⁹ and oil and natural gas.⁸⁰ It separated confined groundwater from oil and natural gas and agreed to take up confined groundwater first.⁸¹ Six years later, the UNGA adopted the 2008 Resolution on the Law of Transboundary Aquifers.⁸² The UNGA borrowed heavily from the 1997 Convention,⁸³ but also crafted provisions specifically tailored to the unique circumstances of TBAs.⁸⁴ The 2008 Resolution covers non-recharging aquifers like the NSAS.⁸⁵

The future of the 2008 Resolution is uncertain. Unlike Conventions, UNGA resolutions are not binding.⁸⁶ During its 2011 session, the UNGA will consider whether to convert the 2008 Resolution into a Convention or simply leave it as a non-binding set of guidelines.⁸⁷ Opinions differ on which is the proper course of action.⁸⁸ Even if the UNGA converts the 2008 Resolution into a Convention, it would require ratification by a certain number of countries to become binding.

78. *Id.* at 59.

79. As discussed above, experts are attempting to eliminate the word “confined” from the field in favor of more descriptive words. This article uses the term “non-recharging.” *Supra* note 31.

80. Rep. of the Int’l Law Comm’n, 54th sess., Apr. 29–June 7, July 22–Aug. 16, 2002, paras. 518–520, U.N. Doc. A/57/10; GAOR, 57th Sess., Supp. No. 10 (2002).

81. *See id.* para. 520 (establishing ILC’s work program, with confined groundwater addressed in 2004, and oil and gas addressed in 2005).

82. 2008 Resolution, *supra* note 25.

83. Compare 1997 Convention, *supra* note 70, art. 6 (listing factors to be considered when defining equitable and reasonable utilization), with 2008 Resolution, *supra* note 25, art. 5 (borrowing several of the same factors while supplementing the list with factors tailored specifically to groundwater).

84. *See, e.g.*, 2008 Resolution, *supra* note 25, arts. 3, 11, 13, 16 (addressing sovereignty, recharge and discharge zones, joint monitoring, and technical cooperation respectively).

85. *See Rep. of the Int’l Law Comm’n*, 60th sess., May 5–June 6, July 7–Aug. 8, 2008, U.N. Doc. A/63/10; GAOR, 63d Sess., Supp. No. 10, art. 4 cmt., para. 4 (2008) [hereinafter 2008 ILC Commentary] (noting that the resolution’s equitable and reasonable utilization provision aims to “maximize the long-term benefits from the use” of “waters in aquifers, whether recharging or non-recharging”). Citations in support of subsequent discussion of the 2008 Resolution will often be to ILC documents that actually pertain to the Draft Articles, which later became the 2008 Resolution. This is because much of the valuable commentary on the articles in the 2008 Resolution comes from the process of creating the Draft Articles. As a result, sometimes the Draft Article cited to will be numbered differently from the eventual 2008 Resolution article, even though the content is identical. Further clarifications on these inexact sources are offered when necessary.

86. *See Definitions*, UNITED NATIONS TREATY COLLECTION, http://treaties.un.org/Pages/Overview.aspx?path=overview/definition/page1_en.xml (last visited Mar. 9, 2011) (explaining that the term “convention” is synonymous with “treaty,” which “has regularly been used as a generic term embracing all instruments binding at international law”); *The General Assembly*, UNITED NATIONS FOUNDATION, <http://www.unfoundation.org/global-issues/united-nations/the-general-assembly.html> (last visited Mar. 9, 2011) (explaining that non-budgetary UNGA resolutions are not binding).

87. *See* 2008 Resolution, *supra* note 25, para. 6 (deciding to include in provisional agenda “the question of the form that might be given to the draft articles”).

88. *See, e.g.*, U.N. GAOR, 61st Sess., 14th mtg. para. 78, U.N. Doc. A/C.6/61/SR.14 (Oct. 30, 2006) (noting Uruguay’s preference that the Draft Articles remain a set of flexible guidelines); U.N. GAOR, 64th Sess., 23d mtg. para. 17, U.N. Doc. A/C.6/64/SR.23 (Nov. 3, 2009) (noting Turkey’s opinion that the ILC should reserve further judgment on the final form of the Draft Articles).

Without the necessary ratifications, the 2008 Resolution will remain a set of unenforceable guidelines, much like the 1997 Convention is today.⁸⁹ That status, however, is not without value. By continually tabling the 2008 Resolution at the UNGA, countries may be less likely to reject it outright and more willing to test its tenets during daily relations with their neighbors.⁹⁰ In this way, the recommended principles could gain support in the international community over time.⁹¹ Regardless of the 2008 Resolution's fate, the act of designing it has been a milestone in the process of codifying international groundwater law.⁹² The Nubian states must determine how best to let its principles inform an NSAS treaty.

III. TASKS THE NUBIAN STATES MUST COMPLETE

Given the NSAS's many vulnerabilities, anything but a thorough, fair, and all-encompassing multilateral treaty would be of little value. This section discusses several tasks the Nubian states must complete in order to build a robust treaty.

A. *Define Equitable and Reasonable Use*

The requirement of equitable and reasonable use (ERU) is one of the two core principles of international water law.⁹³ ERU is always a central part of transboundary water negotiations.⁹⁴ Therefore, an NSAS treaty must address it. In light of the centrality of ERU, Saudi Arabia, in its commentary on the draft version of the 2008 Resolution, pushed for a firm, detailed definition of the principle.⁹⁵ Saudi Arabia expressed concern that the 2008 Resolution did not address, among other factors, banning "directional, slant, and horizontal drilling"; differences in the area,

89. Although progress has been slow, the 1997 Convention continues to accrue more signatories, most recently Nigeria, which ratified it on September 27, 2010. *Convention on the Law of the Non-Navigational Uses of International Watercourses*, UNITED NATIONS TREATY COLLECTION, http://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-12&chapter=27&lang=en (last visited Feb. 6, 2011).

90. Telephone Interview with Gabriel Eckstein, Former Member of Advisory Committee to the United Nations International Law Commission (Oct. 29, 2010) (describing various perspectives on the status of the 2008 Resolution).

91. *Id.*

92. Gabriel Eckstein, *Commentary on the U.N. International Law Commission's Draft Articles on the Law of Transboundary Aquifers*, 18 COLO. J. INT'L ENVTL. L. & POL'Y 537, 542 (2007).

93. See Jutta Brunnee, *Law and Politics in the Nile Basin*, 102 AM. SOC'Y INT'L L. PROC. 359, 361 (2008) (discussing the "equitable utilization principle"). The other core principle is the obligation not to cause harm. *Id.* The two principles taken together are an enduring source of controversy. *Id.* Rather than comment on that lengthy debate, this section focuses just on ERU.

94. Gabriel Eckstein, *Examples of the Political Character of International Water Law*, 102 AM. SOC'Y INT'L L. PROC. 364, 364 (2008).

95. Rep. of Int'l L. Comm'n, *Shared Natural Resources: Comments and Observations by Governments on the Draft Articles on the Law of Transboundary Aquifers*, May 5–June 6, July 7–Aug. 2008, para. 108, U.N. Doc. A/CN.4/595, 60th Sess., (Mar. 26, 2008) [hereinafter 2008 Country Commentary].

extent, and thickness of the aquifer; the direction of the aquifer's flow; population variation; and the climate overlying the aquifer.⁹⁶

Although the 2008 Resolution does delineate several factors to be used when defining ERU, it is not as specific as Saudi Arabia would have preferred.⁹⁷ In this respect, the ERU provision in the 2008 Resolution is less a bright-line standard against which to judge past infractions and more a guideline for future joint management of shared waters.⁹⁸ The Nubian states should interpret ERU creatively, in order to best suit their particular needs.⁹⁹ The underlying goal should be to achieve a degree of sustainability.

Conceptually, sustainability and non-renewable resources like the NSAS are at odds, since by definition a non-recharging aquifer is geologically unsustainable.¹⁰⁰ Sustainability in the context of non-recharging aquifers refers to using the water to "sustain" human life for future generations, even though the water itself cannot be replenished.¹⁰¹ Over time, the usage of NSAS water must contribute to new economic productivity.¹⁰² That way, when the aquifer is finally depleted, the descendants of the individuals who once relied on it will have the socioeconomic means to find other water sources.¹⁰³ In other words, the water itself is eventually depleted, but only after it helps build a socioeconomically sustainable society. Future generations can actually benefit more from the aquifer if some of it is used today rather than saved.¹⁰⁴ The Nubian states should use this socioeconomic definition of sustainability in their ERU clause.

To reach socioeconomic sustainability, wasteful usage of the NSAS must be eradicated.¹⁰⁵ The longer a non-recharging aquifer has been used wastefully, the more difficult it is to institute a socioeconomically sustainable management plan.¹⁰⁶ However, the era of significant, government-supported usage of the NSAS is relatively young, as evidenced by the extreme growth in overall extraction since the 1960s.¹⁰⁷ For example, despite the fanfare surrounding the GMRP and the change it

96. *Id.* para. 53.

97. *See, e.g.*, 2008 Resolution, *supra* note 25, art. 5 (not specifically addressing area, extent, and thickness of the aquifer, direction of flow, and overlying climate).

98. *See* Eckstein, *supra* note 94, at 364 (arguing generally that the ERU provisions in international water law are more likely "devised as tools for negotiating and facilitating cooperation" than as guidelines for adjudicating inequitable use).

99. *See* Rose M. Mukhar, *The Jordan River Basin and the Mountain Aquifer: The Transboundary Freshwater Disputes Between Israel, Jordan, Syria, Lebanon and the Palestinians*, 12 ANN. SURV. INT'L & COMP. L. 59, 85 (2006) (making similar argument for a detailed, responsive agreement regarding equitable and reasonable use of the Jordan River Basin and Mountain Aquifer).

100. *See supra* text accompanying notes 30–44.

101. *See* Mohammed Al-Eryani et al., *Social and Economic Dimensions of Non-Renewable Resources*, in NON-RENEWABLE GROUNDWATER RESOURCES: A GUIDEBOOK ON SOCIALLY-SUSTAINABLE MANAGEMENT FOR WATER-POLICY MAKERS 25, 25–26 (Stephen Foster & Daniel P. Loucks eds., 2006) (distinguishing between preservation of non-renewable groundwater resources and socially sustainable use of such resources).

102. *See id.* at 26 (outlining "planned depletion scenarios" for non-renewable groundwater resources with the goal of maximizing "long-term economic and social development of the community").

103. *Id.*

104. *Id.* at 27.

105. *See id.* at 28 (detailing a plan for socioeconomically sustainable mining of groundwater resources).

106. *Id.*

107. Bakhbakhi, *supra* note 7, at 78 fig.2 (showing that extraction from each geological subsystem of the NSAS was roughly twenty times higher in 1995 than in 1965).

will bring to Libya, it is actually only partially completed.¹⁰⁸ The New Valley Project, Egypt's government-sanctioned westward development, is also a young venture.¹⁰⁹ Although the New Valley Project focuses on moving water from Lake Nasser to irrigate desert areas, it also will draw significantly on the NSAS.¹¹⁰ Since so much of the NSAS usage is relatively new, the Nubian states should require that these new uses be socioeconomically sustainable by incorporating the doctrine of waste into the NSAS agreement's ERU clause.

The doctrine of waste exists to ensure that all water is put to a beneficial use.¹¹¹ "Beneficial use" at first sounds like a requirement that water users "carefully husband the resource, using every drop of water completely and efficiently," but the standard is actually much lower.¹¹² Beneficial use is defined largely by reference to existing practices, rendering the doctrine of waste largely inoperative whenever there are established patterns of water use.¹¹³ However, the doctrine of waste would not be so limited if adopted by the Nubian states. The doctrine of waste, imported into an NSAS agreement, should operate under the assumption that beneficial use in the context of the new NSAS usage has not yet been established. Since water extracted by the GMRP and the New Valley Project has been in use for only a few years, the Nubian states can craft a progressive definition of beneficial use.

Beneficial use is most important in the agricultural context, since 85%–90% of the Nubian states' general water withdrawal goes to agriculture.¹¹⁴ Egypt and Sudan already are ranked first and second respectively in Africa for farmland under irrigation.¹¹⁵ In Egypt, 88.5% of irrigated land uses surface irrigation,¹¹⁶ which is considered to be the least efficient method.¹¹⁷ Despite this and other troubling statistics, however, Libya has pledged that farms fed by the GMRP will use "state of the art irrigation techniques."¹¹⁸

108. See FAO LAND & WATER DEV. DIV., *supra* note 12, at 323 (outlining five phases of the project). Phase III, which will take from the NSAS's Kufra Basin, was not even complete yet as of 2005. *Id.*

109. See, e.g., *Toshka Project—Mubarak Pumping Station/Sheikh Zayed Canal, Egypt*, WATER-TECHNOLOGY.NET, <http://www.water-technology.net/projects/mubarak/> (last visited Feb. 6, 2011) (explaining that the Mubarak Pumping Station, the centerpiece of the New Valley Project (also called the Toshka Project), was completed in 2005).

110. Al-Eryani et al., *supra* note 101, at 32 (explaining that the New Valley Project will take 540 million cubic meters of Nubian water over the next fifty years).

111. Janet Neuman, *Beneficial Use, Waste and Forfeiture: The Inefficient Search for Efficiency in Western Water Use*, 28 ENVTL. L. 919, 920 (1998).

112. *Id.* at 922.

113. See *id.* (calling beneficial use an "elastic concept that freezes old customs, allows water users considerable flexibility in the amount and method of use, and leaves line drawing to the courts").

114. FAO LAND & WATER DEV. DIV., *supra* note 12, at 316 tbl.2 (Libya, 83%), 532 tbl.2 (Sudan, 97%), 556 tbl.2 (Chad, 83 %), and 201 tbl.2 (Egypt, 86%) (calculating percentages by dividing amount of annual water withdrawal dedicated to agriculture by overall withdrawal).

115. INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE, IMPORTANT DATA OF ICID MEMBER COUNTRIES, available at http://www.icid.org/imp_data.pdf (last visited Feb. 6, 2011).

116. FAO LAND & WATER DEV. DIV., *supra* note 12, at 203 fig.2.

117. *Sourcebook of Alternative Technologies for Freshwater Augmentation in Small Island Developing States*, UNITED NATIONS ENVIRONMENT PROGRAMME [UNEP], <http://www.unep.or.jp/iect/publications/techpublications/techpub-8d/irrigation.asp> (last visited Mar. 8, 2011).

118. Great Man Made River Auth., *Water Usage*, THE GREAT MAN MADE RIVER PROJECT

Beyond simply requiring certain types of irrigation systems, beneficial use in an NSAS agreement could require that a certain amount of recycled wastewater be used in every irrigation system.¹¹⁹ In Libya, for example, only 1% of irrigated agriculture uses treated wastewater.¹²⁰ The rest uses water clean enough for domestic consumption. According to Tony Allan, a water specialist credited with devising the “virtual water” concept,¹²¹ “it is madness to use [potable water from the GMRP] for agriculture.”¹²² Beneficial use in the NSAS treaty could also require that only low-water, high-income crops be grown, as other water-stressed states have begun requiring.¹²³ Egypt already has begun to reduce water-intensive crops like rice.¹²⁴

To achieve socioeconomic sustainability, Nubian water must be priced—and priced fairly. Libya’s usage illustrates the problems with current pricing norms: Libya is currently spending billions to get its Nubian water, in the form of GMRP funding.¹²⁵ However, once the GMRP is finished, Libya will be able to bring millions of gallons of water per day to its cities for nothing more than the price of maintaining the pipelines. Citizens of Tripoli currently pay nothing for water, regardless of how much they use.¹²⁶ Assuming Libya continues to provide its citizens with water free of charge once the GMRP is completed, neither Libyans nor the Libyan government will have any reason to use Nubian water sustainably. With water in Cairo costing \$0.03 per 100 gallons, the same disincentive to use water wisely exists.¹²⁷ These examples are evidence that the Nubian states must encourage ERU by including a fair pricing provision.

An NSAS pricing provision should be tailored to the differing circumstances of different Nubian states. For example, a pricing provision should give preference to “vital human needs” by allotting a certain amount of water for each person before any pricing mechanism kicks in.¹²⁸ As defined by the 1997 Convention, “vital human needs” include sufficient drinking water and water with which to produce a subsistence level of food.¹²⁹ Conveniently, a free initial need-based allotment would

http://www.gmmra.org/en/index.php?option=com_content&view=article&id=75&Itemid=41 (last visited Feb. 6, 2011).

119. See Marcella Nanni et al., *Legal and Institutional Considerations, in NON-RENEWABLE GROUNDWATER RESOURCES: A GUIDEBOOK ON SOCIALLY-SUSTAINABLE MANAGEMENT FOR WATER-POLICY MAKERS* 49, 51 tbl.7 (Stephen Foster & Daniel P. Loucks eds., 2006) (listing various legal approaches to groundwater resources planning, including “controlled recycling and reuse of wastewater”).

120. FAO LAND & WATER DEV. DIV., *supra* note 12, at 320.

121. Press Release, Stockholm International Water Institute, “Virtual Water” Innovator Awarded 2008 Stockholm Water Prize (Mar. 19, 2008), <http://www.siwi.org/sa/node.asp?node=25>.

122. PEARCE, *supra* note 10, at 48.

123. See Al-Eryani et al., *supra* note 101, at 32 (describing Jordan’s transformation of its agriculture via technology, training, and investment); see also Nanni et al., *supra* note 119, at 50 (explaining that crop regulation and conversion are key ways for less technologically advanced nations to cut back agricultural water use).

124. Dina Zayed, *Egypt Spat Fuels Water Tension in Nile Basin*, REUTERS, Apr. 27, 2010, available at <http://af.reuters.com/article/topNews/idAFJ0E63Q05C20100427>.

125. PEARCE, *supra* note 10, at 46–47.

126. *Cost of Water*, NAT’L GEOGRAPHIC, Apr. 2010, at 114 (depicting the price per 100 gallons of water in cities around the world).

127. *Id.*

128. See 2008 Resolution, *supra* note 25, art. 5, para. 2 (asserting that “special regard” be given “vital human needs” in calibrating ERU). Water pricing in Iran does something similar, providing domestic, urban customers with roughly thirty liters of water per day before any pricing mechanism kicks in. Naser I. Faruqui, *Islam and Water Management: Overview and Principles, in WATER MANAGEMENT IN ISLAM* 1, 14 (Naser I. Faruqui, Asit K. Biswas & Murad J. Bino eds., 2001), available at http://www.idrc.ca/en/ev-93948-201-1-DO_TOPIC.html.

129. Gabriel Eckstein, *Water Scarcity, Conflict, and Security in a Climate Change World: Challenges*

serve this goal while also functioning as a *de minimis* exception for subsistence farmers and nomads, thus addressing the fact that the Nubian states do not have the manpower necessary to enforce a price structure on small-scale users. When there are wars being fought over access to the rudimentary desert wells, trying to put meters on them and collect usage fees seems ludicrous. On the other hand, affluent urbanites would be capable of paying for their non-vital water use, and urban pricing structures could be enforced.

Whereas the GMRP is bringing water away from the NSAS, Egypt's New Valley Project is trying to incentivize the cultivation of desert overlying the NSAS.¹³⁰ An NSAS treaty's pricing provision could be tailored to address this type of usage as well. Egypt already has pledged tax breaks for companies that move far enough west to get their water from sources outside the Nile Valley.¹³¹ The pricing provision could allow countries to subsidize their citizens' usage under the condition that the countries pay the proper amount in usage fees.

Any pricing provision governing the Nubian states would need to keep in mind Islam's traditional condemnation of the sale of water.¹³² However, given the inequities that such a rule can generate in modern society, some predominantly Muslim countries have begun to circumvent it.¹³³ If a pricing provision is put in place to encourage socioeconomically sustainable use of the NSAS, the biggest question for the Nubian states would become how to use the fees. The options are myriad. For example, the countries already are co-funding 80% of one massive scientific information-gathering project,¹³⁴ so the fees could contribute to further research. Or perhaps the fees could be used to address the lack of irrigation and pumping infrastructure throughout the region, particularly in Chad and Sudan.¹³⁵

B. *Address the Economic Gap Between the Nubian States*

As discussed above, there are significant wealth disparities among the Nubian states.¹³⁶ In order to be a success, an NSAS agreement must compensate for the

and Opportunities for International Law and Policy, 27 WIS. INT'L L.J. 409, 455 (2009).

130. See Tarek F. Riad, *The Legal Environment for Investment in Egypt in the New Millennium*, 15 ARAB L.Q. 117, 117 (2000) (noting that the Egyptian government is trying to encourage foreign investment in "[r]eclamation and/or cultivation of barren and desert lands"); Alker, *supra* note 1, at 247 (describing the government's New Valley Project).

131. *Id.* at 118.

132. See Faruqui, *supra* note 128, at 12 (noting that the Prophet Muhammad "forbade the sale of excess water" to protect the poor).

133. See *id.* at 12–13 (arguing that current water subsidies run counter to the Prophet's concerns by providing wealthy urban and middle-class populations with free water while forcing the poor to pay high prices in informal markets and noting that Islamic scholars generally sanction the sale of water); see also Carl Bruch et al., *Legal Frameworks Governing Water in the Middle East and North Africa*, 23 INT'L J. WATER RESOURCES DEV. 517, 613 (2007) (listing countries that have instituted water pricing schemes, some of which use an increasing block tariff system to charge higher rates as water usage increases).

134. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 20 tbl.1 (dividing combined cofinancing from Nubian states by total amount of financing, including Nubian states and NGOs, to get result of 80%).

135. See *infra* text accompanying notes 152–153, 155 (noting the lowering water tables in Sudan and Chad and lack of efficient irrigation systems).

136. See *supra* text accompanying notes 65–66.

political dynamic created by this disparity. Article 16 of the 2008 Resolution, entitled “Technical cooperation with developing States,” lays out eight ways in which developed nations should cooperate with developing nations, either directly or via international organizations, in order to help them better protect and manage their TBAs.¹³⁷ By including Article 16, the drafters of the 2008 Resolution indicated that the unique circumstances of TBA management necessitate a “unidirectional track of cooperation” from more developed to less developed states.¹³⁸ The 1997 Convention, with its primary focus on surface water, does not include a similar provision.

Other environmentally related international agreements, some of which the Nubian states have signed, also stress scientific and technical cooperation.¹³⁹ Neither Egypt nor Libya is considered a developed nation,¹⁴⁰ but both are significantly more capable of providing cross-border support than Sudan or Chad.¹⁴¹ Therefore, an NSAS treaty should treat them like developed nations for purposes of the agreement’s analog to Article 16.

In the case of many TBAs, valuable technical information is limited or non-existent.¹⁴² Even when studies have been performed, they often fail to extend past national borders, because of a lack of cooperation between the affected countries.¹⁴³ Since TBAs “extend, a priori, over (or under) the administrative boundaries of nations,” research confined within single nations is of limited utility.¹⁴⁴ However, the hundreds of past studies of the NSAS, despite suffering from such limitations, have laid down extensive groundwork.¹⁴⁵ Additionally, in recent years cross-border studies have become more typical.¹⁴⁶ There continues to be extensive focus on hydrogeological modeling,¹⁴⁷ dating NSAS water,¹⁴⁸ and understanding the impacts of

137. 2008 Resolution, *supra* note 25, art. 16.

138. Eckstein, *supra* note 92, at 598 (referencing Draft Article 15, which became Article 16 in the 2008 Resolution).

139. See 2008 ILC Commentary, *supra* note 85, art. 16 cmt., paras. 3–4 (2008) (listing several conventions and declarations that call for scientific assistance and technical cooperation); see also United Nations Convention on the Law of the Sea [UNCLOS], Dec. 10, 1982, 1833 U.N.T.S. 397 (signed and ratified by Chad, Egypt, and Sudan; signed but not ratified by Libya) and United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification Particularly in Africa, Oct. 14, 1994, 1954 U.N.T.S. 3 [hereinafter Desertification Convention] (signed and ratified by Chad, Egypt, Libya, and Sudan).

140. See UNDP, HUMAN DEVELOPMENT REPORT 2010, at 26, 144 tbl.1, available at http://hdr.undp.org/en/media/HDR_2010_EN_Complete_reprint.pdf (ranking Egypt and Libya below the Human Development Index category that corresponds to “developed” nations).

141. *Supra* notes 65–66 and accompanying text; see also CIA, *Egypt, Economy, THE WORLD FACTBOOK*, <https://www.cia.gov/library/publications/the-world-factbook/geos/eg.html> (last visited Mar. 14, 2011) (listing Egypt’s most recent GDP per capita as \$6,200).

142. Eckstein, *supra* note 92, at 598.

143. *Id.*

144. Waltina Scheumann with contributions from Elke Herrfahrtd-Pähle, *Conceptualizing Cooperation on Africa’s Transboundary Aquifer Systems*, in CONCEPTUALIZING COOPERATION ON AFRICA’S TRANSBOUNDARY GROUNDWATER RESOURCES 11, 32 (Waltina Scheumann & Elke Herrfahrtd-Pähle eds., 2008), available at [http://www.die-gdi.de/CMS-Homepage/openwebcms3.nsf/\(ynDK_contentByKey\)/ANES-7FJFVT/\\$FILE/Studie%2032.pdf](http://www.die-gdi.de/CMS-Homepage/openwebcms3.nsf/(ynDK_contentByKey)/ANES-7FJFVT/$FILE/Studie%2032.pdf).

145. See Gossel et al., *supra* note 19, at 698–99 (reviewing gains from several of these studies while also citing their flaws).

146. *E.g., id.*; W. Gossel & A.M. Ebraheem, *A GIS-based Flow Model for Groundwater Resources Management in the Development Areas in the Eastern Sahara, Africa*, in APPLIED GROUNDWATER STUDIES IN AFRICA 43, 43 (Segun M.A. Adelana & Alan M. MacDonald eds., 2008).

147. Gossel, *supra* note 19, at 699.

148. N.C. Sturchio et al., *Krypton-81: An Improved Tool for Dating Old Groundwater*, WATER & ENV’T NEWS (IAEA Isotope Hydrology Section, Vienna Austria), Feb. 2010, at 6, available at http://www-naweb.iaea.org/naweb/ih/documents/Newsletter/issue_26.pdf.

the aquifer's depleting process, as well as present and future extraction.¹⁴⁹ Much of this research is funded at least in part by NGOs.¹⁵⁰ Libya and Egypt, therefore, should not satisfy their duty to provide technical cooperation simply through contributing to more research.

Article 16 also suggests that developed nations supply developing nations with "necessary equipment."¹⁵¹ Experts predict that increased Egyptian extraction will further lower the Sudanese water table,¹⁵² requiring Sudan to somehow get equipment capable of pumping water from deeper under the surface. In some areas, the water table already is too low for Sudan to access Nubian water, given the country's lack of capital investment in the relevant technology.¹⁵³ Libya already has lowered its own water levels pumping water for the GMRP, and Chad may be beginning to feel the effects.¹⁵⁴ Chad has expressed its need for new technology to reach the dropping water table.¹⁵⁵ A system where Libya and Egypt help Sudan and Chad obtain the equipment they need to access their respective shares of the NSAS would effectively satisfy their duty to provide assistance.

"Necessary equipment" also could refer to irrigation equipment. The most efficient irrigation systems are used infrequently in poor regions because they cost more to purchase and maintain.¹⁵⁶ If an NSAS agreement includes an irrigation standard, Chad's and Sudan's relative lack of ability to purchase efficient irrigation systems must be accommodated. Since Libya already has pledged to employ state-of-the-art irrigation techniques for its GMRP-fueled farms,¹⁵⁷ Libya could help Chad and Sudan access and implement similar technology.

When drafting their version of Article 16, the Nubian states should look beyond the 2008 Resolution. For example, Article 16 has its roots in the United Nations Convention on the Law of the Sea (UNCLOS).¹⁵⁸ UNCLOS suggests that more developed nations fulfill their duty to developing nations through training personnel.¹⁵⁹ Effective aquifer utilization tactics and training programs have become a primary missing link in the effort to manage the NSAS. Indeed, NGOs have

149. A.M. Ebraheem et al., *Simulation of Impact of Present and Future Groundwater Extraction from the Non-replenished Nubian Sandstone Aquifer in Southwest Egypt*, 43 ENVTL. GEOLOGY 188, 188 (2002).

150. See, e.g., MEDIUM-SIZED PROPOSAL, *supra* note 5, at 1 (listing amount of financing to be provided by three NGOs: GEF, IAEA, and UNESCO).

151. 2008 Resolution, *supra* note 25, art. 16.

152. Scheumann & Alker, *supra* note 42, at 795.

153. MEDIUM-SIZED PROPOSAL, *supra* note 5, annex 6.

154. See Scheumann & Alker, *supra* note 42, at 795 (noting that lower water levels have been reported in northern Chad, although "there is no indication yet" that Libyan pumping is the cause).

155. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 52.

156. See, e.g., Eric W. Sievers, *Water, Conflict, and Regional Security in Central Asia*, 10 N.Y.U. ENVTL. L.J. 356, 395 (2002) (offering an example of a situation where a surface-based system was significantly cheaper than a drip system); David Lewis, *Can Drip Irrigation Break Africa's Hunger Cycles?*, REUTERS, May 6, 2010, available at <http://af.reuters.com/article/maliNews/idAFLDE63R1NF20100506?sp=true> (describing donors' reluctance to fund expensive but effective drip irrigation systems).

157. See *supra* text accompanying note 118.

158. 2008 ILC Commentary, *supra* note 85, art. 16, cmt. 3.

159. UNCLOS, *supra* note 139, art. 202.

identified the disintegration of institutional mechanisms as a primary risk for the NSAS.¹⁶⁰

Libya has supported research that benefits all of the Nubian states, providing co-funding in amounts that correspond to its own booming NSAS usage.¹⁶¹ Libya also provided the entire 2005 budget for an existing NSAS information-sharing agreement.¹⁶² In drafting an NSAS treaty, the Nubian states should apply this willingness to cooperate to a broader range of potential support tactics, namely the provision of equipment and the training of personnel.

C. *Endorse the Principle of Sovereignty over Shared Natural Resources*

The most controversial provision of the 2008 Resolution is Article 3, which asserts the “sovereignty” of each state over the part of a transboundary aquifer contained in its territory.¹⁶³ Sovereignty is a “politically charged word which changes the dynamics of discussions and negotiations.”¹⁶⁴ It has long been the sine qua non of international law.¹⁶⁵ The 1997 Convention, however, which pertains primarily to surface water, does not contain a sovereignty provision.¹⁶⁶ The inference drawn from that absence is that sovereignty over shared aquifers is a more contentious issue than sovereignty over shared surface watercourses. Thus, in light of Article 3, an NSAS treaty must take a position on the question of sovereignty over shared groundwater.

During the process of drafting the 2008 Resolution, various countries commented on the importance of a sovereignty provision. Paraguay,¹⁶⁷ for example, used as precedent the 1962 Resolution on Permanent Sovereignty over Natural Resources (1962 Resolution), which explained that all states have sovereign control over the natural resources existing within their boundaries.¹⁶⁸ Many countries even objected to the use of the word “shared” when listing transboundary groundwater as a topic on the ILC’s agenda.¹⁶⁹ The 1962 Resolution would later be noted in the annex to the 2008 Resolution.¹⁷⁰

Since one of the 2008 Resolution’s main objectives is to foster international cooperation, using the first substantive article to reiterate state sovereignty over aquifers seems counterproductive.¹⁷¹ Beyond inclusion of the topic being

160. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 22 tbl.2.

161. *See id.* at 20 tbl.1 (listing the amounts of co-financing each of the Nubian states is providing for a current institutional and scientific project, with Libya providing 64% of total co-funding).

162. Alker, *supra* note 1, at 260.

163. 2008 Resolution, *supra* note 25, art. 3.

164. Margaret J. Vick, *International Water Law and Sovereignty: A Discussion of the ILC Draft Articles on the Law of Transboundary Aquifers*, 21 PAC. MCGEORGE GLOBAL BUS. & DEV. L.J. 191, 206 (2008).

165. Anne C. Dowling, “Un-Locke-ing” a “Just Right” Environmental Regime: Overcoming the Three Bears of International Environmentalism—Sovereignty, Locke, and Compensation, 26 WM. & MARY ENVTL. L. & POL’Y REV. 891, 891 (2002).

166. Stephen C. McCaffrey, *The International Law Commission Adopts Draft Articles on Transboundary Aquifers*, 103 AM. J. INT’L L. 272, 275 (2009).

167. U.N. GAOR, 59th Sess., 23rd mtg. para. 6, U.N. Doc. A/C.6/59/SR.23 (Nov. 8, 2004).

168. G.A. Res. 1803 (XVII), U.N. GAOR, 17th Sess., Supp. No 17, U.N. Doc. A/RES/2669 (Dec. 14, 1962).

169. Special Rapporteur on Shared Natural Resources, *Second Rep. on Shared Natural Resources: Transboundary Groundwaters*, Int’l Law Comm’n, paras. 2–4, U.N. Doc. A/CN.4/539 (Mar. 9, 2004) (by Chusei Yamada).

170. 2008 Resolution, *supra* note 25, annex.

171. *Id.* annex (“[a]ffirming the importance of international cooperation”). Articles 1 and 2 discuss

counterproductive, the concept of sovereignty over transboundary groundwater is itself scientifically illusory. Unlike the other types of natural resources—mineral resources, for example—transboundary groundwater is not static; it does not “respect political boundaries.”¹⁷² Even in non-recharging aquifers, where flow is slow, extraction, depending on its location and extent, will cause groundwater to move across national boundaries.¹⁷³

Despite the fact that Article 3 is arguably both legally counterproductive and scientifically unsound, an NSAS treaty must endorse it. Sovereignty—defined as the ability to self-govern, to be recognized as more than just the territory of another state¹⁷⁴—is a real, everyday concern for African states. Three of the Nubian states have been sovereign nations for less than sixty years.¹⁷⁵ Christians and Animists in southern Sudan waged a decades-long fight against Muslims in northern Sudan over the right to become their own sovereign nation.¹⁷⁶ Chad and Libya spent years in armed conflict over who could exercise sovereignty over the Aouzou Strip, much of which overlies the NSAS.¹⁷⁷ A provision on sovereignty would help an NSAS treaty acknowledge this culture of struggle within a new context of cooperation.

Most importantly, a sovereignty provision would make a treaty more palatable domestically.¹⁷⁸ Treaty negotiators’ hardest job is not fostering agreement with one another, but rather convincing their respective domestic interest groups, bureaucrats, and politicians to agree with them.¹⁷⁹ These domestic actors “negotiate internally over what positions will be taken by their party in the external negotiation.”¹⁸⁰ While the words of an NSAS treaty themselves will be about groundwater, whether the Nubian states ratify the treaty will depend on any number of “conflicting domestic interests” within each state.¹⁸¹ For example, much of the fighting in Darfur, which

the scope of the Resolution and the use of terms within it, respectively, leaving Article 3 on sovereignty as the first substantive article.

172. Vick, *supra* note 164, at 209.

173. *Id.*

174. *Id.* at 208.

175. CIA, *Chad, Government*, THE WORLD FACTBOOK, <https://www.cia.gov/library/publications/the-world-factbook/geos/cd.html> (last visited Feb. 8, 2011) (listing Chad’s date of independence as Aug. 11, 1960); CIA, *Libya, Government*, THE WORLD FACTBOOK, <https://www.cia.gov/library/publications/the-world-factbook/geos/ly.html> (last visited Feb. 8, 2011) (listing Libya’s date of independence as Dec. 24, 1951); CIA, *Sudan, Government*, THE WORLD FACTBOOK, <https://www.cia.gov/library/publications/the-world-factbook/geos/su.html> (last visited Feb. 8, 2011) (listing Sudan’s date of independence as Jan. 1, 1956).

176. The climax of this struggle came in January 2011, when southern Sudanese voted to secede. Though the government accepted the results of the independence referendum, violence continues in the region. *See supra* text accompanying notes 55–57.

177. *See infra* text accompanying notes 217–226.

178. *See* 2008 Country Commentary, *supra* note 95, paras. 89–90, 92, 94 (noting the views of Austria, Brazil, Israel, and Turkey, respectively, emphasizing the importance of the sovereignty provision).

179. Frederick W. Mayer, *Managing Domestic Differences in International Negotiations: The Strategic Use of Internal Side-Payments*, 46 INT’L ORG. 793, 793 (1992).

180. *Id.* at 795.

181. *See id.* at 793 (discussing generally the domestic difficulties faced by negotiators of international agreements).

has spilled over into Chad despite Chadian protests,¹⁸² stems from lack of access to water.¹⁸³ If Chadian president Idriss Deby Itno were to sign an NSAS treaty without a sovereignty provision, he could be seen as signaling that the collective needs of the Nubian states—including Sudan—outweighed the needs of Chadians under siege from Sudanese rebels. For each of the Nubian states, particularly Egypt and Libya, NSAS access can legitimately be called a matter of national security.¹⁸⁴ A sovereignty provision would allow the various Nubian leaders to ratify an NSAS treaty but still assert that the water needs of their respective citizens take priority.

Commentators differ on the legal significance that Article 3 will come to have, based on the limitations imposed in its second sentence.¹⁸⁵ However, parsing words and applying doctrines is not the province of an NSAS treaty negotiator. From a realpolitik perspective, leaders of the Nubian states must be assured that agreeing to use the NSAS equitably and reasonably does not mean forfeiting natural resources to the neighbors against whom they are constantly struggling, even if the forfeiture would be largely symbolic.

D. *Craft a Flexible Jurisdictional Clause*

Most treaties include a jurisdictional clause (JC).¹⁸⁶ JCs explain how disputes arising under the treaty will be resolved.¹⁸⁷ Unless an NSAS agreement contains a JC with which all four Nubian states would comply, the agreement would be binding in name only. This subsection analyzes the attributes of a successful JC: flexibility and a specified tribunal.

Flexibility: To determine how flexible their JC should be, the Nubian states could look at two opposing examples. The first is the JC in the 1997 Convention.¹⁸⁸ Member states advocated for a broad, flexible JC in the 1997 Convention.¹⁸⁹ What resulted was a multi-step process offering five interrelated options (internal negotiations, third-party mediation, arbitration, submission to the International Court of Justice (ICJ), or impartial fact-finding).¹⁹⁰ The 1997 Convention is not in

182. Lydia Polgreen, *Darfur Crisis Draws Chad and Sudan Toward Deeper Conflict*, N.Y. TIMES, Apr. 13, 2008, <http://www.nytimes.com/2008/04/13/world/africa/13iht-chad.1.11934808.html>.

183. Lydia Polgreen, *A Godsend for Darfur, or a Curse?*, N.Y. TIMES, Jul. 22, 2007, <http://www.nytimes.com/2007/07/22/weekinreview/22polgreen.html> (explaining that “the heart of the Darfur conflict . . . is the battle for control of resources,” including water).

184. Alker, *supra* note 1, at 267.

185. Compare Eckstein, *supra* note 92, at 561–62 (arguing that the second sentence of Article 3, which requires states to exercise their right of sovereignty in accordance with the rest of the Draft Articles, tempers states’ sovereign rights), with Vick, *supra* note 164, at 212 (arguing that it is “equally plausible” that states will treat Article 3 as an unqualified recognition of their sovereign authority).

186. See *Treaties*, INT’L COURT OF JUSTICE, <http://www.icj-cij.org/jurisdiction/index.php?p1=5&p2=1&p3=4> (last visited Feb. 8, 2011) (explaining that it is “general international practice” to include a jurisdictional clause). But see Agreement (with Annexes) for the Full Utilization of the Nile Waters, United Arab Republic-Sudan, Nov. 8, 1959, 6519 U.N.T.S. 63 (providing example of a treaty with no formal jurisdictional clause). The United Arab Republic was a short-lived political union of Egypt and Syria from 1958 to 1961. *United Arab Republic (U.A.R.)*, ENCYCLOPAEDIA BRITANNICA, <http://www.britannica.com/EBchecked/topic/615447/United-Arab-Republic-UAR> (last visited Mar. 14, 2011).

187. *Treaties*, *supra* note 186.

188. 1997 Convention, *supra* note 70, art. 33.

189. See, e.g., U.N. GAOR, 49th Sess., 24th mtg. paras. 8 and 19, U.N. Doc. A/C.6/49/SR.24 (Nov. 1, 1994) (noting, respectively, Gabon’s rejection of a detailed settlement provision and France’s critique of the then-draft article as too restrictive).

190. 1997 Convention, *supra* note 70, art. 33.

force and therefore its JC has not been tested.¹⁹¹ That said, one can infer that its breadth of options would be well-received by countries unable or unwilling to use one or more of them. For example, internal negotiations between transboundary watercourse states that do not recognize one another's existence is not an option—for them, recourse to the ICJ could be more effective.¹⁹² Conversely, certain nations neither accept the ICJ's jurisdiction as compulsory nor have submitted voluntarily to its jurisdiction, meaning it alone would likely be insufficient.¹⁹³ Arbitration can be very expensive, suggesting poorer countries would prefer other options.¹⁹⁴

Another key attribute of the 1997 Convention's JC is that it is residual, meaning it is preempted by any independent dispute resolution mechanisms agreed upon by groups of two or more signatories.¹⁹⁵ Many other UN Conventions have residual JCs.¹⁹⁶ Making a JC residual gives signatories another option: the option to circumvent the JC altogether.

On the opposite end of the spectrum from the 1997 Convention is the Convention on the Protection, Utilization, and Recharge of the Franco-Swiss Genevise Aquifer (Genevise Aquifer Treaty), between France and Switzerland. The Genevise Aquifer Treaty uses a much simpler and more rigid JC. Disputes are first heard by a Franco-Swiss transboundary-cooperation entity.¹⁹⁷ If that fails, the dispute moves to a higher body of the same entity for resolution.¹⁹⁸ Since any disputes under the Genevise Aquifer Treaty will necessarily be between the same two countries, the JC does not need a broad array of dispute resolution options.

Although there would be only four parties to an NSAS agreement, its JC should strive for flexibility. With more options, countries with tense relationships will more likely find common ground. Most importantly, the JC must be residual. Ideally, a residual JC would encourage countries to integrate bilateral dispute resolution

191. See McCaffrey, *supra* note 75, at 70–73 (discussing the 1997 Convention's value, despite its not being in force).

192. See, e.g., *Convention on the Law of the Non-Navigational Uses of International Watercourses*, *supra* note 89 (listing Syria's declaration that its ratification of the 1997 Convention did not amount to recognition of the state of Israel and Israel's objection thereto).

193. See *Basis of the Court's Jurisdiction*, INT'L COURT OF JUSTICE, <http://www.icj-cij.org/jurisdiction/index.php?p1=5&p2=1&p3=2> (last visited Mar. 13, 2011) (explaining the means by which the ICJ gains jurisdiction and noting cases in which the court could not proceed because the opposing party did not recognize its jurisdiction).

194. Aman Mahray McHugh, Comment, *Resolving International Boundary Disputes in Africa: A Case for the International Court of Justice*, 49 HOW. L.J. 209, 237 (2005).

195. 1997 Convention, *supra* note 70, art. 33, para. 1 (explaining that parties shall use the Convention's dispute resolution mechanism only "in the absence of an applicable agreement" between the feuding parties); *Draft Articles on the Law of the Non-navigational Uses of International Watercourses and Commentaries Thereto and Resolution on Transboundary Confined Groundwater* [1994] 2 Y.B. Int'l L. Comm'n 134, U.N. Doc. A/CN.4/L.493/add.1/corr.1 (noting Article 33's residual nature, i.e., its applicability only in the absence of dispute settlement agreements between states).

196. See, e.g., UNCLOS, *supra* note 139, art. 280; Desertification Convention, *supra* note 139, art. 28, para. 1; International Convention on the Elimination of All Forms of Racial Discrimination art. 16, Mar. 7, 1966, 660 U.N.T.S. 195 [hereinafter Racial Discrimination Convention].

197. Genevise Aquifer Treaty, *supra* note 20, art. 20(2).

198. *Id.* art. 20(3).

mechanisms into existing structures of cooperation.¹⁹⁹ For example, as Nile River copriparians, Egypt and Sudan have extensive experience with water governance vis-à-vis one another.²⁰⁰ In 1959, they reapportioned their respective shares of the Nile and pledged that going forward they would present a unified stance in negotiations with any of the eight other Nile riparians.²⁰¹

The simplicity of the Genevese Aquifer Treaty—currently one of two treaties governing a TBA²⁰²—is alluring, but the Nubian states must remember how different they are from France and Switzerland. Such a rigid JC is tenable only with two states as wealthy²⁰³ and diplomatically stable²⁰⁴ as France and Switzerland. The Nubian states should consider any dispute resolution option that could be successful. An NSAS treaty’s dispute resolution mechanism should be residual in order to encourage bilateral and trilateral agreements. Moreover, it should include both internal and external resolution approaches, like the 1997 Convention.²⁰⁵

Tribunal: All JCs specify a tribunal or forum.²⁰⁶ An NSAS agreement should most likely use the ICJ, the judicial arm of the United Nations, as its tribunal.

First of all, the reputation of the ICJ internationally, and specifically in Africa, is consistently improving.²⁰⁷ In its early years the ICJ faced criticism for allegedly being biased in favor of the West (Europe and North America).²⁰⁸ The court’s initial composition—nine of the original fifteen judges were from the West—certainly lent credence to this concern.²⁰⁹ In the eyes of many newly sovereign African states, the face of this bias was the court’s now infamous 1966 decision in the South West Africa cases.²¹⁰ The petitioners in the cases argued that the Republic of South Africa’s presence in South West Africa (now Namibia) violated the League of Nations Mandate for South West Africa.²¹¹ South Africa was at the time a British colony.²¹²

199. See, e.g., Scheumann & Alker, *supra* note 42, at 794–95 (describing emerging cooperative water-management initiatives in Africa, including the Joint Authority for the Study and Development of the Nubian Sandstone Aquifer System).

200. See Fasil Amdetsion, *Scrutinizing the “Scorpion Problematique”: Arguments in Favor of the Continued Relevance of International Law and a Multidisciplinary Approach to Resolving the Nile Dispute*, 44 TEX. INT’L L.J. 1, 4 (2009) (explaining that Egypt’s and Sudan’s utilization of colonial-era treaties to govern the Nile has been the “defining feature of Nile Basin politics”).

201. Agreement (with Annexes) for the Full Utilization of the Nile Waters, *supra* note 186, art. 5, para. 1.

202. *Supra* note 20.

203. CIA, *Country Comparison, GDP Per Capita*, THE WORLD FACTBOOK, <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html> (last visited Feb. 8, 2011) (ranking Switzerland and France 15th and 40th out of 229, respectively, in GDP per capita).

204. See *Bilateral Relations Between Switzerland and France*, SWISS FEDERAL DEPARTMENT OF FOREIGN AFFAIRS, <http://www.eda.admin.ch/eda/en/home/rep/eur/vfra/bilfra.html> (last visited Feb. 8, 2011) (citing “warm relations in many different areas” between Switzerland and France).

205. Since the 2008 Resolution is not yet a Convention and therefore is not a binding document, no JC is needed. The ILC has made clear that if converting it into a Convention is the chosen route, some type of dispute-settlement provision should be included. Special Rapporteur on Shared Natural Resources, *Fifth Rep. on Shared Natural Resources: Transboundary Aquifers*, para. 41, Int’l Law Comm’n, U.N. Doc. A/CN.4/591 (Feb. 21, 2008).

206. See, e.g., Desertification Convention, *supra* note 139, art. 28, para. 2(b); Racial Discrimination Convention, *supra* note 196, art. 22.

207. P. Mweti Munya, *The International Court of Justice and Peaceful Settlement of African Disputes: Problems, Challenges and Prospects*, 7 J. INT’L L. & PRAC. 159, 173–74 (1998).

208. *Id.* at 168–69.

209. *Id.* at 177.

210. *Id.* at 171–72.

211. South West Africa, Second Phase (Eth. v. S. Afr.; Liber. v. S. Afr.), 1966 I.C.J. 6, 10 (July 18).

212. See *id.* at 10, para. 1 (associating South Africa with “His Britannic Majesty”).

After six years of proceedings, the ICJ, in a “streak of ultra-conservatism,” found against South West Africa on purely technical grounds, dodging the substantive issue of the validity of the Republic of South Africa’s occupation entirely.²¹³

So loud was the international outcry after the 1966 South West Africa cases decision that within four months the UNGA issued a resolution paving the way for South Africa to get out of what would soon become Namibia.²¹⁴ In 1971, the ICJ, somewhat reconstituted after elections in 1968, essentially overruled its own decision in the South West Africa cases.²¹⁵ Since then, the ICJ has arguably become “the right forum” for African states to resolve their disputes.²¹⁶

Secondly, each of the Nubian states has a positive history with the ICJ. In 1990, Chad and Libya substantiated the ICJ’s improved reputation when they voluntarily submitted a border dispute.²¹⁷ The disputed area was a 100 kilometer-wide strip of desert stretching across the entire Chad-Libya boundary, called the Aouzou Strip.²¹⁸ It was purportedly rich in mineral resources, and had been the site of armed conflict for decades.²¹⁹ In 1994, the court found for Chad in a 16–1 decision²²⁰ with all three full status African judges in the majority.²²¹ Libya abided by the judgment, pulling out all of its troops.²²² However, there reportedly has been intermittent Libyan presence in the Strip in recent years.²²³

The Chad-Libya decision is particularly important to the NSAS because much of Chad’s section of the NSAS lies directly under the Aouzou Strip.²²⁴ Chadian desert lakes fed by NSAS springs are in danger,²²⁵ and Libya reportedly supported

213. Munya, *supra* note 207, at 171–72.

214. G.A. Res. 2145 (XXI), para. 4, U.N. GAOR, 21st Sess., Supp. No. 16, U.N. Doc. A/6316, at 2 (Oct. 27, 1966).

215. See Munya, *supra* note 207, at 183–86 (detailing the reasoning of and response to Legal Consequences for States of the Continued Presence of South Africa in Namibia (South West Africa) Notwithstanding Security Council Resolution 270, Advisory Opinion, 1971 I.C.J. 16 (June 21)).

216. Munya, *supra* note 207, at 188–89.

217. Territorial Dispute (Libya v. Chad), 1994 I.C.J. 6 (Feb. 3).

218. *Id.* at 36–37, paras. 69–72.

219. MARK, *supra* note 58, at 8.

220. Territorial Dispute, *supra* note 217, at 40, para. 77.

221. In any ICJ case, each state party is permitted to appoint one ad hoc judge if there is no judge of the party’s nationality sitting on the court. Statute of the International Court of Justice art. 31, para. 3, June 26, 1945, 33 U.N.T.S. 933, available at <http://www.icj-cij.org/documents/index.php?p1=4&p2=2&p3=0> [hereinafter ICJ Statute]. This is why the court, normally composed of fifteen members, was able to come to a 16–1 decision. Territorial Dispute (Libya v. Chad), 1994 I.C.J. 6, 40 (Feb. 3). Not surprisingly, the lone dissenter was Judge Jose Sette-Camara, Libya’s ad hoc selection. *Id.* at 41; see also Public Sitting, Territorial Dispute (Libya v. Chad), at 11 (June 14, 1993), available at <http://www.icj-cij.org/docket/files/83/5587.pdf> (introducing Sette-Camara as Libya’s chosen ad hoc judge).

222. Aloysius P. Llamzon, *Jurisdiction and Compliance in Recent Decisions of the International Court of Justice*, 18 EUR. J. INT’L L. 815, 830–31 (2007).

223. *Id.* at 831–32.

224. Compare Aouzou Strip, LUVENTICUS, <http://www.luventicus.org/maps/africa/aouzoustrip.html> (identifying the Aouzou Strip in extreme northern Chad with a yellow strip) with Bakhbakhi, *supra* note 7, at 76 (demonstrating that the NSAS extends across entire border between Chad and Libya, including the Aouzou Strip).

225. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 11.

rebels in the Aouzou Strip as recently as 2003.²²⁶ Together, these circumstances suggest that armed struggle over Nubian water in the Aouzou Strip is a possibility. Thus, an NSAS agreement must include recourse to a tribunal competent to handle such a volatile situation. Recent history indicates that the ICJ could be that tribunal.

Sudan and Egypt have endorsed the ICJ as well by recognizing its compulsory jurisdiction.²²⁷ However, they both have taken advantage of the fact that states are permitted to tailor the scope of their recognition, since recognition is optional.²²⁸ To that end, Sudan appended several reservations to its declaration of recognition. The most important reservation states that Sudan will not recognize compulsory jurisdiction when the dispute is “essentially . . . domestic”—as determined by Sudan itself.²²⁹ This is called a subjective reservation, since Sudan reserves the right to decide on its own terms which matters are essentially domestic and therefore out of the ICJ’s grasp.²³⁰ Sudan is one of a handful of countries to take this aggressive approach to the reservation process²³¹ (as contrasted to an objective approach, wherein countries allow the ICJ to determine when matters are essentially domestic).²³² Egypt recognized compulsory jurisdiction with no subjective reservation, but only as applied to disputes over a declaration on the operation of the Suez Canal.²³³

Recognizing the ICJ’s compulsory jurisdiction subject to such conditions is not a ringing endorsement of the ICJ. Nonetheless, just 66 of the 192 UN member states currently recognize the compulsory jurisdiction in any form.²³⁴ More importantly for the Nubian states, the ICJ has decided two cases in which the parties were in dispute as to the meaning of equitable and reasonable use in the context of transboundary water disputes.²³⁵ These cases could give the Nubian states guidance on how to most effectively draft their agreement.

Lastly, recourse to the ICJ is cheaper than certain other modes of dispute resolution, namely arbitration, since the UNGA subsidizes the ICJ’s administrative

226. Llamzon, *supra* note 222, at 832.

227. *Declarations Recognizing the Jurisdiction of the Court as Compulsory*, INT’L COURT OF JUSTICE, <http://www.icj-cij.org/jurisdiction/index.php?p1=5&p2=1&p3=3> (last visited Mar. 13, 2011) (listing all countries that have recognized compulsory jurisdiction, including Egypt and Sudan).

228. See RESTATEMENT (THIRD) OF FOREIGN RELATIONS LAW OF THE UNITED STATES § 903 reporter’s note 2 (2009) (explaining the various types of reservations countries will include in declarations of recognition).

229. *Declarations Recognizing the Jurisdiction of the Court as Compulsory, Sudan*, INT’L COURT OF JUSTICE, <http://www.icj-cij.org/jurisdiction/index.php?p1=5&p2=1&p3=3&code=SD> (last visited Feb. 9, 2011).

230. See Raj Bhala, *The Myth about Stare Decisis and International Trade Law*, 14 AM. U. INT’L L. REV. 845, 903 (1999) (distinguishing between subjective and objective reservations).

231. See INT’L COURT OF JUSTICE, *supra* note 227 (follow the hyperlinks for Liberia, Malawi, Mexico, Philippines, and Sudan to access their expressly subjective reservations).

232. Bhala, *supra* note 232, at 903.

233. *Declarations Recognizing the Jurisdiction of the Court as Compulsory, Egypt*, INT’L COURT OF JUSTICE, <http://www.icj-cij.org/jurisdiction/index.php?p1=5&p2=1&p3=3&code=EG> (last visited Mar. 13, 2011).

234. INT’L COURT OF JUSTICE, *supra* note 227 (listing sixty-six states that have deposited declarations); *Member States, Growth in United Nations Membership, 1945–present*, UNITED NATIONS, <http://www.un.org/en/members/growth.shtml> (showing growth in number of UN member states to current number of 192).

235. Gabčíkovo-Nagymaros Project (Hung. v. Slov.), 1997 I.C.J. 7, paras. 77–85 (Sept. 25); Pulp Mills on the River Uruguay (Arg. v. Uru.), Judgment, paras. 170–77 (Apr. 20, 2010), *available at* <http://www.icj-cij.org/docket/files/135/15877.pdf>.

costs.²³⁶ In arbitration, the parties must cover travel expenses for arbitrators, expert testimony costs, and other expenses.²³⁷ Parties before the ICJ pay only their own litigation costs.²³⁸ Theorizing about a treaty governing South America's Guarani Aquifer treaty, in 2005, one analysis identified the ICJ as "too remote or expensive" to be an effective tribunal.²³⁹ However, just one year after that analysis deemed the ICJ a non-option, two of the Guarani states appeared before the ICJ over a surface water dispute.²⁴⁰

E. Encourage Pairs of Nubian States to Enter Bilateral Agreements

The 2008 Resolution devotes an entire article to encouraging groups of countries to manage certain aspects of their TBA via bilateral or regional agreements.²⁴¹ The ILC stressed the importance of integrating the "historical, political, social and economic characteristics" of the TBA.²⁴² Since the NSAS is so vast, a multilateral treaty should be just the first step toward effective management. The four-country regional agreement should encourage additional bilateral treaties between certain pairs of Nubian states. Bilateral treaties would be most feasible between Sudan and Egypt, Chad and Libya, and Sudan and Chad.

Sudan and Egypt: Egypt's planned NSAS extraction will occur very close to the Egypt-Sudan border, and will likely be accompanied by increased Sudanese extraction in the border region.²⁴³ The past forty years of extraction already have caused water tables to drop so far that nearly all wells have had to be replaced.²⁴⁴

The Nile River is a vital water source for both Egypt and Sudan.²⁴⁵ As downstream riparians, Sudan and Egypt have volatile relationships with other Nile River riparians.²⁴⁶ As a result, they have experience negotiating over water rights, both with each other and with the other Nile riparians. In 1959, Sudan and Egypt pledged to present a unified position in all subsequent Nile negotiations.²⁴⁷ They later went so far as to sign an expansive treaty integrating not just their position on the Nile, but also their "social, cultural, economic, political and military relations."²⁴⁸

236. ICJ Statute, *supra* note 221, art. 33.

237. McHugh, *supra* note 194, at 237.

238. *Id.* at 238.

239. Antonio Herman Benjamín, Cláudia Lima Marques & Catherine Tinker, *The Water Giant Awakes: An Overview of Water Law in Brazil*, 83 TEX. L. REV. 2185, 2239 (2005).

240. Pulp Mills on the River Uruguay (Arg. v. Uru.), Judgment, (Apr. 20, 2010), available at <http://www.icj-cij.org/docket/files/135/15877.pdf>.

241. 2008 Resolution, *supra* note 25, art. 9.

242. 2008 ILC Commentary, *supra* note 85, art. 9 cmt. para. 1.

243. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 11.

244. Bakhbakhi, *supra* note 7, at 78.

245. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 8–9.

246. See Zayed, *supra* note 124 (describing an ongoing feud between states upstream of the Nile and Egypt and Sudan after the two countries refused to revise water pacts dating to 1929).

247. Agreement (with Annexes) for the Full Utilization of the Nile Waters, *supra* note 186, art. 5.

248. Charter of Integration Between the Arab Republic of Egypt and the Democratic Republic of the Sudan, Egypt–Sudan, art. 1, Oct. 12, 1982, 1331 U.N.T.S. 329.

Although Egypt is the most economically powerful of the Nubian states, a bilateral treaty with Sudan and a multilateral treaty between all Nubian states are of great importance to Egypt. In recent negotiations between Nile riparians over a new treaty, Egypt could not marshal the influence necessary to maintain its traditional power over the upstream Nile riparians (older colonial-era agreements allow Egypt to veto upstream developments in order to maintain its existing uses).²⁴⁹ The new Cooperative Framework Agreement (CFA) includes an unresolved water security clause,²⁵⁰ which could unseat the principle that existing uses of the Nile must be protected.²⁵¹ Emphasis is instead placed on ensuring that each riparian has the water it needs to achieve water security.²⁵² This new principle could conceivably mean reduced withdrawals by Egypt and Sudan.²⁵³

There is other evidence of Egypt's increasing Nile-related vulnerability. First, the remaining riparians (other than Sudan, which shared Egypt's concerns) boldly opened the CFA for signature without first resolving the dispute over the water security clause.²⁵⁴ Second, rather than responding to encroachments on its share of the Nile with military threats, as it has in the past, Egypt essentially has resorted to paying its upstream riparians to ensure continued Nile access.²⁵⁵

This continuing tension over the Nile reiterates that the NSAS is a "strategic water reserve" that will be "an important part of [Egyptian] development for present and future generations."²⁵⁶ The Nile Valley Project is projected to take 540 million cubic meters of water from the NSAS over the next fifty years.²⁵⁷ Egypt relies on the Nile for 97% of its surface water,²⁵⁸ and the combined population of the Nile riparians is on pace to more than triple between 1990 and 2040.²⁵⁹ Not surprisingly then, Egypt has begun putting more emphasis on groundwater resources in its water policies.²⁶⁰ Generally, integrating groundwater and surface water management creates a greater incentive to reach a successful resolution.²⁶¹ In light of all this, effective governance of the NSAS, through multilateral and bilateral treaties, plays a significant role in Egypt's immediate economic future.

249. Evelyn Lirri, *Storm Hovers Over Calm Nile Waters*, DAILY MONITOR, May 2, 2010, <http://www.monitor.co.ug/News/Insight/-/688338/910032/-/item/0/-/nk49fr/-/index.html>.

250. Agreement on the Nile Basin Cooperative Framework, art. 14(b), annex on art. 14(b), available at http://internationalwaterlaw.org/documents/regionaldocs/Nile_River_Basin_Cooperative_Framework_2010.pdf (unofficial copy) [hereinafter CFA]. The CFA defines "water security" as "the right of all Nile Basin States to reliable access to and use of the Nile River system for health, agriculture, livelihoods, production and environment." *Id.* art. 2(f).

251. See *Egypt Reasserts Nile Water Rights*, AL-JAZEERA, Apr. 20, 2010, <http://english.aljazeera.net/news/africa/2010/04/2010419194851419735.html> (detailing Egypt's insistence that its traditional share of the Nile be maintained in any new water-sharing agreement).

252. CFA, *supra* note 250, art. 14.

253. See *Accord or Discord on the Nile?—Part II*, INT'L WATER LAW PROJECT BLOG (July 26, 2010, 3:35 PM), <http://www.internationalwaterlaw.org/blog/?p=271> (indicating that Article 14(b) of the CFA, as drafted, could affect how states withdraw water and detailing Egypt's proposed revision).

254. *Id.*

255. E.g., Argaw Ashine, *Egypt Offers Support to Nile Basin States*, DAILY NATION (July 8, 2010), available at <http://www.nation.co.ke/News/africa/Egypt%20offers%20support%20to%20Nile%20basin%20states/-/1066/954664/-/format/xhtml/-/13uk4dj/-/index.html>.

256. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 8.

257. Al-Eryani et al., *supra* note 101, at 32.

258. Amdetsion, *supra* note 200, at 8.

259. Lisa M. Jacobs, Comment, *Sharing the Gifts of the Nile: Establishment of a Legal Regime for Nile Waters Management*, 7 TEMP. INT'L & COMP. L.J. 95, 117 (1993).

260. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 8.

261. Scheumann & Alker, *supra* note 42, at 794.

Chad and Libya: Libya's extensive extraction for the GMRP, which has caused the drying up of desert lakes and lowered the Kufra Basin's water level, may adversely affect Chad.²⁶² Even independent of Libya, Chad's NSAS-fed desert oases have begun to drop because of heightened evaporation, forcing Chadians to move in order to find reliable water.²⁶³

As discussed above, Chad and Libya peacefully resolved a territorial dispute less than twenty years ago.²⁶⁴ In 1980, Chad and Libya signed a treaty pledging friendship and alliance, based on the "deep-rooted spiritual, economic, human and cultural ties" created by their common history.²⁶⁵ Diplomatic relationships between the nations are currently strong enough that the nations recently signed several agreements on various communication and transportation issues, one of which allows Chad to use Benghazi, one of Libya's large coastal cities and a primary beneficiary of the GMRP, as an export point for Chadian goods.²⁶⁶ While there reportedly has been Libyan military presence in the Aouzou Strip despite the 1994 ICJ decision discussed above, it has not derailed diplomatic relations as it did several decades ago.²⁶⁷

The relatively cordial relationship between Libya and Chad suggests that a uniquely tailored bilateral agreement could succeed. In carrying out the GMRP, Libya has gained expertise in developing water extraction infrastructure that could be useful to Chad.²⁶⁸ Chad could give Libya the right to extract Nubian water in a way that would cause Chadian water tables to drop, in exchange for Libya's promise to provide Chad with the equipment necessary to reach the falling water table. If Libya were required to purchase and install expensive equipment for Chad whenever Libya's drilling causes the Chadian water table to drop, it would incentivize Libya to use Nubian water sparingly. The idea behind socioeconomically sustainable use of non-recharging aquifers, discussed above, is not to avoid using the aquifer entirely—it is to use the aquifer in a measured way.²⁶⁹

Sudan and Chad: In September 2010, U.S. President Barack Obama made clear that unless Sudan ends the conflict in Darfur, the United States will keep existing sanctions in place and will offer Sudan no trade, investment, or development assistance.²⁷⁰ Any peaceful resolution to the Darfur conflict necessarily implicates

262. See *supra* note 154 and accompanying text.

263. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 7–8.

264. See *supra* text accompanying notes 217–226.

265. Treaty of Friendship and Alliance Between the Socialist People's Libyan Arab Jamahiriya and the Republic of Chad, Libya-Chad, June 15, 1980, 1201 U.N.T.S. 405.

266. *Seven Agreement and Two Memo for Cooperation Between Libya and Chad Signed at the End of the Higher Committee Session*, LIBYAONLINE.COM (Aug. 8, 2009), <http://www.libyaonline.com/business/details.php?id=10639>.

267. See *supra* text accompanying notes 217–226.

268. See *Facts and Figures*, THE GREAT MAN MADE RIVER PROJECT (Oct. 31, 2008), http://www.gmmra.org/en/index.php?option=com_content&view=article&id=76&Itemid=50 (detailing extensive trench excavation and pipe manufacture and installation); *Project Planning of the Great Man-Made River Project*, PROJECT MANAGER TODAY, Apr. 1995, at 18 (chronicling the infrastructure of Phases I and II of the GMRP pipeline and the project's "vast enterprise").

269. See *supra* text accompanying notes 101–104.

270. Neil MacFarquhar, *Obama Presses for Peace in Likely Sudan Partition*, N.Y. TIMES, Sept. 24, 2010, at A6, available at http://www.nytimes.com/2010/09/25/world/africa/25nations.html?_r=1&scp=1&sq=

Sudan's relationship with Chad, since as of 2007, some 140,000 Chadians had been displaced by the Darfur conflict and other civil strife.²⁷¹ Additionally, as of late 2009, there were 250,000 Sudanese refugees living in camps in Chad.²⁷²

It is widely accepted that water availability plays a significant role in the ongoing conflict in Darfur and eastern Chad.²⁷³ A 2008 study identified 23 camps for internally displaced persons (IDPs),²⁷⁴ some holding as many as 125,000 people, that could face complete groundwater depletion in a dry year.²⁷⁵ Militia attacks have destroyed many water infrastructure systems, meaning that even if individuals who fled their villages were able to return home, they would be unable to survive.²⁷⁶ The years 2004–2007 brought above-average rainfall throughout Darfur, suggesting an even greater risk of water shortages once rainfall returns to normal levels.²⁷⁷ Therefore, it would be particularly timely for Sudan and Chad to begin demonstrating that they are capable of working together by ratifying a water-management treaty.

It might seem unrealistic to think Sudanese and Chadian leaders would sit down together and negotiate a bilateral treaty over water, since as recently as 2008 the countries were accusing each other of giving safe harbor to violent rebel militias.²⁷⁸ However, there recently has been some degree of rapprochement between the two nations.²⁷⁹ Chadian president Idriss Deby Itno recently visited Sudanese leadership

Obama%20Presses%20for%20Peace%20in%20Likely%20Sudan%20Partition&st=cse. Obama also made lifting the sanctions contingent on successful administration of the January 9, 2011 referendum on southern Sudanese independence. *Id.* Southern Sudanese voted overwhelmingly for independence. *See supra* notes 55–56 and accompanying text. On Feb. 7, 2011, Obama issued a statement indicating he would consider normalizing relations with Sudan and reevaluate the country's designation as a State Sponsor of Terrorism if it ensured a peaceful transition to Southern Sudan's independence. Press Release, White House, Statement by the President on the Intent to Recognize Southern Sudan (Feb. 7, 2011), http://www.whitehouse.gov/the-press-office/2011/02/07/statement-president-intent-recognize-southern-sudan?utm_source=wh.gov&utm_medium=shorturl&utm_campaign=shorturl.

271. INTERNAL DISPLACEMENT MONITORING CENTRE, INTERNALLY DISPLACED IN CHAD: TRAPPED BETWEEN CIVIL CONFLICT AND SUDAN'S DARFUR CRISIS 11, 20 (2007), *available at* <http://www.unhcr.org/refworld/docid/4695d8672.html>.

272. Annette Rehr, *Tackling Climate Change in Eastern Chad*, UNITED NATIONS HIGH COMM'R FOR REFUGEES (Dec. 15, 2009), <http://www.unhcr.org/4b27b7039.html>.

273. *Water Find May End Darfur War*, *supra* note 54; Didrik Schanche, *Scarce Resources, Ethnic Strife Fuel Darfur Conflict*, NAT'L PUB. RADIO (Oct. 29, 2007), <http://www.npr.org/templates/story/story.php?storyId=6425093>.

274. IDPs are individuals who are forced from their homes but take refuge elsewhere within their own countries, and are therefore not officially "refugees." *See* Guiding Principles on Internal Displacement, INTERNAL DISPLACEMENT MONITORING CENTRE, [http://www.internal-displacement.org/8025708F004D404D/\(httpPages\)/168DF53B7A5D0A8C802570F800518B64?OpenDocument](http://www.internal-displacement.org/8025708F004D404D/(httpPages)/168DF53B7A5D0A8C802570F800518B64?OpenDocument) (last visited Feb. 10, 2011) (distinguishing between IDPs and refugees).

275. UNEP, DARFUR: THE CASE FOR DROUGHT PREPAREDNESS 18, 19 tbl.5 (2008), *available at* http://postconflict.unep.ch/publications/darfur_drought.pdf.

276. Eric Reeves, *Humanitarian Conditions in Darfur: An Overview (Part 2)*, SUDANREEVES.ORG (July 3, 2010), <http://www.sudanreeves.org/Article266.html>.

277. *See* UNEP, *supra* note 275, at 4 (noting that above-average rainfall could not be relied upon).

278. *See, e.g., Chad Accused Sudan on Rebel Raid*, BBC NEWS, Apr. 2, 2008, <http://news.bbc.co.uk/2/hi/7325171.stm> (describing one accusation by the Chadian government that Sudanese forces were assisting Chadian insurgents).

279. *See* Jeffrey Gettleman, *Regional Shift Helps Darfur, Amid Doubts*, N.Y. TIMES, Feb. 25, 2010, at A9, *available at* http://www.nytimes.com/2010/02/25/world/africa/25darfur.html?_r=1&ref=chad (noting improvement in Sudan-Chad relations); Sudarsan Raghavan, *U.S. Envoy Pushes for Darfur Peace Deal Before Sudanese Elections*, WASH. POST, Mar. 10, 2010, <http://www.washingtonpost.com/wp-dyn/content/article/2010/03/10/AR2010031003105.html> (noting rapprochement between the two countries); Opheera McDoom, *Sudan, Chad Agree "Definitive End" to Proxy Wars*, REUTERS, Feb. 9, 2010, *available at* <http://uk.reuters.com/article/idUKTRE6183EH20100209> (detailing countries' agreement

in Khartoum.²⁸⁰ Sudanese president Omar al-Bashir returned the favor, traveling to N'Djamena several months later.²⁸¹ It was al-Bashir's first trip out of Sudan since being indicted by the International Criminal Court (ICC) for war crimes in 2009.²⁸² Deby's willingness to allow al-Bashir into and out of Chad was particularly notable since, as an ICC member, Chad was required to arrest him and turn him over to the ICC.²⁸³

Most of the camps in eastern Chad and Darfur do not lie above the NSAS.²⁸⁴ However, the NSAS is still relevant to successful resolution of the Darfur conflict for two reasons. First, the NSAS will be vital to supplying water to certain areas that have taken on IDPs and refugees during the conflict.²⁸⁵ For example, Nyala, a town south of Darfur whose population has grown as a result of the conflict, already plans to begin piping in Nubian water.²⁸⁶ Second, the NSAS could support agricultural operations, allowing refugees and IDPs to earn livelihoods.²⁸⁷ Since one of the primary "carrots" being provided by the Obama administration is funding for agricultural development,²⁸⁸ a water agreement geared toward future agricultural development in Darfur would be a positive development.

At the very least, a bilateral NSAS treaty between Sudan and Chad would further solidify relations between the two countries. It would show that the countries are prepared to proactively move past the Darfur conflict, which could yield new forms of economic support. A bilateral treaty also would likely help lay the groundwork for future efforts to effectively resettle hundreds of thousands of refugees and IDPs.

Which components of a regional NSAS agreement should the Nubian states allow to be preempted by bilateral agreements? While encouraging bilateral cooperation generally, the Nubian states must ensure that certain aspects of the NSAS are managed at the regional level. The 2008 Resolution allows states to make bilateral agreements with respect to anything that does not "adversely affect[], to a significant extent, the utilization by one or more other aquifer states."²⁸⁹ Because it is often impossible to understand the impact that a certain activity will have on a TBA until

to engage in talks and joint development programs).

280. McDoom, *supra* note 279.

281. *Sudan's President Bashir Defies Arrest Warrant in Chad*, BBC NEWS, July 21, 2010, <http://www.bbc.co.uk/news/world-africa-10718399>.

282. *Id.*

283. *Id.*

284. TEARFUND, DARFUR: WATER SUPPLY IN A VULNERABLE ENVIRONMENT vii (2007), available at <http://www.tearfund.org/webdocs/website/Campaigning/Policy%20and%20research/Darfur-%20%20Water%20supply%20in%20a%20vulnerable%20environment.pdf>. *But see* UNEP, *supra* note 275, at 19 tbl.5 (identifying one camp, Kutum Rural, that relies on Nubian water).

285. *See* UNEP, *supra* note 275, at 4 (stating importance of water infrastructure to support areas with large population influxes based on the conflict).

286. TEARFUND, *supra* note 284, at 23.

287. *See id.* at vii (explaining that while piping water all the way from the NSAS to the camps in southern Darfur is not presently viable, the NSAS could be a resource for remote commercial farming).

288. MacFarquhar, *supra* note 270.

289. 2008 Resolution, *supra* note 25, art. 9.

years after the activity takes place,²⁹⁰ the Nubian states should narrowly construe the bilateral freedoms envisioned by the 2008 Resolution.

As discussed above, an NSAS agreement should include a residual jurisdictional clause, in order to encourage Nubian states to draft their own dispute resolution mechanisms.²⁹¹ The Nubian states also could use bilateral means to meet established extraction limits, through specifically tailored combinations of drilling technology and well spacing. Overall, however, the Nubian states must not allow bilateral treaties to depart from the overarching emphasis on encouraging socioeconomically sustainable NSAS usage. The means by which to reach the limits, not the limits themselves, should be the province of the bilateral treaties between Nubian states.

IV. CONCLUSION

Some experts believe that if managed properly, the NSAS will last for centuries.²⁹² Scientific research suggests a minimal transboundary impact from current and future Nubian extraction.²⁹³ Based on this, some argue that international management of the NSAS is unnecessary.²⁹⁴ This view is short-sighted, since the longevity of a non-recharging aquifer is not determined simply by its overall volume and flow. If the water table decreases so far that poorer countries cannot afford the technology necessary to reach the aquifer, the overall volume of the aquifer becomes irrelevant. If unregulated future usage causes different sub-basins within the NSAS to become disconnected, leaving certain overlying areas with no access to water whatsoever,²⁹⁵ the overall volume of the aquifer becomes irrelevant. If the water is polluted by agriculture or wastewater, or if saline intrusion occurs,²⁹⁶ the overall volume of the aquifer becomes irrelevant. Finally, no matter how well-intentioned and scientifically sound the usage of a TBA may initially seem, there is a significant time lag before the impact of that usage can be fully understood.²⁹⁷

Given these many risks, now is the time for the Nubian states to push ahead with a binding regional treaty. The NAP is in the process of laying a framework for multilateral cooperation. In the initial NAP project proposal, the Nubian states identified the NSAS as a “significant example and global reference for rational management” of non-recharging aquifers.²⁹⁸ Hopefully, after the NAP concludes, the Nubian states will make good on this pledge to be an example for the rest of the world by ratifying one of the first comprehensive multilateral transboundary aquifer treaties.

290. Scheumann & Alker, *supra* note 42, at 800–01.

291. *See supra* text accompanying notes 195–205.

292. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 11.

293. *See* Gremillion, *supra* note 36, at 5 (discussing modeling technique used to gauge “anticipated transboundary impacts” of pumping on the NSAS and comparing results with current observations).

294. *See, e.g.*, Al-Eryani et al., *supra* note 101, at 32–33 (citing one scholar who argues that the proposed NSAS development schemes are small enough that they can proceed according to domestic laws).

295. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 11.

296. *Id.*

297. Scheumann & Alker, *supra* note 42, at 800–01.

298. MEDIUM-SIZED PROPOSAL, *supra* note 5, at 45.