

# CTAHR RESEARCH NEWS

A photograph of a man with glasses and a colorful patterned shirt, smiling while holding a large open book in a library. He is standing in an aisle between tall bookshelves filled with books. The lighting is bright, and the perspective is from a slightly low angle, looking up at the man.

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**Natural  
resource policy  
for Hawaii**

**MOU's extend  
the global  
impact of  
CTAHR**

**Grants are  
abundant in  
this season**

Gopal can often be found in the UHM Hamilton library doing research for his next book.

# Natural resources policy for Hawaii: CTAHR's cutting-edge research

By Chennat Gopalakrishnan  
Professor

Department of Natural Resources and Environmental Management



Gopal and Lukas Sheild (Minnesota) are studying the use of Hawaii water.

Natural resources play a pivotal role in Hawaii's economy. Given this fact, crafting a workable, effective, and sustainable natural resources policy for the state is of the highest importance on the research agenda of CTAHR, especially the Department of Natural Resources and Environmental Management (NREM). It has been my privilege to contribute to this effort as a member of the NREM faculty. The research goals that have guided my work here at the University of Hawaii are:

1. To undertake original research in natural resource and environmental economics and policy, in collaboration with my colleagues from other relevant disciplines, with a view to help develop innovative policies to address and solve major problems;
2. To focus a significant part of my research, in the spirit of the land grant philosophy, on issues of pressing concern to agriculture and natural resources in the State of Hawaii;
3. To communicate my research findings to professional colleagues, policy makers and other relevant constituencies through books, journal articles, technical reports, policy papers and other appropriate outlets; and
4. To provide rigorous training to both graduate and undergraduate students in natural resource and environmental economics and policy through academic courses, research projects, directing thesis and dissertation research and other activities.

I have done extensive research in the natural resources field, especially in water resources, ocean resources, and energy. Research on issues of pressing concern to Hawaii's natural resources accounts for over 75% of my work. This includes my studies on Hawaii's water laws and institutions, analysis of the changing configuration of water demand in Hawaii, including projections of water demand for individual sectors of the economy, Hawaii's coastal zone management, and alternative energy sources, especially biomass. My current research focuses on the political economy of water, water institutions and policy, conflict resolution, and water and disasters. I will discuss below selectively some of my current and past research activities.

My recent work includes a comprehensive study of the evolution of Hawaii's water institutions, a review and critique of the factors that have stymied their optimal functioning, and a case study of the Waiahole project and the water allocation conflicts surrounding

it. Several papers and book chapters have been published based on this research. These publications have examined comprehensively the interconnections between water and power in Hawaii, identifying several aspects of Hawaii's water institutions that needed to be modified in order to ensure optimal allocation of the state's freshwater supply. Among them are changes in the legal doctrine governing water allocation and transfer in Hawaii, specific mechanisms to resolve increasingly recurring conflicts among water uses and users, incorporation of water banking features to effectively address drought conditions, and measures to safeguard Native Hawaiian water rights.

Conceptual issues in the optimal management of water resources constitute an area of special interest in my research portfolio. An important recent work on these issues is Phuong M. Dang's dissertation on "Optimal Management of Renewable Resources: A Dynamic Model of Surface Water Contamination from



Graduate student, Lara Kozloff (Illinois), discusses the finer points of water research with Gopal.

Pesticide Use in Rice Production in the Mekong Delta, Vietnam” done under my supervision. Further research using Dang’s dynamic model to study water quality issues in Hawaii and elsewhere is planned.

In the course of my research on water institutions, I developed the concept of “institutional entropy” in an attempt to explain the decline and fall of water institutions over a relatively long period of time. In the

context of institutions, the idea of entropy, as I envision it, refers to a progressive decrease in effectiveness and efficiency in performing the goals and objectives as originally envisioned and set forth. I have examined this concept in relation to Hawaii’s water institutions and found it valid. My former graduate student, Usukh Batsaikhan, studied Mongolia’s water institutions and found substantial supportive evidence for this concept. Caleb O’Kray (Michigan), a Ph.D. student in our graduate program, is currently doing a comparative study of the evolution, structure, and performance of water institutions in the US and China and as part of his research is examining the role of institutional entropy in these two disparate settings.



Caleb O’Kray  
(Michigan)

Another important study that was recently completed provides an overview and analysis of water conservation in Hawaii. One of my former students, Greg Grigson, took the lead in this research effort. Policy improvements were found most effective in the residential and visitor sectors. Recycling wastewater could save 6.4 mgd of freshwater resources. Conservation pricing using increasing-block rates is recommended for all sectors to achieve economic efficiency.



Greg Grigson  
(Pennsylvania)

Two of my graduate students, Lara Kozloff (Illinois) and Lukas Sheild (Minnesota), are currently at work on research dealing with political externalities in water resources management and the political economy of water in Hawaii, in that order. The first project examines congressional earmarks and pork-barrel politics that have played and continue to play a major role in the selection and funding of water projects and the impacts of such funding on optimal resource allocation. The second focuses on water and power in Hawaii based on a historical survey and analysis of the evolution of water laws and policies in order to gain insights into the workings of the current water policies of the state.

The changing configuration of agricultural and non-agricultural water use in Hawaii was studied in the 1990s by Parashar B. Malla and myself. Estimates of water demand in the agricultural, industrial-commercial, residential, and the visitor industry sectors



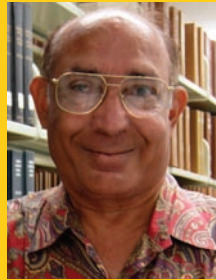
Gopal’s contribution to the area of resource economics includes these five books.

were developed and analyzed and projections for future demand were made. Linda J. Cox and I examined Hawaii's visitor industry and projected that its water consumption would go up markedly in the years ahead, due to an expected 50% increase in golf courses and further expansion of hotels and resorts. The analysis showed that pricing and substitution of non-potable water for potable water could effectively reduce fresh water consumption by the golf courses.

Perhaps the paramount resource problem facing Hawaii is the issue of affordable energy and energy independence. The state has been importing virtually all its energy for the last 100 years by way of oil and oil-based products costing the state over \$1 billion annually. My former graduate students and I have studied in detail the energy situation in Hawaii and suggested viable energy options for the state such as biomass and solar power. In the 1980s, Gholam H. Khaleghi, Prahlad Kasturi, Egnonto N. Koffi-Tessio, and Rajendra B. Shrestha studied energy-nonenergy input substitution in the western United States agriculture, including Hawaii. John F. Yanagida, NREM colleague, also assisted with part of this research. Our findings have pointed to the possibility for input (e.g. labor, land, energy) substitution in times of energy scarcity and also the incentive for conservation that arises when supply is curtailed and prices escalate. I also conducted a study of the impacts of oil price shocks on Hawaii's economy and their policy implications in collaboration with Xijun Tian and Duke Tran using econometric modeling.

Research on management policies related to Hawaii's critical coastal zone dates back to the early 1970s. Our work in this field has been widely used in formulating coastal zone legislation nationally. Jack R. Davidson (former AREC chair) and I identified institutional constraints to coastal zone management and proposed a series of measures to rectify these constraints. John Sisson and I conducted a study to assess the economic impact of additional funding for ocean research as the basis for a more effective ocean policy for the state. I have also done some research on the economic value of non-timber forest products, assisted by Prabodh Illukpitiya.

I am currently collaborating with Professor Norio Okada of Kyoto University on a study of institutional design for integrated disaster risk management and also on the impacts and implications of natural disasters on multiple natural resources. I am also working



## Chennat Gopalakrishnan

**Hometown:** Elankunnapuzha, Kerala, India

**Joined CTAHR:** 1969

**Educational History:** Ph.D., Agricultural Economics, Montana State University; B.A. and M.A., Kerala University, India

**Specialization:** Natural Resource and Environmental Economics and Policy

**Current Work:** Research in applied natural resource economics and policy, with special reference to water resources. Specific areas of research include institutional entropy, political externalities, and integrated disaster risk management.

**Languages Spoken:** English, Malayalam

closely with the members of a western-region multi-state project on "Interfacing Technological, Economic, and Institutional Principles for Managing Inter-sector Mobilization of Water". Furthermore, I am working jointly with Professor Asit K. Biswas of the Third World Centre for Water Management in Mexico and Dr. Cecilia Tortajada of the International Centre of Water in Spain on water institutions and policy.

The impact of my work on the field of natural resource economics and policy can be gauged by my publications (five books, 60+ peer-reviewed journal articles, many research reports, and 25 invited conference presentations) and honors and awards I have received. Examples include my selection as a Fellow of the American Water Resources Association, CTAHR Ka Pouhana Mentor Award, Law of the Sea Institute Professor of Social Sciences, reviewer for NSF and USDA, editorial activities for major professional journals and books, service on important scientific advisory committees, and extensive use of my books and research papers by my peers.

It has been a great pleasure working with graduate students and colleagues on many challenging issues of major relevance in the natural resources policy field. Aside from technical papers and publications, such interaction has emboldened me to try my hands at creative forms of communication in the study of natural resources policy, including poetry. A case in point is my poem, "A Coasean Solution," recently published in "The American Economist" (Spring 2007).