Colorado Journal of International Environmental Law and Policy

Volume 20, Number 3 Summer 2009

ISSN: 1050-0391

Subscriptions

	Personal	Institutional
Single Issue	$15.00	$25.00
Entire Volume with Yearbook	$25.00	$45.00

Payable in US currency or equivalent only. Check should accompany order.
Please add $5 per single issue for postage and $15 per volume for overseas postage.
All correspondence regarding subscriptions should be addressed to:

Managing Editor
Colorado Journal of International Environmental Law and Policy
University of Colorado Law School
Campus Box 401
Boulder, CO 80309-0401 - USA

Manuscripts

The *Journal* invites submission of manuscripts to be considered for publication. Manuscripts may be mailed to the address below or e-mailed directly to cjielp@colorado.edu. Unsolicited manuscripts can be returned if accompanied by postage and handling fees of $3.00 for 3rd class or $5.00 for 1st class mail. Manuscripts should be sent to:

Lead Articles Editor
Colorado Journal of International Environmental Law and Policy
University of Colorado Law School
Campus Box 401
Boulder, CO 80309-0401 - USA

E-mail: cjielp@colorado.edu
Internet Site: http://www.colorado.edu/law/cjielp/

Statement of Purpose and Editorial Policy

The *Colorado Journal of International Environmental Law and Policy* is an interdisciplinary journal dedicated to the examination of environmental issues with international implications. It provides a forum for: (1) in-depth analysis of the legal or public policy implications of problems related to the global environment; (2) articulation and examination of proposals and new ideas for the management and resolution of international environmental concerns; and (3) description of current developments and opinions related to international environmental law and policy.

The *Journal* has a diverse international audience including policy makers, scholars, and organizations concerned with environmental issues. Specific audiences include scholars and students at law schools, schools of international affairs, schools of public policy, programs of study involving the natural and social sciences, and officials in governmental and nongovernmental organizations.

The *Journal* is interested in articles submitted by authors that fall within this stated purpose. Authors uncertain whether their article is suitable for *Journal* publication are encouraged to contact the Editor-in-Chief to discuss the subject matter of their article.

Articles or other materials from authors may be accepted for publication prior to undergoing any editorial modifications. Such materials may also be conditionally accepted with the understanding that the author undertake major modifications prior to publication. Where appropriate, papers may be reviewed by experts within the relevant field to aid the *Journal*'s publication decisions and editing processes. Article Editors will work with authors to refine the written product throughout the publication process, with the overall objective being to enhance the effectiveness of written communication.

Published three times annually by the
Colorado Journal of International Environmental Law, Inc.
University of Colorado Law School
320 Wolf Law Building, Campus Box 401, Boulder, CO 80309-0401,
an incorporated association of students sponsored by
UNIVERSITY OF COLORADO LAW SCHOOL STUDENT FUNDS

Cite as: 20 COLO. J. INT'L ENVTL. L. & POL'Y ___ (2009).

Colorado Journal of International Environmental Law and Policy

Volume 20, Number 3 Summer 2009

Board of Editors

Staff Writers

Advisory Board

JAMES N. CORBRIDGE
Professor Emeritus, *University of Colorado Law School*

DAVID GETCHES
Dean, *University of Colorado Law School*

MICHAEL GLANTZ
Senior Scientist, *Environmental & Societal Impacts Group, National Center for Atmospheric Research*

ANITA HALVORSSEN
Director, *Global Legal Solutions*

HOWARD KENISON
Partner, *Lindquist & Vennum, P.L.L.P.*

WILLIAM L. THOMAS
Counsel, *Clifford Chance US L.L.P.*

Ex-Officio Advisory Board

CHRISTOPHER FRY
Attorney at Law,
The Christopher W. Fry Law Firm, LLC

BRANDON KARPEN
Staff Attorney,
U. S. District Court, District of Idaho

MELISSA M. BONESS
Attorney at Law

JEREMY BOTKINS
Attorney at Law

DAVID BOWER
Attorney at Law

ALAINA STEDILLE
Attorney at Law

RICHARD MURRAY
Attorney at Law

CHRISTOPHER F. KNUD-HANSEN,
Attorney and Scientist,
SolarBee Pump Systems, Inc.

JANET LEE
Attorney at Law

RYAN MCGEE
Attorney, *Davis Graham & Stubbs L.L.P.*

JOHN P. MORGAN
Attorney, *Perkins Coie L.L.P.*

EZEKIEL PETERS
Attorney at Law

Faculty Advisor

WILLIAM BOYD
Associate Professor of Law
University of Colorado Law School

Office Manager

MARTHA UTCHENIK

The University of Colorado Law School

Law School Faculty, 2008-2009

Deans

DAVID H. GETCHES, *Dean and Raphael J. Moses Professor of Natural Resources Law*. A.B., Occidental College; J.D., University of Southern California.

DAYNA BOWEN MATTHEW, *Associate Dean for Academic Affairs and Professor of Law,* A.B., Harvard-Radcliffe; J.D., University of Virginia.

PHILIP J. WEISER, *Associate Dean for Research, Professor of Law, and Executive Director of the Silicon Flatirons Telecommunications Program*. B.A., Swarthmore College; J.D., New York University.

LORENZO A. TRUJILLO, *Assistant Dean for Students and Professional Programs and Professor Attendant Rank*, B.A., University of Colorado; M.A., University of Colorado; Ed.D., University of San Francisco; J.D., University of Colorado.

SUSANI CLAYTON, *Assistant Dean for Career Development*. B.A., University of Colorado; M.A., University of Arizona; J.D., University of Denver College of Law.

KRISTINE H. MCCORD, *Assistant Dean for Admissions and Financial Aid*. B.S., University of North Carolina; J.D., George Mason University.

Emeritus Faculty

CLIFFORD J. CALHOUN, *Professor Emeritus*. A.B., LL.B., Harvard University.

HOMER H. CLARK, JR., *Professor Emeritus*. A.B., LL.D., Amherst College; LL.B., LL.M., Harvard University.

JAMES N. CORBRIDGE, JR., *Professor Emeritus*. A.B., Brown University; LL.B., Yale University.

TED J. FIFLIS, *Professor Emeritus*. B.S., Northwestern University; LL.B., Harvard University.

DAVID S. HILL, *Professor Emeritus*. B.S., J.D., University of Nebraska.

J. DENNIS HYNES, *Professor Emeritus*. B.A., LL.B., University of Colorado.

HOWARD C. KLEMME, *Professor Emeritus*. B.A., LL.B., University of Colorado; LL.M., Yale University.

COURTLAND H. PETERSON, *Nicholas Doman Professor of International Law Emeritus*. B.A., LL.B., University of Colorado; M. Comp. L., University of Chicago; Dr. Jur., University of Freiburg (Germany).

WILLIAM E. RENTFRO, *Professor Emeritus*. B.A., University of Colorado; Th.M., LL.B., University of Denver.

DON W. SEARS, *Professor Emeritus*. B.S., J.D., Ohio State University.

PETER N. SIMON, *Professor Emeritus*. B.S., M.D., University of Wisconsin; J.D., University of California, Berkeley.

NORTON L. STEUBEN, *Professor Emeritus*. A.B., J.D., University of Michigan.

ARTHUR H. TRAVERS, JR., *Professor Emeritus*. B.A., Grinnell College; LL.B., Harvard University.

Tenured and Tenure-Track Faculty

BARBARA A. BINTLIFF, *Nicholas Rosenbaum Professor of Law and Law Library Director*. B.A., Central Washington State College; J.D., M.L.L., University of Washington.

WILLIAM BOYD, *Associate Professor of Law*. Ph.D., University of California, Berkeley; J.D., Stanford University.

HAROLD H. BRUFF, *Charles Inglis Thomson Professor of Law*. B.A., Williams College; J.D., Harvard University.

MAXINE BURKETT, *Associate Professor of Law*. B.A., Williams College; J.D., University of California, Berkeley.

EMILY M. CALHOUN, *Professor of Law*. B.A., M.A., Texas Tech University; J.D., University of Texas.

PAUL F. CAMPOS, *Professor of Law*. A.B., M.A., J.D., University of Michigan.

RICHARD B. COLLINS, *Professor of Law and Director of the Byron R. White Center for the Study of American Constitutional Law*. B.A., Yale College; LL.B., Harvard University.

NESTOR DAVIDSON, *Associate Professor of Law*. A.B., Harvard University; J.D., Columbia University.

WAYNE M. GAZUR, *Professor of Law*. B.S., University of Wyoming; J.D., University of Colorado; LL.M., University of Denver.

LAKSHMAN D. GURUSWAMY, *Professor of Law*. LL.B., Sri Lanka; Ph.D., University of Durham, U.K.

MELISSA HART, *Associate Professor of Law*. B.A., Harvard-Radcliffe College; J.D., Harvard University.

CLARE HUNTINGTON, *Associate Professor of Law*. B.A., Oberlin College; J.D., Columbia University.

SARAH A. KRAKOFF, *Associate Professor of Law*. B.A., Yale University; LL.B, University of California, Berkeley.

MARK J. LOEWENSTEIN, *Nicholas A. Rosenbaum Professor of Law*. A.B., J.D., University of Illinois.

SCOTT A. MOSS, *Associate Professor of Law*. B.A., M.A., Stanford University; J.D., Harvard University.

CHRISTOPHER B. MUELLER, *Henry S. Lindsley Professor of Procedure and Advocacy*. A.B., Haverford College; J.D., University of California, Berkeley.

ROBERT F. NAGEL, *Ira C. Rothgerber, Jr. Professor of Constitutional Law*. B.A., Swarthmore College; J.D., Yale University.

HELEN L. NORTON, *Associate Professor of Law*. B.A., Stanford University; J.D., University of California, Berkeley.

PAUL OHM, *Associate Professor of Law*. B.S./B.A., Yale University; J.D., University of California, Los Angeles.

SCOTT R. PEPPET, *Associate Professor of Law*. B.A., Cornell University; J.D., Harvard University.

WILLIAM T. PIZZI, *Professor of Law*. A.B., Holy Cross College; M.A., University of Massachusetts; J.D., Harvard University.

CAROLYN B. RAMSEY, *Associate Professor of Law*. B.A., University of California, Irvine; A.M., Stanford University; J.D., Stanford University.

PIERRE J. SCHLAG, *Byron White Professor of Constitutional Law*. B.A., Yale University; J.D., University of California, Los Angeles.

AMY J. SCHMITZ, *Associate Professor of Law*. B.A., Drake University; J.D., University of Minnesota.

LAURA SPITZ, *Associate Professor of Law.* B.A., University of Toronto; LL.B., University of British Columbia Faculty of Law; J.S.D., Cornell University.

ANDREW SCHWARTZ, *Associate Professor of Law.* B.A., Brown University; J.D., Columbia University.

MARK SQUILLACE, *Professor of Law and Director of the Natural Resources Law Center*. B.S., Michigan State University; J.D., University of Utah.

HARRY SURDEN, *Associate Professor of Law.* B.A., Cornell University; J.D., Stanford University.

MICHAEL J. WAGGONER, *Associate Professor of Law*. A.B., Stanford University; LL.B., Harvard University.

MARIANNE WESSON, *Professor of Law and Wolf-Nichol Fellow*. A.B., Vassar College; J.D., University of Texas.

AHMED A. WHITE, *Associate Professor of Law.* B.A., Southern University and A & M College; J.D., Yale University.

CHARLES F. WILKINSON, *University's Distinguished Professor and Moses Lasky Professor of Law*. B.A., Denison University; LL.B., Stanford University.

Research and Clinical Faculty

NORMAN F. AARONSON, *Clinical Professor Emeritus, Legal Aid and Defender Program*. A.B., Brandeis University; J.D., Boston University.

J. BRAD BERNTHAL, *Associate Clinical Professor of Law*. B.A., University of Kansas; J.D., University of Colorado.

DEBORAH J. CANTRELL, *Director of Clinical Programs & Associate Professor of Law*. B.A., Smith College; M.A., University of California, Los Angeles; J.D., University of Southern California.

MARGARET ANN ENGLAND, *Associate Clinical Professor*, *Legal Aid and Defender Program*. B.A., University of Michigan; J.D., University of Denver.

H. PATRICK FURMAN, *Clinical Professor Emeritus, Legal Aid and Defender Program, and Director of Clinical Programs*. B.A., J.D., University of Colorado.

COLENE ROBINSON, *Associate Clinical Professor, Juvenile and Family Law*. B.A., Valparaiso University; J.D., Loyola University School of Law, Chicago.

JILL E. TOMPKINS, *Clinical Professor and Director of the American Indian Law Clinic*. B.A., The King's College; J.D., University of Maine.

Legal Writing and Appellate Advocacy Faculty

AL CANNER, *Legal Writing Professor*. B.A., Brandeis University; J.D., University of Colorado.

CATHERINE DU BOIS, *Legal Writing Professor*.

DEREK H. KIERNAN-JOHNSON, *Legal Writing Professor*. A.B. Princeton University; J.D., University of Michigan.

NATALIE MACK, *Legal Writing Professor*. B.S., University of South Carolina; J.D., University of Colorado.

GABRIELLE M. STAFFORD, *Legal Writing Professor*. B.A., University of Pennsylvania; J.D., Boston University.

TODD M. STAFFORD, *Legal Writing Professor*. B.A., Southern Methodist University; J.D., Duke University.

Law Library Faculty

ALICIA BRILLON, *Reference Librarian*. B.A., M.L.I.S., University of Washington; J.D., Seattle University.

GEORGIA K. BRISCOE, *Associate Director and Head of Technical Services*. B.S., Washington State University; M.A., University of San Diego; M.L.S., University of Michigan.

YUMIN JIANG, *Technical Services Librarian* M.S., University of Illinois, Urbana-Champaign; M.A., University of Wisconsin.

ROBERT LINZ, *Head of Public Services and Associate Director of Law Library.*

ALAN PANNELL, *Reference Librarian*. B.A. University of Oklahoma; J.D. Western New England College; M.A. University of Arizona.

KAREN SELDEN, *Catalog Librarian*. B.S., Pennsylvania State University; M.L.S., Simmons College.

JANE E. THOMPSON, *Head of Faculty Services*. B.A., University of Missouri; M.A., J.D., University of Denver.

Adjunct, Adjoint and Visiting Faculty

GARRY R. APPEL, *Attorney at Law, Appel & Lucas, P.C., Denver, Colorado*. B.A., J.D., University of Colorado.

HANK BROWN, *President Emeritus University of Colorado; Professor of Political Science, Adjunct Professor of Law, Boulder, Colorado*. B.S., University of Colorado; J.D., University of Colorado; M.L., George Washington University.

GEORGE BRAUCHLER, *Deputy District Attorney, First Judicial District, Golden, Colorado*. B.A., J.D., University of Colorado.

SHARON CAUEFIELD, *Attorney at Law, Boulder, Colorado*. B.A., J.D., University of Colorado.

STEVEN CLYMER, *Attorney at Law, ACCORD Dispute Resolution Services, Boulder, Colorado*. A.B., St. Louis University; J.D., Case Western Reserve University.

CHRISTINE A. COATES, *Attorney at Law, Boulder, Colorado*. B.A., Houston Baptist University; M.Ed., University of Houston; J.D., University of Colorado.

THE HONORABLE SEAN CONNELLY, *Judge, Colorado Court of Appeals, Denver, Colorado*. B.A., Fairfield University; J.D., Catholic University of America.

TOM CONNOLLY, *Chairman of the Board and CEO, Aeroturbine Energy Corporation and Partner, Connolly Rosania & Lofstedt, PC, Colorado*. B.A., J.D., Ohio State University.

DARLA DANIEL, *Attorney, Zisman Ingraham & Daniel, Denver, Colorado*. B.A., Trinity University; J.D., University of Colorado.

THE HONORABLE WILEY DANIEL, *Judge, United States District Court for the District of Colorado*. B.A., J.D., Howard University.

DANIEL N. DEASY, *Attorney at Law, George Browning & Associates, Westminster, Colorado*. B.A., J.D., University of Colorado.

BRUCE DIERKING, *Attorney at Law, Boulder, Colorado*. B.A., University of Northern Colorado; J.D., University of Colorado.

THE HONORABLE ALLISON HARTWELL EID, *Justice, Colorado Supreme Court, Denver, Colorado*. A.B., Stanford University; J.D., University of Chicago.

TROY EID, *U.S. Attorney, Denver, Colorado*. A.B., Stanford University; J.D., University of Chicago.

ERIC ELIFF, *Partner, Morrison Foerster, Denver, Colorado*. B.S., Washington University; J.D., University of Colorado.

ROGER FLYNN, *Executive Director, Western Mining Action Project, Boulder, Colorado*. B.S., Lehigh University; J.D., University of Colorado.

CRAIG C. GARBY, *Partner, Rothgerber Johnson & Lyons LLP, Denver, Colorado*. B.A., University of Colorado; Graduate Research, Waseda University, Tokyo, Japan; M.P.A., Cornell University; J.D., Stanford University.

HANNAH R. GARRY, *Former Deputy Chief of Cabinet and Legal Officer at the International Criminal Tribunal for the Former Yugoslavia, The Hague, Netherlands*. B.A., Wheaton College; M.I.A., Columbia University; J.D., University of California, Berkeley.

THE HONORABLE NEIL GORSUCH, *Judge, U.S. Court of Appeals for the Tenth Circuit, Denver, Colorado*. B.A, Columbia University; J.D., Harvard University; Ph.D., Oxford University.

RANDI GRASSGREEN, *Shareholder, Gelt & Grassgreen P.C., Denver, Colorado.* BBA, M.T., University of North Carolina; J.D., University of Colorado.

AYA GRUBER, *Associate Professor of Law, Florida International University College of Law*. B.A., University of California, Berkley; J.D., Harvard University.

JASON D. HAISLMAIER, *Partner, Holme Roberts & Owen LLP, Boulder, Colorado*. B.S., Northwestern University; J.D., Franklin Pierce Law Center.

NATALIE HANLON-LEH, *Partner, Faegre & Benson LLP, Denver, Colorado.* B.S., University of Colorado; J.D., Harvard University.

ANDREW HARTMAN, *Partner, Cooley Godward LLP, Broomfield, Colorado.* A.B., University of Michigan; J.D., Georgetown University.

KARI HERSHEY, *Partner, Budman & Hershey LLC, Denver, Colorado*. *B.A. Michigan State University;* J.D., University of Denver.

THE HONORABLE MORRIS B. HOFFMAN, *Judge, Denver District Court, Denver, Colorado*. B.A., J.D., University of Colorado.

ROBERT M. HOROWITZ, *Partner, Pearson Horowitz & Burnett PC, Denver, Colorado*. J.D., University of Colorado.

DOUGLAS KARET, *Partner, Holloway, Brabee & Karet PC, Steamboat Springs, Colorado*. B.S., University of Massachusetts; M.S., J.D., University of Colorado.

DONALD G. KEMPF, JR., *Senior Advisor, Gleacher Partners; Senior Advisor, Blaqwell, Inc.* A.C. Villanova University; L.L.B., Harvard Law School; M.B.A., University of Chicago.

YOUNG KIM, *Scholar-in-Residence*. B.A., Shimer College; J.D., Northwestern University; M.Sc. London School of Economics.

HAMID M. KHAN, *Attorney, McKenna Long & Aldridge LLP, Denver, Colorado*. B.S., University of Wyoming; J.D., University of Michigan.

CAROL B. LEHMAN, *Law Office of Carol B. Lehman, Lakewood, Colorado*. B.A., Lawrence University; M.S., University of Wisconsin; J.D., University of Colorado.

HAIHONG LIU, *Professor, Shanghai International Students University.* LL.M., University of Mannheim.

JASON MENDELSON, *Managing Director, Foundry Group, Boulder, Colorado*. B.A., University of Michigan; J.D., University of Michigan.

JACK MILLS, *Attorney at Law, A.J. Mills, P.C., Boulder, Colorado*. BBA, LL.B., University of Oklahoma.

ROBERT NICHOLS, *Adjunct Professor*. B.A., Baylor University; J.D., University of Oklahoma.

PATRICK O'ROURKE, *Head Litigation Attorney, Office of University Counsel, University of Colorado*. J.D., Georgetown University.

VICKI PATTON, *Attorney, Environmental Defense Fund*. B.S., University of Arizona; J.D., New York University.

ROGER M. PHILLIPS, A*ttorney, Robert M Phillips LLC*. B.A., Emory University; J.D., University of Colorado.

MICHAEL L. RADELET, *Professor of Sociology, University of Colorado, Boulder, Colorado*. B.A., Michigan State; M.A., Eastern Michigan University; Ph.D., Purdue University.

THE HONORABLE NANCY E. RICE, *Justice, Colorado Supreme Court, Denver, Colorado*. B.A., Tufts University; J.D., University of Utah.

THE HONORABLE EDWARD J. RICHARDSON, *Judge, Retired, State of Florida Circuit Court*. A.S., Brevard Community College; B.S., University of Florida; J.D., Florida State University.

TRISH ROGERS, *Partner, Moye White LLP, Denver, Colorado*. B.A., University of Connecticut; J.D., Georgia State University.

THE HONORABLE ROBERT RUSSEL, *Judge, Colorado Court of Appeals, Denver, Colorado*. J.D., University of Colorado.

MICHAEL SAUL, *Attorney, Rocky Mountain Natural Resource Center*. B.S., J.D., Yale University.

KARIN P. SHELDON, *Executive Director, Western Resource Advocates*. A.B., Vassar College; J.D., University of Washington.

KATHERINE SPENGLER, *Deputy Colorado State Public Defender, Golden, Colorado*. J.D., University of Colorado.

WAYNE STACY, *Attorney, Cooley Godward, Denver, Colorado*. B.S., Southern Methodist University; J.D., George Washington University.

CLIFF STRICKLIN, *Partner, Holland & Hart LLP, Boulder, Colorado*. B.A., Baylor University; J.D., Washington & Lee University.

NATHANIEL TRELEASE, *President, WebCredenza, Inc., Denver, Colorado*. B.S., J.D., University of Wyoming; L.L.M, University of Denver.

THE HONORABLE TIMOTHY M. TYMKOVICH, *Judge, U.S. Court of Appeals for the Tenth Circuit, Denver, Colorado*. B.A., Colorado College; J.D., University of Colorado.

NINA WANG, *Partner, Faegre & Benson LLP, Denver, Colorado*. A.B., Washington University; J.D., Harvard University.

PAUL WASHINGTON, *President, LJS Holdings LLC, Boulder, Colorado*. B.S., University of California, Berkley; J.D., University of California, Berkley.

LISA WAYNE, *Attorney at Law, William Murphy & Associates, Baltimore, Maryland*. B.A., University of Colorado, J.D., Pepperdine University.

MAUREEN WESTON, *Professor of Law, Pepperdine University School of Law*. B.A., University of Denver; J.D., University of Colorado.

Research Associates

KEVIN L. DORAN, *Research Fellow, Center for Energy & Environmental Security (CEES)*. B.A., Andrews University; J.D., University of Colorado.

DOUGLAS S. KENNEY, *Research Associate, Natural Resources Law Center*. B.A., University of Colorado; M.S., University of Michigan School of Natural Resources and Environment; Ph.D., Cornell University.

KATHRYN M. MUTZ, *Research Associate, Natural Resources Law Center*. B.A., University of Chicago; M.S., Utah State University; J.D., University of Colorado.

ADAM REED, *Research Fellow, Center for Energy & Environmental Security (CEES)*. B.A., Southern Methodist University; J.D., University of Colorado.

JILL RENNERT, *Research Associate, Silicon Flatirons Telecommunications Program*.

JULIE TEEL, *Senior Research Associate, Center for Energy & Environmental Security*. B.S., University of California, Berkeley; J.D., New York University.

JILL VAN MATRE, *Research Associate, Silicon Flatirons Telecommunications Program*. B.S., Indiana University; J.D., University of Colorado.

Thanks to Our 2008-2009 Endowment Donors

Daniel Magraw and Lucinda Low
Gold Circle

Staunton and Michelle Golding
Copper Circle

Alex Andrews
Gwen Beacham and Gary Fleener
David and Ann Getches
Elizabeth Rohrbough
Alumni

Contributions

The *Journal* is currently focused on establishing a permanent endowment that will help assure the long-term success of its mission. If you are interested in helping with this goal, please contact us. In return for your generous contributions, we offer recognition in our journal and a complimentary subscription for certain levels of giving. Please contact us at:

Endowment
Colorado Journal of International Environmental Law and Policy
University of Colorado Law School
Campus Box 401
Boulder, CO 80309-0401 - USA

E-mail: cjielp@colorado.edu

Colorado Journal of International Environmental Law and Policy

Volume 20, Number 3 Summer 2009

Table of Contents

Articles

BETWEEN AMBIVALENCE AND NECESSITY: OCCLUSIONS ON THE PATH TOWARD A BASIN-WIDE TREATY IN THE NILE BASIN
TAKELE SOBOKA BULTO 291

"CLOUD BUSTERS": REFLECTIONS ON THE RIGHT TO WATER IN CLOUDS AND A SEARCH FOR INTERNATIONAL LAW RULES
TAREK MAZJOUB, FABIENNE QUILLERÉ- MAZJOUB, MOHAMED ABDEL RAOUF, & MIRA EL- MAZJOUB 321

Notes & Comments

MORALS ON STILTS: ASSESSING THE VALUE OF INTERGENERATIONAL ENVIRONMENTAL ETHICS
TREVOR R. UPDEGRAFF 367

NUCLEAR POWER AS CARBON-FREE ENERGY? THE GLOBAL NUCLEAR ENERGY PARTNERSHIP
MARIAH ZEBROWSKI 391

Articles

Between Ambivalence and Necessity: Occlusions on the Path Toward a Basin-Wide Treaty in the Nile Basin

Takele Soboka Bulto*

ABSTRACT

While the Nile riparian states are engaged in legal, political, and doctrinal wrangling pertaining to state sovereignty on the way to a basin-wide agreement over the equitable allocation of their common waters, each day brings a heavy but avertable cost on the lives, security, and economic and environmental well-being of the tenth of the African population that inhabits the Nile Basin. The riparian states of the Nile Basin do not have any significant alternatives to the joint management and equitable utilization of the Nile waters. This Article seeks to identify some of the obstacles that hinder the process of treaty formation over the allocation of the Nile waters among the riparian states. It examines the role of some riparian states' adherence to colonial treaties and the mindset created thereby, the culture of mistrust surrounding interstate interactions, doctrinal controversies, attitudes of the riparians toward the formation of a basin-wide treaty, and problems of good faith on the part of the riparian states. The Article argues that the success of the Nile

* LL.B (Addis Ababa University), LL.M (University of Pretoria), M.A (Addis Ababa University), PhD Candidate and Teaching Fellow, Melbourne Law School, The University of Melbourne. The author can be contacted at t.bulto@pgrad.unimelb.edu.au.

Basin Initiative ("NBI"), and the resultant establishment of a legal and institutional mechanism for the eventual equitable and reasonable allocation of the Nile waters, hinges on the removal of these obstacles.

I. INTRODUCTION

> Watersheds come in families; nested levels of intimacy. On the grandest scale the hydrologic web is like all humanity—Serbs, Russians, Koyukon Indians, Amish, the billion lives in the People's Republic of China—it's broadly troubled, but it's hard to know how to help. As you work upstream toward home, you're more closely related. The big river is like your nation, a little out of hand. The lake is your cousin. The creek is your sister. The pond is her child. And, for better or worse, in sickness and in health, you're married to your sink.[1]

Basin-wide arrangements such as the Nile Basin Initiative ("NBI")[2] are crucial not only to fill the missing links of general international law but also to regulate specific regional problems.[3] If effective, these agreements are better situated to address the special peculiarities of a given hydropolitical region than are the general rules of international law.[4] Conversely, rules of international law could provide a general framework for basin states that negotiate the modus operandi of their

---

[1] Maude Barlow & Tony Clarke, Blue Gold: The Fight to Stop the Corporate Theft of the World's Water xi (2002) (quoting Michael Parfit, National Geographic).

2. Launched in February 1999 in Dar Es Salaam, Tanzania, with all the Nile riparian states but Eritrea as members, the NBI is a temporary mechanism through which the basin states would establish a basin-wide treaty and institutional mechanism for the equitable and reasonable sharing of the common waters. It is expected to draft a basin-wide treaty binding upon all riparian states that establishes a Nile Basin Commission with powers to study and resolve conflicts over the utilization of the Nile waters. It operates from its headquarters in Kampala, Uganda. Nile Basin Initiative, http://www.nilebasin.org/index.php?option=com_content&task=view&id=13&itemid=42 (last visited Nov. 20, 2008).

3. Basin-specific treaties complement and supplement the general rules of international law regulating the use of international watercourses. In cases of conflict between the two sets of rules, the basin-wide treaty prevails through the legal maxim that special rules prevail over the general (*lex specialis rule)* and the general rules give way to the special ones on the particular subject. *See* Philippe Sands, *Watercourses, Environment and the International Court of Justice: The Gabcikovo-Nagymaros Case*, *in International Watercourses: Enhancing Cooperation and Managing Conflict*, 1998 PROC. OF A WORLD BANK SEMINAR 121 (Salman M. A. Salman & Laurence Boisson de Chazournes, eds.) [hereinafter *International Watercourses*].

4. *See* R. D. Hayton, *The Formation of the Customary Rules of International Drainage Basin Law*, *in* THE LAW OF INTERNATIONAL DRAINAGE BASINS 862 (A. H. Garretson, R. D. Hayton, & C. J. Olmstead eds., 1967).

respective access to common waters like the Nile.[5] As Keith Hayward observed, "a clear view of the requirements of international law can provide States with a reference point from which to assimilate the diverse influences that shape their actions and interactions with their riparian neighbors."[6] It is in the same vein that the 1997 United Nations ("UN") Convention on Non-Navigational Uses of International Watercourses ("Watercourse Convention")[7] recognized "the 'framework' character of the [Watercourse] Convention. . . [and it] encourage[s] parties to follow the general principles of the Convention. . . . in their specific agreements without preventing them from departing from it."[8]

Attempts to develop rules of international law pertaining to the regulation of a state's right to consumptive utilization of international waters have met only modest success in terms of codifying binding and universally applicable rules. One scholar observed that "[i]nternational river law is one of the most unsettled areas of international law; it is an area where there are few rules of general application or validity."[9] The only universal instrument that promises to be binding in addressing interstate non-navigational utilization of international waters to date is the Watercourse Convention, which has not entered into force as it is awaiting the necessary trigger—ratification.[10] In the absence of general rules of international law that are applicable to all state parties in the world, the regulation of a state's right to access the waters of an international river, such as the Nile, has been left to the bilateral or multilateral agreements among the riparian states in a given water basin. In the Nile Basin,[11] such a regulatory framework is expected to result

5. *See* Stephen C. McCaffrey, *A Human Right to Water: Domestic and International Implications*, 5 GEO. INT'L ENVTL. L. REV. 1, 17-18 (1992).

6. Keith Hayward, *Supplying Basin-Wide Reforms with an Independent Assessment Applying International Water Law: Case Study of the Dnieper River*, 18 COLO. J. INT'L EVNTL. L. & POL'Y 633, 633 (2007).

7. Convention on the Law of the Non-Navigational Uses of International Watercourses, G.A. Res. 51/229, 51st Sess., Supp. No. 49, U.N. Doc. A/51/49 (May 21, 1997), *available at* http://untreaty.un.org/ilc/texts/instruments/English/conventions/8_3_1997.pdf [hereinafter Watercourse Convention]. The adoption of the Convention saw 103 states voting in favor, three against (Burundi, China and Turkey), and 27 abstaining.

8. Stephen C. McCaffrey & Mpazi Sinjela, *The 1997 United Nations Convention on International Watercourses*, 92 AM. J. INT'L L. 97, 98 (1998); *See also* Watercourse Convention, *supra* note 7, at arts. 3-4.

9. Yimer Fisseha, *State Succession and the Legal Status of International Rivers*, *in* The LEGAL REGIME OF INTERNATIONAL RIVERS AND LAKES 177 (Ralph Zacklin et al. eds., 1981).

10. Thirty-five states must ratify the Convention for it to come into operation. *See* Watercourse Convention, *supra* note 7, at arts. 36 ¶¶ 1-2.

11. The Nile basin comprises two major sub-basins: the White Nile and the Blue

from the efforts of the NBI. However, at present, the NBI framework is more of a promise than an achievement. The NBI has drafted a treaty which would install formulae for the apportionment of Nile waters as well as create a Nile Basin Commission that, inter alia, would oversee the implementation of the terms of the treaty that establishes it. The reticence on the part of some riparian states means that more time must necessarily elapse before the treaty is ratified to become the first binding regulatory mechanism in the Nile Basin.

In a basin that has seen much more discord, mutual insecurity, suspicion, and conflict among the riparian states than trust and cooperation, the establishment of the NBI appeared as a beacon of light. A new dawn of rapprochement seemed to be on the horizon when the Nile riparian states declared that "there is no regional or international Treaty or Agreement among the riparian States of the Nile River Basin . . . on cooperation in the utilization of the waters of the Nile River Basin."[12] This declaration was of crucial significance as it marked a break away from the hitherto prevailing stance of some riparian states who insisted on the continued validity of some colonial and post-colonial treaties and their extended application to non-state parties of the Nile Basin riparian states. The new declaration could have paved the way for a fresh start from a clean slate.

However, recently there seems to have been a retreat from the stance enunciated in the declaration, as well as an apparent change of heart among the lower riparian states. Egypt and Sudan have proposed that the status quo of the existing uses be respected. According to the Chair of the Nile Council of Ministers, Egypt and Sudan have insisted that the other Nile riparian states recognize the 1929 treaty between the United Kingdom ("UK") (acting on behalf of Sudan) and Egypt.[13] This arrangement would benefit the two downstream riparian states, Sudan and Egypt, without much benefit to the interests of the eight upper riparian states. As a result, the treaty that has been drafted within the NBI arrangement could not be acceptable to the other riparian states of the basin. Currently, the move toward a basin-wide collaboration and the establishment of the Nile Basin Commission within the NBI has hit a temporary glitch, casting doubt over the prospect of reaching a final

---

Nile. The Blue Nile contributes 14% of the total water that reaches the Aswan Dam, while the bulk (86%) of water reaching the Aswan flows downstream from the Ethiopian Highlands. See *infra* note 130 at 105 and note 54 at 22.

12. *See, e.g.,* The Nile Basin Initiative Act, Uganda, pmbl. ¶ 2, Oct. 11, 2002, *available at* http://sdbs.nilebasin.org/index.php?option=com_docman&task=doc_view&gid=2&Itemid=58 [hereinafter Nile Basin Initiative].

13. Joseph Ngome, *Clause Holds Key to New Nile Treaty*, DAILY NATION (Nairobi), Mar. 28, 2008, *available at* http://allafrica.com/stories/printable/200803280008.html.

framework agreement over the consumptive utilization of the waters of the Nile. This attitude is not an isolated incident; similar motives and actions have created roadblocks to the conclusion of an agreement over the equitable sharing of the Nile waters in the past several decades.

At least three barriers must be overcome before the ongoing NBI efforts can be successful: the current paucity of regulatory legal regimes, an obsession with history, and doctrinal wrangling. This Article grapples with these three barriers in that order. In the two Parts that follow, the role of basin-specific arrangements and the special role of the NBI are presented. This Article argues that states have a duty to negotiate in good faith to reach basin-wide agreements and any failure to negotiate, or to negotiate in a manner that deviates from the requirements of good faith, implicates international responsibility of states. Finally, conclusions and brief recommendations draw the threads together and conclude the study.

II. LACK OF REGULATORY REGIME: RECOGNIZING THE HOLES IN INTERNATIONAL LAW

An analysis of the rules of international law concerning consumptive utilization of international water basins such as the Nile leaves one in a penumbra of doubt as to whether there are specific normative rules capable of resolving the apportionment of the shared waters. Apart from the Watercourse Convention, which has yet to become operational due to a lack of the necessary number of ratifications, rules of international water law have "always been (and remain[. . .]) vague and uncertain."[14] Except for a few principles such as the principle of equitable utilization, the no-significant harm rule, and the duty to negotiate in good faith that emerge from customary rules (see Part VI below), international law must travel a long distance before declaring itself ready and able to regulate inter-riparian allocation of water for consumptive purposes.

This lacuna points to the heightened importance of basin-specific treaties and mechanisms that should be installed to fill the legal void. In contrast to the basin states of the Niger, the Senegal, the Zambezi river basins, and the Southern African Development Community ("SADC")

14. Lucius Caflisch, *Regulation of Uses of International Watercourses*, *in International Watercourses*, *supra* note 3, at 3, 16; *See also* Ellen Hey, *Sustainable Use of Shared Water Resources: The Need for a Paradigmatic Shift in International Watercourses Law, in* THE PEACEFUL MANAGEMENT OF TRANSBOUNDARY RESOURCES, 127, 127-130 (Gerald H. Blake, et al. eds., 1995); Dante A. Caponera, *Shared Waters and International Law*, *in* THE PEACEFUL MANAGEMENT OF TRANSBOUNDARY RESOURCES, 121, 121-23.

Protocol, which have put in place treaties and mechanisms to enforce cooperation among the riparian states, the Nile Basin states have not entered into any formal and durable agreements concerning their dividend from their shared waters.[15] Saving the dual exceptions of the 1929 and the 1959 treaties between Sudan and Egypt (both at the receiving end of the river with little to no contribution to the river's volume), all the bilateral and multilateral agreements over the waters of the Nile failed to apportion the bounty of the river among the riparian states.[16] Almost all of the colonial treaties were concluded with the sole aim of freezing upstream projects over the Nile in order to secure a continuous and undiminished flow of the water to Egypt. However, many experts agree that these colonial agreements over the Nile have no legal effect whatsoever.[17]

There has never been a treaty that has brought together all the riparian states of the Nile.[18] This has left the basin without any comprehensive regulatory framework where an anarchic situation looms large. This situation inevitably perpetuates the prevailing unilateralism. Thus, the ongoing NBI negotiation is all too important for the purpose of establishing a cooperative atmosphere in a basin where unilateralism, interstate competition, and mutual suspicion have been the norm, while joint management and cooperation over the common resource have been the exception. The crux of the analysis is that the Nile Basin states would progress toward the conclusion of a basin-wide treaty if they could accept the fact that the colonial treaties regarding the Nile waters are of no legal significance and that international law is significantly deficient in apportioning shared waters. Such an awakening would pave the way

15. Valentina Okaru-Bisant, *Institutional and Legal Frameworks for Preventing and Resolving Disputes Concerning the Development and Management of Africa's Shared River Basins*, 9 COLO. J. INT'L ENVTL. L. & POL'Y 331, 348-49 (1998).

16. For an excellent discussions of the chronology and current status of the Nile basin treaties, *see generally* Okon Udokang, *Succession of New States to International Treaties* (1972); O. Okidi, *History of the Nile and Lake Victoria Basins through Treaties*, *in* The Nile: Sharing a Scarce Resource — A HISTORICAL AND TECHNICAL REVIEW OF WATER MANAGEMENT AND OF ECONOMIC AND LEGAL ISSUES, 321, 321-350 (P. P. Howell & J. A. Allan eds., 1996).

17. *See* Science Africa, *The Nile: Water Conflicts*, http://www.scienceinafrica.co.za/2003/may/nile.htm, (last visited Nov. 23, 2008). *See, e.g.*, Okidi, *supra* note 16, at 345; Christina M Carrol, *Past and Future Legal Framework of the Nile River Basin*, 12 GEO. INT'L ENVTL. L. REV. 269, 281282; *See generally* Girma Amare, *Nile Issue: The Imperative Need for Negotiation on the Utilization of Nile Waters,* OCCASIONAL PAPER SERIES 6 (Ethiopian Int'l Inst. for Peace & Dev.), 1997 at 2.

18. Nile Basin Initiative, *supra* note 12, at pmbl. para. 2 (". . . currently, there is no regional or international treaty or agreement among the riparian states of the Nile River Basin.").

for constructive negotiation to start from a clean slate and inaugurate a new, comprehensive Nile Basin treaty and an institutional mechanism for the equitable apportionment of the common resource.

III. DIVORCE FROM THE PAST: THE ROLE OF COLONIAL TREATIES AND THE COLONIAL MINDSET

The history of interstate interactions in the Nile Basin is replete with repeated and overlapping efforts of the European colonizers to bring the river under their respective sphere of influence to achieve their imperial objectives. Thus, reference to the past does not offer much guidance toward harmonizing inter-riparian interactions and initiating a joint search for a cooperative framework over the utilization of the Nile waters. Indeed, some of the colonial rationales and motives have remained after the departure of the colonial masters and are still apparent in the interstate negotiations over the use of the Nile waters. This continues to hamper joint efforts toward the conclusion of a basin-wide treaty regime.

Historically, the Nile was part and parcel of the colonial scramble for Africa, particularly because of the realization that control of Egypt and the Suez Canal by colonial administrations depended heavily upon the possibility of controlling the Nile.[19] This is exemplified by the number of agreements that the United Kingdom—the foremost colonial presence in the Nile Basin—concluded with both other colonial masters and independent African states:

> [t]here are about ten agreements dealing with consumptive use of the waters of the Nile and Lake Victoria. Prior to World War I, the treaties show Great Britain, for Egypt, as the contracting state. The United Kingdom, then the administering colonial power over Sudan, concluded an agreement with Italy (1891), Ethiopia (1902), the Independent State of Congo (1906), and with Italy and France (1906). There is further agreement with Italy, signed by Britain, in 1925. Since then, Britain and Egypt signed all agreements on the Nile waters, beginning with the 1929 agreement dealing with Egyptian rights generally vis-à-vis those of Sudan, and ending with the agreements for construction and maintenance of the Owen Falls Dam achieved by Exchange of Notes between 1949 and 1953.[20]

Notwithstanding Belgian control of Burundi, Rwanda and Congo (now the Democratic Republic of Congo ("DRC")), Ethiopia's independence,

19. Arsano, *infra* note 54 at 97, 208.

20. Okidi, *supra* note 16, at 323.

and Italian control of Eritrea, Great Britain effectively controlled the Nile River from its origins to the Mediterranean Sea.[21] Britain used every possible means it had at its disposal to achieve the full control of the Nile. Despite this, the diplomatic avenue of forming international treaties with Ethiopia, the only independent state in the basin at the time, as well as with other European colonial powers, provided an effective device toward that end.[22] The most striking feature common to all the colonial treaties signed by Great Britain was that the protection and furtherance of Egyptian interests (and colonial interests in Egypt) was the primary consideration.[23]

However, it may not be that Great Britain intended to protect Egyptian interests so much as to protect its own colonial ambitions. First, no colonial power like Great Britain could have failed to take note of the value of Egyptian Red Sea ports that were of central importance to Britain's colonial trade.[24] Thus, during the colonial period, the "Nile waters continued to be the lifeline of British colonial economic interests, same as they had always been for Egypt."[25] Second, the Suez Canal was of central strategic importance for controlling the shortest route from Europe to India,[26] which was referred to as the "Jewel of the British Crown."[27] Third, the colonial policy of exploiting the extensive production of Egyptian cotton for the textile mills in England was contingent upon Egyptian political stability. As Arun Elhance noted, "[t]o a very large extent, this stability became contingent upon satisfying Egypt's growing water needs, without much regard for the interests of the other riparian states."[28]

The desire to manipulate the Nile waters in order to soften the anti-colonial sentiments in Egypt also influenced colonial policy toward the Nile.[29] The British were aware that unless they controlled the Nile waters, it would be impossible to put pressure on Egyptian nationalism that was rising against the colonial rule.[30] As Yacob Arsano noted, while Britain acted as a provider of the Nile waters to Egypt, "it was naïve to

21. Arun P. Elhance, *Hydropolitics in the Third World: Conflict and Cooperation in International River Basin*, (1999) at 68.

22. *Id.*

23. *Id.*; Bonaya Adhi Godana, AFRICA'S SHARED WATER RESOURCES: LEGAL AND INSTITUTIONAL ASPECTS OF THE NILE, NIGER, AND SENEGAL RIVER SYSTEMS 169 (1985).

24. Elhance *surpa* note 21 at 68.

25. Yacob Arsano*, Ethiopia and the Nile: Dilemmas of National and Regional Hydropolitics* (2004) (unpublished Ph.D. dissertation, University of Zurich).

26. Elhance *surpa* note 21 at 68; Arsano *infra* note 54 at 211.

27. Elhance *surpa* note 21 at 68.

28. *Id.*

29. Arsano, *supra* note 25, at 54.

30. Arsano *infra* note 54 at 88.

believe that the British were dying for Cleopatra's Egypt, but . . . [it] was using Egypt's most sensitive resource to soothe the anti-British nationalist anger in Egypt since the end of the First World War."[31] By 1923, this policy was formulated in an unequivocal manner: "[t]he power which holds the Soudan [sic] [through which the whole volume of Nile waters pass] has Egypt at its mercy and through Egypt it can dominate the Suez Canal."[32] Such considerations were behind the lopsided colonial agreements regarding the utilization of the waters of the Nile. In the words of Arsano, "Britain made sure that all Nile related agreements benefited its own colonial interests."[33] It was almost inevitable, therefore, that the various colonial agreements that Britain initiated and concluded with the upstream actors "were far from establishing a regime of reciprocal rights or providing shared benefits on the transboundary water resources."[34]

The striking similarity among all the colonial agreements is that, rather than establishing basin-wide regulatory frameworks, they established precedents of unilateralism. These agreements tended to inform the post-colonial mindset of riparian states whose behavior is modeled to some extent on the colonial era approach to the problem. This mindset has continued to hinder fresh negotiations and agreements upon the equitable utilization of the Nile. [35] In most cases, the treaties of the colonial era banned irrigation, power generation, and other uses of the Nile waters without the prior agreement of the Egyptian government in order to ensure the constant and undiminished flow of the waters to Egypt.[36] These treaties encouraged unilateralism rather than cooperative management of the common resource. Indeed, the utilization of the Nile waters depicted a marked difference between the rhetoric of being common to the riparian while remaining private to Egypt and Sudan. As Kinfe Abraham observed, "[t]he British stance, in more senses than one, represents the early embryo of unilateralism which still bedevils the

31. Yacob Arsano, *Towards Conflict Prevention in the Nile Basin* 491 (paper presented at the 5th Nile 2002 Conference, 1997).

32. John Murray, British Foreign Minister Bureaucrat, *Memorandum on the Political Situation of Egypt, quoted in* Terje Tvedt, *The Management of Water Irrigation: The Blue Nile, in* BEYOND CONFLICT IN THE HORN OF AFRICA 186 (Yacob Arsano et al., 1992).

33. Arsano, *supra* note 25, at 53.

34. *Id.*

35. Y. A. Mageed, *The Integrated River Basin Development: The Challenges to the Nile Basin Countries*, *in* STRATEGIES FOR RIVER BASIN MANAGEMENT 151, 155 (J. Lundqvist, U. Lohm & M. Falkenmark eds., 1985).

36. *Id.* at 151.

relationship among the riparian in general and that of Ethiopia and Egypt in particular."[37]

Notwithstanding the departure of the colonizers and the attainment of independence by the former colonies of the Nile Basin, the colonial era mentality still stands as an obstacle to the possibility of collaboration among the Basin States. Thus, the long standing injustice relating to the utilization of the bounty of the Nile still persists. The Egyptian leaders, from the time of Abdul Gamal Nasser to the present, adopted the concept of "water security" from the British who had stated: "[n]o one can hold Egypt securely unless he also holds the whole valley of the Nile. If the sources of the river is [sic] in hostile or even indifferent hands it must always be a grave cause of danger."[38]

The post-independence era has witnessed only one treaty pertaining to the allocation of the Nile—the 1959 Agreement for the Full Utilization of the Nile Waters—concluded between Egypt and Sudan. This treaty, like its colonial era predecessors, proved to be nothing more than a continuation of the colonial approach to consumptive utilization of the waters of the Nile.[39] Instead of mandating collaboration among all the Basin states, the treaty provided for full utilization of the Nile by two downstream states with extremely marginal water contribution to the Basin while completely disregarding the water needs of the eight other states from which the Nile flows.[40] It is anomalous for two downstream states with extremely marginal water contribution, if any, to the Basin, to agree to the full utilization of a river originating in and shared by eight other states. Like its colonial predecessors, this treaty was aimed to protect Egyptian, and, to a lesser extent, Sudanese interests. Like the colonial era treaties, it did not give any consideration to the interests of the other riparian states that are equally entitled to the utilization of the waters of the Nile. Tesfaye Tafesse has rightly asserted that:

> [e]ver since the signing of the 1959 Agreement[,] Egypt had time and again showed its inflexible stance toward the alteration of the treaty. . . . [Egypt] rather considers the 1959 and preceding agreements as unchanging and sacrosanct. In effect, in as far as Egyptians are concerned, any fresh talk on the Nile water utilization beyond the 1959 status quo must by all means be circumvented. Put

37. Kinfe Abraham, *Nile Hurdles: Psycho-Political Roadblocks to an Agreement and the Way Forward Toward a Rapprochement*, OCCASIONAL PAPER SERIES 7 (Ethiopian Int'l Inst. for Peace and Dev.), Feb. 24-27, 1997, *available at* http://www.addis-eiipd.org/Occasionalp_1_%207.htm (also presented as a paper at the Nile 2002 conference held in Addis Ababa, Feb. 24-27, 2002).

38. *Id.*

39. Elhance *supra* note 21, at 68-69; Arsano *infra* note 54 at 225.

40. Tesfaye *infra* note 41 at 77; Okidi *supra* note 16, at 333.

> another way, the bottom line to any talk and the resultant modus vivendi, if any, should first and foremost take the 1959 status quo for granted and rather discuss the possibility of acquiring additional water in the Nile Basin. [41]

As recently as March 2008, Egypt and Sudan maintained that the framework agreement that was drafted by the NBI should include a clause that reads: "[this agreement shall] not adversely affect *the water security of current users* and rights of the Nile Basin countries."[42] It has been reported that "the water security of current users" referred to here are the uses established under the 1929 and 1959 treaties between Sudan and Egypt.[43] Where the situation stands now, admitted the NBI, the disagreements have presented a significant roadblock to the NBI processes and require intervention and negotiation by the political heads of states to expedite the process.[44]

Yet, the two (1929 and 1959) treaties bind only the signatory parties—Sudan and Egypt—and the impending agreement would have to be redrawn along a fairer equilibrium based on equitable and reasonable utilization.[45] The fact that new uses are of equal importance to existing uses cannot be overemphasized and should be reflected in any new basin-wide treaty.[46] The post-independence (1959) agreement and the attitude of some of the riparian states in the ongoing NBI process proves to be a continuation of the colonial era mentality wherein the Nile was presumably to be used almost exclusively toward the fulfillment of Egypt and Sudan's interests.

As Elhance noted, "The colonial era mentality, subsequently inherited by the rulers of independent Egypt and Sudan, and the resentment it has generated . . . [in the other Nile basin riparian states], have continued to circumscribe hydropolitics in the Nile Basin in the post-World War II era."[47] As a result, the current management of Nile waters is "based on the views articulated by British imperial interests in the first half of the twentieth century, . . . which were based on the assumption that Egypt's interests were paramount."[48] Thus, the post-

41. Tesfaye Tafesse, *The Nile Question: Hydro Politics, Legal Wrangling, Modus Vivendi and Perspectives* 79 (2001).

42. *See* Ngome, *supra* note 13 (emphasis added).

43. *Id.*

44. *Id.*

45. Okaru-Bisant, *supra* note 15, at 349.

46. *See* Part 5.3, *infra*.

47. Elhance, *supra* note 21, at 69.

48. J.A. Allan, *Nile Basin Water Management Strategies*, *in* THE NILE: SHARING A SCARCE NATURAL RESOURCES-A HISTORICAL AND TECHNICAL REVIEW OF WATER MANAGEMENT AND OF ECONOMIC AND LEGAL ISSUES 313, 316 (1996).

colonial mindset of some of the riparian states is a close imitation of the pre-independence period mindset that served as a strong precedent upon which the Egyptian and Sudanese leaders modeled the new post-decolonization agreements on the Nile.

Insistence upon the continuity of the prevailing situation would inevitably mean that the interests of the upstream Nile Basin states would still play second fiddle to those of the downstream states. Such an imbalance has created the impasse that has hindered or slowed down fresh negotiations over the allocation of the Nile's bounty.

IV. DOCTRINAL WRANGLING: RESOLVING DOCTRINAL CONTROVERSIES[49]

As outlined above, international law suffers from incoherence regarding the rules applicable to the consumptive utilization of international rivers among basin states. Against the backdrop of such a legal void, the Nile riparian states have locked horns in their adherence to contradictory doctrines, the choice of which has heavily depended on political expediency. Although these doctrines are devoid of legally binding effects, adherence to them by the Nile Basin states has presented an obstacle to the formation of a new Nile Basin treaty. Of the various doctrines, two of the theories that have been relied upon by the Nile riparians deserve a brief revisit here: the theory of absolute territorial sovereignty (the Harmon Doctrine) and the theory of absolute territorial integrity.

A. The Theory of Absolute Territorial Sovereignty (The Harmon Doctrine)

The theory of absolute territorial sovereignty follows from the assumption that a state is the master of all persons, things, and circumstances occurring in its territory. Accordingly, a state may adopt any measures relating to that segment of the waters flowing on its territory and freely dispose of that resource. In so doing, a state consults and is guided only by its own national interests. In its bare form, the theory advocates that "an international watercourse situated on the territory of a State constitutes part of the public domain of that State and

49. It is beyond the purpose and scope of this work to delve into the details of the doctrinal controversies revolving around riparian users' rights over shared water resources. For present purposes, the intention is to show that arguments emerging from varying theories have contributed not in bringing the Nile riparian states together, but have worked to set them apart.

that since a State has dominion over its territory, another State acquires rights thereon only with the agreement of the first State."[50]

The theory was authoritatively stated for the first time by Judson Harmon, Attorney General of the United States, in an 1895 declaration concerning the disputes over waters of the Rio Grande River between the United States and Mexico. Invited to give his opinion on the position of the United States on the question of whether the United States was obliged to let some of the Rio Grande flow to Mexico, Attorney General Harmon gave his famous statement:

> The fundamental principle of international law is the absolute sovereignty of every nation, as against all others, within its territory . . . . All exceptions . . . to the full and complete power of a nation within its own territories must be traced to the consent of the nation itself. They can flow from no other legitimate source . . . . The immediate as well as the possible consequences of the right asserted by Mexico show that its recognition is entirely inconsistent with the sovereignty of the United States over its national domain . . . . The case presented is a novel one. Whether the circumstances make it possible or proper to take any action from considerations of comity is a question which does not pertain to the Department [of Justice]; but that question should be decided as one of policy only, because, in my opinion, the rules, principles, and precedents of international law impose no liability or obligation upon the United States.[51]

This strong statement has provided the genesis and the strength for the theory of absolute territorial sovereignty.[52] Absolute sovereignty allows upstream states complete freedom of action with regard to the segment of international waters flowing within their territories, irrespective of any prejudicial effect it might have on other countries downstream. This theory is favorable to upper-basin states, and, where there are several of them, to the uppermost one. Therefore, it is not surprising that Ethiopia adhered to the theory in its *Aide-Memoire* of September 23, 1957 addressed to diplomatic missions in Cairo:

> Ethiopia has the right and the obligation to exploit the water resources of the Empire . . . for the benefit of present and future generations of its citizens . . . [and] must, therefore, reassert and reserve now and for the future, the right to take all such measures in respect of its water resources and, in particular, as regards that

50. Godana, *supra* note 23, at 32.

51. Treaty of Guadalupe Hidalgo-International Law, 21 Op. Att'y Gen. 274, 281-83 (1895), *quoted in* Stephen C. McCaffrey, *The Law of International Watercourses: Non-Navigational Uses* 115 (2001).

52. McCaffrey, *supra* note 51, at 115.

> portion of the same which is of the greatest importance to its welfare, namely, those waters providing so nearly the entirety of the volume of the Nile, *whatever may be the measure of utilisation* [sic] *of such waters sought by recipient States situated along the course of that river.*[53]

Two decades later, Ethiopia declared the same stance at the 1977 UN Water Conference held in Argentina. Ethiopia pronounced: "the sovereign right of any riparian state, in the absence of an international agreement, to proceed unilaterally with the development of water resources within its territory."[54]

Absolutist as it is, the theory has not been received well by state practice or by publicists. Foremost opposition comes from downstream states in many parts of the world whose right to the international waters would be sacrificed to the extent of the validity of the theory. Additionally, the great majority of writers emphatically reject the theory of absolute territorial sovereignty or the Harmon Doctrine and no support for the doctrine can be found in contemporary literature.[55] Support for the theory from judicial practice is also minimal.[56] Indeed, the theory is "almost unanimously abandoned today."[57] However, in the Nile Basin, it has yet to be renounced by all of the riparian states. Nevertheless, the Nile riparian states' recent unanimous declaration that they seek "to achieve sustainable socioeconomic development through *equitable utilization* of, and benefit from, the common Nile Basin water resources"[58] seems to be a move toward the renunciation of the doctrine.

B. The Theory of Absolute Territorial Integrity

The theory of absolute territorial integrity is the polar opposite of the absolute territorial sovereignty doctrine. While the latter advocates an upper riparian's complete freedom of action in relation to international waters,[59] the former theory maintains that the upstream state(s) may not do anything that might affect the natural flow of the water into the downstream state(s).[60] The theory of absolute territorial integrity,

---

53. Godana, *supra* note 23, 35-36 (quoting aide-memoire from the Government of Ethiopia to diplomatic missions in Cairo on Sept. 23, 1957) (emphasis added).

54. Yacob Arsano, *Ethiopia and the Nile: Dilemmas of National and Regional Hydropolitics* 90 (2007).

55. Godana, *supra* note 23, at 36; McCaffrey, *supra* note 51, at 123.

56. Godana, *supra* note 23, at 36.

57. *Id.* at 38.

58. *See Nile Basin Initiative*, *supra* note 12 (emphasis added).

59. Godana, *supra* note 23, at 32.

60. *Id,* at 38.

espousing the old common law riparian doctrine, seriously disadvantages upper riparian states of a river that start to develop their water resources more slowly than lower riparian states of the river because they will be prohibited from undertaking any activity that would seriously affect the flow of the river to a state or states downstream.[61]

Not surprisingly, this theory has been advocated by downstream riparian states such as Egypt. The fact that life in Egypt has been totally dependent on the waters of the Nile for millennia prompted Egypt to claim that it has "historical," "natural," or "acquired" rights. Such a claim is rooted in the theory of absolute territorial integrity. According to Amare Girma Amare:

> The Egyptians, and to a lesser extent the Sudanese, favour [sic] the *prior use doctrine*, also known as *prior appropriation doctrine* which provides that "the first user of the water acquires a definitive right to it, 'first in time, first in right.'"[62]

Due to the possibility that Ethiopia and other upper riparian states may begin to construct projects that would reduce the amount of water flowing into Sudan and Egypt, the two lower-most riparian states hold to this doctrine because it would prevent the upstream states from putting the water to new uses. The doctrine is premised on the contention that the lower riparian states have long put the Nile waters to their use before the upper riparian states have, and, as a result, have acquired "historic rights." In Erlich's view, there are dual moral dimensions to Egypt's "historic rights": "first, Egypt has no other option to survive; second, Ethiopia has [and other upper Nile riparian states have] lived without the Nile so far and presumably can do so in the future."[63] It would come as no surprise that the doctrine of absolute territorial integrity, and its corollary, "historic rights," have therefore been advocated foremost by Egypt, the lower-most riparian state in the Nile Basin. But it is too much to assume that the moral dimension of the argument will lead to a legal right. It has been observed that:

> [t]he Egyptians' legal argument for their exclusive rights to the Nile waters is founded on precedence: Egypt has always used the waters of the Nile without restriction . . . . Moreover, they argue, the idea . . . was confirmed by the international agreements signed during the twentieth century. The principle of historic rights was mentioned in the 1929 Egyptian [British]-Sudanese Water Agreement and reiterated in the Agreement for the Full Utilization of the Nile Waters

61. *Id.*

62. Amare, *supra* note 17, at 8.

63. Haggai Erlich, *The Cross and the River: Ethiopia, Egypt, and the Nile* 6 (2002).

> of 1959. In fact, Egyptian (and Sudanese) exclusiveness with regard to the Nile waters was recognized by the British in all their colonial agreements.[64]

As Egypt has always been sensitive to the possibilities of development of the Nile by upstream states, its adherence to the doctrine of absolute territorial integrity has almost always remained unchanged with few exceptions over the years. As early as 1925, during the meeting of the Nile Commission, Egypt expressed its adherence to the theory of absolute territorial integrity on the division of the waters of the Nile among the riparian states. More than five decades later, in 1981, Egypt expressed its unchanged stance in its "Country Report" at an interregional meeting of international river organizations held in Dakar, Senegal. The Report argued:

> [e]ach riparian country has the full right to maintain the status quo of the rivers flowing on its territory. . . . it results from this principle that no country has the right to undertake any positive or negative measure that could have an impact on the river's flow in other countries . . . . a river's upper reaches should not be touched lest this should affect the flow of quantity of its water.[65]

Like the theory of absolute territorial sovereignty, the theory of territorial integrity has been severely criticized as extremist in essence and myopic in orientation. As Godana noted, "[t]he essential inequity of this theory resides in the fact that it allocates rights without corresponding duties."[66] Neither state practice, the practice of international or domestic tribunals, nor the writings of publicists have sufficiently supported this theory. Political statements aside, even Egypt has not been consistent in its adherence to the theory. For example, Egypt's 1949 agreement to projects in upper Nile countries, such as the Owen Falls Dam in Uganda, was a huge departure in practice from the theory of absolute territorial integrity.[67] The theory has gone out of favor in the international community and "may now be considered as discarded."[68]

Nevertheless, the theory does not appear to be completely discarded in the context of the Nile Basin. The insistence on the theory of absolute territorial integrity seems to be at the root of the recent deadlock that has emerged in the NBI negotiation processes, with Egypt and Sudan

---

64. *Id.*

65. Interregional Meeting of International River Organisations, May 5-14, 1981, *Country Report of Egypt*, ¶¶ 3, 4, *quoted in* Godana, *supra* note 23, at 39.

66. Godana, *supra* note 23, at 39.

67. McCaffrey, *supra* note 51, at 131.

68. Godana, *supra* note 23, at 39.

insisting upon the inclusion of a provision that maintains the status quo of prior appropriation (existing uses) of the Nile waters by the two downstream states.[69] However, adherence to the status quo would make the NBI's efforts a futile exercise at best. Such a stance is a bottleneck to the formation of any basin-wide agreement among the riparian states. Most importantly, such a claim has provoked the upper riparian states to counteract by adhering to the principle of absolute territorial sovereignty over the waters flowing in their territories.[70] This is best exemplified by the Ethiopian position, enunciated at the 1977 UN Water Conference held in Argentina, where Ethiopia explicitly confirmed its adherence to the doctrine.[71]

C. Current Trends toward Equity

The competition of the two sovereignty doctrines and respective commitments to one or the other by the Nile riparian states has been a roadblock to reaching a new accord. Since the two doctrines directly conflict with each other, adherence thereto in negotiations on the optimal utilization of the Nile can only set the countries apart rather than bring them together. Although the respective validity of the doctrines in terms of the contemporary practice of states and of international law has been called into question, the position of the Nile riparian states has been locked in these irreconcilable doctrines, hindering a negotiated agreement.

However, despite the apparent adherence to these two largely rejected doctrines, there appears to be a glimmer of hope on the horizon. Recently, the doctrine of equitable utilization has entered the vocabulary of many of the riparian states of the Nile Basin through the provisions of the NBI Act. This new trend may provide a framework from which to work toward equity among the basin states in their respective rights and duties in the utilization of the Nile waters as well as to leave the contradictory sovereignty doctrines behind.

69. *See* Ngome, *supra* note 13.

70. Arsano, *supra* note 54, at 224.

71. Godana, *supra* note 23, at 36.

V. BACK TO THE FUTURE: TOWARD AN EQUITABLE AND REASONABLE UTILIZATION OF THE NILE WATERS

A. Introducing the Concept

The principle of equitable and reasonable utilization of common water resources is the pillar of interstate interactions over the uses of international waters.[72] Predicated on the sovereign equality of states, this theory seeks to ensure that all basin states access a reasonable and equitable amount of the shared waters. It also imposes a duty upon all riparian states to use the resource in an equitable and reasonable manner.[73] At the heart of the principle of equitable utilization is the co-riparian states' "equality of rights,"[74] which means that riparian states have an equal right to use the common water resource *in accordance with their needs*.[75] The principle does not necessarily imply volumetric equality of shares. As Goldberg observed, "[e]quality of rights does not mean in this context the right to an equal division of the waters but rather that each riparian has an equal right to the division of the waters on the basis of its needs, consistent with the corresponding rights of [other] co-riparians."[76] Simply put, the principle of equitable utilization rejects the exclusion of any riparian from the use of a common water resource, while providing for parity of treatment of equally pressing national needs of all riparian states.

The actual share that a riparian state is entitled to from the common river thus turns upon multiple objective factors. According to Jerome Lipper, three criteria must be applied for an equitable apportionment of the actual share of a riparian state:

> *(1)*examination of the economic and social needs of the co-riparian states by an objective consideration of various factors and conflicting elements . . . relevant to their use of the water;

---

72. *See* Hayward, *supra* note 6, at 642 (citing *International Watercourses, supra* note 3, at 414; *See also* Salman M. A. Salman & Kishor Uprety, *Conflict and Cooperation on South Asia's International Rivers: A Legal Perspective* 15 (2002)).

73. Godana, *supra* note 23, at 50.

74. Jerome Lipper, *Equitable Utilization, in* THE LAW OF INTERNATIONAL DRAINAGE BASINS, *supra* note 4, at 44.

75. *Id.* (emphasis added).

76. David Goldberg, *World Bank Policy on Projects on International Waterways in the Context of Emerging International Law and the Work of the International Law Commission, in* THE PEACEFUL MANAGEMENT OF TRANSBOUNDARY RESOURCES, *supra* note 14, at 153, 155.

> *(2)*distribution of the waters among the co-riparians in such a manner as to satisfy their needs to the greatest extent possible; and
> *(3)*accomplishment of the distribution of the waters by achieving the maximum benefit for each co-riparian consistent with the minimum of detriment to each.[77]

The application of the principle of equitable utilization is a process that heavily relies on the degree of cooperation among riparian states.[78] Such a cooperative atmosphere among riparian states results from knowledge of, inter alia, data and information concerning the watercourse and inter-riparian prior notification about impending new uses that might affect the other states in a shared river basin.[79]

Additionally, the equitable utilization theory is also contingent upon other specific factors. Under the 1997 Watercourse Convention, an illustrative (non-exhaustive) list of seven relevant criteria is provided:

> (*a*) Geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character;
> (*b*) The social and economic needs of the watercourse States concerned;
> (*c*) The population dependent on the watercourse in each watercourse state;
> (*d*) The effects of the use or uses of the watercourses in one watercourse State on other watercourse States;
> (*e*) Existing and potential uses of the watercourse;
> (*f*) Conservation, protection, development and economy of use of the water resources of the watercourse and the costs of measures taken to that effect;
> (*g*) Availability of alternatives, of comparable value, to a particular planned or existing use. [80]

It is important to note that there is no preferential treatment attached to the order of provisions of the criteria listed under Article 6 of the Watercourse Convention. One criterion can be the most important consideration in one context while other criteria may take precedence in other circumstances. The bottom-line is that a factor (criterion) must

77. Lipper, *supra* note 74, at 45.

78. McCaffrey, *supra* note 51, at 345 ("[i]t is a dynamic process, which depends heavily upon active cooperation between states sharing freshwater resources.").

79. *See, e.g., id*. at 343.

80. Watercourse Convention, *supra* note 7, at art. 6 ¶ 1.

indeed be relevant as an aid in the determination or satisfaction of the social and economic needs of the co-riparian states of the basin. Once this threshold is met, it is not legally permissible to attach a fixed weight to a singular criterion in all cases. The relative weight of a given relevant factor turns upon its merits relative to all the other factors at a given point in time.[81] In the final analysis, "no other factor occupies a position of pre-eminence *per se* with respect to any other factor."[82] Some factors may even be irrelevant in a given scenario.[83] Under the Watercourse Convention, "all relevant factors are to be considered together and a conclusion reached on the basis of the whole."[84] Additionally, the Watercourse Convention in principle guards against temptations to attach a special weight to a given type of use.[85] The only exception is in cases where conflict of uses occurs among the riparians, where "special regard . . . [shall be given] to the requirements of vital human needs,"[86] presumably drinking and sanitation.

Apart from its codification in the Watercourse Convention, the principle of equitable utilization enjoys the overwhelming support of scholarship and state practice such that "nearly all international accords regarding international rivers are based on this principle."[87] The 1966 Helsinki Rules (although not binding)[88] and the 1994 International Law Commission's Draft Articles (also non-binding)[89] had already solemnly espoused the principle before its eventual incorporation into the Watercourse Convention. Historically, the theory of equitable and reasonable utilization "has been recognized in China and India for many centuries and has acquired a greater significance over the past 500 years with the development of the nation-state."[90] The principle of equitable and reasonable use seems to be part of international custom.[91] As such, its inclusion in Article 5 of the Watercourse Convention is a codification of international custom rather than a progressive development of rules of

81. *Id.* at art. 6 ¶ 3.

82. International Law Association, *Helsinki Rules on the Uses of the Waters of International Rivers*, at art. V cmt., (Aug. 1966), *reprinted in* THE LAW OF INTERNATIONAL DRAINAGE BASINS, *supra* note 4, at 779, 785 [hereinafter International Law Association].

83. *Id.*

84. Watercourse Convention, *supra* note 7, at art. 5 ¶ 3.

85. *See id.* at art. 10 ¶ 1.

86. *Id.* at art. 10 ¶ 2.

87. Erlich, *supra* note 63, at 7.

88. *See* International Law Association, *supra* note 82, at art. IV cmt. a.

89. *See* G.A. Res. 49/52, at arts. 4-5, U.N. Doc. A/49/49 (Dec. 9, 1994).

90. Erlich, *supra* note 63, at 7.

91. *See* Richard Paisley, *Adversaries into Partners: International Water Law and the Equitable Sharing of Downstream Benefits*, 3 MELB. J. OF INT'L. L. 283 (2002).

international law regarding non-navigational uses of international watercourses.[92]

Despite earlier opposition, the leaders of the two intransigent states of the Nile Basin, Egypt and Ethiopia, have in recent years stated their adherence to the theory of equitable and reasonable utilization of the waters of the Nile. The statement of former Egyptian Ambassador to Ethiopia, Marwan Badr, given on August 7, 1998 is instructive in this regard:

> Egypt recognizes that each state has the right to *equitable utilization* of its waters in accordance with international law. Egypt further recognizes that existing water agreements do not hinder the utilization of the Nile waters by any of the riparian states.[93]

This theory has been well received in Ethiopia as well. This can be discerned from the statement of the Ethiopian Prime Minister, Meles Zenawi:

> [w]hat we basically need is to deal with the Nile basin as a single region with shared natural resources. If we take this as a basis for dealing with the Nile issue, we will be able to devise better ways to achieve the maximum benefit from its waters.[94]

The theory's biggest merit is that it takes into account both the current and future water needs of the riparian states and is elastic enough to accommodate a changing set of circumstances. A state's regime of utilization that is equitable vis-à-vis its co-riparian states today may not be so next year. As McCaffrey noted, a "new use in one state may change the equitable utilization calculus as among all riparians and therefore should be the subject of prior notification, consultation, and, if necessary, negotiation. And this is true whether the new use is made by an upstream or downstream state . . . ."[95]

92. It must be noted that the 1997 Watercourse Convention explicitly states that it is an embodiment not only of progressive development of international water law but also of codification of an existing custom. *See* Watercourse Convention, *supra* note 7, at pmbl. ¶ 3.

93. Robert O. Collins, *The Inscrutable Nile at the Beginning of the New Millennium*, 2003, www.history.ucsb.edu/faculty/Inscrutable%20Nile1.pdf (quoting Marawan Badr, Egyptian Ambassador to Eth. (Aug. 7, 1998)) (emphasis added).

94. *Id.* (quoting Meles Zenawi, Prime Minister of Eth. (Apr. 7, 1998)).

95. McCaffrey, *supra* note 51, at 345.

B. Variants of Equitable Utilization: Toward Application

Conceptually, it is important to distinguish between two variants or modes of application of the principle of equitable utilization. The "shared uses" variant refers to the classical apportionment method. This variant is usually achieved through a treaty among the basin states that allocates the dependable flow of wet water of a river among the riparian states, where a right to "water qua water" is created.[96] Each state enjoys complete freedom of action with respect to the choice and manner of utilization of its quota,[97] presumably, with the major caveat that no state can have the right to cause a significant harm to its neighbors through its usage of the common waters.

The second variant of equitable utilization, called the "shared benefits" principle, springs from welfare economics. The gist of this variant is that water is a scarce resource that can be put to alternative uses. In water sharing processes among the riparian users of a given water resource, states must ensure that water is put to a use that is most valuable as compared to the other uses.[98] The implication of this principle in many cases would lead to a situation where "some nations forgo the actual use of wet water but are entitled to monetary compensation for allowing other states to put the water to its most efficient use."[99]

In the NBI discussions, references have been made to the principle of equitable utilization, but it is yet to be seen if the states are ready to commit themselves to the shared benefits variant of the principle. Indeed, the NBI itself started off with a participatory process of dialogue among the Nile riparian states that resulted in their agreeing on a shared vision—to "achieve sustainable socioeconomic development through the *equitable utilization* of, and benefit from, the common Nile Basin water resources."[100]

Due to the Nile riparian states' expressed desire to share benefits equitably amongst themselves, it is instructive to summarize the advantages and demerits of the two variants. At one level, the difference between the two variants appears to be little more than semantics. It could be argued that the object of any equitable distribution of an

96. A. Dan Tarlock & Patricia Wouters, *Are Shared Benefits of International Waters an Equitable Apportionment?,* 18 COLO. J. OF INT'L ENVTL. L. & POL'Y 523, 526 (2007).

97. *Id.* at 526-27.

98. *Id.* at 527.

99. *Id.*

100. *See* Nile Basin Initiative, *supra* note 12.

international river is to ensure that all riparian states receive "water justice," and since "water justice" can be obtained equally by sharing the use of wet water or by monetary compensation, the dichotomy is a distinction without a difference.[101]

Such a line of argument comes from a lack of deeper insight into problems associated with the practical application of the "shared benefits" variant of the principle. At least three concerns are associated with the "shared benefits" variant of the principle.[102] First, upstream headwater states are often less fortunate than the usually wealthier downstream states, and such is the case in the Nile Basin. As a result, the headwater states may be tempted into accepting short-term benefits at the expense of forgoing their future uses.[103] Second, shared benefits may not directly address problems of poverty alleviation and usually fail to benefit those in the watershed of origin.[104] Third, "benefit sharing runs the risk that aquatic ecosystem integrity may not be adequately addressed," and the ecosystem of the basin system may be negatively affected.[105] These problems may not be insurmountable, but they must be carefully addressed. It can only be hoped that the ongoing negotiation over the cooperative utilization of the Nile waters will adequately address these and other related concerns.

C. Equitable Utilization Vis-à-Vis the No-significant Harm Rule

The principle of equitable utilization and the "no-significant harm" rule have been vying for recognition for a long time. Normally, the interplay between the principle of equitable utilization and the rule of preventing "significant harm" in the utilization of common waters are presented as a conflict. The no-significant harm rule emerged before the principle of equitable utilization. It regulated a whole range of neighborly relations, especially transboundary harms caused by an act or omission of a neighboring state. The rule's origin may be traced to the Roman law maxim: *sic tuo utere ut alienum non laedas* (use your property in such a way as not to harm others).[106] It was originally based

101. Tarlock & Wouters, *supra* note 96, at 527.

102. *See id.* at 528.

103. *Id.*

104. *Id.*

105. *Id.*

106. Sompong Sucharitkul, *State Responsibility and International Liability in Transnational Relations*, *in* THEORY OF INTERNATIONAL LAW AT THE THRESHOLD OF THE 21ST CENTURY: ESSAYS IN HONOUR OF KRZYSZTOF SKUBISZEWSKI 289 (Jerzy Makarczyk

on the concept of restrictive enjoyment of one's own property, or limited and regulated proprietary rights subject to the prevention of harm to one's neighbors.[107] Put in the context of interstate relations, it implied that neighboring states "are not allowed to use or to tolerate the use of their territory for causing damage to their neighbors."[108]

Contrary to the rule of "no-significant harm" that aspires to regulate the overall relations of neighboring states, the principle of equitable utilization is limited in scope to the regulation of interstate non-navigational activities on international watercourses.[109] Indeed, the principle of equitable utilization's emergence was prompted by the limitations of the no-significant harm rule in relation to allocation of international watercourses. The no-significant harm rule fails to provide adequate guidelines for the resolution of controversies over allocation issues on fully used or overused international watercourses, or would do so in an inequitable way "by giving complete priority to existing activities and by prohibiting the development of new or the extension of existing uses."[110]

According to Lucius Caflisch, the no-significant harm rule plays two related roles pertaining to the law of international rivers.[111] First, it seeks to provide guidelines for the allocation of the rights of shared water basins. Second, it is of crucial relevance in the area of environmental protection. While it has continued to hold sway in relation to environmental considerations, its water allocation utility has waned in recent years.[112] This is because most international water basins are fully used or overused today and any attempt at a new use by a riparian state would result in harm to the existing uses. The effective result of the no-significant harm rule is to maintain the status quo. Considered in the context of the Nile Basin, where the water is already fully used and new upper riparian states are attempting to put the waters to new uses,[113] the application of the no-significant harm rule would deny the upper riparian states any possibility of developing or expanding their use of the Nile waters.[114]

---

ed., 1996).

107. *Id.*

108. Caflisch, *supra* note 14, at 12.

109. *Id.* at 13.

110. *Id.*

111. *Id.* at 12.

112. *Id.*

113. Ashok Swain, *Managing the Nile River: The Role of Sub-Basin Co-Operation*, *in* CONFLICT MANAGEMENT OF WATER RESOURCES 145, 146-52 (Manas Chatterji, Saul Arlosoroff, & Gauri Guha eds., 2002).

114. Caflisch, *supra* note 14, at 13.

The inadequacy of the no-significant harm rule to resolve the competition between the status quo and new uses has brought into focus the need for clarification of the interplay of this rule with the principle of equitable utilization. It is impossible to completely prevent harm in a basin such as the Nile where ten states share common waters. The question is: which rule—the principle of equitable and reasonable utilization or the no-significant harm rule—takes precedence in the event of conflict between the two standards? A choice must be made between the applications of the two competing principles.

In situations where an upstream state commences a new project that would otherwise be a reasonable and equitable use of a common international river, the new upstream use would almost inevitably result in the reduction of the quantity or quality of the water that flows downstream. In basins that are fully used or over-used, such a reduction in quantity or quality would inevitably harm the pre-existing uses of the downstream state.

Historically, the need for clarification of the interplay of the two principles arose much earlier in the context of the 1966 Helsinki Rules. The International Law Association stated that "the principle of equitable and reasonable utilization should be the guiding principle . . . [wherein the no-significant harm] rule was one among the series of elements to be considered for determining whether a given use was 'equitable and reasonable.'"[115]

Convergence of opinion seems to exist among scholars that in the event of conflicts among principles, "the most fundamental principle of international water law is that of equitable utilization."[116] Thus, the principle of equitable and reasonable utilization should take precedence over the no-significant harm rule in cases of conflict between the two standards. An immediate result of the precedence of equitable and reasonable utilization over the no-significant harm rule would be to reject the prior appropriation doctrine preferred by the lower riparians of the Nile Basin. Thus, the rules of international water law do not approve of downstream states' foreclosure of upstream new projects by demonstrating that the later development would cause them harm.[117]

During the preparation of a draft of what was to later become the Watercourse Convention, the International Law Commission commented that:

---

115. *Id.*

116. Stephen C. McCaffrey, *The Law of International Watercourses: Some Recent Developments and Unanswered Questions*, 17 DENV. J. OF INT'L L. & POL'Y 505, 509 (1989).

117. *Id.*

> The Commission's position . . . seems to be that the conflict between articles 5 and 7 can be made to disappear by adopting a non-rebuttable presumption that a utilization of the waters of an international watercourse system that causes appreciable transboundary harm is *ipso facto* unreasonable and inequitable and thus would be unlawful under both article 5 and article 7. However, it is noted that the Commission . . . has recognized that, in some cases, the attainment of equitable and reasonable utilization will depend on the toleration by one or more watercourse States of a measure of harm.[118]

Thus, applied alongside the principle of equitable and reasonable utilization, the no-significant harm rule imposes the duty of due diligence on the riparian states that start to put the common waters to a new use or a greater use than had been the case. The due diligence duty goes beyond requiring a state to abstain from causing harm to the other riparian and includes a positive duty to "take all appropriate measures to prevent the causing of significant harm to other watercourse States."[119] Events that should be prevented in a state's territory could be lawful activities in that state, but still may implicate the state's international liability if they cause a significant harm in a neighboring state. In the end, everything boils down to the requirements of mutual empathy among the riparian states and the search for "glasses half-full."[120] There is a compelling need to maintain a delicate balance, and departure from such equilibrium is equally prejudicial to the other riparian states in the Nile Basin.

VI. BACK TO THE POINT OF DEPARTURE: THE WATER CONVENTION AND BASIN-SPECIFIC ARRANGEMENTS

The analysis of the interplay of the equitable and reasonable utilization and the no-significant harm rule takes us back to our initial observation that much progress has to be achieved via basin-specific arrangements such as the NBI. The rules of general international law provide a framework within which basin-specific rules can be made. But, given the adherence of some states to contradictory sovereignty theories

118. U.N. Int'l Law Comm'n, *The Law of the Non-Navigational Uses of International Watercourses. Comments and Observations Received From Governments*, add. 1-3, ¶ 7, U.N. Doc. *A/CN.4/447*, published in 2(1) *Yearbook of the International Law Commission* (1993), *available at* http://untreaty.un.org/ilc/publications/yearbooks/Ybkvolumes(e)/ILC_1993_v2_p1_e.pdf.

119. Watercourse Convention, *supra* note 7, at art. 7 ¶ 1; *See also* Sucharitkul, *supra* note 106, at 289.

120. I borrow this phrase from Elias N. Stebek, *Eastern Nile at Crossroads: Preservation and Utilization Concern in Focus,* 1 MIZAN L. REV. 58 (2007).

and the concern for sovereignty still at play, it would take a long time for the general international law, not least the Watercourse Convention, to play a major part in the resolution of water allocation in the Nile Basin. Indeed, some have doubted whether the Watercourse Convention will ever become truly operational.[121]

The adoption of the Watercourse Convention has been met with suspicion, and even rejection, from the Nile riparian states. Ethiopia complained about the lack of balance between the rights of downstream states and those of upstream states and retorted that the Working Group that drafted the Watercourse Convention had made "no serious desire to accommodate" the interests of the upstream states, "particularly [those of] . . . a developing country such as Ethiopia."[122] Rwanda pointed out that the Watercourse Convention lacked regard for sovereignty, which it considered a "sacrosanct principle" in the treaty making processes.[123] Burundi rejected the Watercourse Convention outright and voted against it alongside China and Turkey.[124] Egypt, Ethiopia, Rwanda, and Tanzania have abstained in the voting process and have not signed the Convention since.[125] The DRC, Eritrea, and Uganda did not vote as they were absent, and have not subsequently signed the Watercourse Convention.[126] The only two Nile Basin states that voted in favor of the Watercourse Convention were Kenya and Sudan, but even these two states have yet to ratify it.[127] That leaves the Nile Basin in a desperate situation where an interstate regulatory framework is utterly absent.

Consequently, the hope of establishing a legal and institutional mechanism of interstate cooperation over the consumptive utilization of the waters of the Nile depends almost entirely on the success of the NBI processes. A regulatory framework that is specific to the basin states should be put in place soon. The resultant treaty mechanism must attempt the huge task of balancing differing conceptions of sovereignty, the competition between equitable and reasonable utilization, the no-significant harm rule, and the apportionment of common waters for current and future uses of the riparian, which in turn demands the

121. Caflisch, *supra* note 14, at 16.

122. Aaron Schwabach, *The United Nations Convention on the Law of Non-Navigational Uses of International Watercourses, Customary International Law, and the Interests of Developing Upper Riparians*, 33 TEX. INT'L L.J. 257, 275-76 (1998).

123. *Id.* at 276-77.

124. McCaffrey *supra* note 51, at 315.

125. Press Release, U.N. G.A., General Assembly Adopt Convention on Law of Non-Navigational Uses of International Watercourses, U.N. Doc. GA/9248 (May 21, 1997), *available at* http://www.africanwater.org/UNPressWater.htm.

126. *Id.*

127. *Id.*

accommodation of competing priorities of the Nile Basin states. Achieving this objective is a task of monumental proportions, and wholly depends upon the level of political will to avoid mutual suicide.

VII. TOWARD AN ATTITUDINAL CHANGE: THE DUTY TO NEGOTIATE IN GOOD FAITH

The attitudes of the Nile riparian states have unique features that contribute to the anarchic state of affairs in the Basin. The White Nile riparian states (namely, Burundi, DRC, Kenya, Rwanda, Tanzania, and Uganda) are known for their reticence and ambivalence in the move toward a negotiated agreement over Nile waters utilization. Until recently, their participation in the negotiations has been minimal.

This reticence and ambivalence is attributable to a variety of factors. The upstream states of the White Nile contribute just a modest share to the water volume of the Nile that reaches the Aswan, and the consequent potential gains from the agreed legal frameworks that may accrue to them is of minimal significance compared with the possible gains of the lower White Nile riparian states (Egypt and Sudan) and the upstream states of the Blue Nile (Egypt, Eritrea, Ethiopia and Sudan). Thus, White Nile states may not have much incentive to expend resources on a negotiated agreement. Their relatively low dependence on the waters of the White Nile Basin might lie behind such state behavior as well. Located as they are in the humid equatorial zone, with relatively reliable rainfall and alternative water sources outside the Nile Basin, the White Nile riparian states depend minimally on the waters of the Nile.[128] Besides, the gains that would accrue to them are so uncertain that they have been unwilling to risk their relationships with Egypt, their vital trading partner.[129] In sum, the White Nile sub-basin states do not see any urgent need to strive toward a basin-wide agreement.

Ethiopia, the major Blue Nile upper riparian state and the major contributor of water to the Nile, has historically been a partner without a voice. It has maintained an observer status in both *Undugu* and *TeccoNile*, two agreements that were forerunners of the NBI arrangement.[130] Egypt, for its part, has always sought to "dominate rather than coexist with the Nile Valley."[131] Eritrea, the newest state in the Basin, maintains an observer status to date and is not actively committed

128. Tafesse, *supra* note 41, at 99.

129. *Id.*

130. Simon A. Mason, *From Conflict to Cooperation in the Nile Basin* 200 (2004) (Zurich: Swiss Federal Institute of Technology).

131. Elhance, *supra* note 21, at 75.

to the NBI process.[132] Egypt almost invariably has preferred the "do-it-alone" avenue rather than concerted efforts to develop the basin waters. However, the construction of the Aswan High Dam, completed in collaboration with Sudan, seems to present an exception, but even that project was constructed more to serve Egyptian interests than those of the Sudanese. Egypt saw the importance of using Sudanese land along the common border to build the dam so that it could be closely monitored and controlled from the Egyptian side as well.[133] The catastrophic human cost of the dam in the form of forced evictions of indigenous populations from their ancestral land on which the Aswan High Dam was built was borne almost solely by Sudan.[134] In part, Egypt imposed the project on a partner that was in a weaker bargaining position, which remains the case today.

To date, Egypt is known for its propensity to resort to armed responses to perceived or real hydraulic works on the Nile that would even slightly reduce the amount of waters reaching the Aswan.[135] Thus, the internal attitude of the basin countries is marked either by indifference, mutual insecurity, or silence. This lack of enthusiasm for a basin-wide framework encourages the maintenance of the status quo and unilateralism.

However, the rules of international law require a state to negotiate in good faith with the aim of reaching an agreement.[136] In the negotiations of water basin agreements, failure to negotiate in good faith, or, alternatively, obstructing the move toward the negotiated legal and institutional framework, is culpable conduct that gives rise to state's international liability.[137] More importantly, such obstructive conduct of a state would almost inevitably cause significant harm to other basin states, and a culpable state's liability can also emerge from the causation of such harm. Moreover, it may lend a hand to riparian states' unilateral

---

132. For a complete list of NBI members, *see* NBI website at http://www.nilebasin.org/.

index.php?option=com_content&task=view&id=30&Itemid=77.

133. Shapland *infra* note 135 at 72.

134. Tafesse *supra* note 41, at 40; Shapland *infra* note 135 at 67.

135. *See* Tafesse, *supra* note 41, at 86-87; *See also* Greg Shapland, *Rivers of Discord: International Water Disputes in the Middle East* (1997).

136. *See* Watercourse Convention, *supra* note 7, at arts 3 ¶ 5, 4 ¶ 2, 8 ¶ 1, 17 ¶ 1, 2; *See also* Stephen E. Draper, *International Duties and Obligations for Transboundary Water Sharing*, 123 J. OF WATER RESOURCES PLAN. & MGMT. 344, 348 (1997); Mohamed Sameh Amr, *Diversion of International Water Courses under International Law*, 10 AFRICAN Y.B. OF INT'L L. 150-59 (2003).

137. *See generally* C B Bourne, *Procedure in the Development of International Drainage Basins: The Duty to Consult and negotiate*, 10 Canadian Yearbook of International Law (1972) 212-234.

actions over the common river and continue to breed mutual mistrust among the basin states. On each of these counts, all of the Nile Basin states can be considered suspects at best and a change of attitude as well as complete good faith in intra-basin negotiations is long overdue.

VIII. CONCLUSIONS

As the old adage has it: when the elephants fight, it is the grass that gets trampled. While Nile Basin states have engaged in legal and doctrinal wrangling on the way to reaching a basin-wide agreement, each day that passes before the treaty is ratified imposes a heavy but avertable cost on the economic, security, and environmental well-being of a tenth of the African population that inhabits the Nile Basin.

This Article has identified three major obstacles that hamper the path to a basin-wide agreement in the Nile Basin: the deficiencies of international law in resolving specific basin-wide water allocation issues (legal paucity), the lingering influence of the notion of "water security" bequeathed by colonial masters, and the doctrinal controversies arising from riparian states' adherence to contradictory theories of sovereignty. The result is the prevailing problem of good faith on the part of the Nile Basin states over the renegotiation of water sharing formulae. With the removal of these obstacles, the NBI efforts could succeed in the establishment of a legal and institutional mechanism and the eventual allocation of the Nile waters in an equitable and reasonable manner.

The impending treaty must be able to establish substantive and procedural safeguards of the rights and duties of the riparian states vis-à-vis one another. Sufficient and clear mandates must be entrusted to the would-be Nile Basin Commission that will eventually replace the NBI. In the end, success or failure of the ensuing treaty regime depends on the degree to which it incorporates clear guidelines and institutional arrangements for the resolution of potential disputes. It must make room for flexible provisions that take into account, inter alia, the needs of each riparian country, the annual and seasonal yield of the river, current uses and future projects, mechanisms for ensuring transparency and information exchange, and consultation and prior notification of planned projects. As the riparian states of the Nile do not have significant alternatives to the joint management and equitable utilization of the already fully used Nile waters, the choice is one of sailing together or sinking together. Time is running out, as is water.

"Cloud Busters": Reflections on the Right to Water in Clouds and a Search for International Law Rules

Tarek Majzoub,* Fabienne Quilleré-Majzoub, Mohamed Abdel Raouf,*** & Mira El-Majzoub******

ABSTRACT

Clouds are precious in water-scarce regions. Lurking at the heart of the struggle over our clouds' future is a clash between two contradicting visions. On the one hand there are those who believe that water in clouds is something to be made equally available to all countries. On the other hand, there are those who believe that water in clouds is simply a commodity to be bought and sold in the marketplace according to the ability or willingness to pay.

This Article sounds legal alarm bells about cloud moisture. It maps the legal contours of cloud busting, including the realities of this practice, the threats it presents to arid regions, and attempts by authorities to propose guidelines for cloud busting. It provides a reference point for reflection on how we can strengthen our efforts to monitor cloud activity in all its forms and manifestations. The right to water in clouds will be the focus of those seeking to restrict some users on the grounds that they use too much rainwater to the detriment of

* Associate Professor of Public International Law, Beirut Arab University, Faculty of Law and Political Sciences, P.O. Box: 11-5020, Beirut-Lebanon.

** Doctorate in Law, Researcher, Unité Mixte de Recherche—Centre National de la Recherche Scientifique 6262, Faculty of Law and Political Sciences, 9 rue Jean Macé, 35042 Rennes Cedex-France.

*** International Arbitrator, Attorney at Law, 17 Mohamed Mahmoud St., Bab El-Louk 11461, Cairo-Egypt.

**** Attorney at Law, 17 Mohamed Mahmoud St., Bab El-Louk 11461, Cairo-Egypt.

others. In order to avoid this conflict, three sets of issues have to be addressed. First, who has the right to water in clouds? Second, should tort liability attach to a rainmaker for the damage caused by the rain he induces or prevents, and if so, what sort of regulatory framework should govern such liability? Third, should a rainmaker be able to claim the share of the water induced from cloud modification, and what particular regime should be formulated for cloud water property rights allocation?

As we strive to make this an age built firmly upon a drought-less future, international law plays a crucial role in providing the legal framework within which the international campaign for cloud activity control and regulation can unfold.

I. INTRODUCTION

Water is one of the distinguishing characteristics of our planet. It is the substance that characterizes Earth as "The Blue Planet." Simply put, no life whatsoever is possible without it. Water is the essence of life.

The world is heading toward a major water crisis in the next few decades.[1] Although over seventy percent of Earth is covered by oceans, ninety-seven percent of the planet's water is salty and unfit for direct consumption. Of the three percent that is fresh water, more than two-thirds is unavailable for human use because it is locked up in glaciers, snow, ice, and permafrost. Available fresh water is a fixed quantity resource (its volume never changes); it is thus finite and unevenly distributed in both space and time. Every drop of water counts because that drop never reappears or reproduces, though it may change its state from liquid to gas to solid and back to liquid, and travel from the Arctic to the Arabian Sahara and then on to the Russian steppes. Climate change looks as though it will accelerate this process, increasing rates of evaporation and thus of precipitation as well. In most places, warmer also means wetter in terms of increased rainfall, but drier in terms of increased evaporation rates.

Water has become a focal point for recurring tensions and conflicts all over the water-short world. In the face of this predicament, technological advances offer the possibility of efficient interference with the environment by manipulating natural phenomena. However, the results are not always conclusive. Among the possible uses of new technology is the busting (capture) and use of atmospheric water found in clouds.[2] Such intervention with precipitation and weather

1. *See* WORLD WATER ASSESSMENT PROGRAMME, WATER - A SHARED RESPONSIBILITY, THE UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 2 (2006).

2. Among the ambitious examples, *see* Permanent Interstates Committee for

modification[3] benefits some cloud water users, but could prove to be detrimental to others. As a result, this atmospheric water diversion is fueling conflicts and raising many potential problems.[4]

As certain weather modification activities became a reality in the early 1950s, numerous complex legal questions arose. Many of these have remained controversial and will continue to be so until more experiments are conducted and a more complete understanding of weather modification results is possible. Legal aspects of weather modification may be local, national, regional, or international. One key issue is the ownership of the atmosphere. Questions have been raised as to whether it belongs to the person who owns the land beneath it, to the state that is located beneath it, or to the collective nations over which the atmospheric winds travel.

As stated by the World Meteorological Organization ("WMO"), "Legal aspects may be particularly important when weather modification activities are performed in the proximity of borders between different countries."[5] Furthermore, F.J. Lyden and G.A. Shipman have asked:

Drought Control in the Sahel (CILSS), Ouagadougou, Burk. Faso, May 25–28, 2004, *Report on the First International Scientific Conference on Rainfall Enhancement through Cloud Seeding in the Sahel*, *available at* http://www.agrhymet.ne/PDF/APEN%20-%20Rapport%20final%20English.pdf. *See also* MIGUEL S. MARIENHOFF, 4 TRATADO DE DERECHO ADMINISTRATIVO: RÉGIMEN Y LEGISLACIÓN DE LAS AGUAS PÚBLICAS Y PRIVADAS 247–285 (2006).

3. Weather modification, sometimes referred to as weather control, is the general term for efforts to artificially alter the natural meteorological phenomena of the atmosphere. Attempts to increase or decrease precipitation, dissipate fog, and prevent frost are all included under weather modification. Cloud modification, or cloud seeding, is the best-known type of weather modification, and usually has as its goal either dissipation of the cloud or stimulation of precipitation. Cloud seeding has been of interest for centuries, although it is only in recent times that the possibility of modifying the weather in certain specific ways has become a reality.

4. Since the 1940s, cloud seeding has been used to change the structure of clouds by dispersing substances into the air, potentially increasing or altering rainfall. In 1950, New York City tapped the sky; it was history's first attempt to utilize systematically "triggered" clouds as a direct and steady source of water. *See Wanted: Dairy Clouds*, TIME, Mar. 27, 1950, *available at* http://www.time.com/time/magazine/article/0,9171,805279,00.html. In order to alleviate the 1976 "severe drought" in France that had diminished the region's water supply, the préfet of Loir-et-Cher initiated a cloud modification experiment. As a result, he received a letter of reprimand from several ministries for his leading experiment as if he was a cloud thief, and implicitly referring to the existence of a right to clouds. Gérard Bélorgey, *Le voleur de nuage —1976*, *in* BULLES D'HISTOIRE ET AUTRES CONTES VRAIS (2000). "One might suggest that a central question raised by the Middle East problematic is 'Who owns the rain?' " Malin Falkenmark, *Foreward* to STEPHEN C. LONERGAN & DAVID B. BROOKS, WATERSHED: THE ROLE OF FRESH WATER IN THE ISRAELI-PALESTINIAN CONFLICT, at ix, x (1994).

5. World Meteorological Organization [WMO], *General Summary of the Work of the Fifty Third Session of the Executive Council*, WMO No. 929, 97–98 (June 5–15,

> Is weather modification a public function, analogous to military protection, postal service, or highway construction? Or is it a private, non-governmental function? If the latter, is it a private function vested with public interest, as had been determined to be the case, for example, in rail or air transportation?. . .Or is weather modification an ordinary, lawful business, subject only to reasonable regulation, as in the manufacture and sale of clothing? This view raises questions about property rights, i.e., who owns the clouds?[6]

Who owns the clouds in the sky?[7] It sounds like a silly question or even a provocative one, and a few decades ago it would have been so. This question would not have occurred to most of us because it invokes principles that are hard for the conventionally trained mind to accept. We intuitively think some phenomena of nature should be exempt from mundane property laws. However, just as land is privately owned and water is also increasingly privately owned, so now potential users of the water in clouds (farmers, stock breeders, commercial forestry industry, households, cities, municipalities, and other entities) have begun to struggle over its ownership.

States make legal claims to both air space and territorial waters, so extending ownership to the clouds and the water that the clouds carry is not unreasonable or illogical. Based on current precedent in common law, the first state that can convert clouds to potable water should be able to claim ownership.[8]

The accessibility and exploitation of water in clouds has become the object of covetousness and intemperance. Clouds are potential elements of the economic strength of a nation over which they fly. Their appropriation and interception by virtue of artificial process already generates disagreements and damages. If problems regarding the property right or the right to compensation have arisen inside national boundaries, how would these be resolved between sovereign states, and what theory should apply? To what rule should nations refer? Is international law able to propose acceptable solutions? How should potential conflicts between states be avoided?

This Article will discuss how the international community should approach the political and legal problems inherent to weather

---

2001) (Annex III to agenda item 5.6 of the general summary).

6. F.J. Lyden & G.A. Shipman, *Public Policy Issues Raised by Weather Modification: Possible Alternative Strategies for Government Action*, *in* HUMAN DIMENSIONS OF WEATHER MODIFICATION 289–303 (W.R.D. Sewell ed., Univ. of Chicago 1966).

7. *See generally* Fabienne Quilleré-Majzoub, *À qui appartiennent les nuages?*, 50 ANNUAIRE FRANÇAIS DE DROIT INTERNATIONAL 653 (2004).

8. PETER GLEICK, THE WORLD'S WATER 1998–1999, at 105 (Island Press 1998).

modification. Part II will examine the property rights issues surrounding cloud water. It will detail traditional notions of property law, and will address the economics and ethics behind using cloud water as a commodity. Part III will discuss the type of liabilities that could attach to individuals or governments injuring others using cloud seeding or other weather modification techniques. It will then describe how these liabilities should be enforced via an international regulatory framework. Finally, Part IV summarizes what the international community should do to address these issues and answers several questions surrounding the regulatory framework concept. Cloud seeding and other forms of weather modification have the potential to satiate rain-parched lands, as well as put an end to damaging floods. However, they also have the potential to wreck havoc on natural climates and to cause international legal and economic strife. The consequences of using these methods without international regulation would be dire indeed.

II. PROPERTY RIGHTS, ECONOMICS, AND THE WATER IN CLOUDS

The idea of using clouds as a water resource is not new.[9] Cloud modification provides an interesting example of how this ownership of water can be carried out to the extreme. The two-fold question to be raised is whether the interception of the water in clouds clashes or harmonizes with property rights, and whether cloud-trading is feasible or not. But first, how do clouds form?

9. If the air near the ground is cooled sufficiently, it becomes saturated and fog develops. For centuries, inhabitants of the arid island of El Hiero, the smallest of the Canary Islands in the Atlantic, quenched their thirst with the fog droplets deposited on a legendary laurel, the Garoé, called "the fountain tree." It is said that in 1952 Wilhelm Reich (Mar. 24, 1897–Nov. 3, 1957) invented a method of rainmaking that does not involve cloud seeding with chemicals—cloud busting, otherwise known as etheric weather engineering. Among the properties of the primordial energy orgone, Reich observed, are its absorption into water, its role in controlling weather, and its dangerous state when excited by radioactivity. One of the features of this energy is that it could be manipulated at great distances in the sky, creating rain by altering the relationship of the electrical charge between the earth and the atmosphere using a simple arrangement of tubes that are grounded in running water. This eccentric cloud buster apparatus was supposed to manipulate atmospheric cosmic orgone energy by altering concentrations of this energy in the atmosphere.

A. Background: Cloud Formation and Cloud Categories

Clouds form as air rises and cools by expansion. The ability of water to exist as invisible vapor in air is directly dependent on the temperature. Clouds are classified into ten main groups, called cloud *genera*, which are mutually exclusive.[10] The ten cloud *genera* are grouped according to height (high, middle, and low) and vertical development.[11] The high clouds (cirrus, cirrocumulus, and cirrostratus) form at heights from six to fourteen kilometers. [12] The middle clouds (altocumulus and altostratus) form at heights from two to seven kilometers.[13] The low clouds (nimbostratus, stratocumulus, and stratus) form below two kilometers.[14] Clouds with vertical growth are cumulus and cumulonimbus.[15] Not all clouds produce rainfall or are nascent rain clouds or rain-laden clouds. Therefore the growth mechanism of raindrops is important in determining how much rainfall reaches the Earth's surface.

B. Is the Territorial Appropriation of Clouds Conceivable?

> There is no short and general definition of property. Hence many questions arise when we think of property rights in, over, against, etc., water. What kind of 'thing' is water, in the first place, and is it at all capable of ownership or other interests—like other goods? What property rights can be enjoyed? How are water property rights acquired and how far-reaching are they? Do the theories and/or material rules on water property differ depending on the legal system, and how? How are groundwater rights coupled to land, and can they be decoupled? Who can tamper with groundwater yields, and who can prevent others from doing this?[16]

---

10. WMO, THE INTERNATIONAL CLOUD ATLAS (1956) (establishing criteria for classifying clouds).

11. JOE R. EAGLEMAN, METEOROLOGY: THE ATMOSPHERE IN ACTION 23-24 (2d ed. 1985).

12. *Id* at 24.

13. *Id.* at 24.

14. *Id*., at 24.

15. *Id.* at 24.

16. Jenny T. Grönwall, *Access to Water*, 439 LINKÖPING STUDIES IN ARTS AND SCIENCES 237 (2008) (dissertation from Linköping University, Dept. of Water and Env. Studies), *available at* http://www.indiawaterportal.org/tt/urban/res/urn_nbn_se_liu_diva-11686-1__fulltext.pdf.

One key question arises in the cloud modification context: Does the interception of cloud water clash with the idea of property rights?

The legal right to access water is an important part of property law. In the classic tradition, land appropriation led to a form of water appropriation.[17] The right to reasonably use water beneath property is considered inalienable and considerably increases the value of irrigated land. In the logic of land appropriation, when water in clouds reaches the ground, it becomes a constituent element thereof and is subject to territorial appropriation for the benefit of the receiving estate landowner. It is well-established law that surface water entering a landowner's land can constitute a trespass. For example, the landowner is responsible for the harm done to others by the outgoing streaming water from his property. Liability for trespass requires a plaintiff to prove intent, negligence, or abnormally dangerous activity by the defendant. This liability presumes that the landowner normally undertakes the construction of installations or other necessary works to prevent foreseeable harms after usual precipitation. But if no precipitation occurs, does the water in the cloud itself belong to someone?[18]

> The atmosphere is not a distinct category in international law. Because it consists of a fluctuating and dynamic airmass, it cannot be equated with airspace, which, above land, is simply a spatial dimension subject to the sovereignty of the subjacent states. But this overlap with territorial sovereignty also means that it cannot be treated as an area of common property beyond the jurisdiction of any state, comparable in this sense to the high seas.[19]

As an element of the atmosphere, clouds flying in the airspace above a state are entirely within that state's sovereignty, regardless of where the clouds came from and regardless of their altitude. Furthermore,

> [t]he exclusive and absolute sovereignty of the state over [airspace] is groundless without height limit . . . [Its] true justification lies . . . in the defense of the national security interests, [because] the danger for

17. The core principle is "what falls on your property belongs to you." For the importance of this issue in Bolivia, *see* Josh On, *Defend Cochabamba Water Rights*, SOCIALIST WORKERONLINE 11, May 3, 2002, http://socialistworker.org/2002-1/405/405_11_ReportsInBrief.shtml#Water (visited November 11, 2008); for India, *see Drought in Reforms, But Who Owns the Rain?*, TIMES OF INDIA, July 28, 2001 (dispute between the Alwar and the Bharatpur), http://timesofindia.indiatimes.com/articleshow/437322102.cms.

18. *See* U.N. Env't Programme, Freshwater Consultative Forum, First Session, Dec. 13–16, 1993, Geneva, Switz., *Report of the Meeting* (1994).

19. PATRICIA W. BIRNIE & ALAN E. BOYLE, INTERNATIONAL LAW AND THE ENVIRONMENT 390 (1992).

> the security of the subjacent States is the same as in the case of the foreign aircraft overflight, regardless of the height.[20]

"Aircraft may only traverse the airspace of states with the agreement of those states, and where that has not been obtained an illegal intrusion will be involved which will justify interception, though not (save in very exceptional cases) actual attack."[21] Accordingly, the international law rules protecting sovereignty of states apply equally to the airspace as they do to the land below. As the International Court of Justice noted in the Nicaragua Case, "[t]he principle of respect for territorial sovereignty is also directly infringed by the unauthorized overflight of a state's territory by aircraft belonging to or under control of the government of another state."[22] The security implications of air use give the airspace a specific status. These principles could be applicable to clouds as well because water contributes to national security interests by producing water and, therefore, have the ability to guarantee a state a water-secure future.

Many legal experts have explored the legal consequences of such assimilation, under the assumption that it is expedient to treat clouds like territorial space.[23] Some American courts did the same in order to answer the claims of landowners who considered themselves victims of cloud diversion.[24] These courts have ruled that clouds, and the water in them, belong to individuals situated beneath the cloud; just as landowners have mineral rights to underground resources.[25] This assimilation has allowed states to argue territorial jurisdiction (*ratione loci*) against these new

---

20. NGUYEN QUOC DINH, ET AL., DROIT INTERNATIONAL PUBLIC 1249 (7th ed. 2002).

21. MALCOLM N. SHAW, INTERNATIONAL LAW 464–465 (5th ed. 2003).

22. Military and Paramilitary Activities (Nicar. v. U.S.), 1986 I.C.J. 14, ¶251 (June 27).

23. *See Who Owns the Clouds?*, 1 STAN. L. REV. 43 (1948); Stanley Brooks, Comment, *The Legal Aspects of Rainmaking*, 37 CAL. L. REV. 114 (1949); *Legal Remedies for 'Cloud-Seeding' Activities: Nuisance or Trespass?*, 1960 DUKE L. J. 305 (1960).

24. At the end of 1940s and the beginning of 1950, the first experiences of cloud seeding were revealed to the public in the United States. Disputes have arisen between farmers, landowners, and forest-owners. Does cloud seeding give the right to favor one land user over another? Legal cases of individuals who have allegedly suffered damages because of cloud seeding operations represent a problem for the legal system because plaintiffs generally are unable to establish cause and effect relationships that would allow a positive decision. Because of the unpredictable nature of the atmosphere and the difficulty of obtaining complete and accurate measurements during weather modification activities, it is often difficult to specify the exact cause of damages. Most of the few lawsuits involving weather modification have been decided in favor of the weather modifiers. *See* RONALD B. STANDLER, WEATHER MODIFICATION LAW IN THE USA 5 (2006), www.rbs2.com/weather.pdf.

25. *See supra* note 23.

infringements. Questions arising from this adopted position are not trivial. If the riparian landowner to a watercourse captures all the water in clouds falling on his land, what will happen if the watercourse dries up as a result?[26] Although water is indeed an economic good attached to land, if all rainwater is regarded as the private property of the landowner, what will this real property be in the case of cloud modification or a reduction of precipitation?

The territorial approach was quickly abandoned for the idea of the non-existence of a supposed right to water in clouds or the moisture they contain—that rainwater belongs to nobody.[27] However, this idea has not been well received in the western United States because of a long, conflicted history of struggle for private water and mineral rights.[28] Still, the dominant idea remains that the sky belongs to everybody.[29] In spite of the conflict of interests that these practices may lead to, U.S. federal legislation regarding these issues remains limited.[30] Under many state

26. Stephen Robertson, Minister of Natural Res. and Mines of Austl., Speech: Property Rights, Responsibility, and Reason (Apr. 8, 2003); *see also* Rohan Bennett, Jude Wallace & Prof. Ian Williamson , ACHIEVEING SUSTAINABLE DEVELOPMENT OBJECTIVES THROUGH BETTER MANAGEMENT OF PROPERTY RIGHTS, RESTRICTIONS & RESPONSABILITIES*, in* Expert Group Meeting on Incorporating Sustainable Development Objectives into ICT Enabled Land Administration Systems, Nov. 9–11, 2005, Centre for Spatial Data Infrastructures and Land Administration, University of Melbourne, Australia, *available at* http://www.sli.unimelb.edu.au/research/SDI_research/EGM/papers/Bennett%20-%20Rights%20Restrictions%20and%20Responsibilities.pdf.

27. *See* B.B. Coble, Benign Weather Modification, School of Advanced Airpower Studies (June, 1996) (unpublished thesis, Air University, Maxwell Air Force Base), http://www.fas.org/spp/eprint/coble.htm.

28. *Id.*

29. *Id.*

30. In the United States, there are no federal regulations on weather modification activities. In 1970, the Environmental Science Services Administration of the National Oceanic and Atmospheric Administration ("NOAA") was authorized to establish a mandatory reporting system for all weather modification activities in the country. This reporting system, however, was not designed to represent comprehensive weather modification action at the federal level. Relevant commercial organizations have to report their activities to NOAA as well as to the Department of Commerce ("DoC"). Congressional legislation to establish a National Weather Modification Program ("NWMP") (the Hutchison Bill, S. 517, in the Senate and a companion bill introduced by congressman Udall) stalled in the 2006 Congress. If it had passed, this legislation would have supported and extended existing research efforts and could have lead to such benefits as relief from drought or severe water shortages. Slightly more than half of the states have passed weather modification regulations. These state regulations are not uniform, and in some cases they are even contradictory. The state of Maryland prohibited any form of weather modification for the two year period starting in 1965. Pennsylvania has a law granting the individual county the option to prohibit weather modification if it is considered detrimental to that county's welfare. Some states, such as Kansas, North Dakota, Wisconsin, and Oregon, have laws that attempt to regulate weather modification

laws, the cloud seeder is held to a standard of competence and professionalism, and must take reasonable care to avoid foreseeable and unreasonable risks before performing the cloud seeding operation.[31] State governments grant permits to licensed cloud seeders to conduct seeding operations at a specific place for specific time ranges.[32] Despite these precautions, there has been frequent litigation between individuals in the same state and also between states.[33] The strictly territorial approach of the right to water in clouds was overturned[34] as it was impossible to define the scope of the property right due to the inconsistent nature of clouds. A cloud may naturally dissipate. It constantly changes shape, location, content, and size; it may divide into two or more clouds; it may merge with other clouds; or it may evaporate entirely.

Other seldom-addressed questions regarding property rights to clouds arise as well. For example, who owns the right to the extra water in clouds that is produced by cloud modification? What is the government's responsibility to regulate that ownership equally and fairly on citizens' behalf?[35] Who really owns the rain falling on land? Each of

---

activities through licensing. Some of these also provide for collecting and evaluating data that result from modification activities. States such as Colorado, Louisiana, and New Mexico have regulations prohibiting certain weather modification activities within their boundaries that might conceivably affect another state. On the other hand, some states claim sovereignty over the moisture that is in the atmosphere above. *See* EAGLEMAN, *supra* note 11, at 289.

31. STANDLER, *supra* note 24, at 4 ("There are two common features of state regulations: ensure that commercial weather modification companies are competent . . . and require companies have the resources to compensate those harmed by their weather modification (so-called 'proof of financial responsibility')").

32. *Id.* ("Some states require public hearings before a cloud seeder is granted a permit.").

33. *See id.* at 5, 20. This liability problem is recurrent in the field of weather modification. Regarding the dispersion of fog (transformed in snow) around American military bases, a thirty year old experimental system (COLD WAND Project) is still in service and gives total satisfaction. It is, however, less used because the military authority hesitates to engage their liability for the risks of civil accidents due to ice deposit outside the base. *See also* L. Mampaey, *Le Programme HAARP: Science ou Désastre?, in* LES RAPPORTS DU GRIP, No. 98/5 (1998), *available at* http://www.grip.org/pub/rapports/rg98-5_haarp.pdf.

34. *Slutsky v. City of New York, 197* Misc. 730, 97 N.Y.S.2d 238 (Supreme Court, 1950). In fact, how can a state pursue a cloud if a neighboring state catches it by seeding? What could a state do if another state took a lot of its water by capturing precipitation?

35. In dry areas where every drop of water belongs to someone, large-scale rain collection could hurt downstream users or siphon off water that is reserved to provide minimum flow. Environmental groups worry that large, unregulated rainwater collection operations could bleed water from downstream users. In July 1999, a Victorian farmer in Australia, Julian Kaye, got the shock of his life. The local water authority demanded that he pay $30,000 because the rain that landed on his property did not belong to him. Julian

these questions shows the absurdity of the private ownership position being adopted by some state laws. Does every landowner have a property right in the clouds and the water in them?[36] Is a landowner entitled to such precipitation as nature designs to bestow? Some may argue that laying claim to the rain falling on land, or the claims of rain ownership generally, are outrageous. Do those claims stand when there is a flood? If rainwater was privately owned and some lands were flooded, can we sue the rainwater private owners for letting their water onto others' property? Rain that falls on a landowner's roof or rainwater collected in a barrel or a cistern in his backyard is not his for the taking; it is tributary to the stream, river, or aquifer. Hence, a landowner ought to be restricted from planting trees that would consume tributary water in a recharge area. The recharge area is a zone which absorbs rainfall and feeds it to an underground aquifer or runs down the catchments.[37] Afforestation within the area will negatively impact the irrigation requirements of land downstream. A claim to the rain falling on land does not favor one land user over another. Rain is, in some sense, a resource of the state, and is often regulated through a public waters allocation process that can take years to navigate. Under some states' laws, rainwater is considered a water resource of the state and indeed, a state might start charging citizens if climate change affects water supplies.[38] Where a state holds title to the rainwater it is illegal to use rainwater without a permit from government authorities.[39] This is disillusioning. There is the dismal thought that rainwater has been leased to downstream users in the water

---

Kaye had decided to grow a few grapes just west of Ballarat and put in a dam. Under New South Wales laws, farmers are allowed 10% of the water that falls on their land for free. Any more and they need a license. Some prior or senior water users in Colorado already have rights to the rain before it lands in non-senior rain barrels. "Colorado water law follows the prior appropriation doctrine, of which the core principle is 'first in time, first in right.'" Dan Fitzgerald, *Who Owns the Rain That Falls on Your Roof?*, COLO. CENT. MAG., May 2008, at 14, *available at* http://www.cozine.com/archive/cc2008/01710141.html.

36. According to some authors, every landowner has a property right in the clouds and the right to receive that moisture in its natural form, subject to cloud modification activities carried out by governmental authorities in the public, as opposed to private, interest. *See supra*, note 23; Fitzgerald, *supra* note 35. This vested property right in clouds and moisture was unsupported by legal authority or reason and was not favorably received. *See* Robertson, *supra* note 26; Coble, *supra* note 27; STANDLER, *supra* note 24.

37. Such water is known as green water (i.e. the fraction of rainwater that is available as soil moisture) for rain-fed agriculture, fuel wood production and carbon sequestration. *See* Khaled Abu-Zeid, *Green Water and Effective Legislation on Transboundary Management*, *in* MEDITERRANEAN Y.B. 89 (2008).

38. Some states started trying to craft new regulations to govern rainwater collection and remove legal uncertainties. Past legislative efforts have died in the buzz saw of statewide water politics. *See* Fitzgerald, *supra* note 35.

39. *Id.*

table: Who did these people lease the rain from and how did the lessor get ownership of it?

Despite the unsettled important legal issues about who has property rights in clouds that might provide rain,[40] there are many interesting environmental and economic implications of this kind of water ownership.

C. Can We Put a Price Tag on Clouds?

Cloud modification has been viewed as a promising science of the future.[41] This practice has been used for decades in some developed states, but more and more nations are picking it up in attempts to clean the skies and to either trigger or prevent rain events.[42] Interest in rainmaking has been spurred by factors including drought and the need for irrigation water.

The technology to capture water in clouds is now at an advanced stage and some basic investments in such technology have been made. Several commercial activities sprang up overnight after repeated droughts and dwindling water supply.[43] The first newspaper accounts of cloud commodification were greeted with skepticism.[44] As evidence showed that cloud-trading was possible, skepticism turned to amazement. To most people, the possibility of cloud-trading was truly novel. Others

---

40. It should be noted that "[t]hree states (Pennsylvania, New York, and Texas) have case law dealing with ownership of atmospheric waters… Thus, the cases are scattered;… Consequently, it is difficult to deduce any general rule from the cases directly in point." *See* CONRAD G. KEYES, GUIDELINES FOR CLOUD SEEDING TO AUGMENT PRECIPITATION 58 (2006).

41. *See* Bob Moen, *Scientists Excited for Wyoming Cloud-seeding*, USA TODAY, Dec. 19, 2005, http://www.usatoday.com/tech/science/2005-12-19-wyoming-cloud-seeding_x.htm.

42. *See*, *e.g.*, Ian O'Neill, *The Chinese "Weather Manipulation Missile" Olympics*, UNIVERSE TODAY, Aug. 12, 2008, http://www.universetoday.com/2008/08/12/the-chinese-weather-manipulation-missile-olympics.

43. *See* Moen, *supra* note 41.

44. "China's Office of Artificial Weather Inducement is one of the world's leading users of rain-making technology." Jonathan Watts, *Cities Fall Out Over Cloud*, THE GUARDIAN, July 15, 2004, http://www.guardian.co.uk/environment/2004/jul/15/china.weather/print.

> So far, cloud seeding has been used as a not-for-profit public service, usually to wash away pollution from the coal-contaminated streets in China's capital. For the first time ever, though, the government has started selling clouds to individual investors and large corporations for personal use. Asking cost: between US $700 to $3500 per cloud.

Nico Isaac, *China: Head in the Clouds?*, ELLIOTT WAVE INT'L, June 14, 2007, http://elliottwave.com/features/default.aspx?cat=gw&articleid=3131.

were angered. Arguments against cloud-trading fell into three categories: (1) opposition to interfering with the natural order; (2) concern for the environment; and (3) opposition to the indiscriminate nature of cloud use. Feelings clearly run deep when it comes to pricing what many consider to be "God's domain."

Clouds are most precious in arid regions and in areas affected by drought. Lurking at the heart of the struggle over water in clouds is a clash between two contradicting visions. On the one hand are those who believe that water in clouds is something to be made equally available to all states, people, and nature. On the other hand, there are those who believe that water in clouds is simply a commodity to be bought and sold in the marketplace for profit and distributed according to the ability or willingness to pay.

The legal answer to the question of whether clouds should be tradable economic commodities remains uncertain. If the water competition became keen, it would also raise a difficult legal question: Are clouds tradable commodities, or tradable economic goods? Even in a parched world, this hypothetical question is paramount. Did we open Pandora's Box when we raised it? Should water in clouds be an internationally traded commodity? The idea of cloud ownership is frightening indeed. Technological advances often create new moral conundrums. This is an example of the commodification of a previously "non-valued" resource. Ethical and environmental issues aside, the active market in cloud ownership is a clear sign of an economic problem in the making.[45]The stakes in this legal, moral, and environmental dispute are far higher than people might think. Not only is the future price tag of cloud water at stake, but so are the benefits that could be gained from bulk cloud-trading and the expansion of a cloud credit scheme.

At this particular moment, when everything appears to be up for sale, some of the world's most powerful corporations are lining up to take advantage of lucrative profit opportunities in what has huge long-term growth potential. However, the citizens' movement is fighting back, and is reclaiming water as a right that belongs to all people and nature.[46]

---

45. From a capitalist point of view, this is an opportunity to cash in. From a humanitarian perspective, this seems like another loss to the wheels of underdevelopment.

46. With the natural water cycle, cloud modification is part of the natural environment that belongs to everyone. Many citizens' movements fight for the recovery of the right of water. *See, e.g.,* Blue Planet Project, Right to Water, http://www.righttowater.ca/ (last visited Apr. 27, 2009); WaterAid & Right and Humanity, The Right to Water, http://www.righttowater.info/ (last visited Apr. 27, 2009). United Nations organizations are also involved. *See*, *e.g.*, *What Price Water?*, UNESCO COURIER, Feb. 1999, *available at* http://www.unesco.org/courier/1999_02/uk/dossier/intro.htm; World Health Organization, The Right to Water, http://www.who.int/water_

In dry or parched regions, procedures for triggering rain from clouds can be of enormous importance. However, this cloud modification technique is reportedly sparking rows between neighboring states.[47] The practice has caused considerable controversy in recent years, with some saying that one area's success with rain means shifting moisture from one place to another.[48] While it may be advantageous for some, if a cloud drops all of its moisture in one place, then it will not be able to drop it somewhere else, thereby creating potentially devastating economic effects on people and countries further down the watershed. What if one country gets to the best clouds before they drift over to a neighboring nation? Resource rights and their affiliated economic consequences are at the root of the conflict.

If some weather modification's proponents have their way, not only would the water be owned, but also the owners could control parts of the hydrological cycle. If clouds can be forced to release their moisture before they naturally would do so, or if moisture can be prevented from falling or intercepted by "cloudnappers," great harms are possible. States will soon be accusing each other of what could prove to be one of the defining crimes of the twenty-first century: cloud theft.

III. POTENTIAL LIABILITIES ASSOCIATED WITH WEATHER MODIFICATION

Rainmakers could face tort liability for the damage caused by the rain they induce or prevent. In order to avoid emerging disputes, it is necessary to know if international law is ready or prepared for this endeavor. In other words, are states responsible for all national activities on cloud modification, and will they be liable for damages caused by unwanted rain? Can advances in observational technologies help solve

---

sanitation_health/rightowater/en/ (last visited Apr. 27, 2009); World Water Council, Right to Water, http://www.worldwatercouncil.org/index.php?id=1748 (last visited Apr. 27, 2009); U.N. Comm'n on Human Rights, Comm. on Econ., Soc. and Cultural Rights, *Compilation of General Comments and General Recommendations Adopted by Human Rights Treaty Bodies*, 106–123, U.N. Doc. HRI/GEN/1/Rev.7 (May 12, 2004).

47. China has been accused in the near past by neighboring countries that it is stealing their clouds. *See* O'Neill, *supra* note 42; Watts, *supra* note 44; Isaac, *supra* note 44.

48. Critics say that increasing the rainfall in some areas has the disadvantage of decreasing the amounts of precipitation in other regions. Scientists say that the phenomenon is not well known, but the chance of that happening is remote. *See* NATIONAL RESEARCH COUNCIL, COMMITTEE ON THE STATUS AND FUTURE DIRECTIONS IN U.S. WEATHER MODIFICATION RESEARCH AND OPERATIONS, CRITICAL ISSUES IN WEATHER MODIFICATION RESEARCH (2003).

the causation issue? How will cloud safety fit within the international regulatory framework? And what are the essential elements, desirable features and emerging trends for a cloud safety framework in an age of climate change? The following sections will address each of these questions.

A.Multilateral Nature of the Problem

One of the biggest problems with cloud modification is that its effects commonly involve more than one state. For example, cloud modification in the sky above State A might later cause rain in State B. An unwanted man-made cloudburst or snowstorm in State B could wash out a dam, cause loss of life, and create potentially devastating property damage. Cloud control will also make it possible to divert rain from certain areas potentially resulting in huge property damages due to drought.

The two basic methods used to artificially induce or increase precipitation[49] include collecting the fog[50] and cloud seeding.[51] The

---

49. In some societies, rain dances or other rituals have attempted supernaturally to increase rainfall. Though there is no scientific basis for the belief that this worked, the rituals are surprisingly persistent and known ceremonies are continuing to the present day. Another supposed activity intended to produce rain is generation of electromagnetic transmissions that produce a scalar grid over a given location. This is done by transmitting these low frequency scalar waves in pairs so that they converge at a predetermined point on the earth's surface and cause a disruption of the atmosphere. This technology can be used to alter the course of the jet stream and set up long-term weather blocks. The High Frequency Active Auroral Research Program ("HAARP"):

> is a scientific endeavor aimed at studying the properties and behavior of the ionosphere, with particular emphasis on being able to understand and use it to enhance communications and surveillance systems for both civilian and defense purposes. The HAARP is committed to developing a world class ionospheric research facility consisting of the Ionospheric Research Instrument ("IRI"), a high power transmitter facility operating in the high frequency (HF) range that will be used to temporarily excite a limited area of the ionosphere for scientific study, and a sophisticated suite of *scientific (or diagnostic)* instruments that will be used to observe the physical processes that occur in the excited region. Observation of the processes resulting from the use of the IRI in a controlled manner will allow scientists to better understand processes that occur continuously under the natural stimulation of the sun. Scientific instruments installed at the HAARP Observatory will be useful for a variety of continuing research efforts which do not involve the use of the IRI but are strictly passive. Among these studies include ionospheric characterization using satellite beacons, telescopic observation of the fine structure in the aurora, and documentation of long-term variations in the ozone layer.

See Program Purpose, HAARP, http://www.haarp.alaska.edu/haarp/gen.html (last visited Apr. 14, 2009).

50. The first known project to harness fog for water was initiated in northern Chile,

latter involves dropping dry-ice or silver iodide on cumulus clouds or rain-laden clouds, i.e., seeding the air with dry-ice or silver iodide pellets or crystals.[52] This in turn induces or accelerates the water droplets in the

---

where, in the town of Chungungo, the cost of providing water had risen to almost US $8 per inhabitant per day. The cost of water, in addition to the difficulty of transporting it over a broken and rutted road, was an unbearable burden for the villagers. Had it not been highly subsidized by the municipality, the cost would have been equivalent to forty percent of the average family income.

> In November 1987, Chilean universities and the Corporación Nacional Forestal (National Forestry Corporation) initiated the project to collect water from the fog covering a nearby mountain, using "fog traps." Fifty collectors measuring 48 square metres each were erected above the town. The material used was a double-layer polypropylene mesh net, which costs little and is produced in Chile. The mesh collectors are entirely passive devices, requiring no energy. In addition, since collectors are normally situated on terrain higher than surrounding settlements, water can be delivered by gravity flow. The system gathers an average of 7,200 litres of water a day, a yield that was obtained even during three consecutive years of drought.
>
> Today in Chungungo water from fog traps costs only a quarter as much as water transported by road, amounting to US $1.87 per cubic meter on the basis of amortizing the project over 20 years. The villagers are in charge of maintenance and administration. And, for the first time in their history, the fishermen have begun to cultivate family vegetable gardens.
>
> The project is now establishing alternative water supply systems for all of the populated areas along the coastal desert of Chile. The Chilean example was so successful it inspired other similar initiatives elsewhere, including in the neighboring country of Peru and on the other side of the world in the Sultanate of Oman.

Trapping Fog to Meet Water Needs, TAKING ACTION (Adam Rogers ed., United Nations Environment Programme 1996), *available at* http://www.nyo.unep.org/action/11.htm#jump6. *See also* Nicolas Kuhn*, Filets à nuages,* INSEAULITES (École Supérieure de Journalisme de Lille 2000), http://www.esj-lille.fr/atelier/js/js00/a4.htm.

51. On this basis, the American physical chemist Irving Langmuir and his associates carried on Project Cirrus from 1940 to 1952 to find ways to produce rain. *See* 10 I. LANGMUIR ET AL., THE COLLECTED WORKS OF IRVING LANGMUIR 145–73, 189–96 (1961); 11 *id.* The principle behind the cloud seeding process is actually very simple. The chemicals are injected into the clouds provide small particles on which water vapor can condense. As more and more vapor condenses on a particle, it gets heavier and falls down to the surface of the Earth under its own weight, thus creating rain. Such hydroscopic materials—meaning that they absorb water—are being developed to improve the performance. Certain hydroscopic flares offer a lot of the seeding material and are more effective over wide ranges of temperatures and different types of clouds. *See* G.K. Mather, *Coalescence Enhancement in Large Multicell Storms Caused by the Emissions from a Kraft Paper Mill*, 30 J. APPLIED METEOROLOGY 1134 (1991); G.K. Mather et al., *Results of South African Cloud Seeding Experiments Using Hygroscopic Flares*, 36 J. APPLIED METEOROLOGY 1433 (1997); Jean-François Berthoumieu, *La pluie provoquée. Un mythe qui devient réalité*, 11 SECHERESSE: SCIENCE ET CHANGEMENTS PLANETAIRES 275, No. 4 (2000), *available at* http://www.john-libbey-eurotext.fr/fr/index.md.

52. *See* RONALD B. STANDLER, HISTORY AND PROBLEMS IN WEATHER MODIFICATION

clouds to freeze, become heavier, and fall as rain above lands, reservoirs, and rivers.[53]

In many regions, these methods are studied for their efficiency and effectiveness in facing the water needs of populations affected by drought.[54] This man-made intervention may deprive some populations of beneficial water by capturing the atmospheric water[55] at a given time, and depositing it in a given place. The use of cloud modification to induce rainfall can create tensions between drought-plagued regions, which will be competing to squeeze more drops out of the sky than their equally water-scarce neighbors.[56]

No state has the moral right to determine for itself what its needs are and produce those needs by artificial means to the prejudice and detriment of its neighbors. Cloud modification has been used, and will continue to be used, to produce rain to relieve water scarce regions.[57] Despite the potential damage to neighboring states, these activities undertaken in the public interest, as opposed to private interests, and that are under the direction and control of governmental authority should and must be permitted. In this respect, states should take international responsibility for the harm caused to neighbors by cloud modification. Such responsibility could defuse or resolve disputes and encourage states to moderate and control their uses of this controversial technology.

B. Is the Prohibition Against Significant Harm a Sufficient Deterrent?

A state must commit a wrongful act in order to engage its international responsibility.[58] Such an act can result when the state does not respect its international obligations, i.e., when it breaches or violates

(2003), http://www.rbs2.com/w2.htm.

53. Cloud-seeding guns, rockets, weather balloons, and planes are used to induce rainfall. *See* STANDLER, *supra* note 24; STANDLER, *supra* note 53; Coble, *supra* note 27.

54. WMO, *supra* note 5, at 94 ("Currently, there are dozens of nations operating more than 100 weather modification projects, particularly in arid and semi-arid regions all over the world, where the lack of sufficient water resources limits their ability to meet food, fiber, and energy demands.").

55. *See* ROBERT KANDEL, LES EAUX DU CIEL 181 (1998).

56. State A can enjoy a downpour of more than 1000 millimeters, but state B has to make do with less than 30 millimeters. Senior officials in state B may accuse their counterparts in state A of intercepting and overusing clouds.

57. *See supra* notes 2, 5.

58. Int'l Law Comm'n, *Report of the International Law Commission on the Work of Its Fifty-Third Session*, 26–143, U.N. GAOR, 56th Sess., U.N. Doc. A/56/10 (2001) (Draft Articles on Responsibility of States for Internationally Wrongful Acts). These articles reflect international customary law.

international law. Cloud diversion and moisture appropriation impact the environment and can be the source of possible adverse effects on others. Two international law principles govern environment protection: states have the obligation to respect the environment in general;[59] and they may not cause harm to the environment located beyond the limits of their territorial jurisdiction (*ratione loci*).[60] The latter concept, consecrated by court decisions[61] and arbitral awards,[62] is found in hard[63] and soft law.[64] It is based on the *sic utere tuo ut alienum non laedas*[65] principle and imposes obligations of abstention and prevention.[66] State international responsibility is objectively engaged for risk, and is actually the topic of

59. *See* Antoine Bouvier, *Protection of the Natural Environment in Time of Armed Conflict*, 285 INT'L REV. RED CROSS 567 (1991), *available at* http://www.icrc.org/web/eng/siteeng0.nsf/htmlall/57jmau.

60. *Id.* States should therefore make sure that nothing under their control harms the environment located beyond their territorial jurisdiction.

61. *See* Corfu Channel (U.K. v. Alb.), 1949 I.C.J. 4 (April 9); Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 66, ¶ 29 (July 8).

62. Palmas Island (U.S. v. Neth.), 2 R.I.A.A. 839 (Perm. Ct. Arb. 1928); Trail Smelter Arbitration (U.S. v. Can.) (1938 and 1941), 3 R.I.A.A. 1905, 1965, *reprinted in* 35 Am. J. Int'l L. 684 (1941).

63. *See* RECUEIL FRANCOPHONE DES INSTRUMENTS INTERNATIONAUX DE PROTECTION DE L'ENVIRONNEMENT (M. Prieur & St. Doumbe-Bille eds.) (1998); PROTECTION INTERNATIONALE DE L'ENVIRONNEMENT (L. Boisson de Chazournes, R. Desgagnec & C. Romano eds.) (1998); INTERNATIONAL, REGIONAL AND NATIONAL ENVIRONMENTAL LAW (F.L. Morrison and R. Wolfrum eds., 2000); BIRNIE & BOYLE, *supra* note 19.

64. *See* U.N. Conference on the Human Environment, Stockholm, Swed., June 5–16, 1972, *Stockholm Declaration*, Principle 21, U.N. Doc. A/Conf.48/14/Rev. 1, *available at* http://www.unep.org/Law/PDF/Stockholm_Declaration.pdf; Draft Principles of Conduct in the Field of the Environment for the Guidance of States in the Conservation and Harmonious Utilization of Natural Resources Shared by Two or More States, Principle 3, U.N. GAOR, 33d Sess., U.N. Doc. A/33/25 (May 19, 1978); U.N. Conference on Environment and Development, June 3–14, 1992, *Rio Declaration*, Principle 2, U.N. Doc. A/CONF. 151/5/Rev.1.

65. *See* U.N. Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 396, *amended by* Agreement Relating to the Implementation of Part XI of the U.N. Convention on the Law of the Sea, art. 194, U.N. Doc. A/RES/48/263(July 28, 1994) [hereinafter UNCLOS]; U. N. Convention on the Law of the Non-navigational Uses of International Watercourses, art. 6, U.N. GAOR, 51st Sess., G.A. Res. 51/229, UN doc. A/51/869 (May 21, 1997) [hereinafter Watercourses Convention]; U.N. Convention on Biological Diversity, art. 3, June 5, 1992, 31 I.L.M. 818 (1992).

66. This principle is consecrated by several treaties (e.g., on international watercourses, hazardous waste, sea pollution). *See* WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, REPORT OF THE EXPERTS GROUP ON ENVIRONMENTAL LAW 75–80 (1986); WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, OUR COMMON FUTURE chs. 2–3 (1987), *endorsed by* GA Res. 42/186, U.N. Doc. A/RES/42/187 (Dec. 11,1987) and GA Res. 42/187, U.N. Doc. A/RES/42/187 (Dec. 11,1987), *available at* http://www.un-documents.net/ocf-02.htm.

draft articles prepared by the International Law Commission.[67] It not only concerns the activities prohibited by law, but also those that risk causing significant transboundary harm.[68] There is no list of these activities because such a list would inevitably be incomplete and would quickly become obsolete vis-à-vis technological advances.[69] The risk which ensues from these activities depends above all on their particular application and the context in which they are employed.[70] The scope of this international responsibility is defined by four criteria: (1) activities that are not prohibited by international law; (2) activities that are exerted under state control (territory or jurisdiction); (3) activities that involve the risk of causing significant transboundary harm; and (4) the harm resulting from these activities.[71] Unlike the other criteria which do not pose serious interpretation problems, the third criterion needs more precision in order to determine whether state international responsibility would be implicated when a state uses weather modification techniques. Pursuant to this criterion, the weather modification activity has to present the risk of causing significant transboundary harm to persons, goods, or the environment. This risk encompasses an evaluation and an appreciation element since the occurrence of harm does not mean that the

67. Int'l Law Comm'n, *Report of the International Law Commission on the Work of its Fifty-Eighth Session*, 106–182, U.N. GAOR, 61st Sess., Supp. No. 10, U.N. Doc. A/61/10 (2006) (Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising out of Hazardous Activities).

68. *Id*., Principle 1. Activities which cause harm only to the territory of the state where they are practiced are excluded.

69. *Report of the International Law Commission on the Work of Its Fifty-Third Session*, *supra* note 59, at 146–170 (Draft Articles on Prevention of Transboundary Harm from Hazardous Activities).

70. States can indicate which activities pertain to this liability in regional or bilateral agreements or in their national legislation. *See* U.N. Convention on Environmental Impact Assessment in Transboundary Context, app. I, February 25, 1991, 30 I.L.M. 800 (1991); Convention for the Protection of the Rhine Against Chemical Pollution, Dec. 3, 1976, 1124 U.N.T.S. 425; Convention on Civil Liability for Damage resulting from Activities Dangerous to the Environment, annex II, June 21, 1993, Europ. T.S. No. 150.

71. By virtue of the first criterion, engaging international liability for the benefit of the states does not give states the right to prohibit the hazardous activity. *See Report of the International Law Commission on the Work of Its Fifty-Third Session*, *supra* note 59, at 146–70 (Draft Articles on Prevention of Transboundary Harm from Hazardous Activities). As for the nature of the obligation and the attainment of a balance between interests at stake, *see* Int'l Law Comm'n, *First Report on Prevention of Transboundary Damage from Hazardous Activities*, ¶¶ 43–44, 54, 55(d), U.N. Doc. A/CN.4/487 (1998) (*prepared by* Pemmaraju Sreenivasa Rao). By virtue of the second criterion, there could be no territorial linkage between the state and the activity, which is not the case for cloud-seeding. The fourth criterion excludes non-physical transboundary harm (i.e., monetary or socioeconomical policies).

activity involved a risk if no informed observer was conscious thereof.[72] Still, risks engaging state international responsibility are those which "will probably cause significant transboundary harm and those which will probably not cause catastrophic transboundary harm."[73]

Therefore, the key element for engaging state international responsibility is the significance of the harm. This element constitutes the threshold[74] beyond which outside actors should intervene in order to stop the harm, and assure restoration or adequate reparation. The detrimental impact of such harm must thus reach a certain degree of seriousness. The term "significant" is vague and needs a case by case qualification because it primarily implies factual considerations.[75] The harm must materialize into actual harmful effects that are capable of being measured by their impact on objective criteria such as human health, industry, goods, environment, or agriculture. As long as the harmful effects of the cloud modification could not be qualified as significant, they are regarded as tolerable. The term significant is also equated with important, sensitive, or even substantial.[76] Thus, this criterion supposes a value judgment depending on each case at the time when judgment was rendered. Still, the term "significant" lacks precision. In fact, responsibility for risk introduces the concept of an acceptable harm threshold caused by licit activities such as weather

72. That is, an activity may contain a risk, even when the responsible party underestimated it.

73. *Report of the International Law Commission on the Work of its Fifty-Third Session*, *supra* note 59, art. 2(a) (Draft Articles on Prevention of Transboundary Harm from Hazardous Activities).

74. This idea of threshold is well known in international law. *See* Trail Smelter Arbitration, *supra* note 63; Lanoux Lake Arbitration (Fr. v. Spain), 12 R.I.A.A. 281 (1957).

75. *Report of the International Law Commission on the Work of its Fifty-Third Session*, *supra* note 59, Commentary on art. 2(a) § 4 (Draft Articles on Prevention of Transboundary Harm from Hazardous Activities).

76. *See* Watercourses Convention, *supra* note 66, art. 7; Economic Commission for Europe, *Code of Conduct on Accidental Pollution of Transboundary Inland Waters*, art. 1(b), U.N. Doc. E/ECE/1225-ECE/ENVWA/16 (1990); Organization for Economic Cooperation and Development, *Recommendation of the Council for the Implementation of a Regime of Equal Right of Access and Non-discrimination in Relation to Transfrontier Pollution* , OECD Doc. C (77) 28 (May 17, 1977), *reprinted in* 16 I.L.M. 977 (1977).

modification techniques.[77] If this acceptable threshold is surpassed,[78] the state causing harm will be held responsible to repair the incurred loss.[79]

The harm incurred by the lack of rain is strikingly significant in drought affected regions. However, a lack of rain occurring in traditionally water rich regions must be more severe to reach the threshold.[80] On the contrary, abundant rain caused by cloud modification techniques in a neighboring state constitutes a significant harm not under the terms of rainfall quantities, but according to the actual damage it is causing and its human, economical, social and environmental impacts. Considering the risks which cloud modification techniques involve, engaging state international responsibility seems to be a potentially useful way to avoid abusive uses. However, it is not easy for a state victim of cloud modification to prove causation in tort litigation.[81] The causation relation, which must compulsorily link the activities carried out and the prejudicial result, will be difficult to prove regarding technologies which try to reproduce natural phenomenon.[82] Scientific research has not yet progressed to the point of being able to prove causation in this setting.

Despite satellites, computers, and technical wizardry, it remains difficult to predict exactly how much rain will fall in a given area at a given time, even under normal, unmodified conditions. Because it is impossible to predict exactly how much precipitation a given cloud would have produced in the absence of seeding, it is equally impossible to measure the effect of seeding itself. Each storm system is individual, and it is impossible to ascertain the effect of any modification effort for the very simple reason that a cloud cannot be modified and unmodified at the same time. As a result of the scientific uncertainty in this area,[83] a state resorting to these techniques can thus declare that the harmful cloud

77. Mampaey, *supra* note 33, at 20.

78. Its interpretation will vary according to the states, their territory's extent, economic health, natural resources, biodiversity, and their involvement either as an actor or a victim.

79. *Report of the International Law Commission on the Work of its Fifty-Third Session*, *supra* note 59 (Draft Articles on Responsibility of States for Internationally Wrongful Acts).

80. Quilleré-Majzoub, *supra* note 7, at 662–63.

81. For example, an individual plaintiff must be able to show an "irreparable harm" (i.e., destruction of something unique that cannot be replaced) or "no adequate remedy at law" (i.e., money damages in either contract or tort litigation would not adequately compensate plaintiff).

82. *See* STANDLER, *supra* note 24, at 20.

83. WMO, *supra* note 5, at 98 ("However, any legal system aimed at promoting or regulating weather modification must recognize that scientific knowledge is still incomplete.").

modification impacts are not the consequence of weather modification activities, but those of climate change.[84] With no real effective way to prove causation, and with climate change as a scapegoat, it is doubtful that state international responsibility will be engaged in cloud modification cases at this time. Until science advances to a point where it can link cloud modification to damages on the ground, landowners or states could perhaps purchase insurance against drought and floods. Due to the fact that the threat of engaging the state international responsibility is inoperative, the international community cannot rely on existing international law rules and must be proactive.

Not everyone wants it to rain at the same time. For instance, while some farmers near an international border may want rain to help grow their crops, others may want sunny skies for their crops. These competing interests may lead to the involvement of international law. Cloud modification offers a unique problem when it comes to property rights and tort liability. Assessing responsibility is also a problem concerning cloud modification: if there is a flood or some other water-related disaster, who did what to whom? The defendants in such a case are the cloud modifier and that person's or organization's sponsor. Often that sponsor is a government agency or an authorized or licensed private operator under the direction and control of government authority. However, small rainmaker organizations, who work for local farmers, are usually very secretive about when and where they attempt to make rain. The clandestine nature of the cloud seeding business can cause difficulties in tracking down potential defendants in cloud modification cases.

In addition to the difficulties of finding defendants, it can be much more difficult to identify the injured party or parties. First, it is hard to prove that a particular harmful cloud event was caused by cloud modification. Second, while some in an area may feel that they were harmed by a modified-cloud event, others may have benefited from the same event.

Evidentiary issues also arise in potential cloud modification litigation. Before the courts will award damages in cloud modification cases, they must be convinced that the modification attempt did, in fact, alter the cloud. Furthermore, there must be evidence that the modification was, in fact, the cause of the plaintiff's damage, and that this damage would not have occurred otherwise.[85] Because of the nature of cloud modification, these factors will be exceedingly difficult, if not impossible, to prove. "Few court cases have been successfully argued

84. Another legal issue to be raised is whether the cloud seeder's intent to cause rain is sufficient to justify trespass liability for a consequential flood.

85. Coble, *supra* note 27, at 12; *see also* STANDLER *supra* note 24.

against cloud efforts due to the lack of laws, difficulty in obtaining evidence, and 'fuzziness' of the results of [cloud modification]."[86]

Furthermore, government actors have kept their hands off the issue of cloud modification, only issuing the barest minimum of laws and regulations. For instance, even if one state allows artificially induced rain, an adjacent state may prohibit it. The situation could get difficult if a seeded cloud were to drift across the state line.

Until recently it was hard to monitor cloud modification, but observational technology is not static. Recent technological advances provide an impetus for developing systems and technologies that monitor and manage cloud events such as cloud seeding. Can observational technologies suggest how future cloud modification torts might be argued? Will it be possible to spot and bust the "guilty" cloud in case of loss from transboundary harm arising out of "hazardous" cloud modification? The answers to these questions will help to answer the ultimate question of whether or not international tort liability will be a sufficient regime for holding weather modifiers who damage other states responsible for their actions.

C. Can Advances in Observational Technologies Help Solve the Causation Issue?

The variety of clouds is among nature's oddities. The type of cloud formation frequently indicates the kind of weather to be expected. Thus, the type of weather to be expected can be anticipated from observations of the particular type of clouds. For example, an approaching warm front that may provide extended rainfall in significant amounts is frequently preceded by as much as 1,500 kilometers by cirrus clouds.[87] However, in some geographical areas today, traditional forecasting is no longer accurate because signals have gotten crossed and pattern recognition is nearly impossible.[88]

In the future, our understanding of the atmosphere will further our attempts to produce ideal clouds. Weather forecasts will become more accurate and will be able to be made farther in advance as computer models continue to improve. We may someday be able to plan our

86. Coble, *supra* note 27, at 13.

87. It used to be that from the color, shape, and frequency of the cloud formations you could tell what type of weather was coming. *See* Berthoumieu, *supra* note 52; KANDEL, *supra* note 56.

88. *See* Moen, *supra* note 41 ("The atmosphere isn't a simple thing, otherwise it would be a heck of a lot easier to forecast." (quoting Bruce Boe, director of meteorology with Weather Modification Inc., a Fargo, N.D. company that does weather modification around the world)).

activities with full confidence that the weather next week will be exactly as described by the forecaster. If we do not like the forecast for tomorrow's weather, perhaps we will be able to order our own cloud *genera*. Before this possibility can become a reality, new weather technologies must be developed.

Without a complete understanding of the physical processes of all relevant clouds parameters, one cannot accurately predict the effect of cloud seeding on a single cloud. Evaluation of cloud seeding experiments is difficult because of the natural variability of clouds and precipitation on the ground. Because we lack a comprehensive understanding of these phenomena, we currently only know the effect of cloud seeding through statistical comparison of large numbers of seeded and unseeded clouds.[89] The statistical approach may be used where the target area that is seeded is carefully monitored by remote sensing. The amount of rainfall beneath the seeded area is compared to the amount of rainfall outside it based on measurements obtained from a rain gauge network. Several such experiments provide at least a statistical representation of the effects of cloud seeding.[90]

In the past, the only way to measure cloud characteristics was to strap instrumentation onto a plane and fly it into the cloud. The newest remote sensing and in situ equipment offers more accurate and higher resolution pictures of clouds than ever before. These tools can now estimate the amount of precipitation, and can also describe non-precipitating clouds. Although they have been nominally used in cloud-seeding observations, these tools have yet to be used as integral components of experiments designed to test and evaluate specific scientific hypotheses.[91]

Progress in obtaining answers to the questions surrounding the effects of cloud modification depends on a coordinated international program of weather modification research. This program should be at the heart of a sustained and directed research effort that uses a balanced approach of modeling, laboratory studies, and field experiments and is designed to reduce the key uncertainties underlying weather modification. This program would encompass lessons learned, the recommendations of high-level researchers, and the near term needs of the cloud modification community. Its mission would concentrate on three areas: (1) monitoring atmospheric water resource management parameters; (2) applied research and development of seeding

89. NATIONAL RESEARCH COUNCIL, *supra* note 49, at 23–66.

90. *Id.*

91. *Id.*; *see also* S.Y. Matrosov, M.D. Shupe, R.F. Reinking, *Studies of Cloud Structure and Microphysics with Ground-based Multi-sensor Measurements*, *available at* http://jcsepa.mri-jma.go.jp/outreach/20070131/Abstracts/S1_Matrosov.pdf.

technologies; and (3) fostering cooperation between UN agencies (in particular the WMO),[92] state agencies, and relevant commercial organizations. These efforts will require reliable data, which may be obtained through carefully designed cooperative efforts. The main purpose of this program would be to stimulate collaboration and participation in basic research in clouds and encourage application of this research with particular emphasis on the need for weather modification.

Currently, only a handful of such weather modification research programs are underway worldwide. Such activities can succeed only if the relevant funding agencies and scientific communities make a commitment to answer some of the fundamental underlying questions. Observational technology made little progress until quite recently. One reason for this was the lack of funds for research. These technologies require years of funding and effort in order to collect enough data to show results. Another reason for the lack of progress is the divided effort between various countries. Rather than trying to break new ground, observational technologies tend to concentrate on familiar areas in limited regions; rarely do these areas cross international boundaries.[93] With the introduction of new observational technologies, as well as improved computer modeling, monitoring cloud seeding could potentially pave the way to reduce damage causation issues.

Effective laws and regulations cannot be based on possibilities and conjectures, but as long as cloud modification continues, a national management framework for cloud safety must be established. The cloud management framework will provide drafters, policymakers and technical experts, as well as state governments, with a "tool kit" of the issues related to the regulatory framework for cloud safety. This framework should specify that only the international community may initiate cloud modification activities, although private or multinational cloud seeders might do the actual work. Such an approval would recognize that clouds are part of the natural environment and any attempt to modify them should be controlled or regulated by the international community. Attaching tort liability to those states that do not heed these international norms will help to enforce these regulations.

---

92. "In 1975, the Seventh World Meteorological Congress adopted a Weather Modification Programme. Since then WMO has been recognized as the international body with the necessary scientific and technical expertise to respond to requests concerning weather modification." WMO, Physics and Chemistry of Clouds and Weather Modification Research Programme, http://www.wmo.ch/pages/about/wmo50/e/wmo/today_pages/physics_chemistry_e.html (last visited Mar. 4, 2009).

93. *See* CILSS, *supra* note 2; Mather, *supra* note 52.

D. How Will Cloud Safety Fit Within the International Regulatory Framework?

Preventing environmental damage, the depletion of natural resources, and the deterioration of human health have become key concerns of international environmental law. "The precautionary principle holds that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[94] The meaning of this principle in international law is evolving. The Rio Declaration on Environment and Development's Principle 15 states that in order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities.[95] The Stockholm Convention on Persistent Organic Pollutants ("POPs") states in Article 1: "Mindful of the precautionary approach as set forth in Principle 15 of the Rio Declaration on Environment and Development, the objective of this Convention is to protect human health and the environment from persistent organic pollutants."[96] This principle was also adopted in the 2001 Organization for Economic Co-operation and Development ("OECD") Environmental Strategy and addressed by various multilateral environmental agreements.[97]

Cloud safety is an important consideration at all stages of a cloud's life cycle in many countries. There is now a substantial "bulk stock" of "national and international" regions where cloud failure (cloudburst or snowstorm) could have significantly adverse economic, environmental, and social consequences. In these areas, successful cloud policies will "require that potentially adverse environmental and selected social impacts . . . be identified, and avoided, minimized, to the extent feasible, or mitigated and monitored."[98]

The subject of cloud safety is important to international environmental law for a number of reasons. First, it is essential that each

---

94. BRUCE ELLIOTT JOHANSEN, THE DIRTY DOZEN: TOXIC CHEMICALS AND THE EARTH'S FUTURE 252 (2003).

95. *Rio Declaration*, *supra* note 65. *See also* BIRNIE & BOYLE, *supra* note 19, at 95-102.

96. Stockholm Convention on Persistent Organic Pollutants art. 1, May 22, 2001, 40 I.L.M. 532.

97. Organization for Economic Cooperation and Development, *Environmental Strategy for the First Decade of the 21st Century*, at 6 (May 16, 2001), *available at* http://www.oecd.org/dataoecd/33/40/1863539.pdf.

98. DANIEL D. BRADLOW, ALESSANDRO PALMIERI & SALMAN M. A. SALMAN, REGULATORY FRAMEWORKS FOR DAM SAFETY: A COMPARATIVE STUDY vii (World Bank 2002).

rainmaker or cloud modifier be able to ensure that rainfall and water in clouds are safe and do not pose an unacceptable risk to life, human health, property, or the environment. Second, cloud safety directly influences the sustainability of cloud activities and the extent of their potential environmental and social impacts. Third, cloud safety is relevant to a state's ability to comply with its national and international obligations. A failure to pay adequate attention to cloud safety can cause a country to violate its "obligations," such as those relating to transboundary harm and environmental protection, as stated above. As such, the principle objective of the safeguard policies is that of "doing no harm."

There are three major issues that drafters, decision makers, and technical experts must consider in designing a cloud safety regulatory scheme. First, they must address the safety of the population living in the vicinity of or beneath modified clouds. This assessment should involve technical and non-technical inquiries. The technical issues include the instruments used in measuring the characteristics of the cloud and in determining the adequacy of a particular cloud seeding technique. These technical issues are best decided by technical experts. The "non-technical" issues are those that depend more on the judgment of the decision makers than on objective criteria. They include determining the acceptable level of risk that should be associated with a particular cloud seeding technique, determining the appropriate cost-safety tradeoffs, determining the environmental and social aspects of weather modification, and determining the scale of intervention that fits the scale of activity. For this purpose, both cloud seeding efforts and regulation can occur at local, national, or international levels.[99]

The second issue is whether the cloud safety regulatory scheme should set different safety requirements for different commercial cloud seeders or seeding organizations. This issue is particularly relevant in cases where a government is considering cloud commoditization. It is also relevant in cases where the government itself is the modifier or operator of the cloud. Government cloud modification can affect questions of liability or responsibility for cloud failure and the independence of the cloud safety activities of the regulatory authority with regard to the governmentally-modified cloud.

Third, the drafters of the cloud safety regulatory scheme must decide if they want their scheme to cover the ten cloud *genera*, or only some groups or hazard criteria. They will also need to decide if they want

99. ARCHIE M. KAHAN, GUIDELINES FOR CLOUD SEEDING TO AUGMENT PRECIPITATION (1995).

to have one set of requirements that is applicable to the ten cloud *genera* or to establish different requirements for different groups of clouds.

E. Recommendations for International Regulators

Recommendations on the elements that should be addressed in any cloud safety regulatory scheme are divided into three parts: (1) those that relate to the essential elements of the scheme; (2) those that would be desirable to include; and (3) the emerging trends in cloud modification technology and safety. These last recommendations are designed to highlight elements that could become important issues in the future. These recommendations have purposefully been stated in broad terms in order to facilitate the adaptation of these suggestions to the local conditions in each country.

1. Essential Elements

The essential elements of a regulatory scheme are those that enable the regime to perform the most essential functions with regard to cloud safety. In this regard, it is important to note that the rainmaker, commercial cloud seeder, or seeding company is responsible for making the modified clouds operationally safe. The regulator is responsible for ensuring the safety of the population living beneath or in the vicinity of the clouds by establishing safety standards with which the cloud modifier must comply and by monitoring compliance with these standards.[100] Scientific proof that a cloud modification technique is both safe and effective should occur before a government grants a permit for an operational cloud modification activity that uses that technique. The essential elements of the regulatory framework are intended to achieve five basic objectives. First, regulators must ensure that commercial cloud modification companies are competent and professional. Second, regulators should clarify that the cloud modifier is responsible for cloud safety and the regulators are responsible for monitoring the modifier's performance in this regard. Third, regulators must require commercial cloud modification companies to have the resources to compensate those harmed by their cloud modification, sort of "proof of financial responsibility."[101] The fourth objective is to specify the modifier's responsibilities with regard to the "operation and maintenance" of the cloud, and describe how the modifier should review the safety of the cloud. Finally, the regulators must explain the ways in which they can

100. The standards of care can be designed in several ways. For example, a government agency can properly be held to a higher standard than a typical cloud seeder.

101. The cloud seeder could compensate injured or harmed landowners who were deprived of rainfall or who suffered a flood.

perform monitoring functions, which can include conducting inspections, and what powers they have to deal with non-complying cloud modifiers or rainmakers.

2. Desirable Elements

In addition to the essential elements discussed, a cloud safety regulatory scheme should include certain desirable elements as well. These desirable elements would be implemented by an institutional arrangement contained in the regulations. For example, the regulations could create a regulatory authority exclusively devoted to cloud safety. A cloud safety advisory committee created under this authority would have the power to regulate weather modifiers and to coordinate among all the agencies at all levels to implement the content of the regulatory scheme. The regulatory authority could also initiate periodic inspections of all cloud activities, create a series of benchmarks to measure cloud safety, issue annual reports on cloud safety, and conduct an accidental cloudburst impact assessment.

3. Emerging Trends

While there has yet to be an international consensus on cloud safety, national cloud safety regulatory schemes reflect several identified trends that could reasonably become prominent in an international regulatory scheme as well. These emerging trends revolve around the idea that cloud safety is a dynamic, evolving concept, and should be treated accordingly. The concept of cloud safety evolves as our understanding of the performance of a cloud increases and as our understanding of cloud safety develops. These trends include institutional arrangements—such as a modifier's responsibilities for monitoring cloud safety and for taking all appropriate measures—as well as specific regulatory provisions relating to the social implications of cloud safety including health and environmental implications and risk analysis in cloud safety.

As mentioned earlier, our understanding of the issues surrounding cloud modification (economic, environmental, and social considerations) are in a constant state of evolution. This fact has to be reflected in our handling of cloud safety regulation. As such, we caution against a "straitjacket" or "one size fits all" approach to cloud safety regulatory schemes. Although the regulatory scheme will not, by itself, resolve the problems associated with cloud safety, it is difficult to imagine any effective cloud safety program that is not eventually translated into or coupled with broader legal provisions. As such, the existing international legal framework should embrace a cloud safety regulatory regime.

IV. FROM CRITICAL WEATHER MODIFICATION UNCERTAINTIES TO SHARING WATER IN CLOUDS

The weather has been rather peculiar these past few years.[102] From day to day we never know what types of climatic phenomena are going to take place despite—or perhaps partially as the result of—states' attempts to completely control, or at least manipulate the weather.

Cloud seeding technology quickly attracted the attention of several states to artificially induce or increase precipitation, usually to stave off drought.[103] Atmospheric research led to the development and perfection of cloud seeding which can change the potentials in atmosphere at extreme distances resulting in the creation and dispersion of clouds and rain. These weather modification techniques, however, are only moderately successful, and they cannot be relied upon in cases of severe drought or heavy rain.[104]

As discussed earlier, cloud ownership rights and causal links between weather modification and actual damages remain uncertain. However, weather modification techniques are becoming more operational and efficient and could help resolve these issues. Only after the applicable scientific principles are understood can we rationally apply the law to weather modification. For now, can we codify weather modification if cloud seeding represents the dominant form of weather modification? If not, can we at least probe the legality of rainmaking? Additionally, is the establishment of a true cloud regime now a necessity? The following sections will address each of these questions.

A. Can We Codify Weather Modification?

Currently, weather modification has not yet advanced to the stage of medium-range weather prediction, but there is evidence that it is possible to modify the weather in certain specific ways.[105] Several countries have practiced weather modification in the past century, "all with unproven results."[106] "Because of this uncertainty, the initial euphoria about the promise of weather modification wore off by the mid 1960s."[107] Despite

102. James R. Fleming, *The pathological history of weather and climate modification: Three cycles of promise and hype*, 37 HISTORICAL STUDIES IN PHYSICAL AND BIOLOGICAL SCIENCES 1, 3-25 (2006).

103. For examples of this use in the Sahel, *see* CILSS, *supra* note 2. For examples in China, *see* O'Neill, *supra* note 42; Watts, *supra* note 44; Isaac, *supra* note 44.

104. *See* STANDLER, *supra* note 53.

105. *See* Mather, *supra* note 52.

106. *See* Coble, *supra* note 27.

107. *Id*.

this waning in intrigue, some methods have developed that show scientists whether their attempts at weather modification are succeeding,[108] although even these still lack certainty. This uncertainty poses obvious difficulties to international regulators attempting to codify weather modification regulations.

Another obstacle to codifying weather modification is rooted in chaos theory. This theory relates to how the subtle variations in an environment make that system extremely difficult to understand and predict. Earth's atmosphere is considered the classic example of a chaotic system. Theoretically, any input into the atmospheric "system" via weather modification will result in some unknown and unforeseen output somewhere else. However, if the system is so inherently chaotic,[109] some may wonder why we should worry about tampering with clouds, or furthermore, why we should worry about regulating these manmade weather adjustments.

If science is to make progress in expanding our capability to modify the weather, technical and non-technical resources must be applied to the key uncertainties that currently hamper progress. For example, there are critical gaps in our understanding of the complex chain of physical processes that start with condensation of water vapor and end with precipitation. As we have noted previously, atmosphere prediction for more than a few hours in advance is a complex problem requiring accurate measurements of the current state of the atmosphere and accurate equations to project atmospheric conditions into the future. Both aspects of the problem contribute to weaker weather forecasts as the time projection increases.[110]

Weather is international in scope. Therefore, weather modification may have important international ramifications. The 1972 UN Conference on the Human Environment held in Stockholm recognized this concern and "urged the establishment of an advisory committee to consider the weather modification problems that have potential international concern."[111] Despite this recognition, however, there has yet to be an international attempt to establish global regulations or even policy in this area. Serious problems will probably arise in the absence of such a global legal policy concerning weather modification because the use of this technology is widespread—internationally, a dozen nations are quite active in weather modification activities, and more than forty-five others are involved in it to a lesser degree.

---

108. *Id*.

109. JAMES GLEICK, CHAOS: MAKING A NEW SCIENCE (1987).

110. NATIONAL RESEARCH COUNCIL, *supra* note 49, at 39–66.

111. EAGLEMAN, *supra* note 11, at 289.

Though many of the problems with the law of weather modification are attributable to our lack of scientific understanding on cloud behavior, much of the legal responsibility for weather modification rests with the particular country involved. More and more countries have weather modification regulations, although they vary from one country to another. Some legal experts are now calling for governments and lawmakers to draft laws on cloudfarming—also known as cloud harvesting or cloud milking or dairy clouds—but scientists say the technology's effect is not yet clear enough to be measured and regulated.[112]

The complex interactions that arise because of weather modification efforts emphasize the necessity for cooperation among countries, government agencies, and corporations. The potential benefits from properly applied weather modification activities appear to outweigh the possible disadvantages to such an extent that legislation that would prohibit well-planned programs should not be enacted. The challenge in regulating weather modification is finding the right balance between reducing scientific uncertainties and the need for action to address pressing problems. The characteristics of weather are so diverse and uncertain that we cannot subject them to legal provisions, nor subject them to a system of permanent rules, as is done in the case of most other phenomena.

Scientists say that the practice of weather modification is not currently well known, but also that it will only become more familiar with continued experimentation.[113] Critics say that cloud seeding could affect weather patterns[114] and the planet does not need any more experiments manipulating natural systems before we have a greater understanding of the planet's natural phenomena.

---

112. NATIONAL RESEARCH COUNCIL, *supra* note 49. In 2003, the National Academy of Sciences questioned the science behind cloud seeding as too weak to prove it actually works. *See also* Joe Gelt, *Weather Modification: A Water Resource Strategy to be Researched, Tested Before Tried*, 6 ARROYO, No. 1 (1992), *available at* http://ag.arizona.edu/AZWATER/arroyo/061wthr.html; Critical Issues in Weather Modification: Hearing on Establishing A Weather Modification Operations and Research Board, 109th Cong. (Nov. 10, 2005) (statement of Michael Garstang, Professor, University of Virginia and Chair, Committee on Critical Issues in Weather Modification Research, Board on Atmospheric Sciences and Climate, Division on Earth and Life Studies, National Research Council, The National Academies), *available at* http://www7.nationalacademies.org/ocga/testimony/Critical_Issues_in_Weather_Modification.asp.

113. *See* Gelt, *supra* note 113.

114. NATIONAL RESEARCH COUNCIL, *supra* note 49, at 71–72.

As climate is one of a nation's most important natural resource,[115] states have a strong incentive to alter the global climate in a way that provides them with more favorable climatic conditions. Such a shift could not only increase farming potential and decrease drought, but could also swing the balance of economic power towards this nation. It is clear that rainmaking licensing and regulations are desirable in order to regulate enhancing rainfall.

B. Can We Probe the Legality of Rainmaking?

There are currently no international instruments, global or regional, related to the use of clouds or rain.[116] The work of the United Nations in this area has not led to the adoption of an instrument covering some aspects of clouds. Regional initiatives have also failed to lead to regional treaties. Yet clouds and rain form part of the hydrological cycle. They are elements of the overall ecosystem that includes water, air, earth, and fauna and flora; they are an integral part of the natural and human environment of the planet, continents, regions and states. Consequently, an international instrument relating to the environment and its protection is essential in order to determine the regime of clouds and rain. Such an international agreement should include an explicit description of cloud seeding, cloud harvesting, and other weather modification techniques, and address the legality of each.[117]

---

115. The Chinese have long been interested in using weather modification as a way to control food production. Weather modification offers a chance to bring much needed rains to farmers and large population centers desperate for precipitation. *See* O'Neill, *supra* note 42; Watts, *supra* note 44; Isaac, *supra* note 44.

116. There are also no other relevant instruments, such as bilateral treaties, on the subject matter.

117. Weather modification has apparently been used for military and political purposes in the past. There are indications that artificially induced rainfall was produced by United States military operations to slow down Vietnamese military truck activity and muddy the Ho Chi Minh trail, an important supply route, during the war in Vietnam. There is also some indication that cloud seeding operations were conducted within the wind currents that carry moisture to Cuba and the operation brought erratic weather to the island in 1969 and 1970, resulting in the sugar crop falling far short of goals that had been set. *See* STANDLER, *supra* note 53; Gregory N. Jones, Comment, *Weather Modification: The Continuing Search for Rights and Liabilities*, 1991 BYU L. REV. 1163 (1991); WEATHER MODIFICATION: TECHNOLOGY AND LAW (Ray Jay Davis & Lewis O. Grant eds., 1978); LEGAL AND SCIENTIFIC UNCERTAINTIES OF WEATHER MODIFICATION (W.A. Thomas ed., 1977); WEATHER MODIFICATION AND THE LAW (Howard J. Taubenfeld ed., 1968); Jack C. Oppenheimer, *The Legal Aspects of Weather Modification*, 424 INS. L.J. 314 (1958); Donald D. Stark, *Weather Modification*, 45 CAL. L. REV. 698 (1957).

Currently, the only legal instrument on environmental manipulation or weather control is the 1977 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques ("ENMOD Convention").[118] This treaty prohibits military or any hostile use of environmental modification techniques as a weapon, and the States Parties undertake not to use "environmental modification techniques having widespread, long-lasting or severe effects" during conflicts.[119] Hence, controlling the weather for military purposes is expressly forbidden by this convention. The ENMOD Convention is a timely testament to the commendable achievement of the international community and the unique role played by the United Nations in the fight against "weather tampering."

Despite its apparent success in providing a prohibition on one particular use of weather modification, the ENMOD Convention is vague and open to interpretation.[120] First of all, it applies only to signatory states.[121] Furthermore, in contrast to the vast majority of treaties regarding certain types of weapons, the research and development of new environmental modification techniques are not formally prohibited.[122] Likewise, threats regarding new types of weather modification uses are not prohibited.[123] These gaps are more deplorable as, unlike conventional weapon systems with obvious effects, environment modification techniques create what might appear to be "natural" phenomena. This unique characteristic may easily mask a clandestine war. Thus, the ENMOD Convention provides States Parties with room to maneuver in the pursuit of weapons research, and even their use in given

118. G.A. Res. 31/72, U.N. Doc. A/Res/31/72 (Dec. 10, 1976), 1108 U.N.T.S. 151 (1977).

119. *Id*., art. 1.

120. For instance, "It is the understanding of the Government of the Republic of Korea that any technique for deliberately changing the natural state of rivers falls within the meaning of the term 'environmental modification techniques' as defined in Article II of the Convention. It is further understood that military or any other hostile use of such techniques, which could cause flooding, inundation, reduction in the water-level, drying up, destruction of hydrotechnical installations or other harmful consequences, comes within the scope of the Convention, provided it meets the criteria set out in Article I therefore." Thus, the Republic of Korea (accession December 2, 1986) interprets the Convention to mean that deliberately changing the natural state of rivers is an attempt at environmental modification; in other words, the deliberate destruction of dams to cause flooding is considered illegal. *See* Coble, *supra* note 27.

121. If a non-signatory state uses these techniques, nothing prohibits a state party to use them in response.

122. Quilleré-Majzoub, *supra* note 7, at 655.

123. Clandestine uses or experiments made in the context of developing techniques as a warning in order to demonstrate the operational capacity of the state are not explicitly mentioned in the Convention.

circumstances. The monitoring system[124] and convention enforcement mechanism[125] is based on the principle of mutual consultation and cooperation. If a State Party has reason to believe that any other state is acting in breach of its obligations, it may lodge a complaint with the UN Security Council.[126] In practice, however, this procedure has never been used, and there is no doubt that it is difficult to apply.[127]

Another major deficiency of the ENMOD Convention results from the uncertainty or inaccuracy of several concepts[128] whose ambiguity allows an expansive interpretation of the agreement. Indeed, the treaty has been the object of interpretative agreements,[129] but the resulting interpretations are not compulsory, even if they bring useful precision to the meaning of some terms.[130] These agreements clarify the definition of environmental modification technique in that they refer to "any technique for changing—through the deliberate manipulation of natural processes—the dynamics, composition or structure of Earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space."[131] We cite among these "changes in weather patterns (clouds, precipitation, cyclones of various types and tornadic storms), [and] changes in climate patterns."[132] This list is not exhaustive.[133] Cloud seeding is therefore in sight for potential integration into the definition. Nevertheless, the Convention should not hinder the use of environmental modification techniques for peaceful purposes.[134] "Thus, military or any other hostile use of environmental modification techniques, so as to cause those

124. ENMOD Convention, *supra* note 119, art. 5, ¶ 1.

125. *Id.*, art. 4.

126. *Id.*, art. 5, ¶ 3.

127. Only the most powerful states—technologically as well as financially—are able to resort to environmental modification techniques, and the Member States of the Security Council disposing a veto right to oppose any request of investigation are among those powerful states.

128. For example, its scope of application concerns harms that are "widespread, long-lasting or severe" of the use of the environmental modification techniques. ENMOD Convention, *supra* note 119, art. 1.

129. The understandings regarding the ENMOD Convention are not incorporated into the Convention but are part of the negotiating record and were included in the report transmitted by the Conference of the Committee on Disarmament (CCD) to the U.N. General Assembly in September 1976. *See* Report of the Conference of the Committee on Disarmament, UN GAOR, 31st. Sess., Supp. 27, UN Doc. A/31/27 (1976), *reprinted in* DIETRICH SCHINDLER and JIRI TOMAN, THE LAWS OF ARMED CONFLICTS, 168 (1988).

130. They only apply to the ENMOD Convention and do not prejudge the interpretation of the same expressions made by other international instruments.

131. ENMOD Convention, *supra* note 119, art. 2.

132. *Id.*, Understanding Relating to art. 2, ¶ 1.

133. *Id.*, art. 2, ¶ 3.

134. *Id.*, art. 3.

phenomena as a means of destruction, damage or injury to another State Party, would be prohibited."[135] Warlike or malicious designs and the intention to cause serious harm to any other state are key elements for that convention to apply.[136] It is therefore the state's intent which determines whether the environmental modification technique used is licit or not.

The use of environmental modification techniques for clouds to draw in humidity, to manipulate the precipitation in the sky and actually make rain, does not on its own constitute a military or hostile purpose. According to the ENMOD Convention Preamble, "the use of environmental modification techniques for peaceful purposes could improve the interrelationship of man and nature and contribute to the preservation and improvement of the environment for the benefit of present and future generations."[137] However, a nuance must be introduced regarding the reservation of States Parties to the ENMOD Convention. Guatemala believes that the ENMOD Convention should qualify harmful acts in light of their seriousness, even if they are not emanating from intentional hostile will. Its reservation specifies that "Guatemala accepts the text of article III, on [the] condition that the use of environmental modification techniques for peaceful purposes does not adversely affect its territory or the use of its natural resources."[138] But a drought, even temporary, following a systematic diversion of rainwater during a given period of time, may have these exact effects. It follows from this reservation that a peaceful use of weather modification techniques, without malicious motive, but whose consequences would be detrimental, could be regarded as a *de facto* hostile act.[139] Guatemala thus suggests that neighboring states should take the appropriate measures to avoid harm, regardless of their intent behind weather modification. The intent is overshadowed by the real consequences of the weather modification act.

Nevertheless, the ENMOD Convention provisions do not normally apply in cases of peaceful use of environmental modification techniques. These provisions also fail to discard the application of other international law rules regarding the use of these techniques, should they exist.[140] An exhaustive survey reveals, however, that no treaty or law currently

135. *Id*., Understanding Relating to art. 2, ¶ 2.

136. Quilleré-Majzoub, *supra* note 7, at 656.

137. *Id*., pmbl., ¶ 5.

138. Reservation of Guatemala made on March 21, 1988, date of its accession to ENMOD Convention.

139. Quilleré-Majzoub, *supra* note 7, at 657.

140. *See* ENMOD Convention, *supra* note 119, pmbl., ¶ 5.

regulates non-malicious weather modification.[141] Therefore, with the exception of the ENMOD Convention, international law does not forbid the use of environmental modification techniques.

Although no international regulations exist in cloud seeding activities, some states have established mandatory weather modification reporting systems.[142] In addition, our knowledge is not yet sufficient to legally frame the effect of artificial rainmaking on natural rainfall in most cases. Despite this rainmaking *juris vaccum*, weather modification issues must be assessed and addressed. If state governments and the international community seek to regulate rainmaking, what are their relative powers? This question must soon come before courts. Eventually, disputes will be frequent between states using cloud modification techniques. In order to resolve these disputes, international law must provide a preliminary legal framework within which the international campaign for cloud activity can unfold.

C. Should Clouds be a Sui Generis *Resource?*

Until recently, cloud seeding, cloud harvesting, and cloud milking techniques have been fairly undeveloped. However, new research is underway with the objective to capture water in clouds by virtue of more powerful, more economic, and more effective processes.[143] Scientists have worked for many years on two distinct but complementary tracks. One consists of manufacturing artificial clouds,[144] the other aims at rerouting natural clouds by changing their trajectories and steering them to supposed rainwater release areas.[145] In spite of problems inherent to

141. International instruments aim to protect the environment by preventing the possible harm which may result from human activities such as transportation of oil or hazardous materials, atmospheric, maritime or fluvial pollution, greenhouse effect, biodiversity loss, or financial (rare wood smuggling) or climatic scourges (desertification).

142. *See* for example the US Weather Modification Reporting Act of 1972, Pub. L. 92-205, Dec. 18, 1971, 85 Stat. 735 (15 U.S.C. 330 et seq.).

143. Quilleré-Majzoub, *supra* note 7, at 663.

144. *See* William Underhill, *Rainmaker*, NEWSWEEK, June 30, 2003, at 66; Anthony Browne, *The Spray Turbine*, LONDON TIMES, December 02, 2002, *available at* http://www.mech.ed.ac.uk/research/wavepower/rain%20making/rain%20making.htm (last visited Nov. 14, 2008).

145. In order to manipulate airmass, we use low frequencies, like the American Project HAARP. *See* Mampaey, *supra* note 33, at 36, 64–67; M. FILTERMAN, LES ARMES DE L'OMBRE (2001); Bernard J. Eastlund, *Systems Considerations of Weather Modification Experiments Using High Power Electromagnetic Radiation*, *presented at* European Space Agency Workshop on Space Exploration and Resources Exploitation (Explospace), Cagliari, Italy, Oct. 20–22, 1998. The stationary waves created with low frequency magnetic fields ("amplified transmitter" of Nikola Tesla) can modify the

all scientific research, the latter research track will likely lead to tangible results in the long term.

Normally, evaporation from oceans turns liquid water into water vapor; in the atmosphere this vapor then condenses to form the water droplets with which clouds are formed.[146] Thus, most clouds come from the evaporation of the high seas in the tropics. The ideal location to manufacture clouds ranges from 10 to 20 kilometers from the coast nearest which the rain is desired to occur.[147] As such, manufactured clouds would not be formed over the high seas like their natural cousins, but rather over the territorial sea,[148] or even the exclusive sovereign economic zone of the manufacturing coastal state. Does the installation of weather machine generated clouds in this area mean that the water they contain belongs exclusively to the coastal state? The high seas are not submitted to the jurisdiction of any state; they are a common area that can only be regulated or managed by and for the international community.[149] On the other hand, coastal weather manufacturing processes give rise to host of questions. If a weather machine manufacturing clouds is installed in an area,[150] who owns the resulting clouds? The machine's owner, or the nearest coastal state? The lucky state, having the chance to capture precipitation, or the state that would intercept the clouds by seeding? The state having the necessary know-how to capture clouds over its territory, or all neighboring states, or even the international community? In such a case, how would rain be shared? Finally, what about landlocked states? Would they be deprived of their right to manufacture their own clouds, or would they be stripped from their own natural clouds by their upstream neighbors on the clouds' trajectory? In addition, could states with low precipitation claim a portion of the water which evaporates on the high seas?

Human intervention in weather phenomena, which was, until now, out of reach, could lead to serious problems, and the establishment of a legal regime for the clouds is far from a simple task. However, international intervention stems from a real legal need[151] and requires the

---

weather. *See* MARGARET CHENEY, TESLA, LA PASSION D'INVENTER (1987). But in case of interferences, they can cause a weather chaos.

146. *See* JEAN-PIERRE VIGNEAU, L'EAU ATMOSPHERIQUE ET CONTINENTALE 28–29; KANDEL, *supra* note 56, at 139–48.

147. *University Wins Rainmaking Grant*, BBC NEWS, December 2, 2002, http://news.bbc.co.uk/1/hi/technology/2535343.stm.

148. UNCLOS, *supra* note 66, art. 3.

149. *Id*., art. 137, ¶ 2.

150. *See id.*, art. 1, ¶ 1(1), art. 133.

151. *See generally*, *e.g.*, WMO, *supra* note 5, at Annex IV, ¶ 7(b)–(c) (Annex to agenda item 5.6 of general summary, Guidelines for advice and assistance related to the planning of weather modification activities).

assessment of principles which must govern current and future use of weather modification systems. A cloud is not in a stable physical state, and international law has no ability to govern what is seasonal, momentary, fugacious, or fleeting. Clouds and rain do not have a sufficiently prolonged[152] autonomous life cycle and, unlike land, sea, or air, clouds do not fit neatly into a well defined legal regime. The characteristics of clouds are so diverse and uncertain that we cannot subject them to stringent legal provisions, nor build a system of permanent rules, as is done in the case of other natural resources. These considerations seem perhaps to favor the absence of a particular regime for clouds as clouds' linkage to the elements recognized by traditional international law is often inappropriate. Regardless of this seemingly contradictory nature, a regulatory regime for clouds remains imperative.

Possible solutions to this problem can be drawn from the prevailing laws relating to the use of some spaces. The Montego Bay Convention on the Law of the Sea particularly acknowledges that it is:

> desirable to establish. . . taking into account the sovereignty of all the states, a legal order for the seas and oceans in order to facilitate the international communications and promote pacific use of seas and oceans, an equitable and efficient use of their resources, the preservation of their biological resources and a study on the protection and the preservation of the marine environment.[153]

Thanks to this convention, compensation rights were devoted to geographically disadvantaged states.[154] Concerning a common space such as the sea, the acknowledgment of such rights by the international community reveals the value of redistributive justice according to which states should not excessively suffer from geographical disadvantages. The most favored states should thus help those with fewer available resources.

This principle can be implemented with even more strength to atmospheric space, and to sharing its moisture and water, because it is inappropriate to only reserve the equitable use principle to states sharing terrestrial elements of the hydrological cycle.[155] Evaporated water in the high seas should be redistributed to the benefit of the states least favored by precipitation.[156] In this respect, the procedure provided by the UN

---

152. *See* VIGNEAU, *supra* note 147, at 20–21.

153. UNCLOS, *supra* note 66, pmbl. ¶ 4.

154. *Id.*, art. 69 (right of land-locked states); *id.* art. 70 (right of geographically disadvantaged states). *See also* NGUYEN QUOC DINH ET AL., *supra* note 20, at 1194–210.

155. *See* Watercourses Convention, *supra* note 66, art. 6.

156. Stephen C. McCaffrey, *Water, Water Everywhere, But Too Few Drops to Drink: The Coming Fresh Water Crisis and International Environmental Law*, 28 DENV. J. INT'L L. & POL'Y. 325, 333–36 (2000).

Convention on the Law of the Sea regarding the allocation of the deep seabed resources[157] represents a helpful model. The Area[158] status provides that resources of the seabed and ocean floor and subsoil are subject of an active internationalization.[159] Three principles govern their exploitation: (1) peaceful use; (2) non-appropriation; and (3) exploitation in the interest of mankind. If the high seas' evaporating water volume can be calculated, the necessary volume for water poor states can be calculated as well. With a system roughly similar to the International Seabed Authority and its exploitation rules[160] in force, water in clouds could be managed within the framework of a mechanism managed by a UN agency.[161] Providing and financing water could be done either by rich states' donations, or by the purchase of the water poor states experiencing financial hardship. This system may seem somewhat unrealistic or even utopian. But if we call on the international legal experience in this field, international law grants the geographically disadvantaged states a right over resources recovered in from a common source.

Still, the issue of clouds formed with water vapor from areas submitted to state sovereignty is not resolved. However, this issue need not be addressed because identifying the nature of clouds or their formation is enough to resolve the question. Scientists know that water in clouds is in constant renewal.[162] During its motion, a cloud gradually loses water droplets by evaporation and, at the same time, acquires new water drops from air moisture.[163] In an eternal cycle, the planet's water comes from the sky and all the water in the sky comes from the planet. Water in clouds has indeed countless sources, not just one.[164] This feature makes the idea that a cloud has been owned sometime by someone groundless. The water in clouds, like air and sunshine, is part of the natural environment that, in some sense, can be considered to be a common resource belonging to everyone. Taking this notion as true, it would not be important to know whether the cloud is formed above a zone of sovereignty or not, nor must we concern ourselves with whether

157. UNCLOS, *supra* note 66, Part XI, arts. 153, 170, and Agreements of 1994, Sections 2, 6.

158. *Id*., Part XI.

159. *See* NGUYEN QUOC DINH ET AL., *supra* note 20, at 1212–13, 1214–18.

160. UNCLOS, *supra* note 66, art. 156.

161. This agency could be responsible for the overall development of the program.

162. *See* VIGNEAU, *supra* note 147, at 20–21; KANDEL, *supra* note 56, at 121–24.

163. This moisture is acquired from locations where water is exposed to sun's heat (such as, seas, lakes, marshes, glaciers, and icepack), as well as biosphere evapotranspiration (from fauna, flora, and cultivated lands) and human activities. *See* KANDEL, *supra* note 56.

164. *See* VIGNEAU, *supra* note 148, at 61–67; KANDEL, *supra* note 56, at 167–79.

a cloud stems from the ocean space or continental evapotranspiration. By its nature, a cloud cannot stand, and is even at odds, with the concept of property.

As such, the international community should thus determine a suitable regime respecting clouds' *sui generis* nature. Is the water in clouds, which is a temporary state in a hydrological cycle, a *res communis* or *res nullius*? Is it something belonging to everybody, which can be regulated by the international community? Or, is it rather something belonging to nobody, which states can have it at their disposal, without any consequences and without any accompanying liability? The international legal regime of waters[165] reveals that water in general is regarded as *res nullius* and not as *res communis*.[166] Indeed, the use of water supposes a kind of appropriation far beyond the simple plots case.[167] Of course, the unanimous rejection of Harmon's doctrine[168] and the principle of non-abusive uses of watercourses because of their shared nature temper this consideration. However, these principles do not contain an obligation of co-management, even at the level of the hydrologic basin with its uses unrelated to transport. Still, some are putting too much pressure to make us admit a full *res communis* regime for water.[169]

---

165. *See* Watercourses Convention, *supra* note 66 (surface water regimes); Int'l Law Comm'n, *Fifth Report on Shared Natural Resources: Transboundary Aquifers*, U.N. Doc. A/CN.4/591 (Feb. 21, 2008) (*prepared by* Chusei Yamada) (subterranean water regimes). *See also* Law of Transboundary Aquifers, U.N. GAOR, 63rd Sess., G.A. Res. 63/124, U.N. Doc. A/RES/63/124 (Jan. 15, 2009).

166. *See* HENRI ROLAND & LAURENT BOYER, LOCUTIONS LATINES DU DROIT FRANÇAIS 422, 430–31 (4th ed. 1998).

167. Consider, for example, the disappearance of the Aral sea because of the agricultural use of all the water courses flowing into this sea.

168. Pursuant to this doctrine, the upstream state of a river has the right to use its waters the way it likes (including dams, diversions, etc.), without worrying about the downstream state. The condemnation of this doctrine by the arbitral award of Nov. 16, 1957, in the Lanoux Lake Arbitration, *supra* note 75, at 285, and the recognition of the principle of none harmful use of the territory removed definitely this doctrine. In the exploration, exploitation and development of their natural resources, states must not produce harmful effects in zones situated outside their national jurisdiction. *See* Int'l Law Comm'n, *Report of the International Law Commission on the Work of its Forty-Eighth Session*, U.N. GAOR, 51st Sess., Supp. No. 10, at 103, 113, 120–21, U.N. Doc. A/51/10 (1996).

169. *See, e.g.*, U.N. Econ. & Soc. Council, Comm. on Econ., Soc. and Cultural Rights, *Substantive Issues Arising in the Implementation of the International Covenant on Economic, Social and Cultural Rights*, U.N. Doc. E/C.12/2002/11 (Jan. 20, 2003); Council Directive 2000/60/EC, Establishing a Framework for Community Action in the Field of Water Policy, 2000 O.J. (L 327/1) 1, 7 (setting out EU objectives to prevent further deterioration of water bodies and to achieve "good ecological status"). *See also* L'EAU, PATRIMOINE COMMUN DE L'HUMANITÉ (L'Harmattan 2002). Potable water, like

When encountering unsettled new issues in international law, it is common to seek an analogy in issues for which there are well-settled rules in order to find guidance. Various analogies have been tried, including analogies of clouds to wild geese flying over the land, international watercourses or watersheds flowing through our skies. The remark about "cloudsheds" is not poetic, but is an analogy with well-established legal rules for ownership of water in international watersheds or watercourses.[170]

From this viewpoint, when one tries to develop a regime for a resource as complex as water in clouds, the reasoning will depend on the way one will apprehend the object. Every solution will be intrinsically related to the nature of the cloud. If it can be regarded as a natural resource, one cannot conceive of it without referring to its close relationship with humans and the environment. This special relationship will certainly influence the direction in which the law must progress. One of such a law's key goals must be to allow access.[171] It is thus through this requirement that the law will consider clouds, either as a substantial element for population's survival or as a potential origin of harm. The law may not try to find a regime for the cloud as such, but it has to govern them incidentally by virtue of their importance to the hydrologic cycle. However, as long as a cloud is not considered in and of itself, the scope of such a regime will be greatly reduced. In fact, relevant provisions pursuing a different goal from that of providing a particular regime for cloud may not be effective and address all hypotheses of this resource at stake. Consequently, it is sometimes possible to extrapolate the scope of application of some of these provisions.[172]

In light of recent developments regarding water regimes and the growing attention paid by international stakeholders to this vital resource, the working groups of the Second World Water Forum[173] provide an important analysis. As a crucial twenty-first century issue, water is at the center of a new wave of disputes. If water alone is not

---

ground water, is an example of a class of goods that the biologist Garrett Hardin referred to as belonging to the "commons." *See* Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

170. *See* Brooks, *supra* note 23, at 119; Ray Jay Davis, *Special Problems of Liability and Water Resources Law*, *in* WEATHER MODIFICATION AND THE LAW, *supra* note 118, at 104.

171. If access to water forms a basic human need, the legal analysis of the necessity of recognizing this need as a human right is far from obvious. *See* Second World Water Forum, The Hague, Neth., Mar. 17–22, 2000, *Water and International Law* (*prepared by* Peter van Krieken).

172. *See* MANFRED LACHS, LE MONDE DE LA PENSEE EN DROIT INTERNATIONAL: THEORIES ET PRATIQUE 21–22 (1989).

173. *See* Second World Water Forum, *supra* note 172.

enough to cause a war, it certainly could provide one underlying rationale. Many observers underline the need for developing a consistent legal framework complete with cooperative institutions in order to allow effective prevention of water disputes and their potential to degenerate into international armed conflicts.[174] Thus, a reflection on the most appropriate method, in terms of optimal cloud utilization, must be carried out. A first step aiming at accuracy for better protection may dramatically limit the scope of such a method, since it is impossible to forecast all possible cases involving clouds. Apart from the envisaged assumptions, what will be the regime of this resource? Of course, we can call upon the general principles of law in order to bridge the gaps, but we might end up confronting the situation we are hoping to avoid. The second step of this reflection should more accurately apply the spirit of international law and aim to lay down the applicable fundamental principles for cloud regulation. Nevertheless, this can very quickly turn out to be an obstacle for the management of certain situations, namely in the case where derogations from principles are not clearly stated.

The effectiveness of the protection will finally depend on the ability to reconcile these two steps and to strike a balance between them. Current provisions of applicable international water law tend towards this end, even if some gaps remain. The prevailing regime should thus be reconsidered in light of a broader conception of water.[175] Meanwhile, clouds currently have only a rough regime in international law.[176] However, it should not be forgotten that governments and the international community have an interest in the water cycle, just as they have an interest in the ozone layer, outer space, the high seas and the elements of the common heritage of mankind.

Like earlier instruments, a treaty regulating the exploitation of water in clouds, and declaring clouds to be the common heritage of mankind will not secure universal support.[177] But international law must elaborate

174. *See* NATIONAL SOVEREIGNTY AND INTERNATIONAL WATERCOURSES (Laurence Boisson de Chazournes, Bertrand Charrier & Fiona Curtin eds., Green Cross Int'l 2000).

175. Besides the natural and vital relationship between humans and water, water should be preserved against overexploitation and wastage as an essential component of the environment.

176. *See* U.N. Env't Programme, Governing Council, *Provisions for Cooperation Between States in Weather Modification*, UNEP GC.8/7/A (Apr. 29, 1980).

177. Pierre-François Mercure, *L'échec des modèles de gestion des ressources naturelles selon les caractéristiques du concept de patrimoine commun de l'humanité*, 28 R. D. Ottawa 45 (1996–97); Pierre-François Mercure, *Le choix du concept de développement durable plutôt que celui du patrimoine commun de l'humanité afin d'assurer la protection de l'atmosphère,* 41 R.D. McGill 595 (1996); Pierre-François Mercure, *Le rejet du concept de patrimoine commun de l'humanité afin d'assurer la gestion de la diversité biologique*, 33 A.C.D.I. 281 (1995).

a sound framework for clouds that considers arising needs, new technologies, utilization stakes and the potential use of clouds in a comparable way to a state's territory or the high seas. Like the high seas, the law of water in clouds might be based on principles of equal access and freedom of exploitation and use by all states. States must conduct their activities on clouds with due regard to the interests of others; they must avoid harmful effects and take appropriate measures to avoid adverse changes in the Earth's climate by cloud modification.

Unanimously adopted UN resolutions and the ENMOD Convention, now widely ratified, reflect agreement on a body of general rules governing weather modification. Although the lawmaking effect of these instruments is debatable, it seems likely that their environmental provisions are a good guide to states' obligations in cloud modification. They reflect customary international law relating to other common areas and draw on principles now generally confirmed by the Stockholm Declaration on the Human Environment, such as responsibility for harm. Customary international law also requires consultations to be held in advance of any activity or experiment where harmful interference may be caused to other states.[178] This custom is not intended to give other states a veto right, but it should entitle them to have their views considered in good faith. However, consultation is not meant to protect the climate of Earth or cloud formation as such; it is directed solely at protecting the interests of states in their exploration and use of the water in clouds. States are required to conform to customary international law by authorizing and supervising national cloud modification activities, whether private or public. This formulation suggests a standard of due diligence only. Manufactured, transferable, and tradable clouds should thus be regulated by a stable legal regime.

V. CONCLUSION

This Article has illustrated several points of general significance. First, customary international law remains important in providing a framework for the negotiation of solutions to problems of global and regional cloud modification. Second, progress can be made in refining the operation of international cloud modification regulatory and supervisory regimes. Third, substantial problems of global and regional economic equity remain to be addressed if the necessary action to prevent cloud interference is to be undertaken by a sufficiently large number of relevant states. Failure to settle these issues effectively is likely to ensure the collapse of attempts to prevent bulk cloud

178. *See supra* notes 67–68.

modification. This observation only serves to emphasize that the use of legal controls and the machinery of international justice cannot by themselves ensure the attainment of water goals endorsed by international policymakers given the substantial economic implications this may have for developed and developing states.

It is easy to become very grim about intervention with precipitation and rights to water in clouds. If we were to take a fatalist attitude, we might determine that we will end up being forced to evacuate some areas deprived of rain and settle in rainy ones. Cloud modification could become a serious problem and should be treated accordingly.

Clouds could also be our salvation. Hopefully, future cloud activity will be conducted only in the best interests of the international community. Humanity would immensely benefit if damage from drought and floods could be reduced. But before we reap such practical benefits, we need much more long-term financial support of basic research on weather modification from the international community. It is clear that the responsibility for cloud activity should not be left entirely to one country or to several developed countries. Cloud activity requires the broadest cooperation if it is to result in maximum benefits. It should be a common expectation that cloud activity has such tremendous benefits and should not be allowed to deteriorate to the realm of warfare,[179] where the battle could be won by those countries with the best scientists or the money to buy operational cloud capabilities. In such a situation, because of adverse climatic effects, it is possible that no one will win.

179. Certainly, defense departments are among the larger financiers of weather modification operations and research.

Notes & Comments

Morals on Stilts: Assessing the Value of Intergenerational Environmental Ethics

Trevor R. Updegraff*

ABSTRACT

Environmental degradation and natural resource consumption raise profound ethical and legal questions. The moral framework through which these questions are addressed forms a foundational aspect of international environmental law and policy. The goal of this Note is to encourage a thought exercise examining the basis of our moral connection to future people vis-à-vis the environment. However, this Note does not seek to establish or negate the existence of intergenerational rights. Rather, it questions the value of intergenerational ethics as a part of the moral tapestry underlying acts of environmental protection. This discussion concludes that, given their attenuated nature, intergenerational ethics should be approached cautiously. Ultimately, an ethical framework that focuses on presently held rights and obligations may be preferable for achieving meaningful environmental protection in the long term.

* J.D., University of Colorado Law School, December 2008.

I. INTRODUCTION

On a childhood fieldtrip, a teacher once told me that animals are kept in zoos to protect them so that future generations may someday see them. This assertion did not strike me as particularly odd at the time, and could even be considered mundane in a rhetorical sense. Indeed, the interests of future generations are often evoked in the broad context of environmental protection. The significance of these assertions, however, remains unclear. This Note questions the value of intergenerational ethics as a part of the moral tapestry underlying acts of environmental protection.

I entertain this discussion with a wariness that much has been written about this fascinating intersection between philosophy and law. As an introductory matter, I wish to express my deep admiration for the scholars that endeavor in this field. Among my greatest concerns about the theory of intergenerational ethics, however, is the difficulty of approaching its notoriously complex ideas. Like the late Professor Fred Rodell, "I am the last one to suppose that a piece about the law could be made to read like a juicy sex novel or a detective story, but I cannot see why it has to resemble a cross between a nineteenth century sermon and a treatise on higher mathematics."[1] In this spirit, I seek a degree of simplicity throughout this discussion in hopes of encouraging a thought exercise examining the basis of our moral connection to future people vis-à-vis the environment. There is great value, I believe, in grappling with these ideas. By carefully examining them on an individual level, we can assure that these theories will continue to evolve and gain inroads to the broader legal community.

II. INTERGENERATIONAL ETHICS: WRAPPED IN AN ENIGMA

To be certain, environmental degradation and natural resource consumption raise profound ethical and legal challenges. Meaningfully addressing these challenges will require a fundamental extension in morality.[2] The object of this extension, however, is open for debate.

Intergeneration rights are notoriously difficult to quantify. In a general sense, it is clear that environmental decisions are met with some

1. Fred Rodell, *Goodbye To Law Reviews—Revisited*, 48 VIRGINIA L. REV. 279, 282 (1962).

2. *See* Garrett Hardin, *The Tragedy of the Commons*, SCIENCE 1243, Dec. 13, 1968 ("The population problem has no technical solution; it requires a fundamental extension in morality.").

concern for their effect on future generations. However, "[t]he fact that we may have some universally recognized concern for the future does not convert that concern into a moral imperative."[3] Nevertheless, "a common assumption underlying nearly every book or essay on the global environment is that the present generation owes a duty to unborn generations to preserve the diversity and quality of our planet's life-sustaining environmental resources."[4]

The term "intergenerational rights" refers to a bundle of perceived moral obligations that must be further distinguished. The strongest sense of ethical obligation across generations is felt toward direct progeny over a relatively short period of time. Lawyers commonly act as mediators with regard to such rights, assuming the responsibility to uphold them through legal instruments like wills and trusts. Intergenerational environmental rights are of a distinct and separate character. They speak of broad obligations extending to the global population, rather than a few future individuals with whom our genetic and familial responsibilities impose a stronger sense of obligation. As a general matter, references to "future generations" throughout this discussion refer to remote future people that will live only after all presently living people have died.

Philosopher Jeremy Bentham famously referred to the theory of natural rights, or rights that exist outside a formal legal system, as "nonsense upon stilts."[5] By evoking this language in the title of this Note, I do not intend to discount the value of work that has been done in this field, nor do I wish to imply that the theory of intergenerational rights is nonsense. In fact, this Note does not seek to either establish or negate the existence of ethical obligations to future generations. Rather, it seeks to highlight the attenuated nature of these ethical constructs and to illustrate the uncertainty pervading the field. In this vein, this Part briefly highlights a fascinating contemporary debate over the existence and nature of ethical obligations to future people.

Professor Edith Brown Weiss is perhaps the most influential contemporary legal scholar in the field of intergenerational ethics. Weiss posits that "principles of intergenerational equity form the basis of a set of intergenerational obligations and rights, or planetary rights and

---

3. Jeffrey M. Gaba, *Environmental Ethics and our Moral Relationship to Future Generations*, 24 COLUM. J. ENVTL. L. 249, 259 (1999).

4. Anthony D'Amato, *Do We Owe a Duty to Future Generations to Preserve the Global Environment?*, 84 AM. J. INT'L L. 190, 190 (1990).

5. Jonathan Crowe, *Explaining Natural Rights: Ontological Freedom and the Foundations of Political Discourse*, 4 N.Y.U. J. L. & LIBERTY 70, 73 (2009) (citing Jeremy Bentham, *Anarchical Fallacies*, in 'Nonsense Upon Stilts': Bentham, Burke and Marx on the Rights of Man 46, 53 (Jeremy Waldron ed., 1987)).

obligations that are held by each generation."[6] According to Weiss, these rights are "derive[d] from each generation's position as part of the intertemporal entity of human society."[7]

Weiss further identifies three basic principles of intergenerational equity as related to the environment. Under the principle of conservation of options, "each generation should be required to conserve the diversity of the natural and cultural resource base, so that it does not unduly restrict the options available to future generations in solving their problems and satisfying their own values."[8] The principle of conservation of quality dictates that "each generation should be required to maintain the quality of the planet so that it is passed on in no worse condition than that in which it was received, and should also be entitled to planetary quality comparable to that enjoyed by previous generations."[9] Finally, the principle of conservation of access provides that "each generation should provide its members with equitable rights of access to the legacy of past generations and should conserve this access for future generations."[10] Weiss argues that "[t]hese proposed principles constrain the actions of the present generation in developing and using the planet, but within these constraints do not dictate how each generation should manage its resources."[11]

As with any ethical theory, these propositions are subject to philosophical critique. An initial problem for assertions of intergenerational rights is that it is difficult and often imprecise to speak of morality on a generational level. A generation does not appear to be a moral entity in any meaningful sense, because it does not make conscious moral decisions. To speak of generational obligations implies that individual actors in society (including those acting on behalf of institutions) assume higher ethical standards based on societal or generational challenges.

Another ground-level criticism is that it is difficult to assign rights to an entity that does not in fact exist. Along these lines, Professor Anthony D'Amato offers a particularly strong critique of Weiss' position.

---

6. Edith Brown Weiss, *Our Rights and Obligations to Future Generations for the Environment*, 84 AM. J. INT'L L. 198, 202 (1990).

7. *Id.*

8. *Id.* at 202.

9. *Id.*

10. *Id.*

11. *Id.*

A. Who are These Future People Anyway?

An intriguing philosophical conundrum is encountered when trying to identify the future persons to whom potential obligations are owed. The non-identity problem, illustrated by Parfit's paradox of future individuals,[12] stands as a conceptual barrier to establishing norms of intergenerational environmental justice. The basic theory is that if we act to preserve the environment out of a sense of obligation to future persons, that obligation is nonsensical because in so acting we destroy the obligees. Professor D'Amato outlines the paradoxical situation in the following passage:

> [A]lthough every policy decision of government and business surely affects the composition of future generations, we are nevertheless entitled to examine each and every one of those policy decisions from a moral point of view. If some are immoral, we reject them for that reason alone. But some policy decisions are asserted to be morally required solely because they will benefit future generations. It is just these policy decisions that are subject to the Parfit rejoinder: if you undertake a policy decision only to benefit future generations, and that is its only "moral" justification, it is not morally justifiable at all because it destroys the very persons you claim to protect.[13]

D'Amato's argument has scientific roots in the widely recognized "butterfly effect."[14] Parfit's paradox arises from an application of the butterfly effect to the dynamic system of human relations and reproduction. Namely, a small change to the environment will cause slight reproductive changes, resulting in a different set of people being born than those that the environmental decision in question was initially intended to benefit.

Though intriguing from a philosophical perspective, this argument is probably inconclusive.[15] This Note does not seek to unpack the intricacies of this argument, but points to it as an example of the significant conceptual challenges associated with intergenerational ethics.

---

12. For an excellent discussion, see generally DEREK PARFIT, REASONS AND PERSONS 351 (1984) (developing norms of intergenerational responsibility "is the most important part of our moral theory, since the next few centuries will be the most important in human history").

13. D'Amato, *supra* note 4, at 193 n. 11.

14. This theory provides that tiny variations in a dynamic system may produce large variations in the long run. *See* Edward N. Lorenz, *Deterministic Nonperiodic Flow*, J. ATMOSPHERIC SCI. 20, 130–41 (1963); Edward N. Lorenz, *Atmospheric Predictability as Revealed by Naturally Occurring Analogues*, J. ATMOSPHERIC SCI. 26, 636–46 (1969).

15. *See* James Woodward, *Reply to Parfit*, 97 ETHICS 800–17(1987).

Regardless of philosophical merit, one can make the normative argument that it would be better if people perceived obligations to future generations. While many people probably accept some notions that resemble the basic principles presented by Weiss, it is difficult to say that such principles serve as a driving force in the decision-making processes of those persons. However, even if such principles are a part of a conscious decision-making process, they may not be accorded sufficient weight to provide meaningful impetus for environmental protection. One reason for this is the problem of propinquity and the related phenomenon of time discounting.

B. The Problem of Propinquity

Hi, my name is Trevor. I live in Boulder, Colorado.

"Propinquity" refers to a fundamental aspect of human perception that has profound impacts on the processes of social decision-making. You just made two, and possibly three, broad judgments of propinquity relative to me. One is geographic. If you are reading this in Siberia, you have a sense that we are separated by vast expanses of land and sea. Another is sociological. Perhaps you found my introduction pleasant and folksy, or perhaps you found it obnoxious given the scholarly nature of a law journal. Whether you made the third judgment or not depends on whether you looked at the date on this edition.

Suppose the introduction read, "Hi, my name is Bob. I live on planet Earth in the year 2999." The two introductions elicit very different reactions. A part of the understandably skeptical reaction to Bob stems from the fact that he, as a remote future person, lacks meaningful identity. However, my potential children or grandchildren similarly lack identity, yet these concepts naturally elicit different reactions. The reason is propinquity. Because our powers of prediction—both perceptual and scientific—break down across time, any ontological status we attribute to Bob is inexorably weak. He is merely an abstraction in the form of broad potentiality. Now, imagine that Bob said, "You have an ethical obligation to prevent environmental degradation because it will negatively affect the quality of life in 2999."

The following illustration provides a rudimentary introduction to the phenomenon of time discounting.[16] This concept, often illustrated through an economic model, may call the value of intergenerational rights into question.

16. For an outstanding discussion of time discounting, see Daniel A. Farber, *From here to Eternity: Environmental Law and Future Generations* 2003 U. ILL L. REV. 289, 292 (2003).

Consider a cigarette smoker who knows that smoking will have adverse long-term health consequences but chooses to continue smoking.[17] Despite the predictability of a long-term negative outcome, the present addictive satisfaction is accorded greater weight in the decision-making calculus than are the future health detriments. Similarly, while we may recognize that global warming will probably have a negative effect on future people, it is unclear whether this foreseeable consequence will inspire action. For example, if the horizon for noticeably detrimental effects of climate change was 1,000 years rather than 100 or less, it seems less likely that present people would sacrifice the installation of a coal-fired power plant that promises to supply cheap, reliable power to present people. It is safe to say that such an expanded timeline with regard to effects of global warming on the future human population leads to more attenuated conceptions of obligations to structure present actions around mitigating such effects.

The brief preceding discussion illustrates that the concept of intergenerational ethics is complex and inherently problematic. But, given its uncertainty among philosophers, how is the theory of intergenerational environmental justice to be recognized by the law?

III. SOME MANIFESTATIONS OF INTERGENERATIONAL ETHICS IN LAW

This Part provides examples of ways that principles of intergenerational ethics have pervaded different legal systems, highlighting the difficulties of delineating and incorporating such principles into conventional legal analysis. The ultimate question raised is; to what extent should intergenerational ethics serve as an impetus and justification for environmental protection?

Although appeals to intergenerational justice are commonly used as high political rhetoric, the manifestations of such ethical theories in law are more discrete. While this Note is concerned with the interplay of intergenerational ethics and environmental law, it is instructive to briefly consider the clearly recognized intergenerational aspects of property law.

Intergenerational obligations are most concretely memorialized in the field of property law. A number of legal devices are used to facilitate the passage of wealth and other property across generations, subject to certain limitations. Some limitations are inherent. Property-related

17. *See also*, Alexander Gillespie, INTERNATIONAL ENVIRONMENTAL LAW, POLICY AND ETHICS 15, 117–26 (1997) (further discussing the "motivational and practical" problems associated with intergenerational rights).

obligations typically extend only to close descendants of the obligee. That is to say, the sense of obligation regarding disposition of property is inherently greater with respect to one's children than it is to one's potential great-great grandchildren. Other limitations are procedural. To avoid the inherent uncertainty of structuring property rights around distant generations, Anglo-American law constrains the passage of wealth through the Rule Against Perpetuities. However, the rise of the conservation movement in the United States has seen an intriguing form of environmental protection: conservation through perpetual contractual restrictions on land use.

An interesting feature of the conservation movement is the rise of privately negotiated conservation easements. Statutorily authorized, such agreements are designed to preserve, in perpetuity, lands with conservation value, such as ecological, cultural, or scenic significance.[18] The perpetual nature of these agreements renders them an appropriate object for the debate over intergenerational ethics.

Professor Julia Mahoney observes that the sense of duty to future generations "permeates the history of American land preservation," and that "appeals to the interests of future generations are a ubiquitous feature of assertions that particular tracts of land are unique and worthy of protection."[19] But Mahoney critiques the use of perpetual restrictions, such as conservation easements, because of present people's inability to predict future conditions. She concludes that "there is reason to suspect that . . . the extensive use of conservation servitudes as an anti-development tactic may create ecological, legal, and institutional problems for later generations."[20]

The theory of intergenerational justice has briefly emerged in other fields of American law, though unsuccessfully. One attempt to invoke intergenerational rights emerged in the abortion debate. For example, the Pennsylvania court in *Roe v. Casey* rejected an anti-abortion doctor's motion to be appointed guardian ad litem for unborn children.[21] The court was quick to reject the assertion of legal status for future persons. The court held that "unborn children are not persons with a legally protectable interest within the meaning of [Federal Rules of Civil

18. *See* Jesse J. Richardson, Jr., *Conservation Easements and Ethics* 17 SAN JOAQUIN AGRIC. L. REV. 31 (2008).

19. Julia D. Mahoney, *Perpetual Restrictions on Land and the Problem of the Future*, 88 VA. L. REV 739, 747 (2002).

20. *Id.* at 787.

21. *Roe v. Casey*, 464 F. Supp. 483, 486–87 (E.D. Pa. 1978), *aff'd*, 623 F.2d 829 (3d Cir. 1980).

Procedure] and, thus, the appointment of guardians ad litem is neither warranted nor required."[22]

Returning to the case of environmental protection, while the land conservation movement finds justification in intergenerational principles, the most striking appeals to intergenerational rights theories are often framed in a human rights context. However, the foundational principles underlying the perceived obligations to future generations—and the increased weight of such obligations over time—are based on the argument that mankind's ability to alter the global environment is so profound that decisions regarding such alterations must consider the potential effects on the rights of future generations. Consider the preamble to the Stockholm Declaration, which provides:

> Man is both creature and molder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth. In the long and tortuous evolution of the human race on this planet a stage has been reached when, through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale. Both aspects of man's environment, the natural and the man-made, are essential to his well-being and to the enjoyment of basic human rights—even the right to life itself.[23]

Even if we are to recognize rights for future generations regarding the environment, they may remain unenforceable without a basis for protection in law. One way to establish such a basis is to provide standing to sue on behalf of future generations.

A. Oposa v. Factoran*: Assessing the Merits of Standing for Future Generations*

An intriguing judicial approach to achieving intergenerational environmental justice is to allow for present-day enforcement of the rights of future generations. Though recognizing standing for future generations raises a host of conceptual difficulties, the approach has created something of a stir among legal scholars.

One way to address the question of standing for future generations, or posterity standing, is through constitutional interpretation. As an interesting example, John Edward Davidson argues that the Equitable Jurisdiction Clause of Article III of the United States Constitution

22. *Id.*

23. U.N. Conference on the Human Environment, June 5–16, 1972, *Stockholm Declaration*, pmbl., U.N. Doc. A/CONF.48/14 (1972), *reprinted in* 11 I.L.M. 1416 (1972).

confers standing upon future generations.[24] Davidson argues that "our society presently pursues a number of policies that discriminate against the interests of future generations," and that "[t]he language of the Constitution and the sentiments of the Constitution's framers provide adequate legal grounds for curbing this generationally selfish behavior."[25]

Davidson concludes that a mandate for intergenerational justice can be fairly derived from the existing language of the U.S. Constitution. He explains that:

> The suggested mandate derives its form and its substance from several constitutional clauses. The Equal Protection Clause of the Fourteenth Amendment, for instance, is read to protect remote future generations from discrimination just as it protects other politically disenfranchised groups. The Takings and Due Process Clauses of the Fifth Amendment, both of which are historically rooted in the writings of John Locke, are construed to harmonize with that philosopher's highly developed system of intergenerational rights and obligations. These provisions, and the remainder of the Constitution, are all interpreted in the light of the Preamble's Posterity Clause, which provides that "We the People . . . to ourselves and our Posterity, do ordain and establish this Constitution."[26]

Despite their textual and philosophical intrigue, claims of intergenerational standing are not likely to appear before the U.S. Supreme Court anytime soon. Davidson recognizes the unique nature of constitutionally based arguments, noting a fundamental difference between constitutional interpretation and abstract philosophy. Namely, "[i]n constitutional interpretation, the search for an objective, metaphysical truth is sometimes less relevant than the search for the subjective intent of the Constitution's human framers."[27] However, not all legal systems are as reticent to such notions.

Few cases achieve celebrity status in the international arena, but surely this distinction belongs to the Philippine Supreme Court's decision in *Oposa v. Factoran*.[28] Since the decision, *Oposa* has continued to earn praises as a significant decision in the fight for environmental protection and has been routinely touted as a triumph in

---

24. John Edward Davidson, *Tomorrow's Standing Today: How the Equitable Jurisdiction Clause of Article III, Section 2 Confers Standing upon Future Generations*, 28 COLUM. J. ENVTL. L. 185 (2003).

25. *Id.* at 220.

26. *Id.* at 192.

27. *Id.* at 209.

28. Oposa v. Factoran, G.R. No. 101083, 224 S.C.R.A. 792 (July 30, 1993) (Phil.), *reprinted in* 33 I.L.M. 173 (1994).

the field of intergenerational rights.[29] To be sure, the Philippine Court adopted a unique approach toward the question of standing to sue.

In 1994, the Supreme Court of the Philippines convened *en banc* with an assertion of intergenerational rights on the table. In the opening lines of the case, the issue was broadly framed as, "the right of Filipinos to a balanced and healthful ecology which the petitioners dramatically associate with the twin concepts of inter-generational responsibility and inter-generational justice."[30] Specifically, the case addressed the issue of whether the petitioners had a cause of action to "prevent the misappropriation or impairment" of Philippine rainforests and "arrest the unabated hemorrhage of the country's vital life-support systems and continued rape of Mother Earth."[31]

The named plaintiffs in the case were a group of children from across the country, arguing that the deforestation at issue "will work great damage and irreparable injury to [those] who may never see, use, benefit from and enjoy this rare and unique natural resource treasure."[32] The plaintiffs sought standing to sue on behalf of themselves and future generations to remedy the injuries that they argued would probably occur.

In ruling for the plaintiff children, the Philippine Supreme Court addressed the assertion of intergenerational responsibility as grounds for standing:

> We find no difficulty in ruling that [the plaintiff children] can, for themselves, for others of their generation and for the succeeding generations, file a class suit. Their personality to sue in behalf of the succeeding generations can only be based on the concept of intergenerational responsibility insofar as the right to a balanced and healthful ecology is concerned. . . . Put a little differently, the minors' assertion of their right to a sound environment constitutes, at the same time, the performance of their obligation to ensure the protection of that right for generations to come.[33]

Oposa has received wide recognition in the field of environmental and natural resource law and is probably the most important judicial opinion in history relating to intergenerational environmental rights. It is

29. *See* Maria Socorro Z. Manguiat & Vicente Paolo B. Yu III, *Maximizing the Value of* Oposa v. Factoran, 15 GEO. INT'L ENVTL. L. REV. 487 (2003).

30. *Oposa*, 33 I.L.M. at 175–76.

31. *Id.* at 176.

32. *Id*. at 180.

33. *Id* at 185.

no wonder that scholars have argued for its reasoning to be extended.[34] Consider the following quote:

> The Supreme Court's statement in *Oposa* relating to intergenerational equity and the standing of petitioners therein should be seen not merely as obiter dictum. It should also be seen as an authoritative and ultimately precedent-setting statement that has significantly advanced the meaning and scope of the constitutional right to a balanced and healthful ecology in ways that may be directly meaningful and useful for present generations in relation to their environmental duty to future generations.[35]

But how should the legal community interpret the line of reasoning in *Oposa*? Along with the significant praise it has been given, the case has raised interesting critiques. Despite the high rhetoric of the opinion, it remains questionable whether it has made any meaningful contribution to the people of the Philippines, or has in any way clarified the intersection between intergenerational ethics and law.

B. Critique of Oposa*: Addressing the Practical and Conceptual Difficulties of Posterity Standing*

Although the *Oposa* decision is appealing in the field of environmental law, it has been sharply attacked for having significant shortcomings, both practical and conceptual. Dante B. Gatmaytan asserts that:

> [a] judicial declaration on "intergenerational equity" does not serve any practical purpose. At most, "standing to sue for future generations" is quaint or intellectually stimulating. However, there was no need to invoke the rights of future generations because the present generation can always file a case to enjoin any action that impairs its right to a balanced and healthful ecology.[36]

Professor Dante B. Gatmaytan argues that the *Oposa* decision has been largely misunderstood by the legal community.[37] He critiques the case on the following grounds, particularly focusing on the practical shortcomings of the case and the limited role of intergenerational rights that was used in reaching the final decision.

---

34. *See* Manguiat & Yu, *supra* note 29, at 493–94.

35. *Id.* at 493-94.

36. Dante B. Gatmaytan, *The Illusion of Intergenerational Equity: Oposa v. Factoran as a Pyrrhic Victory*, 15 GEO. INT'L ENVTL. L. REV. 457, 475 (2003).

37. *Id.*

First, the case did not affect government conduct in the protection of the environment.[38] The Philippine Supreme Court did not order the cancellation of the logging proposal at issue, but instead ordered the case to be remanded for trial. The petitioners did not pursue the case after it was remanded, thus no logging was cancelled.[39]

Second, although the case has been praised for recognizing standing to sue for future generations, the Court's statement to that effect is obiter dictum and, therefore, is not binding as precedent.[40] Gatmaytan suggests that, while the opinion stated that the Court saw no problem in extending standing to future generations, the opinion cannot be seen as comprehensively addressing the issues or the potential problems associated with intergenerational standing.[41]

Third, even if standing had been an issue, Philippine Courts have traditionally taken a liberal approach to standing. Accordingly, "[t]he Supreme Court, by relying on case law, could have either assumed the existence of the children's standing to sue or waived the requirement completely."[42] This critique fuels the argument that the reasoning in *Oposa* faces difficulties in extending to other legal systems.

Fourth, Gatmaytan notes that the use of intergenerational equity is ultimately useless in the resolution of the case. He explains that

> [t]he Philippine Supreme Court would have decided *Oposa* exactly the same way had the children filed the case solely on their own behalf. In cases involving the protection of the environment, the distinction between present and future generations is inconsequential . . . we cannot protect the rights of future generations without protecting the rights of the present.[43]

Fifth, the protection of the rights of future generations was already inscribed in Philippine law and jurisprudence even before the ratification of the 1987 Constitution and the promulgation of *Oposa*.[44] This raises a question of utility. Namely, would a judicial declaration on intergenerational equity significantly add to the laws enacted by the legislature?

However, Gatmaytan ultimately argues that despite the shortcomings of the case, it should be celebrated, not for its recognition of intergenerational rights, but "because it held that the constitutional

38. *Id.* at 459.
39. *Id.*
40. *Id.*
41. *Id.*
42. *Id*. at 460.
43. *Id.*
44. *Id.*

provision on the right to a balanced and healthful ecology is an actionable right that is superior to the Bill of Rights."[45]

While the efficacy of *Oposa* can be questioned, the approach to intergenerational equity also raises conceptual difficulties. One such difficulty is that standing alone does not create a right; it simply provides a vehicle for the enforcement of a right. In *Oposa*, without the right to a healthy environment under Philippine law, the plaintiffs would have had no right of enforcement.

The Court did not address whether this standing would extend to suits seeking enforcement of rights and government decisions that are not environmentally related, such as those related to the economy, food security, and energy policy. How can the implications be weighed, given the fact that human environmental impact is also rooted in a number of additional societal decisions like these?

In the Philippines, the fundamental right to a healthy environment is enshrined in the Constitution. A problem with extending the principle of intergenerational standing to other legal systems is that not all countries accord similar weight to the environmental implications of government decisions. If a nation's highest priority is economic security for its citizens, then under an *Oposa*-esque standing regime, citizens could sue to enforce environmentally destructive practices in order to provide economic security for future generations.

A more interesting hypothetical arises if the national priorities are not well delineated. Imagine a jurisdiction recognizing standing to enforce the rights of future generations to "life, liberty, and the pursuit of happiness." Faced with a decision on whether to clear-cut a particular forest, opposing arguments can be advanced on entirely different principles. If a decision is made to cut the forest, one could argue that the decision violates the rights of future people because it will deny them the public enjoyment of the forest. If a decision is made not to cut the forest, one could argue that the greater benefit to future generations is to log the forest to provide economic stimulus, jobs, and infrastructure.

In light of these considerations, it seems that intergenerational standing is an insufficient vehicle for achieving environmental protection. The question remains, however, as to how courts will deal with the profound intergenerational implications of climate change. Perhaps the tiny island nation of Tuvalu provides a window into the future challenges of intergenerational law, and the unique nature of the International Court of Justice ("ICJ").

45. *Id.*

C. The Islands of Tuvalu: A Window into the Unique Intergenerational Challenges of Sea Level Rise

In 2002, in response to the United States' refusal to ratify the Kyoto Protocol, the island nation of Tuvalu threatened to bring a lawsuit against the United States in the IJC for damages to its islands resulting from the impending threat of sea level rise.[46]

Among the theories on which Tuvalu wished to proceed was the deprivation of intergenerational rights. Some predictions indicate that the islands, with a population of roughly 11,000 people, will be immersed by 2054 due to the sea level rise resulting from global warming.[47] One author has observed that:

> Tuvalu's proposed suit against the United States in the International Court of Justice is as much about obtaining relief as it is about obtaining a more public and hopefully sympathetic arena. Tuvalu is not and will not be the only island affected by global warming. Regardless of whether Tuvalu is successful in the international arena, contemplating the issues Tuvalu may face in a possible suit will provide guidance for prospective actions by other nations that will surely face a similarly dire future.[48]

Parties to IJC cases use both intergenerational rights and the precautionary principles to support their policy arguments.[49] But how are such arguments to be recognized? Consider the following case from the international court of justice.

D. The Next Frontier: Intergenerational rights in the ICJ

The *Gabcikovo* case involved a dispute between Hungary and Slovakia over the retention of waters on the Danube River by the Gabcikovo Dam.[50] The ICJ issued a 117-page opinion that grappled largely with issues of international treaties that governed Hungary's obligations to complete the large hydrological project that would ultimately benefit Slovakia.[51] The list of judges' votes on the various issues, by itself, spanned two and one half pages, but the most interesting

---

46. Rebecca Elizabeth Jacobs, *Treading Deep Waters: Substantive Law Issues in Tuvalu's Threat to Sue the United States in the International Court of Justice*, 14 PAC. RIM L. & POL'Y J. 103 (2005).

47. *Id*. at 103 (citing Mark Chipperfield, *Drowning Islands of Tuvalu Sue UK Government to Stay Afloat*, SCOTLAND ON SUNDAY, Apr. 7, 2002, at 20).

48. *Id.*

49. *Id*. at 119 n. 107.

50. Gabcikovo-Nagymoros Project (Hung. v. Slovk.), 1997 I.C.J. 7, 109 (Sept. 25).

51. *Id.*

aspect of the case is the separate opinion of Judge Weeramantry, the Vice-President of the ICJ. It seems rare for a judicial opinion to cite the practices of ancient civilizations, but Judge Weeramantry saw the case as:

> an opportunity to tap the wisdom of the past and draw from it some principles which can strengthen the concept of sustainable development, for every development project clearly produces an effect upon the environment, and humanity has lived with this problem for generations.[52]

Recognizing the broad implications of the field and its interdisciplinary nature, Judge Weeramantry stressed that "especially at the frontiers of the discipline of international law, it needs to be multi-disciplinary, drawing from other disciplines such as history, sociology, anthropology, and psychology such wisdom as may be relevant for its purpose."[53]

Judge Weeramantry described an ancient tribe in Sri Lanka that, while recognizing the need for vigorous and aggressive development, also articulated the need for environmental protection and ensured that the technology it employed paid due regard to environmental considerations.[54] This regard was demonstrated through the construction of a complex irrigation system that overcame technical barriers in order to avoid destroying the environment.[55] He also cites royal edicts from the third century ordaining that certain forests should never be felled because adequate forest cover in the highlands was known to be crucial to the irrigation system because it intercepted heavy rains.[56]

The opinion also discusses two ancient tribes of sub-Saharan Africa, the Sonjo and the Chagga, who had established significant irrigation furrows.[57] Among the Sonjo, it was considered to be the sacred duty of each generation to ensure that the system was kept in good repair.[58] To the Chagga it was their prime social duty to ensure that furrows were well-maintained.[59]

These sources are not cited for rhetorical value, but rather to point to instances that "accorded due importance to environmental considerations and reconciled the rights of present and future

52. *Id*. at 96.
53. *Id*. at 96–97.
54. *Id*. at 98.
55. *Id.*
56. *Id*. at 102.
57. *Id*. at 105.
58. *Id.*
59. *Id.*

generations."[60] Judge Weeramantry goes on to demonstrate how these ideals appear in modern western societies:

> There is a duty lying upon all members of the community to preserve the integrity and purity of the environment. Natural resources are not individually, but collectively, owned, and a principle of their use is that they should be used for the maximum service of people. There should be no waste, and there should be a maximization of the use of plant and animal species, while preserving their regenerative powers. The purpose of development is the betterment of the condition of the people. Most of them have relevance to the present case, and all of them can greatly enhance the ability of international environmental law to cope with problems such as these if and when they arise in the future.[61]

Underlying the opinion is the notion that "[t]he ethical and human rights related aspects of environmental law bring it within the category of law so essential to human welfare that we cannot apply to today's problems in this field the standards of yesterday."[62] As the language of the case suggests, the ICJ is a likely forum for further debate regarding intergenerational duties among nations.

IV. ALTERNATIVES TO AN INTERGENERATIONAL RIGHTS APPROACH

This Part briefly presents a few alternative approaches to establishing environmental rights and obligations. As with other aspects of this Note, these alternatives are not meant to provide a conclusive resolution to the difficult questions of environmental ethics. Rather, they serve as fuel for thought in assessing the ethical foundations of our interaction with the environment.

A. The Land Ethic as a Basis for Environmental Decision-making

Aldo Leopold famously wrote that, "[a] thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise."[63] Under this framework, the conception of environmental justice is rooted in ethical obligations to the

60. *Id*. at 106.
61. *Id*. at 110.
62. *Id*. at 114.
63. ALDO LEOPOLD, A SAND COUNTY ALMANAC 224-25 (1949).

greater biotic community. Such an approach has been advocated by legal scholars and presents an intriguing alternative to intergenerational rights.

Professor Judith Koons proposes a "wholesale moral realignment" that shifts our ethical focus "from human-centered to Earth-centered morality."[64] She argues that "[i]t is not a stretch to propose that species and living systems in nature qualify for moral consideration."[65] Under such a formula, it seems that the interests of future generations may be largely, if not entirely, removed from the moral calculus. If there is an ethical sense that acts of environmental degradation are wrong because of their detrimental effect on the biotic community, then appropriate measures will likely be taken to mitigate those effects regardless of their future implications. In this vein, I offer a rough analogy suggesting that decisions affecting climate change be viewed like pollution, as opposed to broad intergenerational challenges.

1. The Analogy of the Aquarium: A Pollution Model for Climate Change.

Proceeding from an ethical framework rooted in the land ethic, acts of pollution take on a distinctly moral character. This Subpart, through an admittedly primitive experiment, suggests an ethical perspective that considers greenhouse gas emissions as acts of pollution.

Picture a beautiful saltwater aquarium. It contains dozens of species, from the most primitive cyanobacteria to spectacularly complex corals, invertebrates, and tropical fish. These creatures exist in relative harmony, each having been carefully selected for its beneficial contributions to the system as a whole. I am fortunate to have just such an aquarium in my home. It is a great source of enjoyment to me and is the awe of many friends and visitors.

As a rough test for my theory, I conducted an experiment. First, I filled a medicine dropper with bleach.[66] The amount would be certain to wreak havoc on my aquarium. Next, I invited a friend to my home and offered him the dropper. I informed him it was filled with bleach and then asked if he would please add it to my aquarium.

He hesitated. "Won't this kill everything in there?"

"Of course," I said. "Please go ahead."

Thankfully, he refused. In an essentially moral judgment, he determined that it would be wrong to obliterate the little ecosystem.

64. Judith E. Koons, *Earth Jurisprudence: The Moral Value of Nature*, 25 PACE ENVTL. L. REV. 263, 337 (2008).

65. *Id.* at 325.

66. I, in fact, filled the dropper with a saline solution in order to avert catastrophe should my experiment fail.

There was no particular authority that directed my friend not to add bleach to the aquarium; in fact, the only relevant authority at the time was telling him to do it.

I probed further: "Why won't you do it?"

The answer I received was unsurprising. My friend said that it would be intuitively "wrong" to poison the aquarium.

"But why?" I pressed.

He talked about the health and well-being of the creatures and how it would be wrong to willfully kill them. He also expressed concern about the destruction of aesthetic beauty, in reference to the ecosystem's harmony when functioning as a whole.

One justification that was not offered, however, was that to poison the aquarium would deny future people the pleasure of viewing it. This conclusion is also unsurprising. In this circumstance, the interests of future people provide a weak moral justification for either action or inaction. The reason is that the rights of future people allow for a much more attenuated form of ethical decision-making. For my friend, this sense of moral obligation was weak enough that he did not even think of it as a possible justification for his ethical decision not to add bleach to my fish tank. The danger is that if we continue to frame the issues of environmental degradation and climate change in terms of intergenerational rights, then these considerations will rarely arise in the process of everyday choices. When they do, they may be accorded weak status among our priorities to act, because again, we only feel a weak connection with future people like Bob from Part II.B above.

The fundamental ethical shift that is needed is for people to view greenhouse gas emissions like pouring bleach in the fish tank. Here, a somewhat broader analogy is warranted.

Suppose that we power our cars by pouring bleach in the ocean. Every week, each driver has to go to the ocean and pour in a certain amount of bleach relative to his or her amount of driving. This scenario would likely bring the ethical decisions associated with resource consumption into greater focus, as people would see the results of their driving in terms of direct pollution. This would invariably provide a moral disincentive to drive and an incentive to find alternate means of transportation.

Global warming, on the other hand, is a "global" and "intergenerational" issue. For some reason, most of society does not see greenhouse emissions in terms of direct pollution, but rather a broad obligation that will be addressed by scientists, politicians, and lawyers. What are cloaked behind this veil of delegated responsibility are the individual responsibilities to minimize our effects as polluters.

B. Farooque v. Bangladesh*: Approaching Environmental Protection through a Fundamental Rights Analysis*

Four years after *Oposa*, the Supreme Court of Bangladesh also considered an assertion of intergenerational environmental rights. The Court could not afford to take the decision lightly. To say the least, Bangladesh faces environmental threats of great magnitude. [67] From its cruel birth[68] on December 16, 1971, the tiny nation of Bangladesh has faced significant challenges. It lies in the world's largest river delta, which is also home to one of the densest human populations on earth.[69] The Ganges-Brahmaputra Delta is low land subject to severe flooding.[70] Even a marginal rise in sea-levels could potentially devastate the country.

Farooque v. Bangladesh is another standing case.[71] In 1997, the Supreme Court of Bangladesh heard arguments in *Farooque* to decide whether the Bangladesh Environmental Lawyers' Association could challenge the lack of environmental impact assessments for several developments emitting industrial pollution.[72]

The petitioner in *Farooque* used the Philippines Supreme Court's statement in *Oposa* regarding standing on behalf of future generations to argue that, under Bangladeshi law, the petitioners should also be deemed to have standing to sue on behalf of future generations.[73] The Bangladeshi court refused to recognize standing by stating that, unlike in *Oposa* where the petitioners' standing was based on a clear, explicit, and actionable constitutional right, the Bangladesh Constitution did not provide for a similar right upon which the Bangladeshi petitioner could base its standing to sue.[74]

---

67. U.N. ENV'T PROGRAMME, BANGLADESH: STATE OF THE ENVIRONMENT 2001 (2001), *available at* http://www.rrcap.unep.org/reports/soe/bangladeshsoe.cfm (last visited Nov. 16, 2008).

68. *See* ARCHER K. BLOOD, THE CRUEL BIRTH OF BANGLADESH: MEMOIRS OF AN AMERICAN DIPLOMAT (2002).

69. *See id.*

70. *Id.*

71. Farooque v. Gov't of Bangladesh, 17 B.L.D. (A.D.) 1 (1997) (App. Div. 1996), *also cited as* 49 D.L.R. (A.D.) 1 (1997) (Bangl.).

72. *Id.*

73. *Id.*

74. For discussion of this case, see DR. JONA RAZZAQUE, HUMAN RIGHTS AND THE ENVIRONMENT: THE NATIONAL EXPERIENCE IN SOUTH ASIA AND AFRICA (2002) (background paper presented during the Joint UNEP-OHCHR Expert Seminar on Human Rights and the Environment in Geneva, Switzerland, Jan. 14–16, 2002), *available at* http://www.unhchr.ch/environment/bp4.html; JONA RAZZAQUE, PUBLIC INTEREST ENVIRONMENTAL LITIGATION IN INDIA, BANGLADESH AND PAKISTAN (2004).

As Justice Latifur Rahman wrote,

> The operation of Public Interest Litigation should not be restricted to the violation of the defined fundamental rights alone. In this modern age of technology, scientific advancement, economic progress and industrial growth the socioeconomic rights are under phenomenal change. New rights are emerging which call for collective protection and therefore we must act to protect all the constitutional, fundamental and statutory rights as contemplated within the four corners of our Constitution.[75]

However, the Supreme Court held that, because the Bangladesh Constitution protects the right to life as a fundamental right, "[t]his encompasses the protection and preservation of environment, ecological balance free from pollution of air and water, and sanitation. Any act or omission contrary thereto will be violative of the said right to life."[76]

Although the ultimate efficacy of the fundamental rights approach to environmental protection can be questioned—particularly in countries such as Bangladesh that are plagued by corporate and government corruption—it provides a much more concrete basis on which to bring environmental claims than does providing intergenerational standing.

C. Virtue Ethics

An intriguing ethical approach to environmental protection is presented by Professor Jeffrey Gaba.[77] This Subpart provides a brief snapshot of this approach. Professor Gaba argues that "[u]ltimately, the focus on future rights may be unnecessary since we need not rely on principles based on rights or obligations in order to express properly our concern for future generations."[78]

A virtue ethics approach "evaluates the morality of an action as judged in relation to the moral virtue of the actor."[79] Proceeding from a basis of virtue, he posits that "[r]ather than focus[ing] on the obligations we have to the future, perhaps we should focus on our obligations to ourselves."[80] Under this framework, "[w]hat we must strive to achieve

---

75. *Farooque*, 17 B.L.D. (A.D.) 1 (1997).

76. Dr. Parvez Hassan, *Securing Environmental Rights Through Public Interest Litigation in South Asia*, 22 VA. ENVTL. L.J. 215 (2004).

77. Jeffrey M. Gaba, *Environmental Ethics and our Moral Relationship to Future Generations*, 24 COLUM. J. ENVTL. L. 249 (1999).

78. *Id.* at 282.

79. *Id.*

80. *Id.* at 283.

are decisions which reflect our best and deepest moral concerns for benevolence to all humanity."[81]

V. CONSTITUTIONS GUARANTEEING RIGHTS TO A HEALTHY ENVIRONMENT

Because both *Oposa* and *Farooque* involved a constitutional right to a healthy environment, it is worth briefly mentioning the constitutional approach. In recent decades, many nations have incorporated environmental rights into their constitutions.[82] This trend has been radical.[83] In fact, "[s]ome eighty nations have amended their constitutions to provide a basic right to a sound environment."[84]

This Note does not belabor these constitutional provisions, but a few additional examples are instructive. Under Argentina's Constitution, "All inhabitants enjoy the right to a healthful, balanced environment fit for human development, so that productive activities satisfy current needs without compromising those of future generations."[85] In Norway, "[e]very person has a right to an environment that is conducive to health and to natural surroundings whose productivity and diversity are preserved."[86] The Seychelles recognize "the right of every person to live in and enjoy a clean, healthy and ecologically balanced environment."[87]

The list goes on and the trend is undeniable. Moreover, given the general enduring nature of a constitution as compared to other sources of law, an enforceable fundamental right to a healthy environment may provide meaningful environmental protection as a constant.

VI. CONCLUSION

Though difficult to delineate, notions of intergenerational justice are deeply entwined with common justifications for environmental

81. *Id.*

82. Carl Bruch et al., *Constitutional Environmental Law: Giving Force to Fundamental Principles in Africa*, 26 COLUM. J. ENVTL. L. 131, 133 (2001).

83. *See* EDITH BROWN WEISS, IN FAIRNESS TO FUTURE GENERATIONS: THE INTERNATIONAL LAW, COMMON PATRIMONY AND INTERGENERATIONAL EQUITY 297–329 (1989) (Appendix B, assembling a list of nations with constitutional rights protecting a healthy environment).

84. Nicholas A. Robinson, *Enforcing Environmental Norms: Diplomatic and Judicial Approaches*, 26 HASTINGS INT'L & COMP. L. REV. 387, 390 n. 10 (2003).

85. CONST. ARG. § 41.

86. CONST. NOR. art. 110 b.

87. CONST. SEY. art. 38.

protection. However, notions of intergenerational equity may not serve as a sufficient impetus for environmental protection, and indeed may serve to cloud decisions with probable intergenerational implications. Despite some inroads into conventional legal thought, intergenerational ethics remains a quagmire of both law and philosophy. Given the uncertain nature of the beast, perhaps we should approach questions of environmental protection through an ethical framework that focuses on rights of present individuals and incorporates ethical concern for the greater biotic community.

Nuclear Power as Carbon-Free Energy? The Global Nuclear Energy Partnership

Mariah Zebrowski*

ABSTRACT

The world today relies heavily on carbon-intensive fossil fuels for energy, inexorably linking energy and climate change. In order to meet growing energy demand while alleviating the escalating impacts of climate change, all possible sources of carbon-free energy must be considered. This Note evaluates the potential of nuclear power to serve as part of the solution to climate change through the lens of a voluntary international partnership: the Global Nuclear Energy Partnership ("GNEP"). It investigates the extent to which GNEP makes progress in overcoming the major barriers confronting the widespread use of nuclear power, including: perceptions of public health and safety, disposal of nuclear waste, proliferation, and the difficulties of implementing nuclear power in the developing world. While GNEP, at least in its current form, does not appear to constitute a particularly robust answer to the problems of nuclear power expansion, its strategic plans may represent valuable strategies for overcoming these barriers in the future.

---

* University of Colorado Dual Degree Candidate; J.D. and Masters in Environmental Studies, 2011. B.A. with honors, Princeton University, 2005. The Author wishes to thank Dr. Lakshman Guruswamy, Professor Len Ackland, and Kevin Doran for their comments on an earlier draft of this Note.

I. INTRODUCTION

In 1953, President Dwight D. Eisenhower gave a famous speech before the United Nations, entitled "Atoms for Peace," in which he promoted the use of nuclear power as a peaceful and beneficial response to the growing global fear of nuclear weapons.[1] Today, nuclear power is being proposed as a response to another growing global problem: the issue of anthropogenic climate change. Alleviating the negative impacts of climate change will undoubtedly require an expansion in carbon-free energy sources to meet the exponentially growing demand for energy. The potential of nuclear power to provide this energy without further exacerbating climate change has sparked interest in its expansion and development. For example, the U.S. Department of Energy ("DOE") Office of Nuclear Energy has received a rapidly increasing research budget, which grew nearly seventy percent from the $193 million appropriated in Fiscal Year ("FY") 2003 to the $320 million in FY 2006.[2] The amount of money and resources allocated to nuclear power expansion continues to increase.

However, there are several barriers to the widespread implementation of nuclear power, both in the United States and internationally. Perceptions of public health and safety, disposal of nuclear waste, proliferation, and the difficulties of implementing nuclear power in the developing world all stand in the way of development. While these issues have all been addressed extensively in the past, this Note evaluates a new attempt to overcome the barriers associated with the expansion of nuclear power: the Global Nuclear Energy Partnership ("GNEP").[3]

Announced in February 2006 as part of President George W. Bush's Advanced Energy Initiative, GNEP is a voluntary international partnership that attempts to promote the global expansion of nuclear power as a carbon-free energy source to meet growing energy needs.[4]

---

1. Jack M. Holl & Roger M. Anders, *Introduction*, ATOMS FOR PEACE: DWIGHT D. EISENHOWER'S ADDRESS TO THE UNITED NATIONS, National Archives and Records Administration, at 1 (on file with Colo. J. Int'l Envtl. L. & Pol'y).

2. COMMITTEE ON REVIEW OF DOE'S NUCLEAR ENERGY RESEARCH AND DEVELOPMENT PORGRAM, NAT'L RESEARCH COUNCIL, REVIEW OF DOE'S NUCLEAR ENERGY RESEARCH AND DEVELOPMENT PROGRAM 1 (2008), *available at* http://www.nap.edu/catalog/11998.html [hereinafter COMMITTEE ON REVIEW].

3. The Global Nuclear Energy Partnership (GNEP) is a recent and growing international partnership. Nuclear power capacity is also steadily growing in the United States and worldwide. The information in this Note is up to date as of October 2008.

4. Global Nuclear Energy P'ship, U.S. Dep't of Energy, What is the Global Nuclear Energy Partnership?, http://www.gnep.energy.gov/index.html (last visited Nov. 11, 2008) [hereinafter GNEP, What is GNEP?].

Twenty-one countries are members of GNEP.[5] Through the lens of GNEP, this Note will evaluate the potential of nuclear power to act as part of the solution to the issue of climate change. Part II will provide a brief introduction to the problems of increasing energy demand and climate change, as well as a discussion of the reasons nuclear power may be primed to address these issues. Part III will recount the history leading to the development of GNEP, provide an overview of GNEP's objectives, and offer a concise evaluation of the efficacy of international political partnerships in the realm of international law. Part IV will evaluate the extent to which GNEP makes progress in overcoming the major barriers confronting widespread use of nuclear power, including: perceptions of public health and safety, disposal of nuclear waste, proliferation, and the difficulties of implementing nuclear power in the developing world. This Note will investigate whether GNEP, in its current form, will be able to facilitate the expansion of nuclear power as a carbon-free energy source.

II. THE BACKDROP OF THE GLOBAL NUCLEAR ENERGY PARTNERSHIP

The world's primary sources of energy—coal, oil, and natural gas—are fossil fuels that emit enormous quantities of carbon dioxide into the atmosphere when burned. As global energy demand increases, both in developed and developing countries, the negative effects of rising carbon dioxide concentrations are intensified. The need to find carbon-free energy sources to replace fossil fuels, meet growing energy needs, and halt the negative impacts of climate change is becoming increasingly clear. This Part will provide a brief introduction to the issues of increasing energy demand and climate change, as well as a discussion of how nuclear power could potentially address both problems.

A. Increasing Demand for Energy Worldwide

The undeniable truth that must be faced when dealing with the issue of climate change is that demand for energy is increasing worldwide, both in developed and developing countries. In September 2008, the U.S.

5. The twenty-one member countries are: Australia, Bulgaria, Canada, China, France, Ghana, Hungary, Italy, Japan, Jordan, Kazakhstan, Lithuania, Poland, Senegal, the Republic of Korea, Romania, Russia, Slovenia, Ukraine, the United Kingdom, and the United States. GLOBAL NUCLEAR ENERGY P'SHIP, DEP'T OF ENERGY, STAKEHOLDER'S GUIDE TO THE GLOBAL NUCLEAR ENERGY PARTNERSHIP 3, *available at* http://www.gnep.energy.gov/pdfs/Stakeholder_Guide.pdf.

Energy Information Administration ("EIA") issued the International Energy Outlook 2008 ("IEO2008"), which contains the most recent assessments and projections for international energy markets through 2030.[6]

Based on the IEO2008 reference case, which reflects a scenario where current laws and policies remain unchanged throughout the projection period, total world energy use is projected to rise from 462 quadrillion British thermal units ("Btu") in 2005, to 563 quadrillion Btu in 2015, and then to 695 quadrillion Btu in 2030.[7] In other words, worldwide energy consumption is projected to grow by approximately fifty percent from 2005 to 2030.[8]

Although DOE officials have projected that energy demand in the United States will double by 2030,[9] the IEO2008 projects that overall energy demand in nations who are members of the Organization for Economic Cooperation and Development ("OECD") will only increase by nineteen percent by 2030.[10] The most rapid growth in energy demand is projected to occur in non-OECD nations, where almost a third of the human population currently lacks adequate electricity.[11] As non-OECD nations continue to develop, the IEO 2008 projects that their energy demand will increase by eighty-five percent by 2030.[12] While other estimates may vary slightly concerning the exact amount by which energy demand is projected to increase, there appears to be unanimous agreement among experts that energy production will undoubtedly continue to expand to meet growing demands.

While energy consumption for the purposes of development is clearly a worthwhile endeavor, and one that OECD nations have already taken advantage of, the troubling part of increasing energy demand in non-OECD nations is that these countries rely primarily on the combustion of fossil fuels for energy.[13] For example, while coal is the

---

6. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, INTERNATIONAL ENERGY OUTLOOK: 2008 ix (Sept. 2008), *available at* http://www.eia.doe.gov/oiaf/ieo/pdf/0484(2008).pdf [hereinafter IEO2008].

7. *Id.* at 1.

8. *Id.*

9. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, Remarks as Prepared for Delivery by Assistant Secretary for Nuclear Energy Dennis R. Spurgeon at IAEA Scientific Forum, Vienna, Austria (Sept 18, 2007) http://www.gnep.energy.gov/media/PRs/gnepPR091807.html [hereinafter GNEP, Spurgeon at IAEA].

10. IEO2008, *supra* note 6, at 1.

11. Daniel C. Rislove, *Global Warming v. Non-Proliferation: The Time Has Come For Nations to Reassert Their Right to Peaceful Use of Nuclear Energy*, 24 WIS. INT'L L.J. 1069, 1080 (2007).

12. IEO2008, *supra* note 6, at 1.

13. Lakshman Guruswamy & Kevin Doran, *The Effectiveness and Impacts of*

most carbon-intensive of the fossil fuels, it is also the fastest-growing energy source in the IEO2008 reference case projection.[14] China and India together account for seventy-nine percent of the projected increase in world coal consumption from 2005 to 2030.[15] Coal remains the primary source of energy in China's industrial sector, predominantly because China has only limited reserves of oil and natural gas.[16] While China had an estimated 229 gigawatts ("GW") of coal-fired capacity in operation at the end of 2005, to meet rapidly growing energy demand, the IEO2008 projects that China will bring on line an additional 735 GW of coal-fired capacity by 2030.[17] India's coal-fired generating capacity is also projected by the IEO2008 to more than double, from seventy-nine GW in 2005 to 173 GW in 2030.[18] This expansion in the use of coal and other fossil fuels will contribute increasing amounts of carbon dioxide to the atmosphere and further exacerbate the negative impacts of climate change. For this reason, it is important for the world to pursue carbon-free sources of energy to meet growing energy demands while limiting the negative impacts of climate change.

B. The Need for Carbon-Free Energy Sources

In 1988, in response to growing scientific and political concern, the World Meteorological Organization ("WMO") and the United Nations Environment Programme ("UNEP") formed the Intergovernmental Panel on Climate Change ("IPCC") to evaluate the most current scientific data on climate change and make projections for the future.[19] The findings of the IPCC represent the work of hundreds of scientists from all over the world.[20] The IPCC has concluded that carbon dioxide is the most significant anthropogenic contribution to climate change.[21] The global atmospheric concentration of carbon dioxide has increased from a pre-

International Energy Treaties, FROM BARRIERS TO OPPORTUNITIES: RENEWABLE ENERGY ISSUES IN LAW AND POLICY (forthcoming), *available at* http://www.colorado.edu/law/eesi/EIET_Yale_2007.pdf.

14. IEO2008, *supra* note 6, at 94.

15. *Id.* at 49.

16. *Id.* at 50.

17. *Id.* at 49.

18. *Id*. at 50.

19. Intergovernmental Panel on Climate Change, *About IPCC*, http://www.ipcc.ch/about/index.htm (last visited Nov. 11, 2008).

20. *Id.*

21. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS – CONTRIBUTION OF WORKING GROUP 1 TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE: SUMMARY FOR POLICYMAKERS 2 (S. Solomo et al. eds., 2007) [hereinafter IPCC 2007].

industrial value of approximately 280 parts per million ("ppm") to a value of 379 ppm in 2005, which far exceeds the natural range over the last 650,000 years as determined from ice cores.[22] Working Group 1 on the Physical Science Basis of the IPCC released its fourth and most influential IPCC report in February 2007. The report is the first in which the IPCC asserted with more than ninety percent confidence that anthropogenic emissions are responsible for the warming climate.[23]

Historically, the United States has been the number one emitter of carbon dioxide worldwide.[24] However, although the International Energy Agency originally predicted that China would not overtake the United States until around 2010,[25] figures from the Netherlands Environmental Assessment Agency ("NEAA") suggest that China became the number one emitter of carbon dioxide in 2006.[26] The study from the NEAA shows that China emitted 6,200 metric tons of carbon dioxide in 2006, in comparison to the 5,800 metric tons emitted in the United States.[27] IEA2008 projects that China will be responsible for twenty-eight percent of total world carbon dioxide emissions by 2030.[28] India is also rapidly increasing its annual carbon dioxide emissions, by an average of 5.8 percent per year.[29] Since 1990, total Indian emissions have almost doubled.[30]

Unfortunately, there are more consequences associated with increasing emissions of carbon dioxide than mere increases in global surface temperatures. Global ocean temperatures have also increased, causing coral bleaching and contributing to sea level rise through seawater expansion.[31] Glaciers and snow pack have decreased in both hemispheres, which further exacerbates sea level rise and can create water shortages.[32] Changing patterns of precipitation have lead to drought in some areas and floods in others.[33] There is also observational

22. *Id.*

23. *Id.* at 3.

24. G. Marland, T.A. Boden, & R.J. Andres, *Global, Regional, and National CO2 Emission Estimates from Fossil Fuel Burning, Cement Production, and Gas Flaring (NDP-030),* CARBON DIOXIDE INFO. ANALYSIS CENTER (2005).

25. Guruswamy & Doran, *supra* note 13.

26. John Vidal & David Adam, *China Overtakes US as World's Biggest CO_2 Emitter*, GUARDIAN.CO.UK, June 19, 2007, http://www.guardian.co.uk/environment/2007/jun/19/china.usnews.

27. *Id*.

28. IEO2008, *supra* note 6, at 92.

29. Marland, Boden, & Andres, *supra* note 24.

30. *Id*.

31. IPCC 2007, *supra* note 21, at 5.

32. *Id*.

33. *Id.* at 7.

evidence to support an increase in intense tropical cyclone activity in the North Atlantic since 1970.[34] The most recent United Nations Human Development report, released in 2007, stated that climate change will "stall and then reverse progress built-up over generations not just in cutting extreme poverty, but in health, nutrition, education and other areas."[35] The need to pursue carbon-free sources of energy to replace fossil fuels and halt the negative impacts of climate change becomes more urgent each day.

C. A Nuclear "Wedge"

Humanity may already possess the fundamental scientific, technical, and industrial know-how to solve the carbon and climate problem for the next half century. This is the argument made by Princeton University professors Stephen Pacala and Robert Socolow.[36] Although no single technology is a credible candidate for solving the entire problem, or even half of the problem, Pacala and Socolow suggest a portfolio of options from which policymakers can choose, putting more emphasis on some options while leaving others out.[37]

Idealizing the goal of emissions stabilization as a perfect triangle, Pacala and Socolow divide the triangle into seven equal "wedges."[38] Each wedge represents a currently available technology or activity that reduces emissions and could be scaled up to keep pace with the problem over the next few decades.[39] Among the suggested wedges are improvements in energy efficiency, carbon capture and storage, sources of renewable energy, and nuclear power.[40] Pacala and Socolow suggest that a wedge of nuclear power could replace 700 GW of fossil fuel energy by 2054.[41] They argue that the pace of nuclear power plant construction from 1975 to 1990, if continued, could yield such a wedge.[42] A study by the Massachusetts Institute of Technology ("MIT") in 2003 agrees that nuclear power, in addition to increases in efficiency,

---

34. *Id*. at 9.

35. UNITED NATIONS DEV. PROGRAM, HUMAN DEVELOPMENT REPORT 2007/2008 1 (2007), *available at* http://hdr.undp.org/en/media/hdr_20072008_en_complete.pdf.

36. Steven Pacala & Robert Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCI. 968, 968-69 (2004).

37. *Id.*

38. *Id*.

39. *Id.*

40. *Id*. at 968-71.

41. *Id.* at 971.

42. *Id*.

carbon sequestration, and expanded use of renewable sources, should remain on the table as an option for combating climate change.[43]

Martin Hoffert, an emeritus physics professor at New York University, attacks Pacala and Socolow's thesis that seven wedges will be enough to fill the emissions stabilization triangle.[44] In a 2002 report that preceded the notion of "wedges," Hoffert and his colleagues argued that intensive research and development was urgently needed to produce the technological options to allow for climate stabilization to occur concurrently with economic development.[45] After reviewing the wedge theory, Hoffert contends that technologies actually capable of slowing global warming do not currently exist in an operational sense, and suggests that they need to be developed with the urgency of World War II mobilization.[46] Hoffert's argument is presented to illustrate that the wedge theory is not without criticism. The wedge theory merely serves as an example that nuclear power is not being suggested as the single solution or as a replacement for renewable sources of energy. Instead, nuclear power must be considered as one option among many to address the issue of climate change.

Today, the nuclear industry operates a total of 443 commercial nuclear power plants worldwide, with a total capacity of about 364.9 GW.[47] Nuclear power accounts for about seventeen percent of global electrical power capacity.[48] The United States has 104 nuclear power plants and gets approximately twenty percent of its electricity from nuclear power.[49] Although nuclear power plant construction halted in the United States after the partial meltdown of Pennsylvania's Three Mile Island Plant in 1979, nuclear power capacity in the United States is once

43. ERIC S. BECKJORD ET AL., MASS. INST. OF TECH., THE FUTURE OF NUCLEAR POWER: AN INTERDISCIPLINARY MIT STUDY 1 (2003), *available at* http://web.mit.edu/nuclearpower/pdf/nuclearpower-full.pdf.

44. Martin Hoffert et al., *Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet*, 298 SCI. 981 (Nov. 1, 2002).

45. *See id.*

46. Martin Hoffert, *Low-Carbon Sustainable Energy in the Greenhouse Century?*, ALTERNATIVE ENERGY ACTION NETWORK, Feb. 10, 2005, http://www.altenergyaction.org/mambo/index.php?option=com_content&task=view&id=20&Itemid=2.

47. Energy Info. Admin., U.S. Dep't of Energy, World Nuclear Reactors, http://www.eia.doe.gov/cneaf/nuclear/page/nuc_reactors/reactsum2.html (last visited Nov. 13, 2008) [hereinafter EIA, World Nuclear Reactors].

48. Rislove, *supra* note 11, at 1079.

49. Damian Peko, Deputy Dir., Corporate and Global P'ship Dev., Office of Nuclear Energy, U.S. Dept. of Energy, Presentation at the JAEA Symposium/JIIA Forum, Tokyo, 2007, Nuclear Non-Proliferation and Peaceful Use of Nuclear Energy, (Oct. 4, 2007), http://www.jaea.go.jp/04/np/documents/sym07_peko01_E.pdf.

again growing.[50] As of September 2008, the Nuclear Regulatory Commission ("NRC") had accepted nine applications for new nuclear power plants, and at least three more applications were undergoing acceptance review.[51]

France, which has fifty-nine nuclear power plants,[52] gets the highest percentage of its electricity from nuclear power, at 77.7 percent in 2003.[53] Alternatively, China gets only 2.2 percent of its electricity from nuclear power[54] and has only six nuclear power plants.[55] India gets 3.3 percent of its electricity from nuclear power[56] and has fourteen nuclear power plants.[57] However, both China and India have new nuclear power plants under construction.[58] Nuclear power generation appears to be gaining momentum worldwide.

Nuclear power has some advantages over renewable energy sources. Currently, electricity cannot be cost effectively stored on a large scale, so power generators must be able to produce power continually to provide reliable "base-load" power.[59] Solar power, wind power, and even hydroelectric power to a certain extent, suffer from the drawback of being intermittent.[60] Proponents of nuclear power argue that if new nuclear power plants are not constructed, the necessary "base-load" power will be provided by carbon-intensive coal-fired power plants.[61]

Additionally, despite huge government subsidies, solar power is not yet cost effective.[62] And while a one thousand megawatt nuclear power plant occupies less than ten acres of land, an equivalent wind power plant

50. Dennis Myers, *Nuclear Summer on its Way? Opposition to Coal Power Plants is Helping Create Interest in Nuclear Plants*, RENO NEWS REVIEW, (Nov. 1, 2007), http://www.newsreview.com/reno/Content?oid=594959.

51. U.S. Nuclear Regulatory Comm'n, Expected New Nuclear Power Plant Applications (Sept. 4, 2008), http://www.nrc.gov/reactors/new-reactors/new-licensing-files/expected-new-rx-applications.pdf.

52. International Atomic Energy Agency, Country Nuclear Power Profiles, http://www-pub.iaea.org/MTCD/publications/PDF/cnpp2003/CNPP_Webpage/pages/countryprofiles.htm (last visited Nov. 12, 2008) [hereinafter IAEA, Country Nuclear Power Profiles].

53. EIA, World Nuclear Reactors, *supra* note 47.

54. *Id*.

55. IAEA, Country Nuclear Power Profiles, *supra* note 52.

56. EIA, World Nuclear Reactors, *supra* note 47.

57. IAEA, Country Nuclear Power Profiles, *supra* note 52.

58. *Id*.

59. Fred Bosselman, *The Ecological Advantages of Nuclear Power*, 15 N.Y.U. ENVTL. L.J. 1, 5-6 (2007).

60. *Id.*

61. *Id*. at 5.

62. Rislove, *supra* note 11, at 1078-79.

would occupy 250 square miles of land.[63] Hydroelectric power has negative effects on river ecosystems, and there are relatively few places left in the developed world to construct new plants.[64] In fact, the potential locations of all sources of renewable energy are dependent on factors that are beyond human control.[65] Although new renewable energy technologies are promising, most are more than ten years away from large-scale production.[66] These drawbacks help to illustrate the point that no single technology presents a perfect solution to the issue of climate change.

Nuclear power has drawbacks of its own. There is still a great deal of debate over whether nuclear power should be promoted because of concerns about public safety, disposal of radioactive waste, proliferation, and the difficulties of implementing nuclear power in the developing world. While some environmentalists are beginning to support nuclear power as a "bridge" to provide carbon-free energy today while renewable technologies are developed for the future,[67] others remain vehemently opposed to the use of nuclear power.[68] In June 2005, 313 environmental groups issued a joint "Environmental Statement on Nuclear Energy in Global Warming," in which they concluded that the risks to health, safety, and economy associated with nuclear power were too high to consider it as a potential solution to climate change.[69] GNEP attempts to alleviate some of these concerns in order to ease the promotion of nuclear power internationally as a carbon-free source of energy.

III. THE GLOBAL NUCLEAR ENERGY PARTNERSHIP

This Part will review the history leading to the development of GNEP. It will also provide an account of recent GNEP developments. It will conclude with an overview of GNEP's objectives and a brief discussion of the efficacy of international political partnerships in the realm of international law.

63. *Id*. at 1080.

64. *Id*. at 1079.

65. Bosselman, *supra* note 59, at 17-18.

66. *Id*.

67. Jim McNeil, *Nuclear Energy as the Bridge*, DAILY CAMERA, Feb. 10, 2007, http://www.dailycamera.com/news/2007/feb/10/xnuclear-energy-as-the-bridge/.

68. Len Ackland, *Environmentalists Debate Nuclear Power*, ROCKY MOUNTAIN MINERAL LAW FOUNDATION, 4-1, 4-3 (Apr. 27, 2006).

69. *Id.*

A. History of the Global Nuclear Energy Partnership

In May 2001, the U.S. National Energy Policy recommended expanding long-term energy independence and reliability in the United States, as well as diversifying energy supply.[70] The policy called for expanding nuclear power as one way to promote energy security.[71] Four years later, the Energy Policy Act of 2005 ("EPAct 2005") was passed, the first comprehensive energy legislation in over a decade.[72] EPAct 2005 contained a fairly inclusive treatment of nuclear power.[73] It authorized funds for implementing the Nuclear Power 2010 program, a cost-sharing effort between government and industry to identify sites and develop a streamlined regulatory process for new nuclear plants.[74] EPAct 2005 also established the Standby Support program, a form of federal risk insurance to encourage nuclear development.[75] For each nuclear plant seeking federal approval before the end of 2008, EPAct 2005 provided tax credits of up to $125 million for eight years.[76] It also provided loan guarantees for up to eighty percent of each plant's cost, shared application costs, and insurance to cover costs associated with regulatory delay.[77]

With this legal backdrop in place, President George W. Bush announced the Advanced Energy Initiative in his State of the Union Address in January 2006, as a post-EPAct 2005 proposal to reduce dependence on foreign sources of energy.[78] Shortly afterwards, the DOE announced GNEP to promote the expansion of nuclear power as part of Bush's Advanced Energy Initiative.[79] The original GNEP partners were the United States, China, France, Japan, and Russia.[80]

In May 2007, the DOE announced that it would provide up to $60 million in funding over the next two years to engage industry experts in conceptual designs for GNEP, providing $15 million from the DOE's

---

70. NAT'L ENERGY POLICY DEV. GROUP, NATIONAL ENERGY POLICY xii (May 2001), *available at* http://www.whitehouse.gov/energy/National-Energy-Policy.pdf.

71. *Id*.

72. Energy Policy Act of 2005, Pub. L. No. 109-58 (2005).

73. *Id*.

74. *Id*. at § 42 Stat. 16272, 952(c).

75. *Id.* at § 42 Stat. 16014, 638.

76. *Id*.

77. Steven Mufson, *Nuclear Power Primed for Comeback*, Washington Post, Oct. 8, 2007, at A01.

78. Press Release, White House, The President's Radio Address (Feb. 18, 2006), http://web.archive.org/web/20060422235429/http:/www.whitehouse.gov/news/releases/2006/02/20060218.html.

79. *Id.*

80. *Id.*

FY 2007 Spend Plan and an expected $45 million from FY 2008, subject to appropriation from Congress.[81] GNEP also hosted its first ministerial meeting in May 2007 in Washington D.C., where ministers and atomic energy officials from partner countries issued a Joint Statement of Support.[82]

GNEP held its second ministerial meeting in Vienna, Austria in September 2007, just prior to the International Atomic Energy Agency's General Conference.[83] At this meeting, eleven new partner countries–Australia, Bulgaria, Ghana, Hungary, Jordan, Kazakhstan, Lithuania, Poland, Romania, Slovenia, and Ukraine–joined the original four partners in signing the "GNEP Statement of Principles," which established broad guidelines for participation and provided a framework for future involvement in GNEP.[84] GNEP members also agreed to develop an Action Plan and to charter a Working Group to address infrastructure and development, as well as another Working Group to address reliable fuel services.[85]

The DOE completed cooperative agreements in October 2007 with four industry consortia to develop conceptual design studies, technology

---

81. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, Department of Energy Offers $60 Million to Spur Industry Engagement in Global Nuclear Energy Partnership (May 9, 2007), http://www.gnep.energy.gov/media/PRs/gnepPR050907.html.

82. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, World Nuclear Association Annual Symposium London, UK: Prepared Remarks for Assistant Secretary for Nuclear Energy Dennis R. Spurgeon (Sept. 6, 2007) http://www.gnep.energy.gov/media/PRs/gnepPR090607.html [hereinafter GNEP, World Nuclear Association].

83. *Id*.

84. The Statement of Principals was signed by: Samuel W. Bodman, U.S. Secretary of Energy; Chen Deming, Vice Chairman of National Development and Reform Commission of the People's Republic of China; Alain Bugat, Chairman of the French Atomic Energy Commission; Yukiya Amano, Ambassador on Permanent Mission of Japan to the International Organization to Vienna; Sergey Kiriyenko, Head of Atomic Energy of the Russian Federation; John Carlson, Director General of the Australian Safeguards and Non-Proliferation Office; Chavdar Zhechey, Ambassador Extraordinary and Plenipotentiary of the Republic of Bulgaria to the United Nations; Joseph Adda, Minister of Energy in Ghana; Jozsef Ronaky, Director General of the Hungarian Atomic Energy Authority; Khaled Toukan, Minister of Higher Education and Scientific Research of Jordan; Kayrat Abdrakhmanov, Ambassador Extraordinary and Plenipotentiary of the Republic of Kazakhstan to the Austrian Republic; Arturas Dainius, Undersecretary of the Ministry of Economy in Lithuania; Piot Wozniak, Minister of Economy in Poland; Valica Gorea, President of the Romanian Nuclear Agency; Andrej Vizjak, Minister of the Economy in Slovenia; and Yuriy Boyko, Minister of Fuel and Energy in Ukraine. GLOBAL NUCLEAR ENERGY PARTNERSHIP, U.S. DEPT. OF ENERGY, NUCLEAR ENERGY PARTNERSHIP STATEMENT OF PRINCIPLES 2-3 (2007) *available at* http://www.gnep.energy.gov/pdfs/gnepSOP_091607.pdf [hereinafter GNEP, STATEMENT OF PRINCIPLES].

85. Peko, *supra* note 49, at 5.

development roadmaps, and business plans to further the objectives of GNEP.[86] In November 2007, U.S. Secretary of Energy Samuel W. Bodman announced a $250 million FY 2007 request to launch GNEP, as part of a budget that could stretch to $1 billion by 2009.[87] The budgetary implications of GNEP are substantial, and, if appropriated, the President's Budget Request for FY 2008 for the progress of GNEP would almost double the DOE Office of Nuclear Energy's research and development budget from its FY 2006 appropriation level.[88] Along with increasing funds, GNEP's international membership has continued to grow. By the end of 2007, three more countries had become members of GNEP: Italy,[89] Canada,[90] and the Republic of Korea, bringing the number of international GNEP partners to nineteen.[91]

GNEP's first Steering Group meeting was held in December 2007 at the International Atomic Energy Agency ("IAEA") Headquarters in Vienna, Austria.[92] Representatives developed and adopted an Action Plan detailing the groundwork for future GNEP cooperation.[93] Members of the Steering Group also elected the United States to serve as the chair of the group and China, France, and Japan to serve as vice-chairs.[94] In February 2008, two more countries became members of GNEP: the Republic of Senegal[95] and the United Kingdom, bringing the total number of international partners to twenty-one.[96]

---

86. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, Department of Energy Awards More than $1.6 Million for GNEP Technology Development Plants (Oct. 1, 2007) http://www.gnep.energy.gov/media/PRs/gnepPR100107.html.

87. *U.S. launches Global Nuclear Energy Partnership*, NUCLEAR ENGINEERING INT'L MAG. Feb. 8, 2006, http://www.neimagazine.com/story.asp?storyCode=2034203.

88. COMMITTEE ON REVIEW, *supra* note 2, at vii.

89. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, U.S. Energy Secretary Highlights Need for Energy Diversity at 20th World Energy Congress Ministerial Forum in Rome (Nov. 13, 2007) http://www.gnep.energy.gov/media/PRs/gnepPR111307.html.

90. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, DOE Statement on Canada Joining the Global Nuclear Energy Partnership (Nov. 30, 2007) http://www.gnep.energy.gov/media/PRs/gnepPR113007.html [hereinafter GNEP, Canada Joining].

91. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, Department of Energy Welcomes the Republic of Korea to the Global Nuclear Energy Partnership (Dec. 11, 2007) http://www.gnep.energy.gov/media/PRs/gnepPR121107.html.

92. Press Release, U.S. Dep't of Energy, Global Nuclear Energy Partnership Inaugural Steering Group Meeting Makes Marked Progress (Dec. 19, 2007) http://www.ne.doe.gov/newsroom/2007PRs/nePR121907.html.

93. *Id*.

94. *Id*.

95. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, Republic of Senegal Joins the Global Nuclear Energy Partnership (Feb. 1, 2008)

In March 2008, the DOE awarded $18.3 million for further GNEP research to four industry teams: EnergySolutions, General Electric-Hitachi, General Atomics, and the International Nuclear Recycling Alliance, led by AREVA and Mitsubishi Heavy Industries.[97] The DOE released reports and presentations from these teams in May 2008.[98] The reports covered conceptual designs, including cost and schedule, for an initial nuclear fuel reprocessing center and advanced fast reactor. These concepts will be discussed in greater detail below.[99]

In April 2008, the DOE issued another Funding Opportunity Announcement for GNEP, inviting universities, national laboratories, and industry to compete for up to $15 million to advance nuclear technologies closing the nuclear fuel cycle.[100] These projects are expected to provide the necessary data and analyses to further the domestic technology research and development component of GNEP.[101] The DOE also signed a Memorandum of Understanding with the Tennessee Valley Authority in April 2008, agreeing to collaborate on developing and exchanging information on advanced fuel cycle technologies.[102]

GNEP's Second Steering Group Meeting was held in Jordan in May 2008, attended by representatives from twenty-eight countries and three intergovernmental organizations.[103] The Steering Group discussed the

---

http://www.gnep.energy.gov/media/PRs/gnepPR020108.html.

96. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, U.S. Department of Energy Welcomes the United Kingdom as 21s Member of the Global Nuclear Energy Partnership (Feb. 26, 2008) http://www.gnep.energy.gov/media/PRs/gnepPR022608.html.

97. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, DOE Awards $18.3 Million to Nuclear Industry Consortia for GNEP Studies (Mar. 28, 2008) http://www.gnep.energy.gov/media/PRs/gnepPR032808b.html.

98. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, DOE Releases Domestic Global Nuclear Energy Partnership (GNEP) Industry Reports and Presentations (May 28, 2008) http://www.gnep.energy.gov/media/PRs/gnepPR052808.html.

99. *Id*.

100. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, Department of Energy Seeks to Invest up to $15 Million in Funding for Nuclear Fuel Cycle Tecnology Research and Development (Apr. 17, 2008) http://www.ne.doe.gov/newsroom/2008PRs/nePR041708.html.

101. *Id*.

102. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, U.S. Department of Energy and Tennessee Valley Authority Increase Cooperation on Nuclear Fuel Cycle Data (Apr. 18, 2008) http://www.ne.doe.gov/newsroom/2008PRs/nePR041808.html.

103. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, Global Nuclear Energy Partnership Members Convene in Jordan for Second Steering Group

formation of a third Working Group on the development of grid-appropriate reactors, which will also be addressed in greater detail below.[104] The two existing Working Groups presented their program plans, outlining initial activities as well as long-term challenges in their respective areas.[105] Partner countries and observing nations convened again in October 2008 in Paris, France for GNEP's Third Ministerial Meeting.[106] As this list of rapid events shows, GNEP is continuing to grow, and further developments can most likely be expected in the near future.

B. Objectives of the Global Nuclear Energy Partnership

Although the specific details of GNEP will be discussed in the next Part, GNEP's overall objective is to offer a "responsible framework for both international and domestic use of nuclear power to reduce the risks associated with nuclear proliferation and the impacts associated with waste disposal."[107] U.S. Assistant Secretary of Nuclear Energy Dennis R. Spurgeon has stated:

> GNEP is intended to provide long-term and sustainable answers to growing energy needs, concerns about climate change, management of nuclear waste, and proliferation challenges. It blends international cooperation in policy, technical support, and framework and infrastructure development.[108]

Domestically, GNEP plans to design, build, and operate three facilities: a nuclear fuel reprocessing center, an advanced fast reactor, and a fuel cycle research facility.[109] Internationally, GNEP endeavors to ensure reliable nuclear fuel services and develop proliferation-resistant, grid-appropriate reactors suitable for use in developing countries.[110] GNEP's Strategic Plan sets its current task as assembling the requisite

---

Meeting (May 15, 2008) http://www.gnep.energy.gov/media/PRs/gnepPR051508.html.

104. *Id*.

105. *Id*.

106. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, U.S. Secretary of Energy to Attend IAEA and GNEP Meetings (Oct. 2, 2008) http://www.ne.doe.gov/newsroom/2008PRs/nePR100208print.html .

107. GNEP, What is GNEP?, *supra* note 4.

108. GNEP, World Nuclear Association, *supra* note 82.

109. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, Department of Energy Releases the Notice of Intent for the GNEP Environmental Impact Statement (Jan. 4, 2007) http://www.gnep.energy.gov/media/PRs/gnepPR010407.html [hereinafter GNEP, Intent for Environmental Impact Statement].

110. *Id.*

technology, economic, and environmental information in order to present a convincing case for a path forward.[111] GNEP also intends to obtain input from the United States and international industries and governments to develop a detailed technology roadmap to pursue its objectives.[112] Spurgeon advocates, "At its most fundamental core, GNEP seeks to overcome the barriers that have faced the global nuclear industry for decades."[113]

It is important to realize that GNEP is not an international legal agreement under the Vienna Convention on the Law of Treaties.[114] Since the Kyoto Protocol, international legal agreements addressing the issue of climate change have been somewhat stagnant.[115] Instead, recent years have witnessed the formation of dozens of voluntary international political agreements supporting the development of sustainable energy technologies.[116] GNEP is such a voluntary international partnership, negotiated among equals, with an unprecedented industry component.[117] Nations participating in GNEP do not give up any rights, but instead voluntarily engage to share in the effort and gain the benefits of peaceful nuclear power.[118]

Though GNEP lacks legal commitments and is thus not officially binding, there are many reasons that states may feel bound by such an international political arrangement. Since the partnership was negotiated in a political climate, there is an intrinsic pressure to live up to the agreed terms.[119] States may also adhere to voluntary political agreements out of concern for reciprocity, to ensure that other states also adhere, or out of concern for retaliation and sanctions if agreements are not honored.[120] States also seek to maintain an image of trustworthiness in the international arena so that future agreements, whether political or legal,

111. U.S. OFFICE OF FUEL CYCLE WASTE MANAGEMENT, U.S. DEP'T OF ENERGY, GLOBAL NUCLEAR ENERGY PARTNERSHIP STRATEGIC PLAN, GNEP-167312, REV. 0, 9-11 (Jan. 2007), *available at* http://www.gnep.energy.gov/peis/references/RM792_DOE_2007l.pdf [hereinafter OFCWM, GNEP STRATEGIC PLAN].

112. *Id*. at 10.

113. GNEP, World Nuclear Association, *supra* note 82.

114. *See generally* Vienna Convention on the Law of Treaties, *opened for signature* May 23, 1969, 1155 U.N.T.S. 331.

115. *See* Guruswamy & Doran, *supra* note 13.

116. *Id*.

117. GNEP, World Nuclear Association, *supra* note 82

118. GNEP, Canada Joining, *supra* note 90.

119. Lakshman Guruswamy, INTERNATIONAL ENVIRONMENTAL LAW IN A NUTSHELL, 27-28 (3d ed. 2007).

120. *Id*. at 28.

will be possible.[121] These and other motivations can influence states to adhere to voluntary political obligations that are not legally binding.

Furthermore, legally binding agreements present their own set of problems. Because of their binding nature, it can sometimes be difficult for states to reach agreements in the first place, often resulting in legal agreements that are purely aspirational.[122] In contrast, the flexibility of political agreements may enable states to succeed in securing preliminary consensus on an issue that may serve as a catalyst to future binding agreements.[123] Voluntary and political agreements and partnerships, like GNEP, are playing an increasingly important role in shaping international law.[124] The objectives of GNEP may enable nations to more effectively address the issue of nuclear power expansion as a carbon-free energy alternative, and could potentially lead to a legally binding agreement in the future.

IV. THE GLOBAL NUCLEAR ENERGY PARTNERSHIP'S ATTEMPT TO OVERCOME BARRIERS TO WIDESPREAD USE OF NUCLEAR ENERGY

In FY 2006, President Bush requested funds to be set aside for the National Academy of Sciences ("NAS") to review nuclear power research programs and their budgets, and to recommend priorities for the programs reviewed.[125] GNEP was one of the programs reviewed in the recently released report. All the NAS committee members agreed that GNEP should not go forward, but should instead be replaced by a less aggressive research program.[126] These criticisms will be considered in greater detail in this Part, which will evaluate the attempts made by GNEP to overcome the barriers to widespread use of nuclear power, including perceptions of public health and safety, disposal of nuclear waste, concern about proliferation, and the difficulties of implementing nuclear power in the developing world.

121. *Id*.
122. *Id*. at 28-29.
123. *Id*. at 29-30.
124. *Id.*
125. COMMITTEE ON REVIEW, *supra* note 2, at 1.
126. *Id*.

A. Perceptions of Public Health and Safety

Any use of nuclear materials presents a public health and safety threat that must be managed. In general, the public's concerns about nuclear power include potential radiation resulting from reactor accidents, safe waste disposal, and weapons proliferation. The issue of nuclear waste, which can remain radioactive for hundreds of thousands of years, will be discussed more thoroughly in Part IV.B. The issue of proliferation will be addressed in Part IV.C. Although these issues should be kept in mind for their impact on public perception, this Part will focus on the public's perceptions of health and safety as related to potential radiation exposure from reactor accidents.

Radiation is a form of energy emitted by the radioactive elements used or resulting from nuclear power generation. Radiation can be dangerous for hundreds of thousands of years.[127] For example, plutonium-239 has a half-life of 24,360 years, at which point it will be half as dangerous.[128] While humans are constantly exposed to a small level of natural radiation, called background radiation, further radiation exposure can be extremely harmful depending on the type of radiation and the dose received.[129] Exposure to high levels of radiation, such as the doses received by workers at the Chernobyl accident, can cause radiation sickness and death within days or weeks.[130] Low-level radiation exposure can damage cells, and when the damaged cells multiply they may produce mutations that can lead to cancer or birth defects.[131]

The public fear of radiation has undoubtedly been influenced by the threat of mass destruction from nuclear weapons.[132] Concerns about public safety have also been linked to nuclear power due to two fairly recent nuclear reactor accidents: Three Mile Island and Chernobyl. The meltdown at the Three Mile Island Nuclear Power Plant, near Middleton, Pennsylvania, occurred on March 28, 1979.[133] It was the most serious commercial nuclear power plant accident in U.S. history, even though it led to no deaths or injuries to plant workers or the surrounding

127. Karl S. Coplan, *The Intercivilizational Inequities of Nuclear Power Weighed Against the Intergenerational Inequities of Carbon Based Energy*, 17 FORDHAM ENVTL. L. REV. 227, 234 (2006).

128. *Id.*

129. Guruswamy, *supra* note 119, at 577-578.

130. *Id.*

131. *Id*. at 577-78.

132. *See id*. at 577.

133. U.S. Nuclear Regulatory Commission, Fact Sheet on the Three Mile Island Accident (Feb. 20, 2007) http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html [hereinafter NRC, Three Mile Island].

community.[134] The accident was caused by a combination of personnel error, design deficiencies, and component failures.[135]

After the accident, many agencies conducted detailed studies of the radiological consequences, including the NRC, which focuses on the safety of nuclear power as its primary mission,[136] the Environmental Protection Agency ("EPA"), and the DOE. Several independent studies were also conducted. The NRC estimated that the average radiation dose to approximately two million people in the island's surrounding area was only about one millirem.[137] To put this exposure into context, a full set of chest x-rays generally exposes the patient to about six millirems.[138] Also, compared to the background radiation of the area, about 100 to 125 millirem per year, the collective dose from the accident was considered negligible.[139] Nevertheless, the fact that the accident happened in the United States permanently changed the public's image of the nuclear power industry, increasing fear and distrust.

The world's most catastrophic nuclear reactor accident occurred at the Chernobyl Nuclear Power Plant in the Ukraine on April 26, 1986, when a reactor meltdown caused an explosion and a massive release of radiation.[140] The Chernobyl accident caused many immediate and severe radiation effects.[141] Two plant workers died within hours of the explosion, and 134 others received high radiation doses and suffered acute radiation sickness, resulting in twenty-eight more deaths within four months.[142] The accident also resulted in widespread contamination of areas of the Ukraine and Belarus, where some evacuated citizens received radiation doses thirty times higher than the natural background levels.[143]

Estimates of the total harm caused by the Chernobyl accident vary widely. The NRC maintains that "there is no strong evidence" for increased incidences of leukemia or solid cancer from this exposure, with the exception of an increase in thyroid cancer among exposed

134. *Id.*

135. *Id.*

136. Neal H. Lewis, *Interpreting the Oracle: Licensing Modifications, Economics, Safety, Politics, and the Future of Nuclear Power in the United States*, 16 ALB. L.J. SCI. & TECH. 27, 48 (2006).

137. NRC, Three Mile Island, *supra* note 133.

138. *Id.*

139. *Id*.

140. U.S. Nuclear Regulator Commission, Backgrounder on Chernobyl Nuclear Power Plant Accident (Feb. 20, 2007) http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/chernobyl-bg.html [hereinafter NRC, Chernobyl].

141. *Id*.

142. *Id.*

143. *Id*.

children.[144] But while 4,000 cases of thyroid cancer have been detected among exposed children, the NRC maintains that only nine have died.[145] Alternatively, the DOE estimates that the long-term health effects of the Chernobyl accident will include an additional 28,000 cancer deaths, 1,900 children born with genetic disorders, and 700 children born with severe mental retardation.[146] Regardless of the true health effects of Chernobyl, there is no doubt that it symbolizes the dark side of nuclear power generation, invoking even more fear and distrust of nuclear power in the mind of the public.

However, even including the deaths associated with the Chernobyl accident, nuclear power has resulted in significantly fewer deaths per billion watts of energy than coal-fired power plants, when coal mining is taken into consideration.[147] Worldwide, from 1970 until 1992, the coal industry has had the largest number of deaths resulting from energy production, with over 6,000 deaths from coal production-related accidents.[148] Additionally, when statistics are compared on the basis of energy produced per year, hydroelectric is by far the most dangerous energy source, as there are a high number of deaths associated with this relatively little-used energy source.[149] Overall, nuclear facilities have an excellent safety record in comparison with other power industries, with only thirty-one direct deaths since 1970, all of which occurred in the Chernobyl accident.[150]

Furthermore, the two historical accidents have brought about changes and improvements in the nuclear industry, making nuclear power in most parts of the world safer today than it was two decades ago.[151] In the United States, the NRC has upgraded its equipment requirements and increased its safety inspections and regulatory oversight.[152] Many reactors in the United States now use a passive design with broader shutdown margins and robust containment structures, meaning that the reactors shut down automatically in the event of overheating in order to reduce the chance of an uncontrolled accident and to eliminate human error.[153]

---

144. *Id*.
145. *Id*.
146. Guruswamy, *supra* note 119, at 585-586.
147. Rislove, *supra* note 11, at 1082.
148. Lewis, *supra* note 136, at 51-52.
149. *Id*. at 52.
150. *Id*.
151. NRC, Three Mile Island, *supra* note 133.
152. *Id*.
153. NRC, Chernobyl, *supra* note 140.

Nevertheless, public fear about the safety of nuclear power generation continues to exist and is often used as a tool to protest the use of nuclear power and prevent its expansion. As Eisenhower recognized in his "Atoms for Peace" speech in 1953, public acceptance of risks is essential for the promotion of nuclear power generation.[154] The 2003 MIT study found that the public does not yet see nuclear power as a way to address climate change, suggesting that further public education may be necessary.[155]

While GNEP seeks to expand nuclear power to help meet growing energy demand, it does little to directly educate the public or alleviate fears of nuclear power. However, GNEP plans to pursue nuclear expansion through improving the safety of operations, reducing the amount of waste, and promoting "proliferation-resistant" technologies. If the public is made aware of these improvements and the potential of nuclear power to reduce the negative impacts of climate change, GNEP could potentially assist in overcoming the barrier of public fear to allow for expansion of nuclear power.

B. Disposal of Nuclear Waste

A major barrier to the widespread use of nuclear power is the issue of how to dispose of nuclear waste. In nuclear power generation, nuclear fission of the material in fuel rods generates heat that is used to generate steam and run turbines to create electricity.[156] After a period of time ranging from one to five years, fuel rods no longer generate enough heat for economical steam generation and are then considered to be nuclear waste.[157] Depleted fuel rods contain unfissionable uranium-238, unused fissionable uranium-235, plutonium-239, and other waste products.[158] These wastes contain radioactive elements that remain active for hundreds of thousands of years, making the permanent isolation of nuclear waste critical for safeguarding public health and preventing proliferation of nuclear materials.[159]

More than half a century has passed since the first commercial nuclear reactor opened, but there is still no permanent disposal site

154. Holl & Anders, *supra* note 1, at 9-10.

155. BECKJORD ET AL., *supra* note 43, at x.

156. Coplan, *supra* note 127, at 233-234.

157. *Id.*

158. Rislove, *supra* note 11, at 1089.

159. U.S. GEN. ACCOUNTING OFFICE, NUCLEAR WASTE: TECHNICAL, SCHEDULE, AND COST UNCERTAINTIES OF THE YUCCA MOUNTAIN REPOSITORY PROJECT, GAO-02-191 1 (Dec. 2001), *available at* http://news.findlaw.com/hdocs/docs/gao/yuccamtndec2001rpt.pdf [hereinafter GAO, NUCLEAR WASTE].

anywhere in the world for highly radioactive nuclear waste.[160] This failure to properly address the waste disposal issue over the past few decades has intensified public fear and distrust of nuclear power.[161] Many opponents of nuclear power argue that it does not make sense to expand nuclear capacity until a safe and secure method of permanent waste disposal is determined.[162]

The latest available detailed data from the U.S. EIA[163] shows that as of December 31, 2002 there was already 47,023.4 metric tons of spent nuclear fuel being temporarily stored in the United States, awaiting a permanent solution.[164] Experts estimate that this amount increases by approximately 2,000 tons every year from continued nuclear power production,[165] so today the amount of nuclear waste in temporary storage in the United States is probably closer to 59,000 metric tons. With no permanent disposal solution in place, nuclear waste is being temporarily stored in dry cask storage at individual nuclear power plants, meaning that 160 million people in the United States live within seventy-five miles of temporary nuclear waste storage sites.[166] Increasing nuclear power production capacity will place increased pressure on the waste disposal issue, as even more waste will be generated.

Since 1957, scientists have recommended permanent geologic isolation as the safest disposal solution for nuclear waste.[167] Permanent geologic isolation requires permanently storing nuclear waste in an excavated geologic formation, or repository, chosen for geologic characteristics intended to permanently isolate dangerous materials from

160. James Kanter, *Radioactive Nimby: No One Wants Nuclear Waste*, N.Y. TIMES, Nov. 7, 2007, http://www.nytimes.com/2007/11/07/business/businessspecial3/07nuke.html.

161. *Id*.

162. Steve Tetreault, *Presidential Hopefuls Try to 'Out-Yucca' One Another*, LAS VEGAS REVIEW-JOURNAL, Oct. 31, 2007, http://www.lvrj.com/news/10911266.html.

163. Although the EIA website states that detailed data updated by December 31, 2006 was expected to be available in the latter part of 2007, the data was not yet available as of October 2008. Energy Info. Admin., Spent Nuclear Fuel, EIA FORM RW-859 (2000), http://www.eia.doe.gov/cneaf/nuclear/spent_fuel/ussnfdata.html (last visited Sept. 14, 2008).

164. *Id*.

165. Online NewsHour Update, Bush Approves Yucca Nuclear Waste Site, PBS, Feb. 15, 2002, http://www.pbs.org/newshour/updates/february02/nuclear_2-15.html.

166. Jamison Colburn, *The Yucca Mountain Radioactive Waste Site Controversy: The Role a Recent Federal Appellate Decision in the Controversy May Play in the Presidential Election*, FINDLAW: LEGAL NEWS AND COMMENTARY, Oct. 14, 2004, http://writ.news.findlaw.com/commentary/20041014_colburn.html.

167. AGENCY FOR NUCLEAR PROJECTS, STATE OF NEVADA, WHAT'S WRONG WITH PUTTING NUCLEAR WASTE IN YUCCA MOUNTAIN? 2 (2003), *available at* http://www.state.nv.us/nucwaste/news2003/pdf/nv_wwrong.pdf.

the rest of the environment should storage containers fail. After a comprehensive study by the DOE in 1980, examining other potential options for the disposal of nuclear waste, Congress passed the Nuclear Waste Policy Act ("NWPA") in 1982, which charged the DOE with finding a location for a U.S. geologic repository.[168] After several years of initial site investigation, NWPA was amended in 1987, directing the DOE to investigate a single site: Yucca Mountain in Nye County, Nevada.[169] The DOE expected that the licensing process would be finished and the repository would be constructed and operational by 1998.[170]

However, despite almost two decades of preparations to make Yucca Mountain the nation's first nuclear waste repository, the project is still surrounded by intense controversy and the projected opening has been pushed back to at least 2017.[171] Although President George W. Bush formally recommended the Yucca Mountain site as required by NWPA in February 2002, and the site selection became official in July 2002, the fight to prevent the Yucca Mountain repository has continued and intensified.[172] There are four main categories of objections to the Yucca Mountain project: geologic objections, objections of Nevadans, objections of Native Americans, and efficiency arguments. Although a full analysis of this complicated controversy is beyond the scope of this Note, a brief review of the arguments and objections will be given here.

The first objection to the Yucca Mountain project argues that the geologic composition of Yucca Mountain is insufficient to permanently contain radioactive materials, which could lead to contamination of groundwater used for irrigation and drinking in nearby areas.[173] However, after decades of intensive scientific study, the DOE's Environmental Impact Statement asserts that Yucca Mountain was specifically selected for its arid climate and geologic composition, where very little water moves through the geologic features, minimizing corrosion of storage containers and the transport of radionuclides into groundwater.[174] Nevertheless, opponents emphasize fractures in the rock,

168. Colburn, *supra* note 166.

169. *Id*.

170. GAO, NUCLEAR WASTE, *supra* note 159, at 5.

171. Dan Caterinicchia, *Energy Department says Yucca Mountain faces funding shortfall*, YUCCA MOUNTAIN NEWS (Esmeralda County, Nevada), Fall 2007, at 2.

172. Amy Corbin, Yucca Mountain, Sacred Land Film Project (Sept. 2007) http://www.sacredland.org/endangered_sites_pages/yucca_mountain.html.

173. Agency for Nuclear Projects, State of Nevada, Why Does the State Oppose Yucca Mountain?, http://www.state.nv.us/nucwaste/yucca/state01.htm (last visited Sept. 14, 2008).

174. U.S. DEPARTMENT OF ENERGY, FINAL ENVIRONMENTAL IMPACT STATEMENT FOR A GEOLOGIC REPOSITORY FOR THE DISPOSAL OF SPENT NUCLEAR FUEL AND HIGH-

flows of groundwater, [175] and seismic[176] and volcanic[177] activity as proof of Yucca Mountain's geologic unfitness.

A second objection to Yucca Mountain comes from citizens of the state of Nevada, who argue that it is unfair to locate the nation's repository in a state that has no nuclear power plants, and thus produces no commercial nuclear waste.[178] Proponents of the Yucca Mountain project speculate that this opposition is nothing more than the "Not In My Backyard" ("NIMBY") reaction, in which citizens oppose the location of something considered undesirable in their neighborhood despite other arguments in favor of the chosen location.[179] Regardless of whether the objections of Nevadans are legitimate or based on NIMBY, the Yucca Mountain project has sparked intense political controversy. For example, in the 2000 presidential election, then-Governor George W. Bush used the Yucca Mountain controversy to gain an advantage over then-Vice President Al Gore in Nevada.[180]

A third objection to the location of the nation's nuclear waste repository comes from the Western Shoshone Indian Tribe, which argues that Yucca Mountain is part of its cultural history.[181] The Western Shoshone also claim that most of the area in Nevada now used by the U.S. military for nuclear weapons testing, including the proposed Yucca Mountain repository site, legally belongs to the Tribe as explicitly recognized in the 1863 Ruby Valley Treaty.[182] In an attempt to quiet title, Congress passed the Western Shoshone Distribution Bill in July 2004, which offered a $145 million settlement to the Western Shoshone.[183] However, Raymond Yowell, Chief of the Western

---

LEVEL RADIOACTIVE WASTE AT YUCCA MOUNTAIN, NYE COUNTY, NEVADA 1.4.1 (Feb. 2002), http://www.ocrwm.doe.gov/documents/feis_2/vol_1/indexv1.htm.

175. *See* AGENCY FOR NUCLEAR PROJECTS, WHAT'S WRONG WITH PUTTING NUCLEAR WASTE IN YUCCA MOUNTAIN?, *supra* note 167, at 2.

176. *See* Nuclear Waste Project Office, State of Nevada, Earthquakes in the Vicinity of Yucca Mountain, http://www.state.nv.us/nucwaste/yucca/seismo01.htm (last visited Nov. 15, 2008).

177. *See* Eugene I. Smith & Deborah L. Keenan, *Yucca Mountain Could Face Greater Volcanic Threat*, 86 EOS, TRANSACTIONS AMERICAN GEOPHYSICAL UNION 317 (2005), *available at* http://www.state.nv.us/nucwaste/news2005/pdf/eos20050830.pdf.

178. Myers, *supra* note 50.

179. Merriam-Webster Dictionary Online, NIMBY, http://merriam-webster.com/dictionary/nimby (last visited Nov. 15, 2008).

180. Colburn, *supra* note 166.

181. Corbin, *supra* note 172.

182. Jerry Reynolds, *Bush Signs Western Shoshone Legislation: Tribal Leaders View Bill as Massive Land Fraud*, INDIAN COUNTRY TODAY, July 9, 2004, http://www.indiancountrytoday.com/archive/28212424.html.

183. *Id*.

Shoshone National Council, has refused to accept the financial settlement.[184] Yowell claims that the Western Shoshone title to the land is still intact and that the Ruby Valley Treaty can be used to stop the Yucca Mountain project.[185] In March 2005, the Western Shoshone National Council filed a lawsuit based on their land claims in Las Vegas federal district court, which ruled it did not have jurisdiction.[186] However, the Western Shoshone Tribe intends to continue pursuing their claim.[187]

The final objection to the Yucca Mountain project is that it has been a waste of money and does not present an effective solution to the issue of nuclear waste disposal. Since nuclear waste can be dangerous for hundreds of thousands of years, some opponents argue that no political system can assure the security or integrity of permanent storage procedures.[188] The Yucca Mountain project has also cost the United States billions of dollars in return for seemingly little progress.[189] To make matters worse, in October 2007, Director of the U.S. Office of Civilian Radioactive Waste Management, Edward F. Sproat III, told the House Budget Committee that a doubling or tripling of annual project funding would be needed to meet the new repository opening goal of 2017.[190] In addition to the money being spent directly on Yucca Mountain, nuclear power plant owners are owed damages for the delay in permanent disposal of the wastes they have been temporarily holding at their sites.[191] Estimates of these damages vary widely, from the DOE's estimate of about $2 billion to the nuclear industry's estimate of about $50 billion, and this liability continues to grow as the project continues to be delayed.[192]

NWPA also set the capacity for Yucca Mountain at 70,000 metric tons of nuclear waste.[193] Ten percent of this capacity is reserved for military nuclear waste disposal, leaving only 63,000 metric tons of capacity for commercial nuclear waste.[194] As previously mentioned, the amount of waste already in temporary storage in the United States is approximately 59,000 metric tons and continues to grow as nuclear

184. *Id*.
185. *Id.*
186. Corbin, *supra* note 172.
187. *Id*.
188. Coplan, *supra* note 127, at 241.
189. *Id*. at 240.
190. Caterinicchia, *supra* note 171.
191. GAO, NUCLEAR WASTE, *supra* note 159, at 2.
192. *Id*.
193. Coplan, *supra* note 127, at 238.
194. *Id*. at 238-39.

power capacity is expanded. At this rate of increase, Yucca Mountain could effectively be "full" long before it ever opened.[195]

However, the cap at Yucca Mountain is a statutory cap, rather than a physical one.[196] In June 2007, the Electric Power Research Institute completed a study that found that the repository could be redesigned to hold at least 260,000 metric tons of waste and up to 570,000 metric tons with additional site characterization.[197] But while the DOE has asked Congress to pass a bill that would remove the statutory cap and accommodate extra waste, there is bound to be strong political resistance to this move.[198] The fact that the United States has been working on the issue of nuclear waste disposal for decades but is still struggling to find a solution illustrates the magnitude and difficulty of the problem.

The United States is not the only country having difficulty deciding exactly how to deal with nuclear waste. Swiss voters have rejected multiple proposals to bury nuclear waste permanently at a deep underground site.[199] In France, a country that relies heavily on nuclear power, widespread protests in the 1980s led to a law that would allow for other means of disposal if new technology were ever developed.[200] Japan, which generates a third of its electricity from nuclear power, offered the incentive of $17 million each year in subsidies to any municipality that would volunteer to be considered as a repository site.[201] Although a rural town originally applied for the subsidies, the mayor overwhelmingly lost the next election and his successor promptly withdrew the application.[202] No other Japanese municipalities have applied.[203] Worldwide, the issue of nuclear waste disposal is still very much unresolved. Opponents of nuclear power advocate that this continued lack of solutions is the very reason to avoid expansion, as it will only exacerbate an unsolved problem.

Although GNEP does not offer a permanent solution to the problem of nuclear waste disposal, it offers a domestic management strategy to reduce the amount and toxicity of nuclear waste that has already been produced.[204] The United States currently employs an open fuel cycle,

---

195. Steve Tetreault, *Yucca Mountain: DOE: Enlarge Repository*, LAS VEGAS REVIEW-JOURNAL, Oct. 05, 2007, *available at* http://www.lvrj.com/news/10257277.html.

196. *Id*.

197. *Id*.

198. *Id*.

199. Kanter, *supra* note 160.

200. *Id*.

201. *Id.*

202. *Id*.

203. *Id.*

204. GNEP, STATEMENT OF PRINCIPLES, *supra* note 84, at 2.

where all of the materials in depleted fuel rods are marked for disposal.[205] However, as mentioned earlier, depleted fuel rods contain unused uranium in addition to other waste products.[206] Through a method known as "reprocessing," or sometimes referred to as "recycling," usable uranium can be separated from waste materials and used to create additional power.[207] This allows the original uranium to be more completely used for power generation while also significantly reducing the volume of waste material marked for permanent disposal, partially closing the nuclear fuel cycle.[208]

Reprocessing technologies can also isolate transuranic elements such as plutonium, neptunium, americium, and curium. Transuranic elements can then be fabricated into fuel, known as Mixed Oxide fuel ("MOX"), which can potentially be burned in advanced fast reactors.[209] Consuming the transuranic elements would also increase the capacity of a geologic repository by reducing the overall radiotoxicity of remaining waste.[210] GNEP's Strategic Plan envisions that initiating reprocessing in the United States would increase the repository capacity of Yucca Mountain by one or two orders of magnitude, allowing Yucca Mountain, if it is opened, to satisfy U.S. repository needs for the remainder of the twenty-first century.[211]

In order to implement this nuclear waste management strategy, GNEP plans to design and build three facilities to turn the U.S. open fuel cycle into a closed fuel cycle.[212] The first would be a reprocessing center, which would physically separate spent nuclear fuel into reusable and waste components.[213] The reprocessing center would also manufacture MOX from separated transuranic elements.[214] The second facility would be an advanced fast reactor, which would burn the MOX to generate additional electricity.[215] However, considering the difficulty the United States has faced in siting a permanent geologic repository for nuclear waste, siting these two facilities is likely to be politically difficult.[216] The third and final facility would be an advanced fuel cycle

205. Rislove, supra note 11, at 1089.
206. *Id*.
207. GNEP, World Nuclear Association, *supra* note 82.
208. *Id*.
209. *Id.*
210. *Id.*
211. OFCWM, GNEP STRATEGIC PLAN, *supra* note 111, at 6.
212. GNEP, Intent for Environmental Impact Statement, *supra* note 109.
213. *Id.*
214. *Id*.
215. *Id.*
216. Coplan, *supra* note 127, at 240-241.

research facility, which would perform research and development necessary to run the first two facilities and improve the nuclear fuel cycle processes.[217] While the DOE would direct the research facility, the other two would be civilian facilities.[218]

In addition to potential difficulty siting the necessary facilities, there are three problems with GNEP's plans to reprocess spent nuclear fuel as a waste management strategy. The first is that GNEP's goal to reduce the volume of nuclear waste in the United States through reprocessing appears to be in conflict with its stated international goal of aiding developing countries in safely and securely deploying nuclear power to meet growing energy needs. As will be elaborated in Part IV.D, employing nuclear power in the developing world requires the creation of dependable fuel supplies. Under GNEP, partner countries with nuclear technology would participate in a fuel leasing approach, providing fresh fuel to non-nuclear partners for use in domestic nuclear power plants.[219] However, under fuel leasing arrangements, the supplier country would also take responsibility for the final disposal of the spent fuel. This means that potential fuel suppliers, like the United States, would also be responsible for the permanent disposal of nuclear waste from other countries to which fuel is supplied.[220] This responsibility appears to be in direct conflict with waste reduction goals, as it would increase the amount of nuclear waste for which the United States is ultimately responsible.

The second conflict created by GNEP's plans to reprocess spent fuel is that it may aggravate proliferation concerns. Reprocessing spent nuclear fuel involves the extraction of pure plutonium, which could potentially be stolen for the manufacturing of nuclear weapons.[221] Experts regard obtaining fissile material as the most difficult part of creating a nuclear bomb.[222] The issue of proliferation created by GNEP's reprocessing plans will be discussed in greater detail Part IV.C.

Lastly, while GNEP claims to address and reduce the issue of nuclear waste disposal, Steve Kidd from the World Nuclear Association argues that political difficulties in establishing Yucca Mountain undoubtedly influenced the Bush Administration's move toward

---

217. GNEP, Intent for Environmental Impact Statement, *supra* note 109.

218. *Id*.

219. GLOBAL NUCLEAR ENERGY P'SHIP, U.S. DEP'T OF ENERGY, A RELIABLE FUEL SERVICES PROGRAM, *available at* http://www.gnep.energy.gov/gnepReliableFuelServices.html (last visited Dec. 9, 2007) [hereinafter GNEP, RELIABLE FUEL SERVICES].

220. *Id*.

221. *Global Security: Nuclear Terrorism*, Union of Concerned Scientists, June 2007, http://ucsusa.wsm.ga3.org/global_security/nuclear_terrorism/.

222. *Id*.

GNEP.[223] A review by the Institute for Policy Studies has found that GNEP is likely to squander billions in taxpayer dollars on unproven reprocessing technology.[224] Furthermore, GNEP will not be ready to begin large-scale reprocessing of commercial spent fuel until the end of the next decade.[225] The NAS report concludes that GNEP will not provide short-term waste management answers.[226] Thus, there is some speculation that GNEP is in part a political cover to avoid further painful choices on the unpopular Yucca Mountain project.[227]

In the end, no amount of reprocessing can eliminate the need for a geologic repository. At best, GNEP offers a partial and temporary solution to the barrier of nuclear waste disposal.[228] It may simply trade the political problems of Yucca Mountain for the potentially equally intense political resistance that can be expected from trying to site a reprocessing center and an advanced fast reactor.[229] To truly focus on the expansion of nuclear power as a carbon-free energy source, the issue of permanent nuclear waste disposal must be solved. Despite growing stockpiles of nuclear waste, Yucca Mountain is the only permanent disposal solution being seriously considered in the United States. Without Yucca Mountain, any increase in nuclear power capacity will merely intensify an unresolved and controversial problem.

C. Non-Proliferation

The threat of proliferation of nuclear materials and technology for non-peaceful purposes is a major drawback of the use of nuclear power for electricity generation.[230] Throughout the history of nuclear power, safeguards have been the basic building blocks of international non-proliferation programs. Safeguards include accounting for nuclear materials, control of technology, transparency in the use of technology and materials to validate peaceful uses, and the ability to inspect and verify compliance with international agreements and obligations.[231] The

223. Jim Green, *The Global Nuclear Energy Partnership*, ENERGYSCIENCE.ORG.AU, at 2 (Nov. 2006), *available at* http:www.energyscience.org.au/FS14%20GNEP.pdf.

224. Robert Alvarez, *A Costly Radioactive Waste Shell Game*, INSTITUTE FOR POLICY STUDIES 1, *available at* http://www.whistleblower.org/doc/2007/GNEP_ factsheet_Final.pdf (last visited Nov. 15, 2008).

225. Green, *supra* note 223, at 4.

226. COMMITTEE ON REVIEW, *supra* note 2, at 5.

227. Ivan Oelrich, *GNEP: Not Quite Ripe*, NUCLEAR ENG'G INT'L MAGAZINE, Aug. 7, 2006, *available at* http://www.neimagazine.com/story.asp?storyCode=2038013.

228. Green, *supra* note 223, at 3.

229. *Id*. at 4.

230. GNEP, World Nuclear Association, *supra* note 82.

231. *Id.*

U.S. DOE claims that international safeguards have been an effective deterrent against the spread of nuclear technology and materials.[232] The United States is already a primary supplier of safeguards technology and is responsible for training all IAEA inspectors in the use of safeguards for tracking nuclear materials.[233]

GNEP plans to support the IAEA in the use of safeguards technologies and encourage investments in these technologies and integrated systems approaches by its international partners.[234] GNEP also intends to provide the opportunity to design modern safeguards directly into the planning and building of new nuclear power systems, which should allow the IAEA to monitor and verify nuclear material more effectively and efficiently.[235] These safeguards include development of reliable, remote, and unattended monitoring systems, advanced containment and surveillance, and next generation nondestructive analysis and process-monitoring sensors.[236] The DOE contends that a basic goal of GNEP is to make it impossible to divert nuclear materials or modify systems without immediate detection.[237] GNEP's Statement of Principles says "commitments and international obligations, including IAEA safeguards and the requirements of the UN Security Council Resolution 1540, will be strictly observed. The highest levels of nuclear safety and security will be maintained."[238]

GNEP also seeks to reduce the incentives of countries seeking nuclear power to develop uranium enrichment or fuel reprocessing capabilities.[239] Instead, these countries could become "fuel users" and receive the benefit of having a reliable supply of reactor fuel from "fuel suppliers," without having to make the significant infrastructure investment required for enrichment, reprocessing, and disposal facilities.[240] As previously discussed, nuclear fuel would be provided under a leasing approach, with suppliers taking responsibility for assuring availability of fuel and disposal of spent fuel.[241] The United States has already committed 17.4 tons of highly enriched uranium that will be blended down to low enriched uranium to establish a fuel reserve

232. *Id*.
233. *Id.*
234. *Id*.
235. *Id*.
236. *Id.*
237. *Id*.
238. GNEP, STATEMENT OF PRINCIPLES, *supra* note 84, at 1.
239. GNEP, RELIABLE FUEL SERVICES, *supra* note 219.
240. *Id*.
241. *Id*.

and assure supply.[242] This will establish an interim reliable fuel services approach consistent with GNEP's goals while the necessary technologies to implement all of GNEP's plans are developed.[243] In return, fuel users will agree not to develop enrichment or reprocessing facilities and to use the nuclear fuel for peaceful purposes only, which will aid non-proliferation goals.[244]

However, one potential drawback of GNEP's non-proliferation scheme is that the proposal calls for current nuclear fuel producers to become the world's exclusive nuclear fuel producers. This creates two dilemmas. The first, as discussed in the previous Part, is that fuel suppliers will become responsible for the disposal of nuclear wastes from other countries, which will be problematic, as no country has figured out how to deal with even its own wastes.[245] Second, a state determined to develop nuclear weapons may be reluctant to join GNEP if it means abandoning domestic enrichment programs that may be crucial to clandestine weapons programs.[246] However, such refusals could have the benefit of making the intentions of a state to develop nuclear weapons more transparent.[247]

GNEP's waste management strategy also presents a proliferation concern. Reprocessing involves dissolving the spent fuel to enable the reusable uranium and plutonium to be separated from the waste products.[248] Most reprocessing facilities operating in the world today use a solvent extraction system called PUREX, an acronym standing for "Plutonium and Uranium Recovery by EXtraction." This process is currently used in Europe, Japan, and Russia.[249] PUREX allows for uranium and plutonium to be extracted from spent nuclear fuel, independent from each other.[250] Separated uranium can then be re-enriched and used again as fuel, increasing the efficiency of the fuel cycle, and separated plutonium can be incorporated into MOX fuel to be burned in an advanced fast reactor.[251]

However, since fast reactor technology has not yet been perfected, the PUREX method of reprocessing has resulted in the estimated

242. OFCWM, GNEP STRATEGIC PLAN, *supra* note 111, at 6.
243. *Id*.
244. *Id*.
245. Oelrich, *supra* note 227.
246. Rislove, *supra* note 11, at 1096.
247. *Id*. at 1096-97.
248. BECKJORD ET AL., *supra* note 43, at ix.
249. *Id*.
250. *Id.* at 63.
251. *Id*. at 107

accumulation of anywhere from 240[252] to 638[253] metric tons of pure fissionable plutonium worldwide. The Union of Concerned Scientists argues that a crude nuclear weapon could be developed using only four kilograms of plutonium.[254] Current stockpiles of plutonium from reprocessing could thus be enough to make more than 30,000 nuclear weapons.[255] As previously mentioned, most commentators agree the limiting factor in acquiring a nuclear weapon is the availability of weapons-grade fissile material.[256] Once the material is obtained, the actual design and construction of the weapon requires only an advanced degree in engineering or physics and access to high explosives.[257] Stockpiles of plutonium from reprocessing of spent nuclear fuel present potential targets for theft and terrorism leading to the proliferation of nuclear weapons.[258]

Although the PUREX process was developed in the United States at Oak Ridge National Laboratory in Tennessee, the United States has not reprocessed spent nuclear fuel from commercial reactors since 1977, when President Jimmy Carter banned reprocessing due to proliferation concerns.[259] Although President Ronald Reagan officially revoked Carter's ban in 1981, the United States has continued to use an open-fuel cycle and has not reprocessed commercial spent fuel since 1977.[260] Aside from more than a quarter century hiatus, the history of reprocessing in the United States does not paint a hopeful picture for restarting the process. For example, from 1966 to 1972, Getty Oil Company operated a commercial fuel reprocessing facility in West Valley, New York.[261] The facility never achieved profitability and it left behind a $1 billion cleanup bill when it closed, the cost of which was borne by the public.[262]

However, GNEP offers two potential remedies to proliferation concerns when it comes to reprocessing. First, GNEP endeavors to design and deploy new and advanced techniques for reprocessing that do not result in the accumulation of separated pure plutonium.[263] Instead,

252. GNEP, World Nuclear Association, *supra* note 82.
253. Alvarez, *supra* note 224, at 1.
254. Union of Concerned Scientists, *supra* note 221.
255. Alvarez, *supra* note 224, at 1.
256. Rislove, *supra* note 11, at 1088.
257. *Id*.
258. BECKJORD ET AL., *supra* note 43, at ix.
259. Rislove, *supra* note 11, at 1089.
260. *Id*.
261. Coplan, *supra* note 127, at 240.
262. *Id*.
263. GNEP, STATEMENT OF PRINCIPLES, *supra* note 84, at 2.

the resulting plutonium would be combined with other materials, making it less desirable for the production of nuclear weapons.[264] GNEP has expressed a preference for the UREX+ reprocessing method.[265] UREX+ is a modification of the PUREX process that adds a chemical agent to reduce the extractability of plutonium and provide greater proliferation resistance than PUREX.[266] GNEP also intends to continue research on improvements in "proliferation-resistant" reprocessing technologies.[267]

Furthermore, GNEP seeks not only to limit growing stockpiles of separated pure plutonium, but also to reduce these stockpiles by using plutonium as a fuel source, which would strengthen nuclear security worldwide.[268] As previously mentioned, GNEP plans to design, build, and operate three facilities in the United States. In addition to the reprocessing center and the research center, GNEP endeavors to create an advanced fast reactor that could destroy long-lived radioactive elements, like plutonium, while at the same time generating more carbon-free electricity.[269] The ability to destroy or burn these long-lived radioactive elements is key in order to solve both proliferation and waste management concerns.[270]

While the United States does not currently have the technology for an advanced fast reactor that would be cost competitive with current nuclear reactors, countries such as France, Russia, and Japan, all original GNEP partners, have experience in the design and operation of such fast reactors.[271] Within GNEP's framework, the United States, France, and Japan signed a Memorandum of Understanding in February 2008, agreeing to cooperate on the coordination of sodium-cooled fast reactor prototype development.[272] A sodium-cooled fast reactor uses liquid sodium to transfer heat, allowing plutonium and other transuranic elements to be burned to produce power.[273] A prototype reactor is the first step to demonstrate the feasibility of the sodium-cooled fast reactor technology to accomplish GNEP's simultaneous objectives of waste

264. *Id*.

265. Rislove, *supra* note 11, at 1090.

266. *Id*.

267. GNEP, Spurgeon at IAEA, *supra* note 9.

268. OFCWM, GNEP STRATEGIC PLAN, *supra* note 111, at 6.

269. GNEP, Intent for Environmental Impact Statement, *supra* note 109.

270. GNEP, World Nuclear Association, *supra* note 82.

271. *Id*.

272. Press Release, Global Nuclear Energy P'ship, U.S. Dep't of Energy, United States, France and Japan Increase Cooperation on Sodium-Cooled Fast Reactor Prototypes (Feb. 1, 2008) http://www.ne.doe.gov/newsroom/2008PRs/nePR020108.html.

273. *Id*.

reduction and non-proliferation.[274] GNEP's framework also creates the potential for cooperation with additional countries in the future.[275]

Through these strategies GNEP provides some advancement in overcoming the barrier of proliferation for the expansion of nuclear power. However, the NAS report concludes that although UREX+ may eventually meet the goal of creating a justifiable reprocessing system, it is not currently at a stage of reliability that would justify commercial-scale construction of reprocessing facilities.[276] And even the GNEP Strategic Plan recognizes that there is no solution to totally eliminate the proliferation risks associated with nuclear power expansion, especially when reprocessing is promoted.[277]

Furthermore, GNEP has not yet backed its reprocessing proposal with a detailed economic analysis, but has instead made only vague assertions about costs.[278] The costs of all three facilities – the reprocessing plant, the advanced fast reactor, and the research center – could be extremely high in addition to the political difficulties likely to be faced when siting the facilities.[279] According to the NAS report, "the GNEP program is premised on an accelerated deployment strategy that will create significant technical and financial risks by prematurely narrowing technical options."[280] Even the DOE has acknowledged that the cost of GNEP is not commercially competitive under present circumstances.[281] While some opponents argue that these high costs prove that the money would be better spent on renewable alternatives that do not present concerns about radioactive waste and proliferation, a majority of the NAS committee does favor research on reprocessing and advanced fast reactors.[282] NAS also argues that such a program should not be as aggressive as GNEP, but should instead be paced by national needs and take into account economics, technological readiness, national security, energy security, and other considerations.[283]

274. *Id*.
275. *Id*.
276. COMMITTEE ON REVIEW, *supra* note 2, at 5.
277. OFCWM, GNEP STRATEGIC PLAN, *supra* note 111, at 5.
278. Oelrich, *supra* note 227.
279. *Id*.
280. COMMITTEE ON REVIEW, *supra* note 2, at 5.
281. *Id*.
282. *Id*.
283. *Id*.

D. Nuclear Power in the Developing World

To truly make a difference in addressing the world's dependence on carbon-intensive energy sources in order to reduce the negative impacts of climate change, it is necessary to address the developing world. As previously mentioned, a significant part of increasing energy demands will occur in developing countries, where almost a third of the human population currently lacks adequate electricity.[284] While development is clearly a worthy goal, development in these countries will inevitably increase energy demand, resulting in increased carbon emissions through their reliance on fossil fuel energy sources.[285] Thus, if nuclear power is truly going to act as part of the solution to climate change, its usefulness in the developing world must be evaluated.

Unfortunately, traditional commercial nuclear power reactors usually produce about 1,000 megawatts of electricity and are not appropriate for markets with much smaller grids and less well-developed technical infrastructures.[286] Furthermore, nuclear power generally requires infrastructure and a high degree of technical expertise, making it a much less attractive option for developing countries, especially compared to the ease of burning fossil fuels.[287] In order to deploy nuclear power in the developing world, development of future nuclear reactors will require attention to the need for multiple reactor size options and simplicity in operation.[288]

GNEP intends to help developing countries interested in expanding the use of nuclear power by assisting with responsible implementation and management, as well as sharing knowledge and experience to enable these countries to make informed decisions when it comes to implementing a nuclear power infrastructure in a safe and secure manner.[289] GNEP is also researching ways to facilitate the development and deployment of proliferation-resistant, grid-appropriate nuclear reactors for use in developing countries.[290] These reactors would incorporate numerous features to address the intended market: they would operate in the 50 to 350 megawatt range; they would have fuel designs offering very long-life fuel loads so that refueling is not

284. Rislove, *supra* note 11, at 1080-81.

285. Guruswamy & Doran, *supra* note 13.

286. GLOBAL NUCLEAR ENERGY P'SHIP, U.S. DEP'T OF ENERGY, GRID-APPROPRIATE REACTORS, *available at* http://www.gnep.energy.gov/pdfs/FS_Grid_Appropriate.pdf [hereinafter GNEP, GRID-APPROPRIATE REACTORS].

287. GNEP, World Nuclear Association, *supra* note 82.

288. GNEP, GRID-APPROPRIATE REACTORS, *supra* note 286.

289. *Id*.

290. GNEP, STATEMENT OF PRINCIPLES, *supra* note 84, at 2.

necessary; and they would incorporate inexpensive IAEA safeguards.[291] Potential IAEA safeguards include remote monitoring, physical protection against sabotage, fully passive safety systems, and simple operation that requires minimal nuclear infrastructure.[292] No existing developed or installed reactors have all of these grid-appropriate features, so further evaluation and exploration of these concepts among GNEP member nations would be necessary to achieve these goals.

However, readily available information about GNEP does not address how the development of grid-appropriate reactors for developing countries will be financed. Although GNEP's international goals include making nuclear reactors "cost effective and well suited to conditions in developing nations," GNEP does not currently detail its plans to achieve this goal.[293]

Even if such grid-appropriate reactors already existed, nuclear plants are hugely expensive to build, have a history of cost overruns, and generally have long lead times.[294] James E. Rogers, chief executive of Duke Energy, said a new nuclear power plant would cost as much as a quarter of his company's entire value on the stock market.[295] While EPAct 2005 provides streamlined regulations and financial incentives for nuclear development in the United States, neither capital nor financial incentives to develop nuclear power are available in the developing world. Due to the lack of detail provided on how international goals will be achieved, at this point GNEP's domestic goals seem more feasible.

V. CONCLUSION

As the negative impacts of climate change continue to escalate, all possible sources of carbon-free energy must be evaluated. While nuclear power holds potential as a carbon-free energy source, the barriers to expanded use of nuclear power must all be addressed. These barriers include public perceptions of health and safety, disposal of nuclear waste, proliferation of nuclear materials, and the possibility of developing country implementation. While GNEP's strategic plans represent valuable strategies for overcoming the barriers associated with nuclear power, GNEP does not appear, in its current form, to constitute a particularly robust answer to the global expansion of civilian nuclear power. GNEP currently represents an aspirational partnership that has

291. GNEP, GRID-APPROPRIATE REACTORS, *supra* note 286.

292. *Id*.

293. *Id.*

294. Mufson, *supra* note 77, at A01.

295. *Id*.

many good ideas but no major resources and no specific commitments. However, as a still-evolving partnership, evaluating GNEP is in many ways akin to evaluating a moving target. It remains to be seen whether GNEP's strategies can be used to promote the expansion of nuclear power worldwide in the future.