Bali's Water Temples Rescued by Computers
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Two University of California Professors Prove Scientific Validity of Ancient Agricultural System

A few years ago in Bali, Goddess Dewi Danu had a problem. Some human scientists and engineers presumed they could improve upon Her thousand-year-old system of "water temples" which controlled Bali's agriculture. She used to put Her divine power through Gero Gde, high priest of Bali's main water temple, Ulun Danu Batur (situated beside an enormous crater lake). He and his fellow priests combined the mystical power of Hindu rites with a vast store of traditional agricultural knowledge and an artful sense of community relations to produce bumper crops of rice and vegetables year after year. Suddenly the scientists advised everyone to ignore the water temples and Goddess Dewi Danu.

While She did visit temporary ruin upon these presumptuous non-believers, the Goddess ultimately converted the lot into willing adherents of Her temple system, probably insuring its continuance for another thousand years. How? She drafted two California scientists-Dr. Steve Lansing and Dr. James Kramer-and the latest in Apple's Macintosh computer technology to prove the scientific merit of Her system.

It all began in the mid-1970's, when the government of Indonesia, in cooperation with the Asian Development Bank, set out to bring the "Green Revolution" to Bali. Its aim was to greatly increase food production through improved "superstrains" of rice, advanced irrigation methods, pesticides and fertilizers. According to all the expert analysis and predictions given to the government and the bank, the Green Revolution should have been a grand success, as it had become in much of Asia.

But, by 1982, the revolution's resounding failure in Bali was painfully clear to everyone involved. Every time another "modern" method was introduced, crop yields dropped. The pesticides, for example, killed the existing bugs just fine, but new and more resistant ones moved right in. Pesticides also killed the paddies'

once-plentiful fish and eels and, according to the local hospital, even several farmers. Gradually, people abandoned the modern methods and went back to the water temples.

Still the determination to modernize Bali's agriculture did not end. Though Dr. Lansing insists, "There are no villains in this story," the scientists advising the Green Revolution stubbornly refused to accept that the water temple system had any value. "We don't need a high priest, we need a hydrologist [water scientist]," punned one engineer.

Meanwhile, the high priest was about to outmaneuver the scientist, for he had gotten the sympathetic ear of 38-year-old Dr. Stephen Lansing, currently chairman of the Department of Anthropology at the University of Southern California, and Dr. James Kramer, associate professor of biology at USC and Macintosh computer expert. Dr. Lansing told HINDUISM TODAY how they got involved. "I went to Bali [at age 21] in 1971 for six months and lived in the house of a man who was studying to become a priest. [By the mid-1970's] many of the people, who were my friends by then, were having to cope with the real chaos in irrigation and the major problems caused by the unenlightened side-effects of the Green Revolution. The concerns and the ideas of Balinese farmers and priests were not being taken seriously. I got Jim Kramer in this to communicate the meaning of these practices in a way that they would not be simply dismissed."

Studying the Water Temples

There are water temples all over Bali. They are part of a sophisticated form of Hinduism with ties to the ancient Angor Wat civilization of Cambodia. Rituals are conducted in Sanskrit, Balinese and ancient Javanese language, which is itself 50% Sanskrit. Goddess Dewi Danu is considered a feminine form of Lord Vishnu.

Dr. Lansing speaks fluent Balinese. When in Bali, he wears Balinese attire and participates in the religious rituals of the water temples. He knew the temple system worked, but he didn't know how, so he set about systematically studying it. What he discovered explained simultaneously the success of the water temple system and the failure of the modern methods.

The particular set of temples in the Badung district which Dr. Lansing researched are under the authority of Gero Gde of the Ulun Danu Batur temple and control about half of Bali's agricultural land. The highly productive system is an intricate complex of canals, weirs, tunnels and ditches connected to 74 square miles of rice paddies. Every field has a temple at one corner, and every important point along the irrigation system has one also all the way up to the main temple.

Successful agriculture in Bali requires careful timing of planting, crop rotation and efficient and timely use of the ample, but not unlimited, water resources. The priests control the network of canals, ditches and tunnels which deliver the water to each farmer's paddy. Any change in this system must receive the approval of the head priest, Jero Gde. The priests' approach is quite simple and can be seen in the following description given by the second high priest, Jero Gde Alitan, of how he settled a water dispute between farmers and nearby villagers:

"I said to them, 'Who created this water? Who decides if this spring is full or dries up?' I said, 'Do you understand that if we fight over this gift from the Goddess, Her spring might just dry up? Completely vanish?' I brought them all up to the temple here, and when we had it settled, work began. The new canal ran off below the spring, and took off quite a lot of water. But-now this is the point-not 200 meters further downstream, the flow was back to normal. In fact, [the water supply] actually increased after everything was finished! I tell you, that made quite an impression. They're still afraid the spring might dry up!"

Dr. Lansing also discovered how the complex Balinese calendar system accurately set the optimum rice planting times each year. An earlier scientist had dismissed the calendar as, "completely divorced from the flow of observable natural events." In fact, the early study missed nearly every significant aspect of the water temple system. Dr. Lansing attributes this to the typical western attitude that ancient systems have nothing to teach us. He thinks they can teach much. (For Dr. Lansing's study, see the American Anthropologist, Vol 89, 1987, page 326-340.)

Convincing the Authorities

Even after successfully making the case for the water temples, Dr. Lansing could get nowhere with the concerned officials. The ecological interrelationships

regulated by the priests and their temple rites were just too complex to easily grasp. Dr. Lansing turned to Dr. James Kramer, biochemist, ecologist and computer expert, to create some kind of simple demonstration of the system. Dr. Kramer set out to create a computer program which would show graphically how and why the water temples worked.

Dr. Kramer's Macintosh computer program considers the important variables of Bali's agriculture, such as rainfall, predators, pest outbreaks, etc. It also shows how the water temple system successfully adjusts to each of these factors to maximize the rice crop. At the same time, the program shows how the government's methods quickly led to extreme outbreaks of pests, just as happened in real life. Dr. Lansing and Dr. Kramer hauled their computer and its programs all the way to Bali. In a meeting held at the Ulun Danu temple, they demonstrated for scientists, high priests and government officials alike the value of the water temples. The demonstration opened many eyes. Now the scientists are looking into how they can integrate some of the Green Revolution's advancements into the water temple system.

Was it Science Versus Religion?

HINDUISM TODAY asked Dr. Kramer how the priests felt about scientific research into their religious, mystical and supernatural world. He explained, "The way the priests say it, it is not a coincidence that Dr. Lansing and I began working on this project at this time. They see our influence in a very positive way in trying to use a line of reasoning to support the temple system which is understandable to people who are not part of that religion." Asked if he felt, as the priests did, that the Goddess brought them to protect Her temples. Dr. Kramer said, "I would be the last to deny that. The circuitous route by which I found myself involved in this project is something less than rational."

In Bali, Dr. Lansing offers prayers at the water temples, receives holy water and is treated as any other devotee. Asked about his personal religious background, he said, "I was raised as an Episcopalian.

But by now-I don't know how to put it-I'm very sympathetic to the Balinese and try to be helpful. One thing that is different about their set of beliefs is that the

question of belief, whether or not you believe this, what things you believe or don't believe, never really arises. It is more a question of what you do and I am quite comfortable with that. The Episcopalians say that you have to begin by promising to believe a whole series of things. The Balinese don't ask for this. And I think that is nice."

The project has received good news coverage in the USA, appearing in Newsweek and The San Francisco Chronicle. Unfortunately, the journalists did not share the researchers' feelings or at least sensitivity toward Balinese Hinduism. The Chronicle said, "The key was not that the priests have supernatural allies blessing the fields," even though Hindus would say that indeed there are supernatural allies giving blessing. Usually tactful Newsweek still talked cynically about the farmers taking "great care not to offend Dewi Danu," and "placating the Goddess," as if the farmers lived in terror of what is really a beloved Goddess. Dr. Lansing and Dr. Kramer proved the scientific value of the system. But neither is prepared to claim his work discredits the supernatural side of the water temples or the benevolence of Goddess Dewi Danu.

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