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Democratization and capacity building for environmental governance: managing land subsidence in Taiwan

Ching-Ping Tang
Department of Political Science, National Chung Cheng University, 168 University Road, Ming-hsiung Chia-Yi, 621 Taiwan, ROC; e-mail: polcpt@ccu.edu.tw

Shui-Yan Tang
School of Policy, Planning and Development, University of Southern California, Lewis Hall 312, Los Angeles, CA 90089-0626, USA; e-mail: stang@usc.edu
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Abstract. A major challenge for any decentralizing regime is to develop more inclusive and participatory decisionmaking processes and to be responsive to conflicting demands from diverse constituencies while maintaining its governing capacity. Using Taiwan's experience in managing groundwater overextraction and land subsidence in its coastal areas, in this paper we demonstrate how democratization at its early stages may create added difficulties for the political system to face when trying to solve environmental problems. Yet in the long run, democratization may lead to an increase in participative and integrative governing capacities, bringing about more effective and equitable solutions to complex environmental problems.

By one definition, democratization means the development of institutional mechanisms that include a wider range of participants, a larger scope for participatory decisionmaking, and a more authentic involvement of the public in governance.[1] According to this definition, democratization may involve efforts to make the governing practices of well-established democracies more participatory and deliberative (Fung and Wright, 2003), or it may involve a dramatic transition from authoritarianism. In the former, political reforms can be undertaken in a piecemeal and orderly fashion as representative and administrative institutions are already well established and there is considerable consensus about what constitutes acceptable political practice. In the latter, that is newly democratized countries, many representative institutions have just been established, consensus on new political rules has barely evolved, and many historically underrepresented groups have emerged to make various demands on the political system. Amidst all these underlying changes, the governing regime is pressed to develop more inclusive and participatory decisionmaking processes and to be responsive to conflicting demands from diverse constituencies while maintaining its governing capacity.

There is, however, a curious gap in the literature regarding the evolution of state capacity in the context of democratic transition (Suleiman, 1999, page 141). If defined as "a set of individuals and organizations legally authorized to make binding decisions for a society" (Dryzek, 1996, page 36), the state includes both political elites and a large administrative system. Political elites—elected government representatives and officials, leaders of political parties, union and civic leaders, etc—usually play a key role in initiating democratic reforms and thus have been the focus of most of the literature on democratization (Diamond, 1999). In the literature, however, much less attention has been paid to the role of the administrative system, which is the key arena for carrying out various reform measures and for maintaining effective governance

[1] Dryzek (1996, page 5) distinguishes between *franchise*, *scope*, and *authenticity* as the key dimensions of democratization.

during the transition process. As the administrative system possesses the expertise and organizational resources necessary for daily governance, it is not feasible to replace or reconstitute it entirely within a short period of time. Yet this part of the state can become an obstacle for democratic reform because bureaucrats often perceive efforts to open up the administrative system as a threat to their vested interests. In the long run, however, the administrative system must interact with various political constituencies and adjust itself to a new set of political constraints that are quite different from those during the authoritarian era.

First, as it becomes more democratic, the discretionary power of the state becomes more constrained. The administrative system is put under the control of newly elected political leaders who might not have any previous connections to it. Procedural requirements for information disclosure and public participation are added to its decisionmaking processes. Indiscriminate coercion and intimidation, common tools used to enforce administrative decisions during the authoritarian era, are no longer viable in most circumstances. Second, check and balance mechanisms are introduced into the political system to ensure horizontal accountability of various branches of government. Administrative units are now required to contend with other competing administrative units, alternative knowledge centers, as well as various legislative and judicial units (Grugel, 2002). Third, multiple institutional channels become available for interest groups to access the policy process, potentially exposing decisionmakers to various rent-seeking influences. In other words, democratization is not only a process that requires the state to carry out reform objectives, but also to change the attributes of the state itself by redefining the limit of its power, a process described by Dryzek as "democratization *against* the state" (1996, page 46).

In what ways would these challenges to state capacity affect the governing performance of newly democratized countries? Take environmental protection as an example. Many theoretical and empirical studies have argued that stable democracies tend to pay more attention to environmental issues and have stronger state capacity to tackle them than authoritarian systems (for example, Congleton, 1996; Fiorino, 1996; Janicke, 1996; Payne, 1995). Despite these arguments, one can easily find examples showing a more complex picture among countries that have undergone democratization in recent years.

Writing in the mid-1990s, for example, Silva (1996) documented, from 1989, the mixed results of Chile's transition to democratic rule. The new democratic administrations since the fall of military dictatorship were more willing to address environmental problems by "drawing up fundamental legislation to address those problems, and by either creating or strengthening public institutions to administer them" (Silva, 1996, page 2). Yet the new political leaders found themselves compelled to yield to the concerns of major business interests by limiting the environmental protection efforts of the government to incremental strategies of tackling merely the symptoms but not the causes of environmental degradation.

Similar complexities have also emerged in Asian countries that have undergone democratization in the past two decades. Lim and Tang (2002), for example, documented the positive effects of democratization on Korea's environmental governance capacity. But they also showed how increased local autonomy accompanied by democratization has contributed to increased environmental conflict among local jurisdictions. During democratic transition, local government officials became more responsive to their local constituencies, and the central government began to lose its tight grip on local governments. When environmental conflicts arose across local jurisdictions, there were few institutional mechanisms that would enable government officials from different

jurisdictions and levels of government to arrive at mutually agreeable solutions, and this resulted in prolonged political gridlock.

These experiences and those in other countries show how the democratization may have mixed impacts on the environmental governance capacity of a country.[2] Many environmental problems, for example, involve large numbers of individuals who suffer from the spill-over effects of actions undertaken by a relatively small number of individuals or firms. Some air-pollution and water-pollution problems may be caused by a few factories, but their adverse effects are suffered by many, even in places far away from where the pollutants are first emitted. During the authoritarian era, government authorities might easily have chosen to close down these factories, but they might also have chosen not to do so if they decided that the polluting factories were key to their economic-development strategies. In a more democratic setting, popularly elected officials may have an incentive to develop policies to limit the polluting activities if the electorate begins to raise concerns about them. But these officials may also be influenced by a small number of polluters who are better organized and resourceful in pressing their case in the policy process. Following this logic, one cannot definitely predict, at least in the short term, that democratization will increase state capacity in solving environmental problems.

Yet in the long run, compared with authoritarianism, democracy does have some advantages, especially in regard to building up what Janicke (Weidner and Janicke, 2002) called the participative and integrative capacities of environmental governance. With respect to participative capacity, democratization helps create policy channels and processes that are more open to inputs from diverse social groups and scrutiny by the mass media. This helps counterbalance the influence of economic development interests that tend to be more dominant in authoritarian settings (Tang et al, 2005). In addition, many environmental problems cannot be solved solely by government regulations, but require the active involvement of organizations from multiple sectors—public, private, and nonprofit—in gathering relevant information, devising solutions, and implementing community-based conservation programs (Agrawal and Gibson, 2001). In comparison with an authoritarian system, a democratic system is more conducive to the emergence of these cross-sectoral and community-based solutions to conservation problems, as it provides more freedom and opportunities for nonstate actors to get organized (Gibson et al, 2000).

As the participative capacity of a governing system increases, its integrative capacity may suffer initially because the policy and administrative systems may easily be overloaded by irreconcilable demands from multiple groups. Yet, in the long run, officials in the policy and administrative systems will likely be compelled by political circumstances to learn to develop more sophisticated solutions by involving multiple policy stakeholders and multiple approaches in conflict resolution. In the process, the integrative capacity of a governing system can be gradually built up by incorporating more policy discourse, more participants, more complex networks, and more politically viable criteria and values for judging policy performance.

In this paper, we illustrate how democratization has contributed to the development of these governing capacities, and how they have contributed to the solution of a specific environmental conservation problem in Taiwan—the problem of coastal land subsidence associated with groundwater overextraction. Before discussing the case, we provide in the next section a brief overview of the past two decades (mid-1980s to 2004) of democratization in Taiwan.

[2] Case studies have accumulated in the past decade, for example, see Baker and Baumgartl (1998), Brown et al (2000), and Cherp (2001)

Two decades of democratization in Taiwan

Riding on the 'third wave' of democratization (Huntington, 1991), Taiwan has undertaken a drastic transition from authoritarianism to liberal democracy in the past two decades. Since the mid-1980s, the ruling party (the Kuomintang, KMT) has undertaken a number of landmark steps towards democratization—lessening control on the mass media in 1985, tolerating the formation of the opposition party (Democratic Progress Party, DPP) in 1986 and granting it legal status in the following year, and lifting martial law in 1987.[3] Political liberalization was soon followed by increased electoral competition, with the opposition party gaining a critical number of seats in the National Assembly and the Legislative Yuan in 1991 and 1992, respectively, giving the opposition party some political influence (Cooper, 1998). After several rounds of constitutional reforms, the first direct election of the president was eventually held in 1996.[4]

Although the opposition party did not defeat the KMT in the ballot and did not win the presidency until the 2000 election, many democratic institutions had been introduced before then to make public policymaking more accountable and responsive to the public. Such sunshine laws as the Act of Asset Disclosure by Public Functionary (1993) and the Governmental Procurement Act (1998) were introduced to reduce the influence of undue private interests on public officials. According to the revised Public Service Act, public officials are prohibited from engaging in related private businesses right after leaving their government positions.

Other less-publicized reforms began to target governing behaviors that had traditionally been free from public scrutiny. Through a number of legislative enactments and judical reinterpretations of existing laws, additional legal provisions were established to safeguard human rights and to encourage public participation in policymaking. A notable example was the abolition of the notorious Article 100 of the Criminal Code, which had allowed the government during the authoritarian era to arbitrarily prosecute political dissidents for spreading or advocating 'rebellious' opinions. Other new legislation such as the Administrative Procedure Act and the Environmental Impact Assessment Act mandate public consultation and hearing processes before major official decisions are made. Many other special rules were also added in different acts and codes to assure bureaucratic responsiveness. A key example concerns the Public Nuisances Prevention Act, which specifies that officers-in-charge must formally and promptly reply to citizens who filed complaints through any channels (for example, via telephone calls, letters, or e-mail). Officers are subject to disciplinary action for failure to do so. These legal requirements accumulated quickly and imposed profound constraints on administrative action. Yet these requirements also create institutional incentives for government officials to work with various social groups to solve complex environmental problems.[5]

The case

Our case on land-subsidence management in Taiwan illustrates, on the one hand, how democratization may overload the governing capacity of the state; it also illustrates, on the other hand, how democratization may trigger the state to improve on its participative and integrative capacities for dealing with larger and more complex

[3] For detailed discussions on possible reasons why the KMT undertook these democratic reforms, see Myers and Chao, 1998. Rigger (2001) explores the same story from the perspective of DPP's development.

[4] For a good overview on Taiwan's democratic development, see Tien and Chu (1996) and Wong (2001). See also Bellow's (2000) interesting comparison between Taiwan and Singapore.

[5] Case studies on how these democratic reforms have impacted public policymaking are still very limited. Some exceptions are Tan (2000), Tang (2003), Tang and Tang (2000), and Wong (2003).

environmental problems in ways that would not have been possible in the context of authoritarianism. In the following sections, we first describe the origin and development of land subsidence in Taiwan, and then analyze how the state responded to the problem during its democratic transition.

A successful aquaculture policy

Land subsidence has become a noticeable problem in the Taipei Basin since the late 1960s, and the same problem has been found in the southwestern coast extending northward along the western coast to the middle and northeastern coast of the island. According to an official survey, since the 1960s the accumulated amount of subsided land has increased to 1747 km^2 (in the year 2000), which is approximately 6.4 times the area of Taipei City and is around 16% of the entire plain area in Taiwan. Except for the Taipei Basin, where groundwater extraction was successfully controlled and land subsidence effectively stopped, land subsidence in most other areas has continued, with average annual rates from 1.3 cm to 10.4 cm (figure 1).

Land subsidence may be caused solely by such natural events as the spontaneous dissolution of subsurface limestone rock or the compaction of soils associated with earthquakes or volcanic activities. Land subsidence is recognized as an environmental problem, however, when it happens on a large scale and is caused mainly by human activities, such as the removal of underground water. In addition to its impact on local ecological systems, land subsidence in coastal areas may create huge social and economic costs. An obvious consequence of uncontrolled land subsidence is that some beaches and coastal territories become forever submerged under the sea. Although most populated areas that have been experiencing land subsidence are protected by enhanced sea walls, a dramatic drop of land elevation could undermine the function of the sea walls and thus subject local residents to the threats of rollers and waves, especially during the typhoon season. Other problems could be inundation and floods (associated with either loss of elevation or destruction of drainage systems) resulting in salinization of arable lands, damage to buildings as well as surface and underground infrastructures (for example, bridges and highways, and gas and water pipelines), destruction of aquifers thus reducing groundwater storage

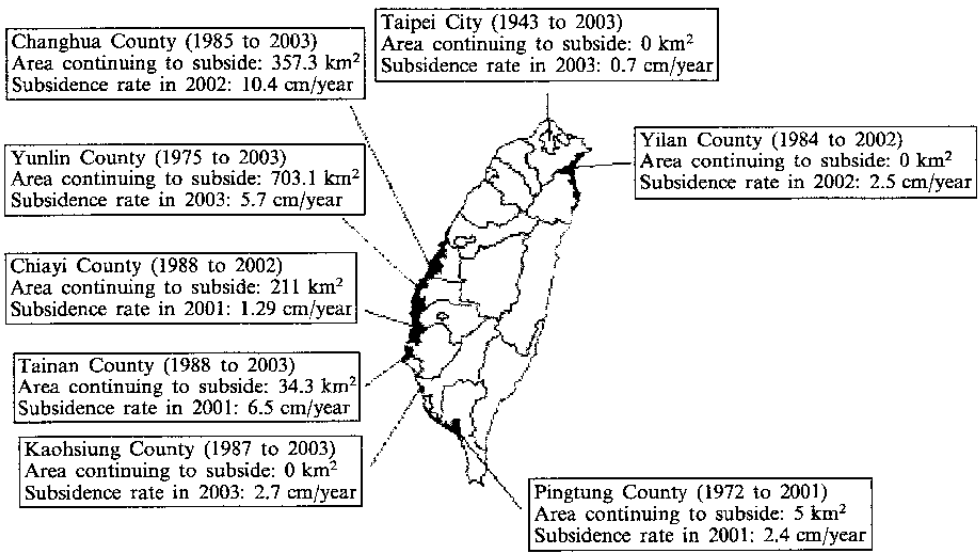

Figure 1. Areas of land subsidence in Taiwan (translated from Lu, 2004).

capacity, and intensified erosion of coastlines [US Geological Survey (USGS, 2004); Lu (2004)].[6]

The large-scale land subsidence in Taiwan is caused mainly by overextraction of groundwater for industrial, agricultural, and, especially, aquacultural use (Lin, 1998). Intensive use of groundwater started as early as 1958, when the provincial government began a policy of promoting aquaculture in the southwestern coastal areas. Many areas in this part of Taiwan are unsuitable for agricultural activities: the headwind is very strong and salty in the winter; as the areas are located near the mouths of rivers surface-water supply is either insufficient or polluted because of upstream uses of the rivers; most land is barren because much of the soil has become salinized as a result of seawater inundation during stormy conditions. Until the late 1980s, there were no major industrial projects in these areas. Residents in these areas mostly lived below the poverty line, and most young people chose to leave the areas for better employment opportunities elsewhere. To improve the economic conditions and enhance social stability in these areas, the government began in the 1960s to develop policies to promote the aquaculture of these areas—mostly in the form of freshwater farms for raising such delicacies as eel, milkfish, and prawn. There were several reasons for these policies. First, land in these areas was less arable and thus was much cheaper than most other areas on the island. Aquaculture does not require high-quality, fertile lands. Second, aquaculture as a labor-intensive business could provide employment for excess labor in the areas.[7] Third, the warmer weather in these areas allowed fish and shrimp to grow faster than in other places in Taiwan.

Because of these local conditions, governmental policies for promoting aquaculture worked extremely well in terms of improving local residents' economic conditions. Just like other successful export-led farming and industrial policies in Taiwan's economic history, government agencies were effective in helping individual businesses to participate in the world market. Besides organizing associations to search for export markets for specific products, the government also offered loans to interested individuals, engaged in research and development activities via an official agency (Fisheries Research Institute), and then transferred necessary knowledge and skills to eligible farmers (Chen, 1998).

Despite these effective strategies, all government entities involved with aquaculture policy neglected to tackle one key issue—the supply of fresh water. Aquaculture demands huge amounts of good-quality fresh water. Every acre of eel farm, for example, needs about 3300 to 5500 tons of fresh water per year. Since aquafarms were mostly located downstream of irrigation systems, it was a formidable challenge for farm operators to maintain a stable supply of water that met their operational standards. Incidentally, though, as these areas were sparsely populated at the time, groundwater underneath the areas had remained largely intact and was easy to access. Aquafarm operators were able to obtain sufficient amounts of good-quality water at relatively low cost by pumping from their own wells.

As a result of the great economic success of aquaculture policies, aquafarms quickly spread along the southwestern coastal line, turning 6.8 million acres of barren land into an aquacultural bonanza. The entire aquaculture industry generated New Taiwan (NT)

[6] Overextraction may also lead to the contamination of remaining groundwater. "When underground water levels drop drastically, sediments lose their porosity and become compacted, the minerals they contain may emerge and mingle with the remaining groundwater, causing water quality to decline. In a coastal basin, such a fall may allow seawater to intrude into the freshwater in the aquifer" (Blomquist, 1992, page 17).

[7] Since fish and shrimp are highly sensitive to water quality (temperature, oxygen level, germs, and viruses, etc), they require intensive monitoring and care around the clock.

NT $32.5 billion (roughly one billion US dollars) in national income in 1996, supporting 41 000 families (161 000 individuals), with an average household annual income of NT $797 000—somewhat lower than the national average (NT $826 000) but substantially higher than the average in the agriculture sector (NT $725 000).[8] This particular sector was also competitive in the international market. In spite of higher labor costs and land prices in Taiwan, farmers were able to offset these higher costs by maintaining a high level of productivity. The productivity of shrimp farms, for example, reached 57 kg/acre in 1995—more than four times higher than that in Central America (for example, 11 kg/acre in Ecuador) and seven times higher than that in South Asia (for example, 7 kg/acre in Indonesia). From a macroeconomic perspective, Taiwan's aquaculture industry has been a great success in the past few decades. Taiwan, for example, earned the title of 'the Kingdom of the Eel' in the 1970s, and 'the Kingdom of the Giant Tiger Prawn' in the 1980s (with 95 000 tons of production and 42 000 tons of exports in 1987, both ranked at the very top of the world). More recently, major production has shifted to milkfish and then back to eel again—making Taiwan the sixth largest aquaculture producer in 1994 (Chen, 1998).

Behind these dazzling records, however, was an emerging crisis. Promoting aquaculture was another 'develop first, pay later' incident typical in Taiwan's economic history. As the government did not offer such infrastructures as reservoirs and aqueducts to assure an adequate supply of fresh water to aquafarms, farm operators had no choice but to help themselves by drilling wells to pump groundwater. Strictly speaking, many of these wells were illegal because they were not registered with governmental agencies.[9] However, government authorities seldom took action against these wells because it was common practice and most agreed that it resulted from the failure of the government to supply enough water to meet local farmers' needs. Unregulated groundwater extraction eventually created what Hardin (1968) called "the tragedy of the commons".

Groundwater is a typical renewable common-pool resource (Ostrom, 1990). When many people can conveniently access it without restriction, the incentive for each appropriator in the absence of basin-wide agreements is to extract as much as he or she needs without considering the consequences of overextraction such as land subsidence. If many people in a community rely on the same groundwater basin for earning a living and there is a fear that water from the basin will be exhausted soon, appropriators of the basin may be motivated to engage in an extraction competition (Feeny et al, 1996), for example by using larger pipes and more powerful pumps. Whoever gives up pumping the groundwater would be a 'sucker' because this individual would lose the benefits that other individuals have but would not be able to escape from bearing the costs of land subsidence caused by groundwater overextraction.

The failure of initial countermeasures

The 'tragedy of the commons' was exactly what happened in the southwestern coastal areas where aquafarms were widespread and the demand for groundwater grew dramatically, especially during the 1970s and 1980s when eel and prawn farms proliferated and became major foreign-exchange generators. According to an official survey, the safe yield of nine groundwater basins in Taiwan was estimated to be about 400 billion m^3/year, but the extraction amount had climbed from 320 billion in 1975 to 710 billion in 1995, with an overextraction rate as high as 178%. Although only about

[8] For related statistics, see Chen (1998) and Directorate General of Budget, Accounting and Statistics (2002).

[9] Not all unregistered wells are illegal, however. The Water Conservation Law stipulates that it is not a requirement to register smaller wells (with an extraction amount of less than 144 m^3/day).

32% of the total extracted amount was for aquacultural use (compared with 45% for agricultural use), these aquafarms were located mostly in the coastal areas that were geologically very sensitive to rapid groundwater extraction. In other words, aquaculture eventually suffered from its own success—land subsidence and groundwater contamination due to saltwater invasion which started in the 1970s (Cheng, 2004). By 2001, the affected areas totaled 1747 km^2, roughly equal to 4.7% of the entire island area (36 000 km^2) or more than 11% of Taiwan's plain area.[10] Some areas have subsided as much as 2.26 m in the past three decades, while many places continue to subside more than 10 cm/year. At this rate of subsidence, many public infrastructures under construction, such as the high-speed rail system, will suffer from insurmountable technical problems.

It did not take long for the government to recognize the crisis and its causes. The central government undertook its first effort in 1969 to control land subsidence in the Taipei Basin where the capital is located. Strict control of groundwater extraction was enforced under the central government's administrative order "Groundwater Control Ordinance for Taipei Area". When subsidence in the southwestern coast of the island (which started mainly in Pingtung County) was identified, another ordinance was passed in 1971 to incorporate the area in restricting the use of groundwater in geologically sensitive areas island-wide. This ordinance has since then been revised several times,[11] with more and more areas classified as restriction zones.

Government efforts appeared to have worked in the Taipei Basin, in which an iron-fist crackdown on illegal pumping was deployed soon after the announcement of the groundwater extraction ban. The crackdown was further aided by the government supplying alternative sources of fresh water. In addition, most economic activities in the Taipei Basin did not require intensive use of water after all. The level of groundwater began to rise again after 1978 and land subsidence slowed down and eventually stopped in the 1980s (Lee, 1989).[12]

Similar results failed to materialize in the southwestern and central coastal areas, which presented a more complex set of problems than those in the Taipei Basin. One of the problem areas was the inconsistent policies promoted by different government agencies. For example, although the Water Conservation Bureau (of the Taiwan Provincial Government) tried to control groundwater use,[13] the Fisheries Agency, which was subordinated to the Council of Agriculture (COA, a cabinet-level agency), was still actively promoting in the areas which were eel farming for export, regardless of the issue of fresh-water supply.

Another major problem concerned the effectiveness of the enforcement system. In these areas, most aquafarms violated some extraction regulations—the vast majority

[10] For related statistics (in Chinese), see http://www1sprc.ncku.edu.tw/now00.htm.

[11] For the contents of the Groundwater Control Ordinance for Taipei Area (in Chinese), see http://wr.wra.gov.tw.new_raws/910206b.htm.

[12] The rise of groundwater level has also caused other problems. Some underground infrastructure developments, such as subway systems, are subject to greater water pressure than originally anticipated by the designers. Rising groundwater levels also make cities more vulnerable during an earthquake because dry soil could easily dissolve in water and move when an external shock occurs (interview with the manager of the Land-subsidence Prevention and Reclamation Corps, 6 August 2004).

[13] The Water Conservation Bureau was originally subordinated to the Department of Reconstruction, Taiwan Provincial Government. It was promoted to Department of Water Resources under the direction of the provincial governor in 1997. After the reorganization of the provincial government in late 1998, it was further integrated into the Water Resources Agency under the Ministry of Economic Affairs.

of them used unregistered wells; many even used electricity without paying fees; and some violated zoning restrictions on land use. If the governing bodies intended to prevent groundwater pumping, there were many legal instruments available. The problem, however, was a lack of genuine effort in enforcement by local government officials, who had a rather different set of incentives from the officials who designed the regulations at higher levels of government.

For the professional bureaucrats in the central (and provincial) government, the problem of land subsidence could be solved in a straightforward manner. As groundwater overextraction was clearly the main cause of land subsidence, it made perfect sense to crack down on illegal extraction activities. Many of the central government bureaucrats had engineering or economics backgrounds, and they often had limited appreciation of the social and political consequences of a government crackdown on illegal groundwater pumping. In addition, these bureaucrats were responsible for the enactment of regulations, but not their day-to-day enforcement; and they tended to neglect the political difficulties local officials might encounter when enforcing those regulations.

In contrast, local government officials, as designated regulation enforcers, were in frequent contact with the local residents, and they tended to be more sympathetic with the economic hardships suffered by aquafarmers in the event of a crackdown on illegal water pumping. As democratic reforms progressed and local electoral competition intensified after the mid-1980s, local officials became more sensitive to the electoral implications of their enforcement actions. In these areas, the lower the government level and the smaller the jurisdictional boundary, the more likely that members of the constituency were involved with aquaculture in some way (through either business or family connections), and the less likely that local officials could restrain groundwater pumping without suffering from electoral backlash.

In addition to political considerations, there were other socioeconomic, and perhaps ethical, considerations that made enforcement difficult. It was indeed government authorities that had initially promoted aquaculture as a solution to the poverty problem in these areas. Yet they had done so without providing the farmers with an adequate water supply. Now the local residents were able to lift themselves from poverty by running successful aquafarms, but government authorities were threatening their livelihood by cracking down on their 'illegal' groundwater extraction.

As a result of these various factors, government authorities have for decades failed either to persuade or to force the aquafarmers to give up illegal groundwater extraction in the areas. Although 170 000 out of 190 000 wells (about 89%) in the country were unregistered (Hsu et al, 1995), according to reports less than 4000 had been sealed by 2004 (Lu, 2004, page 9). On rare occasions a local government might take a strong position against illegal groundwater users. Yunlin County Government, for example, attempted to crackdown on the illegal groundwater users in Mailiao Hsian (a township) out of concern that land subsidence was threatening the construction progress of the Sixth Naphtha Cracker Plant, a huge development project by the Formosa Plastic Group.[14] Although on sound legal ground, the crackdown encountered violent resistance by the aquafarmers and attracted considerable media attention. The incident appeared to have tainted Magistrate Liao's political career.[15] Lessons like this have

[14] The Formosa Plastic Group threatened to withdraw its investment if the government failed to control land subsidence. The area targeted for crackdown was mainly within the construction site of the Sixth Naphtha Cracker Plants.

[15] Although there was no direct evidence showing how this might have influenced the next magistrate election (in 1997), the faction of the incumbent magistrate (Liao) did lose that election to its adversary faction (Lin).

made local governments reluctant to cooperate with upper-level governments in cracking down on illegal groundwater users. In response to the continuous demand by the central government for enforcement, some local governments chose to implement the policy in a perfunctory manner by sealing wells which had already been abandoned, and some others simply refused to follow the directive (Lu, 2001).

The emergence of more effective measures

Because land subsidence is a problem, the cause of which goes beyond illegal groundwater pumping, it is not likely to be solved entirely by attempting to crackdown on it. Yet before the 1990s, all major policies for tackling the land-subsidence problem were designed by the Water Conservation Bureau of the provincial government, whose main mission was water preservation rather than land-subsidence prevention. When the Water Conservation Bureau was trying hard to stop land subsidence by limiting groundwater pumping for aquafarm activities, it found that another central agency, the Fisheries Agency of the COA, was conducting a contradictory policy of assisting aquafarms to expand their businesses. In response to an appeal to reconcile the conflict, Prime Minister Hao Po-Tsun ordered the COA to come up with a solution to the land-subsidence problem. As a result, the COA proposed its own ambitious crackdown plan in 1992, paralleling the efforts of the Water Conservation Bureau.

It did not take long to prove that the COA was no more effective in coping with the problem than the Water Conservation Bureau. The COA was not originally designed as a regulatory bureau. In the past, it had been relatively effective in providing valuable services to its clients, such as transferring agricultural technology to farmers, providing relief to farmers who suffered from natural disasters, and stabilizing market prices of agricultural products. Yet, as a 'council', the COA lacked surplus staff, let alone well-trained ones, to enforce regulations on its clients. As a result, it had to rely on local governments to carry out the enforcement. Unsurprisingly, the plan failed as before because the incentive structure for local officers had not changed.

The year of 1993 witnessed a convergence of parallel efforts on tackling the problem. As its crackdown plan had encountered tremendous resistance, the COA began to seek help from other government agencies, especially those that had frequent contact with groundwater users. It organized a number of coordinating meetings of representatives from several related ministries. This series of meetings, however, did not lead to any major breakthrough as the thrust of all proposed solutions continued to be hard-nosed crackdown on illegal aquafarms. The participating agencies proceeded to organize a 'Central Supervisory Panel' to deal with local resistance, which subsequently developed a priority list for illegal-aquafarm crackdown. For example, a priority target would be those illegal aquafarms on the riverbed that would interfere with the drainage of floodwater. Although cooperative measures, such as assisting farmers to develop other businesses, were mentioned every once in a while, concrete measures were seldom seriously considered.

The policy window for addressing the land-subsidence problem reopened almost every year. Whenever a typhoon struck, subsiding areas would suffer from flooding, and complaints would surge. When a natural disaster occurred, local governments always attributed it to inadequate flood-control plans drawn up by the central government or to inferior infrastructure constructed and maintained by the central or provincial governments. The central government, on the other hand, would condemn local governments for failing to crackdown on illegal aquafarms, and would pledge to enforce the laws again. Nevertheless, repeated failures irritated national leaders. In a cabinet-level meeting, Prime Minister Lien Chan reassigned the task to the Water Conservation Agency (under the Ministry of Economic Affairs), which had an ambitious new head, with an

academic background.[16] This aggressive new director further invited representatives from the Fisheries Agency (of the COA) and other agencies to draft the "Land Subsidence Prevention and Reclamation Plan" in 1995.[17]

Being aware of the causes of past failures, in this plan there was no longer a single-minded emphasis on cracking down on illegal aquafarms. Instead, the agencies focused on the incentive structure of the concerned parties and incorporated multifaceted strategies in land-use replanning and industrial transformation in the subsiding areas, in developing alternative freshwater supplies, in public education regarding land subsidence, and in involving various nongovernment organizations in coordinating water-use practices among appropriators. A more comprehensive approach to solving the problem thus began to emerge.

A prominent feature of this program was the establishment of an integrated task force in 1998 to tackle the multidimensional nature of land subsidence, the Land Subsidence Prevention and Reclamation Corps (the Corps). Housed in a multidisciplinary research center (the Hydraulics Laboratory) of a well-known university (the National Cheng-Kung University) in southern Taiwan near to areas suffering from land subsidence, the Corps has good connections with both fishery industries and flood-control engineering communities. Thus the Corps occupies a strategic position in conducting research and in developing operational plans for solving the complex land-subsidence problem. In addition to being a consulting think tank for central government agencies, the Corps also serves as a coordinator among local and central governments—a role which used to be played by the provincial government and was abolished in 1998 as a result of a major overhaul of the governing structure in Taiwan. The central government no longer has to order its reluctant partners at the local level to carry out its plans. Rather, with the help of the Corps, local governments are now able to address the land-subsidence problem without necessarily undermining their own political and economic interests.

In addition to the special task force, the central government also created an ad hoc steering committee at the cabinet level, which was headed by the Minister of Economic Affairs and included the Construction and Planning Commission (in the Ministry of the Interior) in addition to the Water Conservation Bureau and the Fisheries Agency. Although this ad hoc committee was originally established to ensure that an adequate budget would be in place to implement plans for solving the land-subsidence problem, it happened to play a pivotal role in coordinating a complex network of government units that were involved in searching for solutions to the land-subsidence problem. One solution, for example, involved turning aquafarms into wind-shielding woods that would not only reduce the demand for groundwater, but also help conserve groundwater. The implementation of this policy required coordinated efforts in rezoning land

[16] The officers in-charge in the Fisheries Agency seemed to be happy to see this task transferred to another agency. They called the new officer in-charge of the Water Conservation Agency to offer their 'congratulations' in a relieved tone (interview with then officer in-charge, 10 August 2004).

[17] The Water Conservation Department in the central government had been very passive in the preceding decades. Although resource management and flood control were very important tasks in mainland China, the task force shrank substantially when the KMT retreated to Taiwan from the mainland. It eventually became a mere staff branch in the Ministry of Economic Affairs. With very limited personnel, this office was usually staffed by senior officers who liked to supervise the work of its subordinate organizations, mainly the Water Conservation Bureau in the provincial government, rather than designing their own policies. This passive organizational culture underwent a substantial change when a new director, Dr Shu, was appointed by a proactive Minister, Mr Chiang, in the mid-1990s. Dr Shu believed that land subsidence was caused by excessive groundwater extraction and the tackling of this problem should therefore be under the direction of water management agencies (interview with then officer in-charge, 10 August 2004).

use, in arranging seedlings, and in providing incentives for aquafarmers to stop their businesses, each by a different agency. The ad hoc committee provided a forum for representatives from various agencies to coordinate their efforts.

This new organizational configuration helped to promote a shift from an exclusive focus on cracking down on illegal groundwater pumping to a more comprehensive and incentive-based approach. Although cracking down on illegal groundwater pumping was still emphasized in some targeted areas, more attention was paid to various methods for reducing users' dependence on groundwater. Agencies were also required to explore alternative sources of surface water for the targeted areas and to develop more efficient water distribution and management systems.

One such approach was to help farmers shift from aquaculture to mariculture. This approach was especially attractive to tenant farmers who were interested in moving from traditional aquafarming on leased lands to using net cages in shallow seawater if the government would offer them technical and financial support to make the transition.[18] Another approach was to promote the culture of brackish-water fish, especially among owner-farmers who had access to seawater. By mixing seawater with fresh water, aquafarms could substantially reduce their demand for groundwater. The third approach was to help reduce water consumption by recycling used water. Using water-quality management and filtering technologies, farmers could not only reduce their reliance on groundwater, but also potentially reduce costs by saving on the electricity needed for pumping groundwater.[19] The fourth approach was to set up aquaculture parks (similar to industrial parks), in which many aquafarms could be served simultaneously by a central distribution system that combined surface water with groundwater, thus controlling the amount of groundwater needed. Carefully designed drainage systems could also help prevent possible contamination of fresh water thus reducing the total amount needed.

Some other strategies were also developed not only to cope with the problem of land subsidence, but also to help domestic aquaculture meet intensified competition in the international market. Programs, for example, were developed to help larger aquaculture operators to identify opportunities to move their operations to other countries in Southeast Asia and Central America. Some aquafarmers were encouraged to upgrade their businesses to fry cultivation, which is potentially more profitable than other forms of aquaculture. Fry cultivation requires much less water and land, and so can help reduce the demand for groundwater; it also requires more skills and techniques and thus is a higher value-added sector of the aquafarming industry.

In addition to government agencies and programs, a network of nongovernment organizations has also been involved in developing solutions to the land-subsidence problem. A number of research institutes have been involved in providing technical support. For example, the Land Subsidence Prevention and Reclamation Corps, mentioned earlier, has been running projects that measure the rate and scale of land subsidence and monitor changes in groundwater levels in different locations. Other institutes such as the Water Resources Management and Policy Research Center at Tamkan University have played an active role in educating groundwater users and the public about the causes and consequences of land subsidence. Other semipublic organizations like the National Yulin University of Science and Technology and the Industrial Technology Research Institute have been active in developing new techniques and equipment for water recycling and purification as a way to help aquafarms to reduce water use.

[18] There are two obstacles to promoting mariculture. One is the high fixed costs for running a mariculture farm. The other is the risk that net cages can be easily destroyed by strong currents.
[19] According to research, such technology would also increase productivity (Chen, 2001).

Furthermore, aquafarmers have begun to form voluntary-based organizations among themselves. One example is the membership-based Aquaculture Development Association of the Republic of China, which provides members with support services such as improved methods in shipment and marketing. The association has also served as a useful forum for enhancing social connections among users and for coordinating water use among them.

All these initiatives appeared to have produced tangible results by the end of the twentieth century. The total area of aquaculture was reduced from 52 000 acres to 39 000 acres; the total amount of groundwater extraction was reduced from 7.1 billion km^3 to 5.7 billion m^3. The total subsiding area was reducing from 1616 km^2 to 920 km^2. The rate of subsidence in the hardest-hit areas, like Yunlin, Chiayi, and Pingtung Counties, was slowed down substantially. Although some observers might still be disappointed by the overall results as some government targets have remained unmet, the initiatives on the whole did provide some tangible results in terms of actually slowing down the trend of subsidence.

Building governing capacity during democratization

Conserving groundwater and controlling land subsidence are no easy tasks in any political setting. As a common-pool resource, groundwater basins can easily fall prey to the 'tragedy of the commons' in which users are motivated to extract as much water as they need regardless of the collectively disastrous consequence of destroying the water-carrying capacity of the basin itself. Users may be able to develop self-governing institutions to limit use and to preserve a groundwater basin if a number of favorable physical and sociopolitical conditions exist—for example, a well-defined group of major users, a shared understanding among users about the geological features of the basin and the interdependency of their appropriation activities, and some preexisting social and political networks among users (Blomquist, 1992; Ostrom, 1990). In the case of the groundwater basins in Taiwan, these conditions were largely absent.

First, aquafarmers in Taiwan are usually small in scale and highly dispersed, and most groundwater basins are easily accessible to those who are able to drill a well at relatively low cost. It is inherently difficult to limit potential access to the groundwater unless an extensive monitoring system is adopted to crackdown on unauthorized users. Second, unlike users of many surface-water systems who can easily see the need to act cooperatively to construct and maintain water storage and diversion facilities, groundwater users in Taiwan seldom see an immediate need to work with each other in the process of appropriating groundwater. If one fails to pump enough water from a well of a certain depth, the convenient solution is usually to drill a deeper well. Finally, in the case of Taiwan, the boundaries of various groundwater basins are largely unknown to the users, and most users do not even know who is actually sharing the same basins with them. As a result, there is a lack of social networks and connectedness among users.

With these unfavorable conditions for the emergence of self-governing institutions among users, some type of government intervention or regulation is warranted. Yet government regulation in this case is subject to some classic political problems associated with a distributional configuration of diffuse benefits and concentrated costs (Wilson, 1995). The potential beneficiaries of government regulation in this case include local residents who suffer from floods and property damage associated with land subsidence, taxpayers nationwide who pay for recurring disaster relief and various flood-control works, and future generations who would benefit from the long-term preservation of groundwater basins. These beneficiaries, however, are numerous and

widely dispersed, thus suffering from the classic problem of needing to become collectively politically organized to protect their interests.

Government regulation, on the other hand, can cost a small group of aquafarmers dearly. With almost no alternative supply of fresh water in these coastal areas, an effective ban of groundwater extraction may lead to the total ruin of their businesses, investments, and land values. Thus aquafarmers are determined to resist any government ban on their extraction activities. Even though they are relatively small in number, they can potentially exert considerable influence on electoral outcomes in local jurisdictions. It is therefore difficult for local elected officials to be enthusiastic about a crackdown on groundwater extraction. In addition, unlike during the authoritarian era, since 1987 bureaucrats have found it increasingly difficult to enforce government regulations without regard to possible social reaction and various procedural requirements. All these points explain partly why attempts at a straightforward crackdown during the early stage of Taiwan's land-subsidence management failed dismally.

Neither has democracy allowed such serious problems to remain unsolved for long. Repeated mass-media exposure on the various disasters associated with land subsidence has helped to maintain public awareness about the issue and made it an embarrassment for the government agencies concerned as they were repeatedly pressed to explain the cause of their failure to solve the problem. For example, whenever a typhoon strikes, these subsiding areas suffer from inundation associated with drainage failure. Expecting such an incident, reporters with satellite news vehicles often arrive preemptively to catch the story as it breaks and, via the interviews with the victims, blame the governmental authorities for the drainage failure and inundation. As public criticism increases, bureaucrats have begun to feel the need to create innovative solutions to tackle the problem. As illustrated above, the new solution has involved a complex policy network of central-government agencies, local governments, and academic institutions. The new countermeasures created by the network no longer take operational convenience as the first priority, as was the case in the past. Although a crackdown on illegal aquafarms remains on the agenda, the emphasis has been shifted to service-oriented measures, such as helping aquafarmers to develop alternative production methods. To do this, collaboration among different agencies becomes a necessity.

Even in well-developed democracies, collaborative policymaking is difficult to develop and sustain because it is inherently difficult to initiate authentic dialogue and trust among a wide variety of stakeholders who come to the process representing divergent interests (Agranoff and McGuire, 2001). Being part of a newly democratized polity, government officials in Taiwan still have a lot to learn about how collaborative policy networks may work within Taiwan's specific cultural and political setting. Yet the very fact that they have been willing to engage in such initiatives creates opportunities for the governing system to grow in capacity. Indeed, an increase in governing capacity in Taiwan is evident not just in relation to land-subsidence management, but also in a number of other environmental-management issues. The government, for example, has made considerable progress in improving air quality island-wide by consulting with diverse stakeholders and by introducing a wide variety of market-based and incentive-based instruments on top of the traditional regulatory regime (Tang and Tang, 2002).

Conclusion

One important element of democratization is that public policymaking and implementation are subject to increased influence from diverse citizens and political groups. In some cases, extensive and intensive public involvement in policy debates may force government officials to consider a wide range of interests before making public

decisions. Yet if an issue is highly polarized among the stakeholders, a government may find it difficult to reach any politically feasible decision. These scenarios often result in gridlock and can undermine the governing capacity of the political system. As evidenced in our case, these problems can be further exacerbated as political authority is devolved to local jurisdictions, whose political agendas may conflict with those of the central government, thus undermining its environmental governing capacity.

Despite these potential problems, as illustrated by our case study, a more open and democratic system may create opportunities for enhancing, in the long run, the participative and integrative capacities of the governing system, both of which are crucial for resolving complex environmental problems. Participative capacity is enhanced as information about complex environmental problems becomes more available, and organizations from multiple sectors are involved in solving them. Integrative capacity increases as government officials are motivated to search more actively for comprehensive solutions to complex environmental problems by trying different approaches and by involving different sectors and groups in developing solutions to the problems.

In comparison with their authoritarian counterparts, democratic regimes are also more likely to develop environmental policies that are more sensitive to divergent interests in society, especially those of the social groups that are traditionally disadvantaged. Although the rich and the politically well-connected may still have disproportionate influence in a democratic polity, the traditionally disadvantaged groups often fare better in a democratic than in an authoritarian polity as they have more chances to have their plight heard by decisionmakers. It is more likely that when making environmental policy, a democratic polity will be more sensitive to the interests of the underclass.

Although democratization in no way guarantees an increase in environmental governing capacities, our case illustrates a hopeful scenario in which democratization can bring about more effective and equitable solutions to complex environmental problems.

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