Human Population and Freshwater Resources: U.S. Cases and International Perspectives

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Summary of Experts’ Meeting on Human Population and Freshwater Resources

Held March 22-23, 2001 at Yale University

Victoria Dompka Markham, Karin M. Krchnak, and Nancy Thorne

Water may be the resource that defines the limits of sustainable development. It has no substitute, and the balance between humanity’s demands and the quantity available is already precarious.


Only 2.5% of all water on the Earth is freshwater, and of that, 0.5% is accessible to us through ground or surface water supplies. Although water supplies are finite, the world population has grown – tripled in the past 70 years – and water-use has increased sixfold, mainly from irrigation and industrial use.¹

The trends are particularly striking. In any given year, 54% of the available freshwater is used. If per capita consumption remains the same, in less than 25 years we could be using 70% of available freshwater as a result of population growth alone. We could use 90% of available water by 2005 if the per capita level worldwide reaches that of more developed nations.²

What does this mean for each of us? How will it affect our daily lives, and those of generations to come? How much do we know about how population factors affect pressures on freshwater resources in the United States and around the world? Where are the gaps in our knowledge, and what do we need to know? What can we do about it?

These questions, among others, prompted the Center for Environment and Population (CEP), National Wildlife Federation (NWF), and the Population Resource Center (PRC) to hold an experts’ meeting on the relationship between human population and freshwater resources, as part of CEP’s “Emerging Issues in Environment and Population Project.”

The Emerging Issues Project involves a series of integrated activities including: experts’ meetings and meeting reports; materials development; and, policy, media and public outreach briefings – all centered on a range of topics relating to the human population’s environmental impact. The objective is to focus on what is “new and emerging” in relation to a given topic (in this case, population and freshwater), so that we can work more effectively towards achieving environmental sustainability.

Water was selected for this set of activities because it is something on which all life depends, and there is evidence that humans are altering water resources at rates, scales, and in ways never before experienced.³ Analysis of


these issues—particularly the most current scientific thinking and emerging trends in the field—is not necessarily reflected in public policies, outreach, and advocacy efforts.

Through the experts’ meeting, this Yale F&ES Bulletin Series meeting report, and follow-up activities, we hope to make available good quality research and analysis that will be integrated into policies and public outreach efforts to conserve freshwater for a healthy planet.

THE EXPERTS’ MEETING
The meeting on which this report is based took place on March 22 and 23, 2001 at Yale University. It was hosted by the Yale School of Forestry & Environmental Studies (Yale F&ES) and co-sponsored by the Yale University Institution for Social and Policy Studies (ISPS). James Gustave Speth, Dean of the Yale School of Forestry & Environmental Studies, gave the opening remarks. The meeting was attended by 18 participants. Yale F&ES students acted as rapporteurs. A meeting agenda can be found in the Appendix.

The Center for Environment and Population (CEP), National Wildlife Federation (NWF) and Population Resource Center (PRC) jointly convened the meeting. The organizations represented the three legs of the event: science, policy, and public outreach. CEP was responsible for bringing the best and latest scientific research to the table, PRC oversaw the U.S. and international policy links, and NWF focused on the public outreach, advocacy, and grassroots links. Together, the team of organizations was able to bring a range of expertise to the meeting, something that would have been difficult for any one of the groups to do on their own. The organizations are described in more detail at the end of this Summary.

The purpose of the Population and Freshwater working meeting was twofold:

• First, to present a sampling of the latest scientific research on the topic, in the form of case studies; and,

• Second, to determine common themes for action relating to policy, research, and public outreach.

OPENING REMARKS
James Gustave Speth, Dean of the Yale School of Forestry & Environmental Studies, provided the welcome and opening remarks to the working meeting. He opened by stating that water and climate change would be the two dominant issues of the next few decades in terms of environment and natural resources and took special note of the interaction between the two, remarking that the most profound effect of climate change in the short and long run will be its major impact on water resources. Dean Speth described the challenges of providing safe water for drinking, agriculture, and other
purposes and stated that, in almost every environmental resource sector, we have destroyed or degraded a substantial portion of the natural resources. He urged that environmental restoration become a priority on the science and policy agenda for water as for other resource sectors. Dean Speth closed by noting that people are beginning to understand what sustainable management of water resources really is, and they are relating it to demographics, which is critical if we are to move beyond research to action.

U.S. CASE STUDIES
Moving to the more specific, experts presented five case studies from around the United States and its international borders. They included cases from the West, Midwest (Michigan), Mid-Atlantic (Chesapeake Bay area), Southeast (Florida), and Southwest-Border (Texas, Mexico). The case studies as presented at the working meeting were designed to include information on:

- Status of freshwater resources and ecosystems;
- Population and consumption factors (such as population growth rates, composition, density, movement, tourism, migration, rates of natural resource consumption and pollution) which influence freshwater resources;
- How population factors affect plant and animal species and their habitat;
- How ecosystems are affected;
- Historic and present population – water resource dynamics, and what the issues will be in the near and long term future; and,
- Suggestions for policy responses, public outreach, education and activism, including how the print and broadcast media should address the issues.

Each case study as presented at the working meeting represented quite different perspectives on the issues. Although the complete case studies are included in this Bulletin, some highlights include the following:

West: University of New Mexico Law Professor Denise Fort oversaw the Western Water Policy Review Advisory Commission Report, Patterns of Demographic, Economic and Value Change in the Western U.S.: Implications for Water Use and Management. The report showed how the rate of population growth in the Western U.S. was much faster than the rest of the country, growing at 32% in the last 25 years, while growth in the rest of the U.S. was 19%. The population is forming “urban archipelagos,” with 86% of Westerners living in or near cities. Agriculture use for irrigation represents 90% of water use. The demands of the fast growing and highly concentrated populations, combined with low rainfall, have resulted in the
lack of water supplies and major water management problems in many of the 17 western states. Ecological effects include species loss and endangerment; alteration of river, stream, and spring ecosystems; and imperilment of fisheries.

**Southeast:** Bonnie Kranzer, Senior Supervising Planner with the South Florida Water Management District and former Executive Director of the Governor’s Commission for the Everglades, noted that rapid and steady growth characterize South Florida’s population change. Increased urban sprawl, greater per capita land use, and increasing pressure for additional development accompany the residential growth. Reconciling the intense population pressures and development in the fragile South Florida ecosystem is the greatest challenge. Over the past 50 years, over half of the Florida Everglades has been destroyed, mainly due to massive drainage to allow human occupation in areas otherwise too wet for habitation. Dr. Kranzer pointed out that if current trends continue, there will be continued degradation of wetlands, estuaries and aquatic plant and animal life; increased water shortages for agricultural and urban use; increased flooding, and, loss or movement of groundwater well fields. The recently passed Comprehensive Everglades Restoration Plan by the U.S. Congress is seen by many as a viable means to restore the South Florida ecosystem if rigorously implemented.

**Mid-Atlantic:** Margaret Palmer, Professor of Biology at the University of Maryland (UM), discussed how human-induced changes to natural landscapes have been identified as one of the greatest threats to freshwater resources. She is part of an interdisciplinary team established to study and later develop predictive models for how land use change will affect stream ecology in four urban-area watersheds in suburban Maryland, northwest of Washington, DC. The team is examining the relationship between land use and stream ecosystems for the urban watersheds, and how they expect the land use to change over two decades, and the ecological consequences. They have based their work, in part, on evidence that demographic trends and human activities are such that the rate of urbanization of the landscape is increasingly rapid, and there are no signs that the pattern of increasing human alteration of landscape will slow. The effect on the ecosystems can persist for many decades and may be difficult to reverse.

**Midwest:** David Rankin, Vice President and Director of Programs of the Great Lakes Protection Fund, discussed how the combination of biological and chemical pollution, and landscape conversion adversely affected the Great Lakes, the largest freshwater system in the world. Mr. Rankin cited population density and rates of resource consumption as the two major population factors contributing to the lakes’ degradation. Reshaping the
land and rivers around the lakes, introduction of nutrients and chemical poisons, and introduction of non-native species are the three most prominent alterations that affected the lakes’ ecosystems. A government-led, coordinated resource and management strategy begun in the 1960s made much progress in restoring the health of the lake system. The challenge now is to create governance systems that support its recovery over the long term.

Texas-Mexico Border: Mary E. Kelly, Executive Director of the Texas Center for Policy Studies, described how demographic trends, such as movement to urban areas and high rates of natural increase in population, characterize the overall population growth in the Texas/U.S.-Mexico border. Rapid industrialization and the rapid growth of populations in urban areas in the Río Grande River Basin have resulted in severe stress on water and wastewater infrastructures. Ms. Kelly discussed how the combined factors of high temperatures and frequent droughts, high pollutant dischargerates, inefficiencies in water use, differing national politics, and the aforementioned population dynamics, all contribute to the stress on water resources in this region.

OVERVIEWS AND OUTREACH
The meeting included experts from the international, policy, media and advocacy sectors who presented their perspectives on population and freshwater issues, including how the information can be used or conveyed in their respective fields.

International Overview: At the time of the meeting, the United Nations Population Fund (UNFPA) was preparing the new State of the World Population 2001, Footprints and Milestones: Population and Environmental Change. Report researcher and writer Stan Bernstein presented a global view of the issues, reviewing the status of freshwater resources on the planet, and how irrigation, industry and household use affect the resources. Mr. Bernstein pointed out that the availability of water between and within nations is often related to income. The most developed nations have, on average, higher rainfall than the lesser developed nations. To further exacerbate inequities in water availability, richer countries are better able to develop reservoirs, dams, and other technologies to capture freshwater run-off and available ground water. He said that the quality of water is far from adequate for all people: approximately 1.1 billion people do not have access to clean water worldwide, and 2.4 billion lack access to sanitation. Mr. Bernstein highlighted the challenges of gender issues, international conflict, and climatic change as relates to water resources.

Media and Public Outreach: Kathy Bonk, Executive Director of the Communications Consortium Media Center (CCMC), discussed steps needed to bring information about the population-water issue to the
attention of the media and public. Her polling data indicated that pollution of drinking water and water pollution in general were top amongst the public’s environmental concerns. She described how the data revealed the sectors of society that might be most open to becoming likely supporters on the issues, persuadable, and unlikely supporters. Ms. Bonk said that telling stories, general framing of the topic rather than providing details, news you can utilize with a local link, presenting solutions, and “weather stories” relating to the issue were the most effective ways to reach audiences through the media. She stressed how communicating “values,” or why people care about environment and population issues, was central to success in message development on these issues. Ms. Bonk described how a strategic communications plan including positive news stories and use of editorials, op-eds, and articles are important tools in reaching the media.

Policy and Decision Makers: The U.S. Department of State Office of Population’s Director Margaret Pollack discussed America’s foreign policy, the use of family planning and reproductive health as an important public health intervention, and environmental linkages. She stated that U.S. international population policy is based on the premise that achieving a healthy and sustainable world is vital to U.S. foreign policy interests. Ms. Pollack said that U.S. foreign assistance is focused on reducing the challenges of a growing population to the environment. She also noted several U.S. Agency for International Development (USAID) programs linking population to the environment, including the Honduran-based “Farm Management Plan” involving rural families’ sustainable management of natural resources, the University of Michigan Population and Environment Fellows Program, and the Environmental Health Project in Madagascar.

Advocacy and Grassroots: Pamela Goddard, NWF’s Senior Grassroots Outreach Manager, presented the view that although public opinion polling demonstrated that there is much interest in clean water issues, the public has not yet made the explicit connection between water quality, quantity, and population pressures. She said that although polls show people care about clean water, this does not necessarily translate into action. Ms. Goddard suggested that what is needed is to educate the public about the connections between water quality, quantity, and various population pressures, and how they personally are affected by water-related problems. She said credible spokespersons were needed to bring the topic to the forefront in the media, and more media coverage was necessary to increase the level of understanding people have of the issues so they may eventually take action.

Yale F&ES Commentary: During the meeting, Dr. Wargo, Professor of Environmental Risk Analysis and Policy and Director of the Environment
and Health Initiative at the Yale School of Forestry & Environmental Studies, highlighted several important overarching issues. First, he noted that he was increasingly pessimistic about “top-down” institutional strategies, and stressed the need for “bottom-up approaches,” including improving environmental and scientific literacy, encouraging individuals to think differently about their own involvement and approach to the environment, and motivating people to think of the ecological system as a whole.

Second, Dr. Wargo observed that we are not getting information on current approaches to environmental issues through to people. He pointed out: “...People have over 400 chemicals in their bodies that did not exist prior to 1900. We need a different approach to address these kinds of new problems, approaches that we are not currently using.” He said it is necessary to respond to the complexity of the issues by thinking of them strategically, to try and “reframe the nature of the problem.” For example, he commented that we should be looking at land use and its connection to watersheds, water-related species loss, and human health effects, as a whole. He noted that much has to do with the “invisibility of the threat – when you eat swordfish, for example, you cannot taste the mercury, but it is there.”

Third, Dr. Wargo pointed out that water scarcity is driven by many factors with population growth being one of them. In addition, water is being contaminated by chemicals to a greater degree than previously understood and that this contamination is a serious threat to human health and biodiversity. There are important equity issues to consider, as water is not distributed equally throughout the world. Pollution is also more prevalent in some areas of the world and, thus health threats differ across regions. Dr. Wargo commented that many of the “at risk water-related ecosystems” are not being managed effectively or at all. For example, there is no agreement between Israel and Jordan on how to manage water. He emphasized that we need to determine what information is required to inform various target audiences, and how to respond with the best solutions. Finally, Dr. Wargo noted that the case studies presented as part of the meeting are an excellent start in providing some viable solutions to address the world’s water issues.

COMMON THEMES, POLICY RESPONSES AND PUBLIC OUTREACH
The working meeting’s case studies and other presentations provided a wealth of information and insights on how human actions and other dynamics affect freshwater resources. These are best brought out in the presentations as they appear in this Volume. In addition, a number of common themes emerged from the meeting. They provide an excellent reference on how to approach the issues in general, and in the policy, research, advocacy, and public education sectors. A sampling of the themes appears below:
General

- Approach the issues with the concept of “connectivity,” using the whole ecosystem as a central theme;
- Show tangible benefits from making the ecosystem connections, from watershed and water source, to land, biodiversity, plant and animal species’ habitat, “services” provided, humans, food on the table, health, and so on;
- Present the issues and/or problems with viable, proven solutions and lessons learned;
- Develop and use “indicators” of “water health;”
- So people get the whole big picture and context in which water issues occur, frame the issues globally, then go to regional, national, local, community, and individual levels, using specific case studies to illustrate points at all levels; and,
- Focus on the individual’s responsibility towards and stewardship with water resources and ecosystems.

Land Use Development

- A better understanding is needed on the environmental effects of land use development patterns, as well as when policy instruments are effective in relation to land use development and watershed impacts; and,
- Land use patterns, whether they be “smart growth” or “uncontrolled sprawl,” will generally have a dramatic affect on stream ecosystems.

Local to Global Issues

- Pollution from the local to global atmosphere affects water quality. This includes pollution from coal-fired power plants and the use of airborne pesticides that enter the water. This points to the need for global as well as local resource management.

Research Needs

- Better data on water use patterns, water availability and environmental water needs is needed, and should be made widely available to the public and professionals alike;
- Research is needed on instream flow required to maintain healthy aquatic ecosystems and riparian habitats; and,
- A scientific research agenda is needed on the land connections to water, and vice versa, and on the gaps of what is not known, what is known, what needs to be known on water and population pressures.
Management

- Water conservation in the agricultural and municipal sectors, including application of more “water-use efficiency,” can play a major role in saving on water supplies;
- Future water demands must be met by a combination of factors, including: greater water use efficiency; better responses to environmental stimuli such as rain and drought; better pricing policies; and additional, different water sources, such as reservoirs and wastewater re-use;
- Use dynamic rather than static measures for assessment and management;
- Need modernization of the legal, administrative, and governing systems for water management;
- Water management must be done at the local as well as global level, because pollution comes from all levels. For example, biological pollution in the form of invasive species can be carried to the U.S. on international commercial ships to U.S. waterways, and can come from local sources; and,
- To restore degraded water systems, natural flow regimes to tributaries and coastal lake areas need to be reinstated.

Policy

- Sustainability needs to be put at the center of water policies. Current policies reflect separate, unconnected management approaches for irrigation, household, and industrial use;
- Ecological functions of rivers and other freshwater ecosystems are not, for the most part, currently taken into account in public policy and need to be;
- When watersheds are threatened by development, setting aside areas for protection from further development has been a successful policy option;
- Where cross-U.S. border issues apply, there should be binational policy frameworks for addressing water issues;
- Economic factors like subsidies and water pricing, are often hidden causes of water problems; and,
- Often an area’s economy exacerbates its environmental problems, with expanding agricultural, commercial and tourism sectors. A good approach is to reconcile these needs by making water a “draw” or “currency” so as to support the economy, however in a way which is sustainable for the water systems.
Public Outreach

• There must be a concerted effort on the part of water management agencies and non-government organizations (NGOs) to build broader public awareness of water scarcity and water policy issues;
• Educating the public about the environmental affects of urban sprawl and people’s individual actions are key ingredients to successful watershed management and stream protection; and,
• There is a need to focus on state governments in conjunction with local groups for action on the issues.

Future Issues

• Water may become central to international conflicts as more and more pressure is placed on increasingly scarce or degraded water resources;
• Technological fixes, such as desalination, are proving too difficult to count on to increase future freshwater supplies; and,
• Climate change may have increasing affects on water resources, influencing rainfall patterns, sea level rise, and increased incidence and severity of major weather events such as storms, thus affecting human settlement patterns along coastal and other areas.

Follow-up Activities

A number of follow-up activities based on the Population and Freshwater Experts’ Meeting held at Yale University are planned for 2001-2002. Among them are: production and broad dissemination of the working meeting proceedings as part of this working meeting report; reporting on the working meeting in CEP, NWF and PRC venues such as web sites and publications; and, development, distribution, and use of the materials based on the meeting, for policy makers in the U.S. Congress and at the state level, and for NWF’s network of grassroots activists.

In addition, CEP, NWF and PRC have been invited to convene a special experts’ panel session based on the Yale meeting at the American Association for the Advancement of Science’s (AAAS) Annual Meeting in Boston in February 2002. The launch of the Yale Bulletin will be held at the AAAS Meeting. NWF and PRC will hold a briefing for students, activists and state policymakers on “Population and the South Florida Ecosystem” in 2002. The three organizations will also be using the meeting’s information and recommendations to help shape the policy debate at the national and international levels at such fora as the World Summit on Sustainable Development in fall 2002, and subsequent reviews of the implementation of the 1994 International Conference on Population and Development (ICPD).
ORGANIZERS

Center for Environment and Population (CEP)
The Center for Environment and Population (CEP), a non-profit organization and project of the Tides Center, addresses the relationship between human population, resource consumption, and environmental impacts. The Center works to strengthen the scientific basis of policies and public outreach to achieve a long-term sustainable balance between people and the natural environment around the world. CEP partners with leading organizations to link science to policy and public education efforts, so as to better understand and effectively address the issues. To do this the Center and its organizational partners undertake a series of activities to: compile and assess the current knowledge and emerging trends on the issues; produce expert and research-based materials for policy makers and the public; and; conduct activities to disseminate the materials and information for policy and public outreach.

The Center has three major program areas: Emerging Issues in Environment and Population, Building New Population-Environment Leadership, and the AAAS Atlas of Population and Environment Distribution and Briefing Project. Activities center on producing science-based materials including Issues Papers, and undertaking strategic distribution and briefings based on the new materials from the local-community to international level. The Center also utilizes its CEP Experts Network to engage leading scientists and other issues-experts in policy and public outreach projects. For more information contact, Victoria Dompka Markham, CEP Director, at vmarkham@cepnet.org or visit the web site at www.cepnet.org.

National Wildlife Federation (NWF)
The National Wildlife Federation (NWF) is the nation’s largest, not-for-profit, environmental education and advocacy organization with more than four million members and supporters. Its purpose is to educate, inspire, and assist individuals and organizations of diverse cultures to conserve wildlife and other natural resources and to protect the Earth’s environment in order to achieve a peaceful, equitable and sustainable future. Founded in 1936 as a national group of outdoor enthusiasts, NWF is a member-supported national network of affiliated organizations and individual members throughout the United States and its territories. Combining the local knowledge and focus of its strong grassroots network with the perspective, resources, and strength of a national organization, the National Wildlife Federation generates unparalleled support for wildlife, wild places and a healthy environment.

People and Nature: Our Future is in the Balance – This statement of NWF summarizes the recognition by NWF that environmental issues are increasingly global in scope and that human demand for and use of natural
resources relate to environmental deterioration worldwide. We are in danger of losing the balance between population and nature as the world’s population continues to rise. NWF’s strong educational focus and broad constituency of members and grassroots activists enables individuals of all ages and backgrounds to work together toward achieving a balance between people and nature. NWF’s Population & Environment Program makes a significant contribution toward promoting responsible national and international action by informing people of how population growth and pressure are imperiling the wildlife and wild places that they love and how they can take action. NWF works to achieve a sustainable balance among the world’s population, environmental quality, wildlife and wildlife habitat, and our finite natural resources. For more information contact, Karin Krchnak, Population & Environment Program Manager, at krchnak@nwf.org or visit the web site at www.nwf.org/population.

Population Resource Center (PRC)

The Population Resource Center’s (PRC) mission is to improve public policy by promoting the inclusion of sound objective analyses of demographic data in the policy process. To achieve this goal, the Center organizes 50 to 70 programs annually that provide national, state and local policymakers with information about the effects of demographic and related social and economic change on public policy issues. For almost 30 years, the Center has organized educational briefings for government leaders on issues such as immigration, teenage pregnancy, aging, the well being of children and families, and international population growth and change. At each of these programs, we arrange for leading experts to discuss with policymakers the latest research in the field and answer specific questions about the implications of their research findings for policy.

The information gained from this experts’ meeting on population and freshwater is part of a larger effort to engage and educate the public about the importance of international population issues. PRC is conducting a four-year project to promote understanding of how demographic dynamics affect economic development, the status of women, public health, and the environment. The nation’s foremost sociologists, demographers, public health and environmental experts donate their time to participate in PRC’s issue focused programs. The core values of PRC are nonpartisanship and objectivity. Briefing programs for federal, state and local policymakers are based on academic research. Policymakers from both political parties serve on the PRC board of directors and participate in programs as moderators and co-sponsors. For more information, contact Jane De Lung, PRC President, at Jdelung@prcnj.org or Nancy Thorne, PRC Vice President, at nthorne@prcdc.org, or visit the PRC web site at www.prcdc.org.