Institutional Adaptation and Community-Based Conservation of Natural Resources: The Cases of the Tao and Atayal in Taiwan

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Abstract Traditional institutional rules, values, and beliefs help support conservation regimes of natural resources in many indigenous communities. Such traditional conservation regimes may break down as a result of influences from the outside world. This paper examines two cases in Taiwan—the Tao communities on Orchid Island and the Atayal community in Smangus. The former illustrates a process in which traditional institutions supporting local conservation broke down as a result of external influences, leading to the loss of the local community's ability to govern the use of a coastal fishery. The latter, in contrast, demonstrates how local people are able to adapt their traditional institutions to meet the challenges from the outside world while preserving a local forest. The paper concludes by examining factors that affect institutional adaptation in community-based conservation of natural resources.

Keywords Taiwan · Institutional change · Community-based conservation · Forests · Fisheries

Introduction

Community-based governance has gained increasing attention as an effective approach to natural resource conservation (Agrawal and Gibson 1999). At the interface between social and ecological systems, local appropriators tend to have both the incentives and knowledge to conserve local natural resources for sustainable use (Folke *et al.* 1998). Many, but not all, aboriginal peoples have been identified as successful in preserving such local natural resources as coastal fisheries, forests, and water systems by means of self-governing arrangements that effectively limit the rate of resource extraction and use (Kellert *et al.* 2000; Ostrom 1990, 2005). It is possible that such successes result less from effective conservation practices than from low demand relative to supply or poorly developed resource distribution networks (Hunn 1982; Alvard 1995). Nevertheless, in many cases, there is evidence that aboriginal institutions did function effectively in preventing overconsumption of renewable local resources and thus played a vital role in conservation (Gibson *et al.* 2000; Warren and Pinkston 1998). Can these aboriginal institutions survive the increasing pressures on their local resource systems triggered by various internal and external socioeconomic changes (cf. Ross 1978)?

As part of the overall trends of modernization and globalization, for example, many historically isolated indigenous communities have come into contact with the outside world and begun to undergo social, economic, and cultural transformations; their traditional arrangements for natural resource governance are being challenged, often leading to an imbalance between supply and demand. As a result, local resources in these indigenous communities could be ruined within a relatively short period of time, manifesting what some refer to as the "real tragedy of the commons" (Anoliefo *et al.* 2003; Monbiot 1993).

One often-suggested solution is the involvement of indigenous communities as partners in modern conservation efforts (Rangan and Lane 2001; Ross and Pickering 2002). This approach advocates the application of local knowledge (Berkes 1999) and, in some cases, the revival

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of indigenous cultural practices that have historically proven successful (Colding and Folke 2001). Despite such an argument, little attention has been devoted to explaining the circumstances in which indigenous institutions can help, and if so how they can be adjusted, transformed, or rebuilt amidst rapid social changes triggered by forces of modernization and globalization such that they remain effective in natural resource governance.

In this paper, we explore how such institutional adaptation processes are possible by focusing on how traditional values and beliefs may contribute to nature conservation in indigenous communities. As indigenous values and beliefs are replaced by those from the outside, to what extent would traditional practices in nature conservation be affected? Can outside influences be combined with indigenous practices to support effective governing institutions for environmental conservation? What are the potential challenges in these institutional adaptation processes? In what ways do various physical, cultural, and economic factors combine to shape such processes? We address these questions by examining the evolution of two aboriginal communities in Taiwan.

In one case, the Tao people on Orchid Island had traditionally maintained communal rituals that governed how boats were built, fish were caught, and seafood was cooked and served. These rituals contributed to the maintenance of a sustainable stock in its coastal fishery. Yet in recent years, with increased outside influences and other social transformations, traditional values and norms have begun to lose their importance among the local population. As a result, the traditional rules governing the use of the coastal fishery have become ineffective. This, together with increasing consumer demands and extraction activities from the outside world, has led to rapid depletion of the fish stock.

In the other case, an aboriginal Atayal tribal community in the mountainous area was initially faced with a similar challenge as indigenous practices became ineffective for governing their nearby forests. This tribal community underwent key social transformations as the local economy became increasingly tied to the outside economy and Christianity began to displace traditional values and beliefs. Leaders in the Christian church in this community were able to blend Christian values with some indigenous beliefs and practices to develop a new cooperative arrangement for preserving the forest.

Both cases illustrate how forces of modernization and globalization may open up economic and social opportunities for people in indigenous communities, giving them greater opportunities to pursue a potentially more individualist and economically secure way of life. These forces, however, may also transform traditional beliefs, values, and cultural practices that in the past helped to support effective systems of natural resource conservation. In some situations, such transformations may lead to the breakdown of an effective conservation regime; in other situations, such transformations may lead to the refashioning of old cultural practices such that alternative approaches to resource conservation can be adopted. Our study of two cases with divergent outcomes adds to the literature by showing the role of aboriginal communities in natural resource conservation as well as the conditions and dynamics for institutional adaptation in the midst of modernization and globalization.

Aboriginal Communities and Natural Resource Conservation

In a struggle to survive in harsh physical and biological environments, aboriginal communities often need to develop social institutions, such as hunting and diet restrictions, to regulate the consumption of scarce resources (Ross 1978). As argued in the anthropological literature on cultural materialism, material conditions shape social institutions and human behaviors (Price 1982). While this functionalist perspective helps explain the existence of specific social institutions related to resource use, it is not particularly helpful in explaining how social institutions evolve, especially when the changes are not associated with changes in the physical world. In this regard, the political-economic literature provides more useful insights for understanding institutional evolution as not just a result of changes in physical and biological systems but also strategic choices of and interactions among individual resource users, in the context of interlocking layers of institutional influences, various collective learning processes, and distributional conflicts among resource users (cf. Thelen 1999; Berkes and Turner 2006). Institutions and processes for natural resource governance are intricately tied to such issues as economic development, property rights, cultural preservation, social justice, and democratic participation.

From a political-economic perspective, residents in rural communities are motivated to preserve their local resources only if they are able to overcome many obstacles, for example, by (1) resolving collective-action problems and distributional conflicts inherent in resource governance, (2) developing effective monitoring arrangements to guard against free-riding behaviors, (3) developing solutions to their resource governance problems that are compatible with traditional social values and local socioeconomic realities, and (4) gaining recognition from external authorities to have the rights to govern their local resources (Berkes 1999; Kellert et al. 2000; Ostrom 1990, 1995; Tang 1992). As these are often formidable obstacles to overcome,

not all indigenous communities are equally successful in preserving their local natural resources. Some indigenous tribes, for example, lack the social structures and cognitive models for sustainable use of natural resources (Smith 2001), and some have contributed to local resource depletion by acting as agents of the state apparatus (Dombrowski 2002).

Among the indigenous communities that are successful in conservation, most have developed elaborate institutional rules for defining resource boundaries, user rights, resource allocation rules, monitoring arrangements, conflict-resolution mechanisms, and more (Ostrom 2005). These institutional rules are supported not just by knowledge of the local environment, but also by deep-rooted social values and belief systems passed down through generations (Klooster 2000). In some aboriginal belief systems, natural resources are considered as gifts from gods, and deserve care and respect from humans. In some cases, routine social rituals may have evolved for other purposes, but have contributed to maintaining an effective resource conservation regime (Fowler 2003).

These institutional rules, values, and beliefs are often challenged when the indigenous community becomes exposed to the outside world. These challenges may come in different forms. For example, when outsiders begin to arrive and make claims on the resource, traditional allocation rules may begin to lose their effectiveness in limiting the use of the resource (Tang and Tang 2001). Or, as the local economy becomes more integrated with the larger economy, local residents' reliance on the local resource may diminish, creating different incentives for resource use. Another key challenge concerns the erosion of indigenous belief systems that are supportive of nature conservation. Once these belief systems become ineffective in constraining social behaviors, traditional conservation regimes can be undermined easily.

A key question in natural resource conservation becomes how indigenous communities may meet these challenges by adjusting their institutional rules, values, and belief systems in support of effective resource governance. This question has become increasingly important as many international agencies and governments worldwide are seeking to devolve governing authority to the local level and to engage indigenous communities in developing or regenerating self-governing institutions for local natural resource governance (Ribot and Larson 2005; Natcher and Davis 2007). It is, however, uncertain if these indigenous communities can effectively shoulder such responsibilities, especially in a world in which most rural communities, no matter how remote, are inevitably connected to the outside world through various political, social, and economic linkages. To be successful in conserving their local natural resources, residents in these communities have to adapt their community-based institutions to these new realities.

In the following two sections, we present the two cases—the Tao communities on Orchid Island and the Atayal community in Smangus—the former exemplifying on-going challenges to the resource governing system and the latter, innovative adaptation in such a transition. In conducting our research on the two cases, we have drawn on a rich anthropological literature accumulated since the beginning of the twentieth century (Yang 2005)[1] which provides detailed documentation about key historical backgrounds, and many of the traditional social institutions as well as cultural beliefs and practices examined in this paper.

In addition to documentary sources, one of the authors and several research assistants conducted field research in both areas from 2004 to 2006. Groups of 22 informants (Atayal) and 24 informants (Tao) were interviewed, some in person and some on the phone. Informants included tribal elites, ordinary residents, and tourists in Smangus, and township-level officials and residents on Orchid Island. Most interviews focused on the informants' assessment of the tribal situation, their understanding of traditional norms and taboos as they relate to resource appropriation and conservation practices, and their understanding of the impacts of the Christian faith on their traditional values and cultural practices.

Generally speaking, interviews with the Ataya people in Smungus were more focused and intensive because of their clear efforts in building new institutional arrangements. In contrast, interviews with the Tao people on Orchid Island were generally conducted in a less formal manner in part because their taboo system was still a sensitive topic. Therefore, the first interviews were conducted with homestead owners who had more experience with tourists and were used to answering questions relating to their traditional lifestyle. We also interviewed non-Tao souvenir vendors who had integrated into the local community and observed various social and cultural practices for long periods of time. Through their recommendations, snowball sampling was used to contact further indigenous informants.[2]

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[1] The Tao and Atayal have been the most thoroughly investigated aboriginal tribes in Taiwan. Since the establishment of Taipei Imperial University (now National Taiwan University), many Japanese scholars, for example, Oshuma Masamitsu, Miyamoto Nobuto, and Kano Tadao, undertook systematic anthropological research on Taiwan (Yang 2005). The colonial government encouraged studies of the Atayal in order to develop strategies for preventing rebellion. On the other hand, the geographical and social isolation of the Tao attracted them to Japanese anthropologists.

[2] An additional research challenge on Orchid Island was that most native elders had trouble understanding Mandarin spoken by the interviewers, and tended to decline to be interviewed.
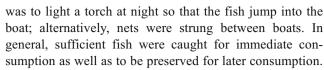
The Tao of Orchid Island: No Longer "Blessed" by the Evil Spirits

The Tao (meaning "genuine human being") are related to the Malayo-Polynesian populations, and have lived on Orchid Island for about 1,000 years (Wong 2001). The island is 45 km^2 in size and 88 km from Taiwan Island. Before its opening to outsiders in the 1970s,[3] the island was largely isolated from the rest of the world because on the one hand, the island supported Tao subsistence requirements, except for a few items such as pottery jars, gold, and silver (to make helmets) for ceremonial purposes; on the other hand, ironically, the island was too poor to be coveted by outsiders (Wei and Liu 1962).[4]

The Tao were organized into six communities. Within each community, there were several cognate corporate groups, each consisting of siblings and close relatives from the same bilateral system. Production associated with land property (such as agriculture, construction of irrigation facilities, and fishing activities) was mostly limited to cooperation among members from the same cognate system, while for other types of work (such as house construction) collaboration could cross the boundaries of cognate lineages (Wong 2001). Nevertheless, there was no unitary authority or permanent chieftainship at the tribal (island-wide), community, or corporate group level that significantly affected the conduct of public life.

Under such a decentralized structure, Tao society was regulated by many traditional laws in the form of social taboos held to be enforced by evil spirits (*Anito*) which could be everywhere and could cause terrible troubles for humans (Kuan 1989; Lee 1986). These taboos were interwoven with a wide array of other social practices contributing to the maintenance of social order (Wei and Liu 1962).

A key natural resource for the Tao was the migrating fish found in their coastal fishery, mostly "flying fish" (*Exocoetidae*) or "*Alibangbang*" locally, a general name applied to some 20 fish species in Taiwan and some 40 species worldwide. In spring, large numbers of flying fish migrate northward on the Kuroshio Current. The Tao, usually with several boat teams from each community, used two main methods of capture: the most convenient was to light a torch at night so that the fish jump into the boat; alternatively, nets were strung between boats. In general, sufficient fish were caught for immediate consumption as well as to be preserved for later consumption.

There were complicated taboos on fishing activities, diet, and fish stock preservation. To fish in the strong ocean currents, the Tao needed big boats with many oars for greater propelling power, and boat construction and crew recruitment were carefully regulated. There were traditional guidelines about what kinds of wood could be used for which parts of the boat, and many were in short supply on the island (Chen 2004).[5] Many ritual requirements had to be met before the boat's maiden voyage, and the ability to fulfill these requirements was usually determined by the builders' social status and wealth.[6] The organization of the crew also involved many taboos about social relations. Although adhered to for reasons not directly related to conservation, these taboos put serious constraints on the ability of the Tao to conduct large-scale fishing activities that might endanger the sustainability of the fish stock.

In addition, there were complicated taboos on the actual fishing methods. There were a series of Flying Fish Ceremonies (*feiyu ji*) from late February to early October.[7] The arrival of flying fish was considered the most important annual event for the Tao. Directly after the Big-Boat Fish-Attracting Ceremony (*dachuan zhaoyu ji*), held in mid-January of the lunar calendar that is roughly around late February and early March, extensive taboos were imposed. Specific rules governed the timing of boat launching, the specific fishing methods (torch, rod fishing, or net fishing) to be used, and banned catching other types of fish. Most of these rules were based on local indigenous knowledge of their environment. For example, when the boats were out catching flying fish, no other individual coastal fishing activities were allowed. Since this occurred during the breeding season, this rule enabled coastal fish populations to recover over several months.

The most ecologically significant taboo related to the duration in which flying fish could be eaten. The annual flying fish season ended with the Fish-Preservation Ceremony (*feiyu shou cang ji*) in June, after which all remaining

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[3] The island was isolated from the outside world during the Japanese colonial era mainly because the Japanese government intended to preserve the aboriginal conditions for anthropological investigations. When the Nationalist regime from mainland China took over, they kept this closed-door policy for security reasons. Most small islands around Taiwan were reserved for military use.

[4] The population of Tao was quite stable at around 1,500 until the island was opened to outsiders. This was probably due to the scarcity of natural resources. Recently, there are about 3,500 registered residents, of whom about 1,000 actually live on Taiwan Island (Tien 2002:49).

[5] Many of these taboos are associated with indigenous knowledge. For example, to deal with the shortage of large logs, all boats were made of small pieces of wood. The wood for the keel had to be hard wood to prevent damages, while the upper hull had to be lighter and softer wood that can keep the boat in balance (Chen 2004: 164; Syaman-Rapongan 2004).

[6] For example, the builders had to be able to raise sufficient numbers of pigs and goats for ceremonies and recruit enough crew members in advance. Building a boat was thus considered an important social event that most young men dreamed of doing at least once in a lifetime. For further details, see Cheng (2004).

[7] See http://www.sinica.edu.tw/~video/main/tribe-art/festival/ym/ym-all.html (in Chinese, checked on October 2008)

flying fish could be dried and salted for future consumption. About three months later, however, the Stop-Eating-Flying Fish Ceremony (*feiyu zhongshi ji*) was held at which all unconsumed flying fish were discarded. It was a strongly-held belief that whoever ate flying fish after this would face immediate misfortune. Although this taboo might have originated for sanitation and health reasons, since high humidity and primitive drying techniques meant the preserved fish could easily develop maggots and rot after that period of time it had the effect of making the fish valueless after a defined period, and thus contributed to their conservation.

From the 1950s, some Christian missionaries were allowed access to the island. In addition to bringing items such as clothes and rice, they devoted themselves to improving the welfare of the islanders, and played a key role in mediating disputes between natives and the police officers, soldiers, and bureaucrats from government agencies in Taiwan (Lin 2004). The missionaries were quite successful in earning respect from local people and thus converting them to Christianity. More than 60% of the population is now Presbyterian, with the remainder Catholic (Chien 2004). Christianity did not replace the indigenous belief system immediately since the missionaries realized the effectiveness of tolerating many traditional cultural values and integrating Christian teachings and rituals into indigenous tribal practices (Chien 2004: 159–163). However, as more Tao converted to Christianity, the traditional taboos that actually imposed constraints and costs on their individual daily life began to fall out of favor.

In addition to the erosion of the taboo system, other factors also triggered behavioral changes, for example, the introduction of motorboats to the island by the local government in an effort to improve their fishing efficiency. Motorboats obviously could run much faster and farther than the traditional boats, but they did not require a lengthy construction process, which in the past was accompanied by traditional rituals and ceremonies; nor did they require a crew that had a long-term partnership based on intimate social relations. Although some islanders initially refused to use motorboats to avoid possible sanctions from the evil spirits, as time went by, more and more islanders began to appreciate their speed and range, especially when they faced the competition from non-Tao surface gillnet fleets nearby (interview with a township officer in Lan Yu, July 24, 2006).

What finally made the Tao people embrace the new motorboats and other modern conveniences was that Christianity offered a belief system in which an individual did not face possible harassment by evil spirits. The younger generations were the most likely to convert to Christianity. Since the island is quite small and lacks economic opportunities, most younger people look to the main island of Taiwan for employment opportunities.

Taking part in church activities increases the chance of being selected for training in seminaries in Taiwan (interview with a theological college student in Lan Yu, July 24, 2006). In addition, they had been less socialized into the traditional belief system, were lower in the social hierarchy, and frequently had to support their family. Since the erosion of the taboo system had also facilitated the development of local tourism, young men now use the motorboats to catch flying fish that they dry and trade to tourists without any ritual constraints

Obviously, Christianity *per se* did not bring about a "tragedy of the commons." The resource depletion danger was also brought on by increased fishing and roe collection by non-Tao fishers in the region. Yet the erosion of the aboriginal belief system has played a key role in undermining the institutional foundations for local conservation and has promoted appropriation competition between Tao and non-Tao fishermen. According to one estimate, the amount of flying fish available to islanders has dropped more than 50% from less than a decade ago (Lai 2005). In recent years, the Tao have not been able to catch enough flying fish even for ceremonial use. Although there has been some awareness and reflection among native residents on the need to preserve the Tao culture and traditions, it remains unclear as to how they can work in sync with the modern market economy. They managed the problem of fish depletion by asking the government to restrict offshore fishing by non-Tao fishers. Through such governmental policy as specifying a restricted zone (five nautical miles from the shore), Tao flying fish yield increased slightly from eight tons to 26 tons in 2007, while the nationwide yield continued dropping to a historical low of 71 tons in 2007.[8]

The Atayal in Smangus: Guarding the Dark Forest by Reviving Communal Spirit

The situation of the Atayal in Smangus is in sharp contrast to the Tao. The Atayal (or "Tayal," also meaning "genuine human being") are probably the earliest residents of Taiwan, famous for their bravery and agility (Tien 2001:12). They had the second largest indigenous population, and were broadly spread over Taiwan's mountainous areas (Allis-Nokan and Yu 2002). Since the Atayal were in competition with other Atayal and non-Atayal tribal groups for access to land for millet fields and hunting grounds,

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[8] While the average annual yield of flying fish nationwide in the 1990s was about 810 tons, the number has dropped to 520 tons over the past decade. It was only 147 tons in 2006 and 71 tons in 2007. For the statistics, see Annual Reports on Fisheries information Service Site at http://www.fa.gov.tw/chnn/statistics_publish/statistics/year_book/ (in Chinese).

they had to manage both internal collective action as well as external threats.

The Atayal are the most famous head-hunting tribe in Taiwan (McGovern 1922) and ceremonies related to head-hunting raids helped to stimulate a sense of having a common enemy and a sense of internal cohesion among tribal members (Tien 2002: 255–264). Retaliatory raids by neighboring tribes were a constant threat. An indicator of the severity of such external threats was the value placed on weaponry. In contrast to the knives, wooden pikes, and stones the Tao used in combat, Atayal started using rifles about a hundred years ago. Their heavy emphasis on weaponry was also evident in their rituals for welcoming war heroes—if rifles were part of the captured trophies, the ceremony would be upgraded to a higher level (Tien 2001).

Atayal tribal members were organized in cohesive groups that shared the chores of patrolling during peacetime and deploying coordinated strategies during hunting and wartime. As well as kinship relations, they relied on a shared belief system called "Gaga" for social cohesion. In a Gaga, a communal spirit was held by a group of cognates who functioned as a social unit, sharing the same sacrificial rituals and ancestor lore, as well their personal safety and resources.

An integral part of a Gaga is the ancestral belief system. The Atayal believed that everything was governed by a specific kind of demon that demanded respect. At the same time the spirits of their ancestors, whose blessings reached out to the entire community, wielded great influence on their fate. The Atayal placed more emphasis than the Tao on the good spirits ("Utux") rather than the evil spirits, which could be dealt with through witchcraft.

Gaga and Utux were two mutually supportive pillars of Atayal communal solidarity and contributed to their reputation as an unconquerable aboriginal tribe (Tien 2001: 252). Even under the Japanese colonial regime, many Atayal communities still guarded their forest hunting grounds fiercely and successfully deterred commercial loggers from entering them. Nevertheless, the Atayal confronted the same modernization challenges experienced by other aboriginal tribes. In the early twentieth century, Christianity was introduced to the Atayal by a Japanese missionary (Tien 2001: 95). As increasing numbers converted to either Catholicism or Presbyterianism, not surprisingly, ancestral rules were gradually replaced. Utux could no longer effectively regulate tribal members' behavior and activities; the communal Gaga spirit, once a central feature of Atayal communities, gradually disappeared (Wong 1986: 575).

Similar to the Tao case, other factors went hand in hand with religious conversion to change the behaviors of the Atayal. When entrance restrictions to the mountainous areas were lifted in the 1970s, many Atayal found themselves without the necessary knowledge, skills, and resources to participate in complex economic exchanges in the modern market economy. They were also subject to increasing numbers of government regulations that sought to prevent mudslides and to conserve water resources by limiting their rights to use the forests. When in 1990 the government released the alienable rights of the reserved lands back to the Atayal, many of them sold their shares illegally for cash to financial conglomerates which undertook development projects, mainly construction of hot spring hotels and vacation villas, that further endangered the forests (Allis-Nokan and Yu 2002: 177). In other cases, the Atayal used their cultural heritage and the thick forests nearby as a commercial asset by developing ecotourism initiatives which helped lift many of them out of poverty. However, some of these initiatives led to a proliferation of tourist accommodations, both legal and illegal, which depleted water resources; and the heavy tourist traffic caused ecological damage.

The Smangus Atayal community represents an exception to these trends. The community is located deep in the mountains of Hsin-Chu County in northern central Taiwan, near an ancient forest of Taiwan red cedar. The village of Smangus was first mentioned in Japanese documents (Senchou Zhizhu 1917) in the early twentieth century, at which time it had a population of approximately 110 people. The village did not have electricity until 1979, and there was no paved road connecting it to the outside world until 1995. Yet Presbyterian missionaries reached the village as early as 1948. Within the next 20 years all villagers had converted to Christianity. Many villagers moved to urban areas for better job opportunities, mainly as construction workers during the economic boom in the late 1980s, while others stayed and tried to make a living by cultivating mushrooms for sale.

In the early 1990s, the rise of tourism provided an opportunity for the remaining villagers to enhance their livelihoods. They successfully packaged the nearby red cedar forest as an ecotourism attraction. With no paved roads until 1995, many of the early tourists would stay overnight in the village at the end of their long trip before going into the forest. After hiking and back-packing in the forest, the tourists would return to the village for lodging and food, in addition to buying aboriginal art work and engaging transportation services from the villagers.

However, shortly after the initial influx of tourists tensions emerged as those villagers with sufficient resources to provide lodging facilities benefitted disproportionately from the tourist trade, triggering complaints from those without sufficient resources. At this time the village comprised approximately 150 villagers (26 households). Intensified competition among lodging providers also contributed to rising tensions. More importantly, intense

competition among facility owners to attract customers also created an incentive for them to offer extra activities in the forest and to construct more lodgings, many of which were illegal, ugly, and unsafe, so that the villagers risked destroying the scenic beauty that drew tourists to the area in the first place. To manage these emerging threats, the villagers developed a collective strategy centered on the revival of some of their traditional religious practices.

Based on their lingering memory of the communal spirit, *Gaga*, and the practical rules specified by their ancestors, *Utux*, the villagers developed a cooperative model called "*Tnunan*" (*Gungtong Jingying* in Mandarin). The system integrates the traditional *Gaga* spirit with modern corporate concepts. The lodging facilities, the restaurant, and the convenience store are collectively owned by the participants, who share all the work of running the businesses according to the chief's direction. In return, the participating households are paid in accordance with the shares they hold (rather than the actual work they do), in addition to a fixed monthly allowance. Participants also enjoy a variety of benefits such as health insurance, various subsidies (for weddings, education, funerals, etc.), and access to emergency loans (Horng and Lin 2004).

Since the cooperative's establishment in 2001, visitors now can conveniently reserve rooms using the same telephone line, register at the same counter, and dine in the same restaurant. The income inequality among villagers has drastically decreased, and the negative impact of ecotourism on the environment has been greatly reduced. Smangus' achievement can be compared with two neighboring villages, Cinsbu and Smagus, which engaged in a similar type of ethno-ecotourism at about the same time. However, tourists visiting these free-market villages expressed their concerns with the on-going ecological deterioration in the nearby forest, and indeed these villages suffered much more serious mudslides than Smangus during the typhoon seasons (Su 2006).

Behind the visible achievement, however, the cooperative has faced various challenges in sustaining collective action. Some villagers, for example, had invested heavily in building lodging facilities, and thus needed income to repay the debts they carried. The community went through a lengthy negotiation process to develop a financial arrangement that satisfied all major concerns among participants. The Presbyterian Church appears to have played an essential role in the negotiation process. One participant openly stated that he had made his commitment to the deal because of his faith in God. When the final agreement was reached, the leader said in the prayer that he apologized for all the past contentions and promised to forget all past feuds so that they could all engage in the cooperative whole-heartedly and with God's blessing (Horng and Lin 2004).

Another threat to the cooperative is potential shirking. In the Atayal tradition, ancestral admonition, *Utux*, was an effective check on temptations to shirk one's work obligation. To secure ancestral blessing, one must follow ancestral teaching that included working hard for the community and abiding by *Gaga*, the community spirit. In modern Smangus, ancestral religion has been replaced by Christianity. Nevertheless, the Church regarded these ancestral tenets as moral principles that guided the secular practices of the villagers and therefore chose not to oppose them. Consequently, it appears that the Church has been a positive force promoting cooperation among members of the cooperative.

Discussion

The cases of the Tao and Atayal illustrate the complicated process of institutional adaptations not only as a response to harsh material environments, as cultural materialism has argued (Price 1982; Ross 1978), but also as a response to outside influences. Deep-rooted informal restrictions on appropriation and consumption of local resources may have been developed over long periods of time in response to material conditions and have unintended conservation effects, as shown in the case of the Tao. Yet the balance between nature and society might be undermined rapidly not because of any drastic change in the natural environment, but because of the erosion of the institutional foundations for natural resource governance.

The critical question becomes how societal transitions can be managed to meet the need of sustainable development and, more specifically, how elements of traditional culture and heritage can be utilized to restore local resource governance capacities. In both cases societies were exposed to outside influences that diminished their adherence to traditional institutions and beliefs, eventually contributing to the breakdown of the local resource governance systems. Such changes may be triggered by multiple exogenous sources, such as the introduction of new political and economic systems, advanced technology, and Christianity. Drastic social changes may lead to disequilibrium in nature-society relationships and thus fast depletion of natural resources.

External influences often interact with indigenous practices in unforeseen manners. As shown in the case of Tao, the introduction of motorboats, ironically as a goodwill gesture by the government, not only unleashed the resource extraction power of the local people, but also helped undermine the social cohesion associated with the building and operation of the traditional rowing boats. Initially, tribal taboos had prevented the Tao from fully embracing the powerful fishing tool. Yet as more and more

people converted to Christianity and began to lose their fear of punishment by the evil spirits, motorboats became more widely used to compete with external fishery activities, and tribal taboos against over-fishing began to lose their restraining power.

Similar scenarios can be found in the case of Smangus. Early conversion to Christianity made the Atayal more sensitive to other external sources of changes. When external political and economic forces began to undermine local resource control, the Atayal responded swiftly by selling their reserved lands to financial conglomerates or by practicing ethno-ecotourism at considerable ecological costs. Both cases show that, if not properly designed, government policies meant to empower indigenous communities may actually create undesirable consequences.

Opening up an aboriginal society to the external world may not inevitably lead to the destruction of community-based conservation. With the right circumstances, traditional tribal norms can adapt to external institutional forces in redeveloping sustainable conservation practices. As shown here, although the natural resource governance regimes in both the Tao and Atayal communities were under stress as a result of external influences, there have been differences in subsequent developments. The Atayal in Smangus were able to transform their social and economic institutions and subsequently resumed their role as guardians of the nearby forests, while the Tao on Orchid Island are still searching for ways to save the fast depleting coastal fishery.

Many contingent factors have contributed to the divergent developments in the two communities. One such factor is the underlying physical characteristics. Compared with the coastal fishery of Orchid Island, the local forest in Smangus has better defined physical boundaries, and it is much easier for the Atayal to control access to the forest by guarding the main entry points. The Tao on Orchid Island face a more daunting challenge because the flying fish are migratory species so that fishers from other parts of the region also have access to them. As argued by Ostrom (2005), a key condition for successful governance of a local common-pool resource is the presence of well-defined boundaries of the resource system and user group. Compared with the Tao, the Atayal have a better chance of maintaining sustainable use of their forest because they themselves receive most of the direct benefits from its preservation. The Tao face a greater challenge because any unilateral reduction in fishing on their part may not necessarily help preserve the fish stock.[9]

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[9] Despite this challenge, coastal fisheries are not doomed for depletion. While some aborigines are known to have depleted their local resources for short-term consumption (Aswani 1998), others have developed ingenious institutions to preserve their coastal fisheries (Schlager 1990).

Another possible explanation for the divergence in performance concerns differences in traditional social structures, especially in regard to their capacity for mobilizing collective action. For centuries, the Atayal in the mountainous areas were surrounded by other hostile peoples and had been adaptive to external challenges. They had to learn to deal with other mountain tribes, the Han from the mainland, and the Japanese. They defended their territory aggressively and their social institutions also developed to fit their need to live together as a collective. This sense of collectivity, *Gaga*, proved important in later institutional developments as tribal members tended to have a strong sense of trust, and to accept authoritative enforcement of collective rules.

In contrast, the Tao's natural environment segregated them from external threats for long periods of time. Except for such natural disasters as typhoons or droughts, they only had to deal with their fellow villagers, many of whom are related to each other through kinship. Although the Tao had developed some collective-action arrangements based on principles of reciprocity, they basically had a decentralized, individualistic society that would have a hard time to organize community-wide collective action. As external cultural challenges arrived, they confronted them more as individuals rather than as a group.

Another factor affecting the development of a new conservation regime is the compatibility between new and old belief systems. The Atayal's traditional belief consisted of more proactive elements. In it, ancestors' teaching, *Utux*, specified some moral principles for descendants to follow. Those who followed the teaching faithfully would be rewarded with good fortune and with chances to live with their ancestors in the afterlife. Such a positive attitude of ancestral belief fits well with Christianity, to which most Atayal were converted. Although the missionaries might have preferred the aborigines to be thoroughly converted to Christianity, they appeared to be more tolerant of traditional beliefs that helped reinforce Christian moral values. Atayal priests, indeed, have drawn on Christian beliefs as a tool to reactivate the traditional *Gaga*. In contrast, the Tao's taboo system involved negative sanctions by evil spirits (*Anito*). Even though the system had played a positive role in nature conservation, it was discouraged by church leaders as superstition. Without the endorsement of church leaders, most of them also community elites, it became difficult for the old taboo system to survive for long.

Conclusion

In summarizing several decades of research on common-pool resource governance, Ostrom (2005) argues that no matter how well designed a common-pool resource governance system is it is always vulnerable to threats arising from either

inside or outside. A robust system is one that can survive multiple threats over long periods of time. Although much has been learned about the basic design principles underlying many long-enduring community-based resource governance systems, less is known about how these systems can confront and survive various exogenous and endogenous threats. As argued by Agrawal and Gibson (1999), many common assumptions about communities—well-defined territories, small size, stable and homogenous residents, shared identities and understandings—are no longer the reality in most local resource governance situations. Indeed, most indigenous communities, no matter how remote, are inevitably connected to the outside world through various political, social, and economic linkages. To be successful in conserving their local natural resources, residents in these communities have to adapt their community-based institutions to these new realities.

Our study of the Tao and Atayal cases illustrates the challenges for such institutional adaptation. Foremost, our cases illustrate the holistic nature of institutional adaptation. Social institutions that are effective in governing natural resources usually have evolved as part of the larger physical, social, and political environments. Values and beliefs, no matter how they originated, are integral parts of social institutions, and play a crucial role in supporting them. Traditional values and beliefs, however, are not immutable. They can change accordingly when challenged by various modernization and globalization forces. Changes in values and beliefs may in turn create an institutional imbalance that upsets a delicate nature conservation regime.

Exposure to the modern world may not necessarily lead to the destruction of conservation regimes in an indigenous community. The key is to search for creative solutions that adapt traditional values and practices to contemporary realities and expectations. Our cases illustrate several factors that may affect the institutional adaptation process:

(1) The adoption of new religious beliefs (in our two cases, Christianity) may affect traditional cultural practices related to resource appropriation and use; and the extent to which traditional cultural practices are compatible with new religious beliefs affect the chances for successful institutional adaptation (which partly accounts for the smoother transition in the Atayal case than in the Tao case).
(2) Modern technologies and government policies may unintentionally undermine traditional conservation practices (as with the use of motorboats in the case of the Tao).
(3) The involvement of outsiders in a previously isolated resource system (tourists and non-Tao fishers in the Tao case, and tourists and developers in the Atayal case) may undermine traditional conservation practices.

(4) Being a mostly irreversible trend in the context of modernization and globalization, the involvement of outsiders needs to be managed rather than totally rejected (as in the Atayal case in which ecotourism allows outside tourists to enjoy the forests in a more sustainable manner).
(5) Physical characteristics may affect the ease of institutional adaptation. For example, it may be easier to adjust institutional arrangements for governing a resource system with well-defined physical boundaries (as in the case of the Atayal forest) than one with ill-defined boundaries (as in the Tao fisheries).
(5) Institutional adaptation often requires the resolution of various collective-action problems among resource appropriators, and the resolution of these problems can be facilitated by what Lounsbury and Glynn (2001) call "cultural entrepreneurs" who creatively forge traditional cultural traits into modern institutions, enhance the legitimacy of the hybrid, and overcome the collective-action problems that might impede new institutional development (an example being the church leaders in the Atayal case).

Although a two-case study offers insufficient materials to develop a theory that explains all possible scenarios, it illustrates patterns of interactions between human society and the environment, and the dynamics of institutional adaptation in the face of external pressures. While the physical world inevitably shapes configurations of the cultural and institutional arrangements, as cultural materialism has argued, institutional changes may also result from the interactions between different social and cultural systems. As more research is directed to examining the dynamics of institutional adaptation and innovation, this study echoes the current literature by emphasizing both structural constraints and human agency (Colomy 1998; Seo and Creed 2002). It also extends the current literature by showing how specific factors affect the institutional adaptation process.

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