

Institutional Analysis of the Tanowong Bwasao Irrigation System in Philippine
September 27, 2015

1 Part I: Static Analysis - Collective action

This case covers the Bwasao stream diversion irrigation system (an expansion of the traditional terraced irrigation system; case #38 in SES library) of the Tanowong people who live in the western portion of the Mountain Province in the Northern Luzon highlands of the Philippines, located within the municipality of Sagada. The Tanowong people occupy four villages that live at varying altitudes, ranging from the bottom of the mountainside to the summit. The total population is estimated to be about 1,000 people. Despite living in discrete villages, the villagers seem themselves all as one sociopolitical unit and share the same cultural traits (i.e., Bontoc).

The key resources in the system are private land and shared water streams along with cultivated social capital between villages, including: shared culture, intermarriages and cooperative agreements. The key resource relevant to the commons dilemma faced by the Tanowong is water rights to the Bwasao stream diversion.

The original CPR report, developed in the 1980s by Edella Schlager and Shui Yan Tang at Indiana University, may be found at <https://seslibrary.asu.edu/seslibrary/case/34/cpr>. Coupled Infrastructure Systems framework is explained in more detail in Anderies (2014) <http://link.springer.com/article/10.1007/s11538-014-0030-z>.

1.1 The Commons Dilemma

- **The potential appropriation problem / poor coordination of appropriation:** When traditional irrigation system could no longer fulfill the needs of the community, a new water supplemental water source was sought out; this was the Bwasao stream diversion. This appropriation of the Bwasao stream created conflicts with a different community. The neighboring Agawa people also claimed rights to the Bwasao Stream. Due to initial unclear property rights regulating the Bwasao Stream, it was difficult for the Tanowong people to exclude other users from the Bwasao stream, even if they choose to invest in tapping this water source.

- **The potential under provisions of public infrastructure:** In order to construct the necessary 25 kilometer canal (hard-human infrastructure, "HI") to tap the Bwasao Stream, the villagers had to contribute a significant amount of voluntary labor work (soft-human infrastructure "SI"), which functioned well because of the existing dap-ay system (SI), that was developed under the traditional irrigation system, and monetary support from the government (SI). However, there remained a threat of both an internal and external free-rider problem to the hard public infrastructure. Internally, the Bwasao canal (HI) requires regular maintenance and community members generally participate without difficulty and penalties exist for noncompliance. Externally, the Agawa people (who did not contribute to the provision of the hard public infrastructure) tried to claim water rights to the stream after the new canal was built. The Tanowong people faced the challenge of (1) making lobbies to the central government so that they would be given the exclusive formal use right of the Bwasao stream (2) eliminating the threat from the Agawa people by helping them build another physical infrastructure system that could tap into a different water source. Tackling these challenges required a significant amount of soft infrastructure, including: voluntary labor, fees, and investment in social capital with neighboring villages (i.e., intermarriages with neighboring village, Pedlisan, expanded the sense of community of the Tanowong people outside their physical village).

1.2 Biophysical Context (IAD)

- **Natural infrastructure:** The Bwasao stream is north of the Tanowong village and maintains a strong, annual flow of water. The location of the Bwasao stream is relatively distant from Tanowong and much closer to the Agawa village, who felt that their proximity to the stream entitled them to it. At the time of the conflict, there were no formal water rights. Application for water rights by the Tanowong people would be soon be initiated, but the process of gaining the formal water rights through the local government would take almost two decades. Additionally, two irrigation system supplement seasonal rainfall to provide continuous water for private, terraced agricultural fields, used for growing both sweet potatoes and rice located on a mountainous sloped terrain. Furthermore, there is also a nearby pine forest, which when dense enough, functions as a watershed for the nearby villages and to external communities is a potential resource to harvest oleoresin.

- **Hard human-made infrastructure:** An original traditional irrigation system existed prior to the construction of another supplementary irrigation system, the Bwasao irrigation system, which consists of a dam and 25-kilometer ditches from the Bwasao stream to the Tanowong village. The Bwasao irrigation system was initiated in 1954 and took two years to complete. It was built by the Tanowong villagers and required self-organization of people to provide sufficient labor and supplemental monetary financing from the regional government of Sagada.

1.3 Attributes of the Community (IAD)

The Tanowong people occupy four villages: Tanowong (the mother village), Kadatayan, Nadatngan, and Madongo. About 1,000 thousand people lived in these villages around 1980. These four villages are homogenous in terms of culture and sociopolitical regime. Although living in discrete villages, the people see themselves as one sociopolitical group separate and distinct from their neighbors and there is much coordination in the social, religious, and political life of the entire group.

- **Social Infrastructure:**

- **Identifying resource users and public infrastructure providers:** Water resource users are the Tanowong people. As described, additional villages have been competing for rights to access the water source, as populations increase in surrounding villages. Types of public infrastructure providers in Tanowong include: (1) management and decision making regarding water use choices through the role of dap-ay; (2) financial support and formal recognition of water rights through government; and (3) public support through lobbying from local Congressmen.

- **Description of dap-ay:** The Tanowong are organized into different dap-ay groups. A dap-ay group consists of the families belonging to a particular dap-ay which in Tanowong would number up to thirty. There are four different groups of dap-ay in Tanowong. Multiple instances of a social unit called dap-ay exist in each village and these organizations function as social, political, and religious centers of village life. Through the dap-ay, various decisions regarding irrigation systems (e.g., labor allocation, fee collection, building a new physical infrastructure, etc.) are made and carried out.

- **Trust and solidarity within the community:** There is explicit competition and coordination between the dap-ay. The competition between the dap-ay is always within the framework of a "loyal opposition," with the welfare of the village remaining utmost in everyone's thinking. There is no known case of anyone being fined or punished for outright refusal to cooperate on the Bwasao irrigation project (including: building the dam, ditch and maintenance). Instead, there has been eager support from the community to initially build the hard public infrastructure; work crews were composed of villagers from both sexes and all ages, led by the old men. There was a strong feeling of common purpose and solidarity among the Tanowong people the as a result of the Bwasao project, that still prevailed in 1972. Additionally, funds from the government to assist with the Bwasao project garnered a new consciousness and favorable attitude toward the normally remote national government. Furthermore,

the irrigation system is a source of strong social cohesion among villagers, in that it provides the entire community with a central issue with which all members identify strongly with and can be a focal point during times of external conflict

• **Human Infrastructure:**

- **Experience/skills:** Because of the new project to bring water from the Bwasao Stream, villagers gained a new dimension of experience and education in leadership, particularly in the skills of negotiation with other villages and in dealing with a modern government bureaucracy. All of the formal and informal negotiations which the Tanowong undertook with the opposing village of Agawa, with her close neighbor of Pedlisan, and with the various government officials and agencies of the national government have been fertile fields of social and political experience for the villagers. This was especially true for the community leaders, who learned to deal with a much wider universe than the village and were able to progressively build skills and confidence in coping with internal and external challenges.

- **Knowledge:** Often each dap-ay is assigned responsibility for specific segments of regular projects like trail and irrigation repair. In such a case, year in and year out, the members of each dap-ay know exactly where to go at the appointed day or days of work. The Tanowong people were able to construct the dam in Bwasao and a ditch from it to their village even with no sophisticated surveying equipment. This remarkable engineering feat was made possible only through their indigenous knowledge from their detailed familiarity with the territory from years of hunting and foraging. In the spring of 1972 the people of Tanowong and Pedlisan united strongly in opposition to the owners of a paint manufacturing firm in Manila who wanted to gain concessions to tap for oleoresin in the local pine forests. This opposition to the exploitation of the pine forest resources is due to the realization of the correlation between the density of trees and the amount of available water.

1.4 Rules in Use (IAD)

Position Rules: There are 3 explicit positions mentioned in the research: 1) water user 2) dap-ay and 3) water distributor.

- **Water users:** Water users provide maintenance assistance for the canal to maintain water flow for all water users. The responsibility for maintenance rotates among water users and is communal during the dry season. From the start of the rainy season until the next season, irrigation is individualistic and not communal.

- **Dap-ay:** The dap-ay are the key decisions makers and decide how to implement decisions, such as how to collect materials or money, how to distribute labor for community trail and irrigation repairs, and also disseminate information throughout the village. The dap-ay divides the distribution of goods, money, or labor among its families and enforces their delivery. The dap-ay are also in charge of negotiation with other villages and the government.

- **Water distributors:** There are eight to twelve water distributors who govern the flow of water from the canal to different fields, as necessary.

Boundary Rules: Each member of the community can be a water user and can also assume the sub-position of repair crew-member, based on physical capabilities. The research does not describe the selection process of or requirements of the dap-ay. The water distributors are informally selected by the people on the basis of dependability, diligence, and fairness. While it is not explicit that females cannot assume the role of dap-ay or water distributor, there is no mention of a female holding this role.

Choice Rules: Every water user must contribute to the public infrastructure provisioning. Water users may withdraw water from the system but must not withdraw more than what is assigned to them by the water distributors. The water distributors must work on the fair distribution of water to the private

terraces of the water users. When there is unusually heavy damage to a segment, such as massive landslide, all villagers must help out with repair efforts, unless they are physically incapable. While not explicit that all water users must grow rice, traditionally each family has owned at least one rice field and payment to the water distributors requires a rice harvest.

Aggregation Rules: Community problems are discussed in individual dap-ay gatherings as well as village-wide meetings. Water distribution problems are resolved by the water distributors.

Scope rules: It seems that there are not clear rules of who can appropriate water in the system, neither are their clear physical boundaries of the system.

Information Rules: The water distributors have to go to the top of the mountain to overlook the terraces and exchange information of which part of the area will need water the most that evening. Any Tanowong villager can report violations of a dap-ay's civic duties, if they witness it.

Payoff Rules: Men from the village collect fines from those who failed to participate in repairing ditches during the communal repair season. The fines take several forms: money (one peso), rice (fine bundles), or a good drink and meal for the group. Water distributors are paid at the end of each harvest by receiving 5 percent of the total harvest.

1.5 Summary

The tightly knit social structure of the Tanowong community was instrumental in combating local problems. The organization of the dap-ay and the successful rules-in-use of the original irrigation system, provided the framework and necessary social motivation to initiate the diversion of the Bwasao stream project. Disputes over water rights to the Bwasao stream with the Agawa community (who did not contribute to the construction the Bwasao irrigation structure) required negotiation skills of the dap-ay and community action from Tanowong villages to the resolve the additional water—use threat from Agawa.

2 Part II. Dynamic Analysis - Robustness

This update extrapolates additional information collected regarding the current state of the Tanowong community, from a 2011 interview with the author of the original source document.

2.1 Update on the Commons Dilemma

While the original threat of new users (the Awaga) to the Bwasao stream was overcome by the skillful negotiation of the dap-ay and the community effort of all water users, new threats to water rights over the Bwasao stream are surfacing. Currently, in the nearby region of Sagada, populations are steadily increasing and so is the demand for water. The government officials in Sagada have been looking to the Bwaso stream as a potential water resource for their increasing needs.

2.2 Shocks, Capacities, Vulnerabilities

... to and of the Resource (link 7 to R)

- **Link 7 to R (shock):** Growing internal and external populations create shocks to the water resource in the form of increased demand. Internal pressures may include: (1) the expansion and increase in the number of terraces on the original site, (2) the construction of new terraces along and below the irrigation ditch which necessarily diverted water permanently, and (3) the denuding through careless cutting and frequent fires of the pine forest of the mountains in the environs of the streams which served as the source of irrigation water.

- **Link 1 between R & RU (cultural significance of rice):** Rice and sweet potatoes, both grown in the terraced fields are the main diet of the villagers. Rice does not grow easily in this mountain area and its cultivation is both time consuming and water-intensive. Nevertheless, rice is considered to be the best food by the Tanowong people because of its cultural significance (e.g., their religious ceremonies are

keyed to rice cultivation; payments are often made with rice). The alternative crop, sweet potatoes, are easier to grow and use less water, making it the most economical crop for the village.

... to and of the Public Infrastructure (link 7 to PI)

- **Link 5 between PI & Resource (R) dynamics:** Tanowong and Pedlisan are very similar culturally, closely situated, and traditionally friendly due to both intermarriages and shared territory (shared territories are a positive feedback of intermarriages). These factors result in them sharing water resources. Their established social capital played a critical role in preventing a paint manufacturing firm (RU) from gaining concessions to tap for oleoresin in the pine forests (R) whose function is to keep available water (R) in the Bwasao stream.

- **Link 2 between PI (water rights) & PIP (government):** In the course of placating the water conflict with Agawa, the Tanowong people became convinced of the necessity of obtaining government (PIP) sanction for their irrigation system as a means of ensuring permanent control of the water source to future potential encroachments. An application to the government for a water right, accompanied by a petition from the community, was filed early in 1956 to initiate the proceedings. In April 1972, the Tanowong village was granted a temporary water right (PI) certificate by the secretary of the Department of Agriculture and Natural Resources.

... to and of the Resource Users (link 8 to RU)

- **Link 1 between R & RU (capacities):** The Tanowong people (RU) recognized the water shortage for rice terraces and came up with the idea of tapping the Bwasao stream (R) as a new source of water. The Tanowong people were familiar with Bwasao stream because it lies within their hunting and gathering range; they knew the stream had a strong annual flow. Because this resource is steady and dependable, additional villagers have tried to become resource users of the stream; this has created tension between the Tanowong people and external villages who compete for the resource.

- **Link 6 between RU & PI (vulnerabilities):** Unclear water rights create tension among potential users. No sooner had the Tanowong (RU) begun work on their expanded irrigation project than another village, Agawa of Besao municipality, asserted claim to the water resource. After much negotiation between the leaders of Tanowong and Agawa, the Agawa people reluctantly agreed not to interfere further with the Tanowong project from 1954 to 1955. However, in 1970 the Agawa people tried to tap one of the springs above the Tanowong dam at Bwasao, relying on their previous claim that if at any time in the future Agawa should need water, the Tanowong were to share some with them. The Tanowong people were so upset that they let their determination be known to fight any incursion of their water resources. But their new negotiation was achieved with the help of the increasing number of intermarriages and the resulting joint ownership of rice fields: 1) The Tanowong people proposed that the Agawa tap another stream in the vicinity; 2) The Agawa argued that they would accept the Tanowong proposal if the Tanowong people would carry and install the pipes from the proposed water source toward the Besao municipal center; and 3) the Tanowong people finally agreed in order to eliminate the Agawa threat to their water source. Currently, growing populations in the region of Sagada (potential RU) have increased external interest in water rights to the Bwasao stream (PI).

... to and of the Public Infrastructure Providers (link 8 to PIP)

- **Link 3 between PIP & PI (dap-ay):** The traditional Tanowong irrigation system had existing social organization in the form of the dap-ay system; this system proved adequate for the construction and continuing maintenance of the Bwasao irrigation system. The Bwasao ditch is repaired annually every January. Different dap-ay are assigned specific segments of the ditch as their maintenance responsibility. As soon as the water is safely flowing through the ditch beginning from the Bwasao dam, the water distributors take over as in the pre-existing irrigation system.

- **Link 3 between PIP (congressman) & PI:** A Congressman (PIP) supported the Tanowong's Bwasao irrigation project with his "pork barrel" funds following his election to office. These funds supplied

additional labor needed to complete the irrigation work. After these government funds were expended, subsequent grants were obtained from the government for further work on the irrigation system (PI) for widening and straightening its course.

- **Link 2 between PIP (government) & RU:** The Bwasao irrigation expansion heightened the awareness of the Tanowong people (RU) of the national government (PIP) system as a source of financial, material, and technical aid. Earlier experience with the government was often negative, in that the government demanded taxes and free labor for roads and other kinds of construction, and demonstrated its power through incarceration of individuals in prisons. For a relatively isolated minority group, this positive development is of critical importance in furthering Tanowong's identification with and integration into the national political system.

- **Link 3 between PIP (villagers & government) & PI (communal forest):** Co-operation efforts between Tanowong (PIP) and Pedlisan (PIP) succeeded in protecting their pine forests from a paint manufacturing firm (competing RU). As a result there is a strong movement to have the surrounding forest areas declared a watershed or communal forest (PI) by the government (PIP), which would make them immune to outside exploitation for lumber or oleoresin.

2.2 Robustness summary

Internal shocks to the water resource occurred in response to the Tanowong people's increasing demands for agriculture (link 7 to R). While switching some agriculture from rice to sweet potatoes helped conserve water, rice is still grown as it is part of the Tanowong's cultural heritage (link 1 between R & RU). The Tanowong people have abundant indigenous knowledge of the Bwasao stream and its yield (link 1 between R & RU). The traditional social organization and pattern of maintenance established for the pre-existing irrigated terrace system (see case #38) proved adequate for managing the dam and ditches from the Bwasao stream to the Tanowong village (link 3 between PIP & PI). Financial support came from the local government and a local Congressman (link 3 between PIP & PI). The Tanowong people were concerned about future resource users who might try to lay claim to the Bwasao irrigation system (i.e., Agawa village and villages in Sagada) (link 6 between RU & PI). Therefore, the Tanowong people applied for an official water right to the Bwasao stream and were granted a temporary water right certificate in 1972 by the secretary of the Department of Agriculture and Natural Resources (link 2 between PIP & RU). Also, cooperation between Tanowong and Pedlisan succeeded in protecting their pine forests from a paint manufacturing firm. As a result there is a strong movement to have the surrounding forest areas declared a watershed or communal forest by the government, which would make them immune to outside exploitation for lumber or oleoresin (link 3 between PIP & PI). The Bwasao irrigation expansion heightened the awareness of the Tanowong people of the national government system as a source of financial, material, and technical aid. This positive development is of critical importance in furthering Tanowong's identification with and integration into the national political system (link 2 between PIP & RU). To this day, competing interests from the people in the region of Sagada threaten the Tanowong's use of the Bwasao stream.

3. Case Contributors

Heather Turrentine, School of Sustainability, Arizona State University

Shui Yan Tang, University of Southern California (case #38)

Cathy Rubinos, School of Sustainability, Arizona State University (case #38)

Hoon C. Shin, School of Human Evolution and Social Change, Arizona State University (case #38)