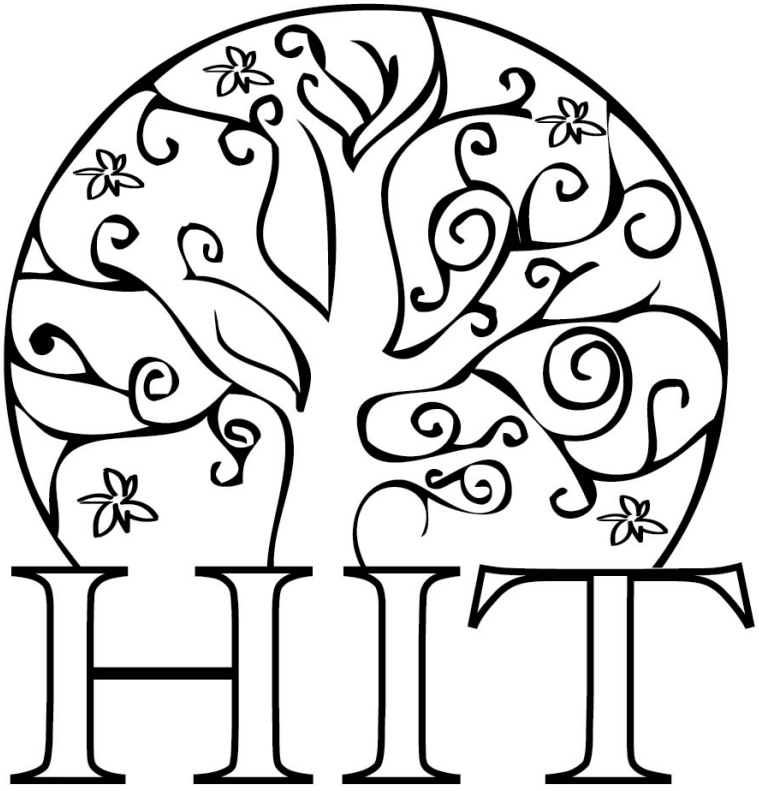


heritable innovation trust

**Amendment to original Trust document**

# Ecuador, Mongolia, and Papua New Guinea Documents

## 2012 Edition

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**New to This Document**

The 2012 Heritable Innovation Trust document includes one new community analysis for Navunaram and eight new Trust Items. These include the entries titled **Aigir**, **Bamboo Roofing**, **Ku**, **Lemongrass Cultivation and Processing**, **Mumu Tapioc Na Minmin**, and **Tolai Bandicoot Traps**. Both the Ku and Tolai Bandicoot Trap entries contain two processes or artifacts.

# Heritable Innovation Trust Foundation and History

Since the advent of seafaring and transcontinental global trade, two competing economic frameworks have attended the nature of civil and commercial engagement. In the Sino-Indus-Persian experience, loosely defined by the Silk Road, novelty of geographically defined products and knowledge were transacted across vast expanses. Trade, aided by the science of navigation and the cultural practices of metaphoric arts for multi-lingual communication, was a controlled commerce defined by those who were capable (and courageous enough) to venture outside their cultural or nationally defined boundaries to transact with a 'certain' unknown. Imperial impulses were imposed for trade efficiency and slavery of conquered peoples was typically a tariff extracted for non-compliance to trade agreements and tribute expectations. In the monarchy and Church-subsidized colonizing West, land and resources over which humans had ultimate perceived dominion led to impulses to 'claim' land for resources and people for labor. Wealth and value were defined by the colonizer rather than by the art, resources, and knowledge of the local populations.

Current global asymmetries in wealth distribution and access to well-being have provided the world with numerous opportunities to experiment with new, integral value exchange and economic models. Engaging this unique period in history affords communities the opportunity to explore new options of creating value exchange networks that challenge many consensus assumptions. Society, in general, needs to consider the humanity of new models of engagement so that previous injustices are not repeated. One new model available for consideration is that of the Heritable Innovation Trust, the framework for which is presented by Dr. David E. Martin in the International Bar Association's journal, *Convergence* ("Heritable Knowledge Framework and the Development of Communal Innovation Trusts: An Ethical Framework for Development, Stewardship, and Trade." Volume 5, Number 1, pages 106-112).

Heritable knowledge is manifest in four dynamics. The first principle is the recognition that knowledge of how to engage in and with a local ecosystem and its resources has been used or maintained by past generations and is utilized and adaptable for present and future generations. This is especially important because the heritability of the knowledge is derived from its ability to synthesize the environmental changes and technological advances of each generation. The second principle recognizes that knowledge is passed down and remembered through cultural customs, as opposed to strictly formatted documentation. Unlike knowledge "property" concepts like copyright, there is neither "creator" nor "created work" in a fixed temporal sense. Rather all are simultaneously stewards and adaptors. This knowledge is recorded through various forms of expression including, but not limited to, technological practices, normative behaviors or modes of engagement, language, paintings, ceremonies, carvings, song, dance, and storytelling. Thirdly, heritable knowledge is animated through constant consideration of its original intent. Without this consideration, the knowledge loses its value within the community and is increasingly vulnerable to misuse. When the values of the community take a backseat to individual aspirations the knowledge is no longer fulfilling its original purpose - serving the community. Since much of this knowledge is based in cultural traditions, respect for the community necessarily requires engagement within communal values which are celebrated when engaged and shunned when disrespected or circumvented. Finally, the knowledge cannot be owned by an individual or generation, rather it is stewarded by the community as a whole. This precludes exploitation or monopolization of the knowledge, as it cannot be sold because it lacks a single creator and therefore a legal transferring counterparty.

The aforementioned knowledge is managed under the framework of the Heritable Innovation Trust – a perpetual executory contract which exists in dynamic perpetuity. Unlike property and enclosure based systems, perpetual contracts – recognized by customary and civil law – provide the circumscribed manner of social engagement between sentient parties fully informed of each others' knowledge and intent. As the name of the trust suggests, the nature of this knowledge is, by definition, innovation as it is dynamic and constantly modifying to address contextual and cultural adaptations. The Trust is a compilation of the knowledge present in a community in a fluid document form, meaning that, like the knowledge itself, the document can be expanded and adapted as needed. Since the Trust creates a visible accreditation to a specific community or region, the knowledge cannot be monopolized by external constituents because it can be traced back to the area from which it came. The Trust provides a community and an outside party the framework for opening a two-way flow of information and to create a positive, lasting working relationship. Regardless of the extent to which the information is used, it is the outside party's immediate responsibility to reciprocate the flow of information. If the outside party desires to utilize a specific method or practice, for example, they must first obtain permission from the stewards of the Trust. If authorization is granted, information provided in the Trust flows to the outside party while its external use, including such things as its involvement in production processes or any discovered properties, flows back into the community, enriching both parties.

To inaugurate this model, M·CAM and Pacific Spices collaborated to form the Heritable Innovation Trust Internship of 2009. The purpose of the internship was to deploy the Heritable Innovation Trust program in an inaugural environment which integrates social, ecological and historical context diversity. East New Britain, Papua New Guinea was chosen for this location because of its abundant natural resources that provide multiple options within varying world-markets and it's deeply rooted and celebrated cultural heritage. Four university students from the United States were sent to engage with communities and, when offered information, document heritable knowledge and customs in order to establish the world's first Heritable Innovation Trust. They were based at the Pacific Spices plantation in Vunakanau. There, they recorded unique processing techniques and farmer-community empowerment strategies. Their first week was spent in meetings observing the provincial and national government systems. They then spent two weeks in and around the village of Raunsepna, and four days in the Komgi village with the keepers of Qaqet (pronounced "cock-ĕt")

customs[1]. In both villages they lived with different families, participating in everyday activities in order to experience firsthand the interplay between community, business and government. These specific locations were selected because of their pre-existing working relationships with Pacific Spices, a company already utilizing the reciprocal, socially responsible business practices outlined in the Heritable Innovation Trust framework.

Now reaching from the newest soil erupting from Tavurvur in Papua New Guinea, to the Ecuadorian Amazon, to the oldest and largest known empire on Earth in Mongolia, the Heritable Innovation Trust is diversifying and growing. The Heritable Innovation Trust framework has already linked people in unprecedented ways and is providing evidence that reciprocal knowledge networks can create perpetual benefit to whole communities and ecosystems. During the 2010 H.I.T. Internship programs in Papua New Guinea, Ecuador, and Mongolia, the Trust stewardship expanded both in size and scope. In 2009, the Qaqet communities contributed the first trust items to the world by means of the H.I.T. Their debut on the world stage was disseminated around the world reaching Parliaments in Europe and Asia, was studied by policy-makers in South America and Africa, and served to coalesce economic engagement conversations from New York to Auckland. Over twenty items were included in the first Trust; that number has expanded to now over 80.

The Heritable Innovation Trust (or "H.I.T.") is based on the six values expressed in Integral Accounting through:

- Commodity – those elements present in communities which, through cultivation, production or value-add, can be used to generate means of social or commercial engagement;
- Custom & Culture – practices and expressions of individual or community held values and traditions which create a context for social interaction;
- Knowledge – information and experiential awareness which can be transmitted through language, art, or other expressions;
- Money – modes of transmitting and recognizing value exchange using physical and virtual surrogates including currency, systems of credit and barter;
- Technology – the artifacts or schemes by which value-added experiences and production can be effectuated; and,
- Well-being – the capacity for any person or ecosystem to function at their optimal level.

It is worth demonstrating an example of the global consequence of the H.I.T. framework evidenced in the 2010 experience. Christmas Maradei, a member of the Anesmetki village near Raunsepna added a cooking method to the H.I.T. in 2009. In her teaching, she described the process of taking stones (usually river-rounded volcanic stones about the size of a softball), heating them in a wood fire and then layering them with uncooked vegetables and meats. The stones and food are sealed under leaves and cloths to steam cook the food (see the **Cooking with Volcanic Stones** entry). In 2010, Enkhbayar, a nomadic horse herder in Arkhanghai Province in Mongolia (at 47º 30' N; 101º 54' E) demonstrated a similar process. The river stones were heated in a wood fire, placed with fresh food and sealed – this time in an aluminum pressure cooker pot rather than covered in leaves and burlap. During the teaching in Mongolia, the team immediately shared the similarity in processes between the two communities' approaches. After the food was cooked, the team learned about an additional element (which was then shared with the Papua New Guinea communities one week later). The heated stones were removed from the cooking pot and handed – still scalding – to each guest who, for 30 seconds, tossed the stones from hand to hand to disinfect them before eating. This example shows how the knowledge to knowledge exchange opened a dimension that facilitated a transfer of well-being to the Papua New Guinea community from Mongolia.

Isolation, in most instances, is created by opacity in awareness and information. People can perceive themselves to be "alone" in dealing with challenges. This perception leads to considerable inefficiencies. Both challenges and opportunities are seen as individual, which, in turn, presents the basis for an illusion of innovation. Many "discoveries" or "inventions" are neither new nor novel. In fact, they are simply efforts, in a new context, aiming to solve the same problem that was manifest elsewhere. While one can argue that this redundancy in research, analysis and problem solving helps communities evolve, in a market-based proprietary world, it feeds an illusion of ideas becoming property. However, in the example above it is clear that communities separated by over 5,000 miles and millennia both found that the same volcanic river stones were ideal for cooking. They found that super-heating stones in a wood fire until the stones take on the same color is the perfect temperature with which to cook raw food. They found that food, prepared in this fashion, is best steamed. It would be illogical to ascribe "ownership" of these ideas to one community at the express ignorance of the other. In the H.I.T., the ability to link Trust Items by their borderless similarity actually creates improbable linkages which can serve as immediate connections for collaboration. Over the longer horizon, these observations can serve to aggregate like-minded communities to collaborate on new challenges as behavioral patterns evidence a cultural and contextual similarity.

[1] The term "Qaqet" is a name that we have chosen to use in lieu of the more conventional term "Baining". While both describe the same community, we have been made aware of some deep sensitivity to the ethnic history of the Baining term and, as such, we seek to honor the heritage of those about whom this report has been prepared and with whom the first Trust was compiled.

As you review the Heritable Innovation Trust, you are immediately receiving an Integrally Accounted investment. The communities of Ecuador, Mongolia and Papua New Guinea have decided that you are a person or community into which they would like to invest some of their knowledge. Pursuant to the Trust, you are obliged to communicate knowledge back to build the first step of the fortuitous cycle. However, this is not the end but rather just the beginning. From this first step of knowledge exchange, the diversity of engagement can move – as it did in Mongolia – to well-being. You may have technology, custom, or money that you can contribute to make an engagement grow. On one level, you are being invited to participate. On a deeper level, something more profound is possible. That is you are entering an accountable obligation to engage in a more thoughtful manner where by virtue of your participation, you are evidencing a new form of social consciousness. You are playing your part in manifesting a system that strives to reciprocate network exchanges that benefit all stakeholders on a human and ecosystem level.

# COMMUNITIES AND ENVIRONMENT

**East New Britain, Papua New Guinea**

**Environment and Ecosystem** *Date Entered: June 2010*

The Northern half of the New Britain island (referred to as the Province of East New Britain) has a total land area of 15,816 square kilometers and mountains with elevations reaching as high as 2,316 meters. These changes in elevation not only affect temperatures, but also have an effect on the growth rates of various crops, dividing them regionally. For example, cardamom, distilled for essential oils and dried as a spice, is primarily grown at higher altitudes while cocoa can be found throughout the lower elevations. Because of East New Britain's proximity to the equator (4° to 6° S), the province does not experience a wide range of seasonality. Instead, East New Britain has a nearly constant growing season intermingled with wet and dry seasons. Seismic disturbances as a result of volcanic activity are a predominant feature of East New Britain as well. Due to the number of active volcanoes in the area (6 with significant activity), the landscape and environmental conditions across the province, primarily in coastal areas, are continuously changing. This geographic and topographic diversity plays an essential role in the environmental identity of East New Britain. The heterogeneous terrain, flora, climate, and seasons, as well as the distribution and availability of land and water contribute to a high level of cultural diversity within the province. The 2010 H.I.T. team was able to experience this diversity as the communities we stayed with were located in the various regions of East New Britain.

***Coastal*** *Date Entered: June 2010*

The coastal regions of East New Britain are characterized by the prevalence of coral reefs, volcanic coastlines, urban centers, and palm plantations. The people on the coast rely heavily on fishing and the many uses of the coconut in their cooking since both are in abundance. While small scale agriculture is less prevalent than in the highlands, diets include local vegetables and a fairly high protein composition from rice, fish, and canned meats. Because of the tropical weather conditions, there is a wide variety of fruit trees that flourish on the coast, coconuts being the most common along with papayas, star fruits, and bananas among many others. We noticed the coastal regions also tend to be drier and dustier than the highlands. There is little fresh water that is easily accessible since there are not many rivers or streams in the immediate vicinity. Frequently communities must dig wells near the shore to access underground streams of fresh water. Due to low elevations, the coast also remains exceptionally hot with temperatures averaging around 27°C with a high percentage of humidity during the day and cooling to around 24°C with high levels of humidity persisting into the night. Temperatures and the environment are continually influenced by the volcanic activity in close proximity to the coastal regions.

While volcanic eruptions in 1937, 1994, and 2006 altered the environment of the whole province drastically, the coastal regions continue to be most affected by Tavurvur, active since 1994. Tavurvur resides on the Eastern rim of the Rabaul caldera near the old city of Rabaul, the island of Matupit, and other surrounding villages, including Raluana. Tavurvur constantly emits ash and sulfuric steam, with larger, more violent eruptions periodically. Due to the volcanic activity in and around the caldera, the temperature of the waters along the Northeastern coast of East New Britain has increased. This has caused a number of environmental changes, including a shift in plant and animal life. While learning about the history of the area, we were told that the sea snails harvested for their shells used in Tambu (referred to as "shell money" since colonial influences came to the islands in the 16th century) by some of the communities have migrated to other areas where the water is cooler. In areas, like Matupit, near the base of the volcano, the water in some parts of the harbor contains a high concentration of sulfur and can reach boiling temperatures. Tavurvur also affects the rainfall in areas in the immediate vicinity. Sulfur present in the volcanic steam condenses in the atmosphere occasionally creating acidic rain. However, an even greater area is impacted by Tavurvur's constant flow of ash. While the communities and villages in close proximity to the volcano experience regular ash deposition, depending on the spontaneously shifting winds, ash can even affect areas as far as 12.68 kilometers from the volcano.

***Highlands*** *Date Entered: June 2010*

In the highlands of East New Britain, the temperature is greatly affected by the elevation. During our stay in the mountains, temperatures ranged from an average of around 26°C during the day to roughly 18°C at night. The level of humidity is slightly lower than down by the coast, making it feel much cooler. The change is so apparent that wool blankets were required to stay comfortably warm while sleeping. The cloud cover, warm daily temperatures, and cool evenings create a greenhouse effect in the mountains keeping the soil moist consistently. As a result there is an overwhelming amount of greenery and the plants are able to grow rapidly. There are also a large quantity of fresh water streams and rivers which are the main source of drinking water. However, this is not the only source of fresh water in the region. The highlands experience a great deal of heavy rainfall, generally leaving the exposed ground as pits of mud. Though there are times of the year when rainfall is less frequent, when it rains it usually pours.

There is an abundance of broad leaf and fern type plants at these higher elevations which also make up the majority of the highland communities' diets. The environment promotes a large number of vegetable greens and root starches, like taro. There is very little protein in the typical diets of the highland communities.

**Trust Communities**

***Qaqet (kok·et)*** *Date Entered: June 2010*

Qaqet communities are part of the customary indigenous society on the island of New Britain. They have lived in the area for thousands of years; in fact, they hold an oral tradition that includes 20,000 years of human history. The tribe itself is split into five clans united by their common heritage and traditions. Currently, the Qaqet steward the Qunsop Watershed, which is the region in the middle of the East New Britain province spanning from coast to coast. There are a number of villages scattered throughout the entire Watershed.

Alakasam *Date Entered: June 2010*

Alakasam is one of the most remote communities in the highlands of East New Britain. To get there, the team traveled four hours inland by truck until the dirt road ended at the village of Malasaet. The drive was then followed by a six hour trek down the mountainside, across the valley, and up the neighboring mountain into the village of Alakasam. The village itself is organized into clusters of two to four bamboo structures, usually including at least one raised structure used primarily for storage and a ground level structure used for cooking and sleeping (called a "housecook"). Usually up to three families, which function as a singular family unit, live in these collections of buildings. Community responsibilities rotate among these family groups throughout the month. For example, groups rotate the responsibility of harvesting and processing the community's main crop, peanuts. It is a two day labor intensive process requiring the farmers to work through the night and carry the large bags of peanuts (some weighing as much as a grown man) from the village all the way to the markets by the coast so they can be sold. Since this requires extensive work, groups take turns sharing this task as needed so one family is not responsible for every harvest.

Though a number of nuclear families create these bigger family groups, everyone in the community cares for each other regardless of blood relation creating an overarching family structure. The children of the community treat every adult as their mother, father, aunt, or uncle. From the moment the team arrived, we were incorporated as part of the larger family instead of simply being visitors in the area, making interactions much more personal and relaxed. While taking part in the harvesting of peanuts, we were told that the community as a whole decides what to do with the profits from their sale. They have been able to pool funds to purchase a Land Cruiser and long bed truck which are kept at Malasaet so they can drive the rest of the way to the markets, cutting down on the travel time and ensuring more of their products get to the market.

This same sense of communal support exists among Alakasam and the surrounding villages. The network of villages collaborates to make sure church services are prepared and the school is taken care of among other communal responsibilities. The church and primary school are located in close proximity to one another and serve as the center for community activity throughout the week. Frequently during our stay, we noticed that the field located between the school and church was utilized as a meeting place primarily for small community gatherings. Throughout the week, it serves as a place for members of the communities to meet or hold smaller community events. On Sundays, the communities utilize this area to plan for the upcoming week's responsibilities and the next week's church service. We learned that a great deal of planning goes into the church services as each community is given the opportunity to incorporate their traditions into the service. Since the time Catholic missionaries introduced the religion to the area, the communities have blended their own traditions with those of Catholicism creating a way for them to keep their identity alive while incorporating the religious traditions they value.

Located in a clearing farther up the mountain is a large field surrounded by a number of buildings which serves as the gathering place for sizeable community events. This field is roughly the size of one and a half football fields. It is managed by everyone in the community and groups rotate cutting the grass and preparing it for events. While we were there, we learned that, on Saturday mornings, all of the surrounding communities come together to have a small market where everyone can socialize while selling their goods. Traditional ceremonies take place in this larger gathering area as well. The field is large enough for all of the communities to unite making it the ideal area for these types of events as the majority of the community usually attends.

We were able to experience a Qaqet fire ceremony while we were staying in Alakasam and noticed that such events require a large area because hundreds of people come together ranging from the youngest to the oldest and the people must keep a safe distance from the large bonfire used in such ceremonies. These types of events also bring the members of the community together since they are all taking part in a common celebration. Even people who are not members of the Qaqet society participate in the ceremonies, extending the community family to everyone in the area.

Komgi *Date Entered: June 2010*

The members of the Komgi community (discussed in the Heritable Innovation Trust document from 2009 located in Appendix A) are the custodians of the Qaqet traditions. As a result, they hold the Qaqet knowledge of medicine, customs, and the traditional ways of life. Though they are located a vigorous day's walk from the coast, the people of Komgi maintain the knowledge of salt production and are aware of very specific salts available from particular locations in Lassul Bay. There are numerous types of salt used by the community with applications ranging from cooking to medicines. They are frequently requested to assist other communities in performing custom and traditional community practices; a service for which they are typically compensated.

***Tolai (tohl·ahy)*** *Date Entered: June 2010*

Tolai communities are parts of the indigenous tribe of the New Ireland island. Over time, they made sporadic incursions into, and finally immigrated to, East New Britain and have been there for centuries. The tribe is split into two clans, the Marmar and the Pikalawa, both of which are present in East

New Britain. Currently, Tolai villages are concentrated in the coastal areas of the province; however, they have begun moving into the highlands due to an increase in the Tolai population size.

Matupit *Date Entered: June 2010*

The village of Matupit faces a unique set of challenges due to its proximity to the volcano Tavurvur. Every aspect of daily life has been influenced by the steam and ash routinely emitted from the volcano. The people of Matupit have developed their knowledge in the geologically active region for millennia. Following the most recent series of eruptions and at the encouragement of development experts from around the world, the conclusion was made that the best course of action for the community at Matupit would be to relocate the community from its traditional customary land.

Through the relocation efforts, called the Gazelle Restoration Project, land plots of up to 1.2 hectares with average garden plots measuring approximately 30 meters by 15 meters have been provided at Sikut Matupit for relocation. However, this relocation site is located at a higher elevation, thereby differing in soil makeup, water sources, and plant growth from the coastal village. Despite pressure from some organizations encouraging the people of Matupit to relocate, many remain on the peninsula, as their biological systems and living methods have all become accustomed to their environment. In the years following the 1994 eruption, many of the relocated community members actually became quite ill, some dying, as a result of drastic changes in diet and lifestyle in the relocation areas. Most families chose to return to Matupit; out of a population of over 4000, approximately 250 families have relocated and 400 families have stayed in the village. Though not every family has chosen to relocate, total community relocation is reportedly not possible due to a land allocation deficit.

According to Vincent, councilor of Matupit Ward 2, knowledge learned and passed down from their ancestors' has equipped the people of Matupit for life by the volcano. Using this knowledge, the community was able to anticipate the 1994 eruption of Tavurvur having observed receding tide and rolling vibrations from within the Earth. This led to their exodus, which in turn motivated the inhabitants of Rabaul to evacuate prior to official notification.

It is this type of knowledge that has also helped the people of Matupit survive in an area where nothing is able to grow at a subsistent level. Currently, the community relies on a protein diet since there is an abundance of Megapode eggs at the base of Tavurvur and the harbor surrounding the island is heavily populated with small fish (called Lala fish). Though they have some level of food security, the same cannot be said for water security. The community members explained that there is no fresh water on the island or any that is easily accessible close by. Members of the community must travel between four and six hours from the village to obtain fresh water for drinking.

While much attention has been paid to the Tavurvur eruption, a tsunami caused by a neighboring volcano, Vulcan resulted in the destruction of 14 homes on the west side of Matupit Island. In our conversations with the community leaders, the absence of this information from official reports of the disaster has been deeply hurtful as the world has been unaware of this particular community tragedy. While natural destruction, looting, and other challenges confronted the communities immediately following the eruption, there was a sense that the needs of the community were not being considered by aid organizations. For example, in close proximity to the village are six large water tanks built during the Second World War that are currently filled to the brim with ash. These tanks have the potential to provide the village with a fresh water source if they were restored; however, they remain unusable at present.

The periodic ash fall from Tavurvur interferes with the children's ability to go to school. The children of Matupit must go to school in a village which is up to a two hour walk away. Their attendance is completely dependent on the weather conditions and when the ash cover is too heavy, they do not go to school at all. A number of the youth do not enroll in school because they end up missing most of the days due to lack of reliable access to transportation.

Navunaram *Date Entered: June 2012*

Navunaram is located in the Gazelle District of East New Britain. The community is relatively close to Kokopo, only about a one hour drive inland. With two thousand inhabitants it is large enough to be its own ward. The community is further organized into five zones making it more manageable. Each zone has an elected councilor that is charged with managing the affairs of that zone and representing their interests at community-wide councilor meetings. The main road runs through the middle of the community, connecting it to both Kokopo and Rabaul. This is critical because Navunaram is an agriculturally based community meaning that it functions around the sale, export, and cultivation of crops.

Raluana *Date Entered: June 2010*

The coastal community of Raluana is located on a mountainside and is close to a 30 minute drive from the city of Kokopo. A dirt road runs through the center of the village itself and extends up the mountain from the paved main road running around the Rabaul caldera. Their close proximity to town gives them the opportunity to utilize technologies not available in more remote areas. For example, while some buildings were constructed with bamboo or palm with thatched roofs, there were many more homes made with poured cement foundations, framed and floored with milled lumber. Some of the larger buildings, like the school and the church, were constructed using cement blocks.

Not only does the community have access to building technologies, but electricity, vehicles, and other appliances as well. The family we stayed with in Raluana owned a pick up truck which they used frequently to go into town or transport water and other supplies around the village. They also had a gas powered burner used for cooking. While fires were used for warmth and some cooking, the majority of the meals were cooked on this burner in the main house. Many of the people we interacted with in Raluana had cameras, video cameras, cell phones, and one family had a television. Though it is not in

constant use, several members of the community have generators which provide them with electricity when necessary. Often times these generators are shared among a number of families and used for community wide events like watching rugby games broadcasted on the television at the councilor's house. Each house or group of houses generally has a driveway leading into the complex and a fence surrounding the area. Houses in the same vicinity hold group bible studies on a weekly basis and generally act in a polite familiar way like one would see in a neighborhood. This village network is connected by a web of paths leading from house to house and down to the coast where the church, school, and wells are located.

**Integral Accounting**

The six aspects of Integral Accounting, commodity, custom and culture, knowledge, money, technology, and well-being, outline a system in which value is ascribed to every part of a society. Each part adds its own unique aspect of value, benefiting the group as a whole.

**Commodity**

*"Those elements present in communities which, through cultivation, production or value-add, can be used to generate means of social or commercial engagement."*

Alakasam, Komgi, Matupit, and Raluana *Date Entered: June 2010*

The ecological diversity in the province of East New Britain provides the people in the various regions with the opportunity to utilize different natural resources which are present in abundance to add value to their communities. The fertile soil, warm temperatures during the day, and prevalence of water from rivers, springs, and rain makes the highlands an ideal region for agricultural crops to flourish. Komgi has taken advantage of this natural greenhouse effect by cultivating cardamom, the seeds of which are dried for use as a spice or distilled for its oil. The crop itself thrives in higher elevations and the community has adapted an effective cultivation process to maximize their output. For a number of years, the community has been selling their harvested cardamom to Follywell No. 6, Ltd. (formerly Pacific Spices) who then processes the product. To increase the output for the community, Komgi, with the collaboration of Follywell, has set up a network of dryers shared among the community. During our stay in Komgi, we stayed at the construction site of what would be the fifth dryer in the cardamom blocks of the community. Currently, three to four farmers share one dryer, providing them with the ability to produce and sell more of their harvest. Cardamom is the primary source of income for the community. A portion of each farmer's earnings is pooled into a community fund to be used for things like school fees or supplies.

The same idea is utilized by the neighboring community of Alakasam. The community makes the sale of fresh peanuts a lucrative business benefiting the community as a whole having become known for the quality of their peanuts. Michael Guniarik, a member of the village, told us the story of the peanut business while we were staying in Alakasam. In 1993, Michael was walking through the market in the town of Rabaul with his son who kept asking him to purchase some peanuts. He realized there was a high local demand for a crop which could easily be grown on his land at minimal cost. After three months, he was able to harvest an entire plot of peanuts, which he then sold to the other members of the community at the local market. All the other families in the community followed his example and by the end of the year, every family had a peanut plot making it futile to sell at their local market. By 1994, Michael began to search for a way for the community to sell the peanuts outside of the village and found a transport car in the village of Lan, (another Qaqet community), a day's walk from Alakasam. The people would then transport their peanuts to Lan and the car would take them into town to sell their goods. This became the routine until the community began running into problems from 1996-1998 with the high cost of the transportation and a surplus production that was unable to reach the market because the transport car had other obligations. In 1999, it was decided that the community would work to raise funds to purchase their own vehicle to transport the peanuts to market. The elders and councilors agreed that there would be a community garden made to raise money specifically for the car; families would take turns planting, harvesting, and selling the peanuts; each family would raise and donate 500 kina (equivalent to about US$175); and a community bank account would be created for the funds raised toward the community car. Later that year, the community was able to purchase a green Toyota Land Cruiser aptly named the "Peanut Car".

Money from the communal garden and the transport of passengers was deposited into the bank account to pay for drivers from Alakasam, fuel, maintenance, and spare-parts. The drivers take six to ten week shifts of driving during which families in the community help with their family food and peanut gardens, collecting firewood, and general housework and construction. This trend has continued to date and enabled the community to acquire a second vehicle, a Diahatsu long base truck in 2009. The peanuts sold by the community of Alakasam are not roasted, but air dried. This technique of air-drying the nuts increases the possibility for spoilage making time to market a paramount concern.

Matupit, the community at the base of the volcano Tavurvur, has been able to sustain its population by utilizing their abundant resources as well. Though the environment does not lend itself to an agricultural cash crop, it does present the community with a viable source of income in the sale of scrap metal and Megapode eggs; both of which are dug from the ash at the base of the volcano. A high level of risk is involved in both due to the instability of the volcanic ash. We were told by our host, Oxy, that cave-ins are not uncommon making digging in the ash a very dangerous job.

Following the eruption of 1994, the area in the immediate vicinity of the volcano was completely destroyed leaving nothing but an expanse of ash roughly two meters deep. However, the people of Matupit have made a business of uncovering scrap metal from the ash-buried area across the harbor from the volcano and selling it for ten toea (roughly US$0.05) per kilogram. Large groups of men and women go to the location of the old shipyard at the original site of Rabaul everyday and dig up old machinery and other metal objects. There are a number of small shelters around the digging area where people take breaks, but the groups work consistently from

sun up to sun down.

The same is true for the community members, usually men, who hunt for Megapode eggs directly at the base of Tavurvur. In the morning, as we experienced during our stay in Matupit, the egg hunters take boats across the harbor to the base of the volcano where they dig up eggs for the entirety of the day with a few breaks throughout. Some members of the community even stay in the area instead of in the main village. There is no shortage of nests at the site. In fact, we had to walk around the nesting grounds cautiously so as not to slip off the narrow path into one to two meter deep nests on either side. Oxy, explained that an egg hunter can expect to find anywhere from 10 to 15 eggs in one nest because multiple birds use the same nest, each laying one or more eggs at a time. Matupit is the only community in East New Britain that harvests and sells Megapode eggs not only because the Megapodes only lay their eggs at the base of Tavurvur, but also because the people of Matupit are the only ones who have developed an effective method for digging two meters into the ash and locating the eggs at minimal risk. Each egg is sold at two kina (approximately US$0.90) per egg and customers usually purchase them in groups of four, making the eggs a very efficient source of income for the community. Most customers come to Matupit to pick up their orders as well, cutting down on the transportation costs for the people of Matupit to get the eggs to market. The eggs are so abundant that the community is able to make a profit from the sale of the eggs while still relying heavily on them for their diet.

The environmental effects of the nearly constant volcanic activity have also created a unique opportunity for the coastal regions of East New Britain. The water temperature in the area has increased drastically over time making thermal energy an abundant resource. At the base of Tavurvur, hot springs are not at a shortage and at some points, they reach boiling temperatures. Though there are small areas where the water is relatively cool, the majority of the harbor near Matupit is too hot to comfortably walk in making it another source of this thermal energy.

Navunaram *Date Entered: June 2012*

Agriculture is a key component of life for the people of Navunaram. Not only do many people engage in subsistence farming, but most also have multiple hectares of land set aside for commercial farming. The community of Navunaram takes advantage of its substantial amount of traditionally-held land to grow a variety of commercial and subsistence crops such as coffee, coconuts, peanuts, bananas, mangoes, oranges, and most recently introduced -- nutmeg. The primary cash crop for farmers in Navunaram was cocoa for a number of years. However, with the introduction of the cocoa pod boar a few years ago, their cocoa trees have been decimated, as is the case across the majority of Papua New Guinea. Since Navunaram is a community dominated by farmers, everything revolves around agriculture leaving the people looking to cultivate new crops to replace their cocoa plots.

Since many in the community depend heavily on selling their crops either at local markets or to large export companies, access to roads and forms of transportation is crucial. One of the main roads connecting the town of Kokopo to the major port town of Rabaul runs through the middle of Navunaram. Everyday there are multiple buses running between the two towns, providing the farmers of Navunaram with the access they need to commercial outlets for their crops. Branching off of this main road are a number of smaller access roads providing those living on the outskirts of Navunaram with a means by which to reach the main road with relative ease.

These access roads also provide the community with paths to reach the many meeting places in Navunaram. The majority of these meeting places are churches, which serve their traditional purpose, but also serve as a central meeting place for community gatherings. These churches along with the schools and community halls serve as places for leaders of the five zones to meet and for the community at large to congregate for announcements or planning. Due to the size of Navunaram (a population of 2,000 people living in five zones) these meeting places are a fundamental commodity as they facilitate the function and betterment of the whole community

## Custom & Culture

*"Custom and culture are practices and expressions of individual or community held values and traditions which create a context for social interaction."*

Alakasam, Komgi, Matupit, and Raluana *Date Entered: June 2010*

In addition to the more than 800 languages spoken at the community level in East New Britain, Tok-Pisin (commonly called Pidgin) and English are the two nationally recognized languages. Though not everyone speaks English or Pidgin, the majority of the population understands both, making communication possible despite the communal language differences. Many of these community languages even differ depending on what area you are in, similar to the differing vocabulary and dialects of English across the United States. For example, Kuanua is the language spoken in the Tolai tribe. There are small variations across the separate communities, meaning that the people in Matupit may speak a different dialect of Kuanua than the people of Raluana. The same can be said for the Qaqet communities as the villages are spread out across a very large area. Physical topographical barriers play a large part in creating the variations in languages, as physical barriers, such as mountains or volcanoes, are one of the main sources for community separation.

Despite the physical separation of communities and the wide range of cultural traditions, the exchange of betel nut ("buai" in Pidgin) is a common practice amongst all the peoples of East New Britain and the greater Pacific Island area. Betel nut is a small nut harvested from a particular variety of palm tree. The first step in every interaction we had during our stay was an exchange of buai, whether we already knew the people or we were meeting them for the first time. It is a general greeting regardless of tribe, status, or language, serving as a sign of goodwill and familiarity. When exchanging the betel nut, lime, and mustard (the purpose of which is discussed in the 2009 Heritable Innovation Trust document, see Appendix A), the buai is given and received using only the right hand as a sign of respect. This tradition goes for giving or receiving anything, not just buai.

Politically, Papua New Guinea is organized into provinces. Each province is then divided into a district, which is further divided into Local-level Governments, LLGs. The districts have their own presidents and cabinets, while the LLGs have representatives at the district level. A key part to the current civil society of East New Britain is the Autonomy Committee. Working towards financial security by creating a sense of ownership in provincial finances, the Autonomy Committee of East New Britain is attempting to set an example for the rest of the provinces. They emphasize that their movement for autonomy is not a separation from the national government, but a desire to add value to the country by stabilizing infrastructure beginning at a local level through establishing financial security. The committee is using the H.I.T. framework as the structure of their financial strategy.

In both the Qaqet and Tolai communities, land is traditionally stewarded by the communities rather than individuals. The elders within the community allocate plots to each person based on a matrilineal system. However, if a family moves away or the tenant of the plot dies leaving no one to maintain the plot, the land is returned to the community and reallocated as necessary.

***Qaqet***

The Qaqet communities are deeply traditional, however, over time they have integrated aspects of Roman Catholicism into their customs and values. In both communities, Alakasam and Komgi, we attended Catholic masses on Sundays. Due to the shortage of priests in the province and the remoteness of both communities, there are no permanent priests in Alakasam or Komgi so the majority of the services are led by community members and a government appointed church administrator. About once a month or on holidays, a priest from a neighboring village comes to lead the service. Angela, the administrator at the Komgi church, explained to us that she had attended seminary school and is fulfilling a three-year contract in the community. Though she is not from the village, they have integrated her into the community and she feels comfortable participating in their ceremonies and other community activities. The community firmly trusts her guidance and opinion on spiritual and community matters.

Alakasam and the three villages in the surrounding area rotate the responsibility of leading mass. Each village incorporates their own traditions into the services in how they lead prayers and hymns, select and present scripture readings, and bless and present the offering. Qaqet traditions are even incorporated into the decoration of the church building. Along with the image of the Virgin Mary and various depictions of Jesus' miracles, characteristic of Catholic churches, the traditional Qaqet design (a black, red, and white design resembling clovers) is usually a prominent feature of the Qaqet churches. By integrating all these elements, unity is inspired through displays of Qaqet culture and values intermingled with traditional Catholic symbols.

The same sense of unity is a result of the traditional ceremonies as well. We were invited to attend a ceremony in Alakasam called the Fire Dance. The dance is usually done to celebrate significant events in the history of the community, to celebrate the life of someone who has passed away, to remember those that have passed away, and to commemorate the community's relationship with their natural surroundings. The dance is generally split into two different events with the biggest being the night event. During the afternoon portion of the ceremony, the whole community gathers to dance with the selected traditional dancers while a group of women sing and create music by drumming pieces of bamboo. This continues until the sun goes down, then preparation for the night portion begins. During this part of the ceremony, 6 to 20 male dancers wearing elaborate costumes and masks representing the various aspects of nature dance to songs sung by a group of men, again, drumming pieces of bamboo. Before the dancers come out, a huge bonfire is built which is maintained and added to until the fire is raging. These dancers and the bamboo band do not stop singing and dancing until every ember of the fire has been stamped out. The community preparation for such ceremonies takes roughly six weeks. When these ceremonies occur, the community unites in celebration. While we were able to attend the ceremony, it was apparent that everyone in attendance, from the youngest to the oldest, was in high spirits and the bond within the community, regardless of whether they were originally from Alakasam or not, grew stronger.

***Tolai***

Tolai society is organized around a matrilineal system of inheritance, land stewardship, and respect. During our stay in Raluana, we were told about the way this system works and how family structures function within it. According to the numerous people who explained this to us, there are two distinct clans within the tribe: the Marmar and the Pikalawa. Marriage is generally supposed to be across the clans, meaning a member of the Marmar clan must marry a member of the Pikalawa clan and vice versa. After the marriage, the husband will be incorporated into the wife's clan. He and his wife will move onto the plot of land allocated to her by her clan at birth. The first-born child is cared for primarily by the father's family and is considered to be a member of his clan. Every other child the couple will have is part of and the responsibility of the mother's family and clan. When a boy turns 18, he leaves the family home and builds his own dwelling, called a "boy house," in the same village as his mother's clan where he lives until his marriage.

Religion plays a significant role in the Tolai communities as well. They take great pride in their ties to Christianity. Matupit was the village through which five of East New Britain's current religions were introduced. Due to its proximity to Rabaul, what used to be the main port city, missionaries established themselves in this village before moving inland. Matupit prides itself on this distinction. Of the five Christian denominations that have entered the region, Seventh-day Adventist, Roman Catholic, and United Church are still present within the community. Immediately following the eruption of Tavurvur in 1994, the three churches on the island became angry at each other; each blaming the others for the disaster. However, the tensions between the three eventually died down and they decided to collaborate in efforts to rebuild Matupit. As a result, the community has been successfully recovering. While we were in Raluana, the importance of

religion was apparent. The majority of people in the community attend their respective denominational church services on Sundays and at least one Bible study during the week. Many members of the Tolai communities even have both traditional and Christian weddings.

While staying in Matupit, we were able to attend the first of three parts of a traditional wedding, called the Warkulkul (*var·kool·kool*). The Warkulkul is the ceremony where arrangements are made for the bride to leave her home and live with her husband's family for the time between marriage ceremonies. Once the appropriate ceremonies have taken place, the husband and wife will return to the wife's plot of land in her home village and the husband will become a member of her clan. The Warkulkul takes place in the bride's village and only the bride and the families of the couple attend; the groom is not present. The ceremony that involves the groom takes place roughly two weeks later in his community. The bride and groom's respective clans sit facing each other across a wide aisle and the exchange of gifts and the dowry begins. The proceedings are overseen by elders and councilors of the village one of which is specifically charged with facilitating Warkulkul ceremonies. Throughout the first part of the ceremony, the bride hides in an undisclosed location somewhere nearby where the festivities are taking place. After the opening prayer, the leaders facilitate the exchange of the dowry, the amount of which has been agreed to prior to the ceremony. The Tambu, which is measured in fathoms, is presented to the bride's family. After the Tambu has been presented, measured, and both the families and the facilitating local leaders have deemed the amount appropriate, the agreement is considered indisputable. The exchange of this Tambu creates a unique financial climate unavailable in a cash-based economy, where things bought or traded with cash can be taken back and exchanged for the original amount. When the amount of Tambu exchanged at the Warkulkul is agreed upon by both families, it is pronounced finished by the councilors. Once they announce its conclusion, it is not to be discussed further. The finality of this statement means no further objection is considered; in fact the matter is never again discussed.

After this primary exchange has taken place, it is common for the family of the bride to give several lengths of Tambu to the groom's clan as a gesture of goodwill, along with an exchange of buai. Later in the ceremony, this gift will be reciprocated as compensation for the transportation of food and other items provided by the bride's family for the bride and groom's new home. After the various exchanges of Tambu take place, the technicalities of the ceremony are finished and the celebration begins. The women from the groom's family run through the village searching for the hidden bride. Often times the bride is hiding somewhere close by, but some brides build small shelters with no doors or windows making the search even more difficult. The search for the hidden bride appears to be the highlight of the community experience. Once the search parties locate the bride, they bring her back to the location of the Warkulkul. Several women from the husband's clan create a curtain around her and change her clothes. They remove the clothes she was wearing, return them to her clan, and replace them with new clothes they have made for her. This new outfit symbolizes her acceptance into the groom's family and the beginning of her new life as a wife. After the ceremony has concluded, the bride returns with the groom's family to his community where they will live until the next ceremony.

The matrilineal system in Tolai communities also affects the family structure common in most Western societies. Since it is matrilineal and everything passes through the women of the community, there is a high degree of respect shown toward females. The son of Eunice, our host in Raluana, explained the intricacies of the Tolai family structure. According to William, the term "grandmother" is used to refer to any woman who is highly respected in the community. This woman would be seen as very wise and would have a lot of influence on community matters and decisions. Children refer to both their birth mothers and biological grandmothers as "mother" out of respect. Similarly, children refer to their birth fathers and the brothers of their father and mother as "father". In addition, an individual is given a higher degree of respect depending on their relationship to the mother of the family. Two individuals we interacted with, Leba and Alan, were technically cousins. However, Leba referred to Alan as his uncle out of respect, because Alan was the son belonging to the mother's clan while Leba, the son of the husband's brother, was from the father's clan. In this case, whoever is referred to as the uncle is also responsible for their relations should anything happen to their families.

Navunaram *Date Entered: June 2012*

The population of Navunaram is part of the Tolai ethnic group and therefore, the community functions under the traditions of the Tolai. Traditional weddings are one of the many Tolai ceremonies celebrated in Navunaram. Tolai weddings consist of three separate ceremonies over an extended period of time; each representing an important step the new couple is taking. The first is the Warkulkul (*var·kool·kool*), the ceremony in which the wife leaves her home and is accepted by her husband's family. While visiting Navunaram, we had the opportunity to attend a Warkulkul. In the ceremony there is an acknowledgement of the wealth of both families and exchanges take place between the families. Following this ceremony, the bride bids farewell to her family and leaves with her husband's family to stay with them until all the ceremonies are complete and the marriage is finalized. The wealth of the families of the bride and groom are displayed through the exchange of multiple items; the most common being tambu, bananas, and pigs. During the Warkulkul, all of these things were exchanged in some fashion. Prior to the event, the family of the bride prepared a large quantity of food for the husband's family including Ku, a food that is made of pure coconut milk (in this case the milk of 300 coconuts). This was mixed with a large quantity of potatoes, taro, and other goods in a homemade, barrel-like basket. Along with the large basket of food, the husband's family was given a pile of bananas nearly two meters tall and an entire pig. The size of these contributions will vary depending on how much the family is able to offer. Sometime multiple families related to the bride contribute to the offering as this is meant to be a gift from one community to another to celebrate the binding of their communities. Tambu was exchanged a few times throughout the ceremony as well. The husband's father presented an amount of tambu agreed upon by both families as a way to illustrate the husband's ability to provide for his wife and future family. This tambu has been acquired by the husband throughout his life.

Often times these ceremonies are organized with the help of the whole community. In this case, many people from Navunaram that were not part of the immediate family contributed in any way they could by providing food or helping to prepare everything.

The members of the Navunaram community are very aware of both individual and community-wide needs and function on the basis of collectivity. The usage of vehicles is a prime example of the sense of community in Navunaram. It is common for people in Navunaram to walk from one location to another, however, vehicles are required to get to Rabaul or Kokopo to sell goods and therefore are crucial to doing business. Not everyone in Navunaram has a vehicle though because it is unnecessary with the frequent buses and the sense of community. The individuals who do own trucks or cars provide transportation for those who need it. When an individual is planning to go to town, they will often give multiple people rides. Such is the case when people need rides around the community to church or community meetings.

Navunaram's zone two has both a community hall and a church in close proximity. At both of these locations, the community congregates once a week to discuss topics relevant to all of Navunaram. These meetings are a time for announcements to be made and for members of the community to voice their opinions regarding various issues and projects. Every member of the community is encouraged to participate in the meetings; men, women, and children alike.

Community meetings are held for many reasons one of which is addressing the welfare and maintenance of their homes. Most families in Navunaram build their homes in close proximity to the rest of their relatives. A family's home typically consists of multiple buildings; most commonly one for living, one for cooking, and an outhouse. Since multiple generations live together, there is a strong sense of connection between all members whether they are parents, children, aunts, uncles, cousins, or grandparents. Each group of nuclear families functions as a unit in parenting, cooking, cleaning, farming, hunting, and all other household responsibilities.

Structurally, each house has some kind of system in place to collect and store rain water. Most commonly, pipes are linked to a gutter system on the house to direct the water into larger storage tanks. Water conservation is an integral part of everyday life in Navunaram and therefore shapes the way the community functions. Alternatives to water are used whenever possible in everyday activities. Papua New Guinea experiences dry and wet seasons and, due to its location, dry seasons for Navunaram are exceptionally dry. Droughts and rain shortages are common during that time of year making water conservation all the more important.

Each day in Navunaram follows the same basic schedule revolving around farming and agriculture. Each day is filled with planting, maintaining, or harvesting each family's blocks and selling crops. Every member of the family aids in each task. Around nine o'clock each morning someone leaves to take the crops into town to be sold at a local market or to an exporter, while the others take care of the house and the garden. By mid-afternoon everyone is out working until dinner time. Such is the case with the majority of Navunaram families during weekdays, which makes weekends a time when all other responsibilities are taken care of.

## Knowledge

*"Knowledge is information and experiential awareness which can be transmitted through language, art, or other expressions."*

Alakasam, Komgi, Matupit, and Raluana *Date Entered: June 2010*

Tavurvur dominates the landscape and history of East New Britain and is the basis for much heritable knowledge. While in Matupit, Vincent, the councilor of Ward 2, explained how in 1994 the people of Matupit were fully aware of the upcoming eruption that took place based on a description passed down from their ancestors. Vincent said, "Our grandparents told us, 'If you feel an earthquake and that earthquake sort of rumbles along under the ground, and it goes like 'brrrrr', that is telling you that the volcano will erupt'." When the community recognized this was happening, they chose to evacuate despite the official reports that were broadcast on the radio claiming it was safe to remain in the area. Some people in the city of Rabaul chose to evacuate as well when they saw all the inhabitants of Matupit leaving the island. After returning to the island, the knowledge adapted by their ancestors enabled the community to sustain themselves even in the harshest of conditions. Though ash had buried the village and destroyed their crops, they were able to return because of their knowledge of fishing and Megapode egg collection.

Heritable knowledge is passed down in a number of ways which are unique to each community. In Tolai communities, the Tombuan secret society contributes to the leadership structure and facilitates a continuation of knowledge. From what the team was told, the term "Tombuan" can refer to: the spirit protecting a Tolai community or an elderly woman who is greatly respected. The members of the Tombuan secret society are keepers of the traditional knowledge of the community. The men from the community go through three stages to become members of the society. Once all the stages are completed they are considered full members of the society and community. The stages require the men to complete certain tasks and pay varying amounts of Tambu. Both the difficulty of the task and the amount of Tambu increases with each stage. The final step is the most intensive. Members are usually required to spend one to three weeks in the bush with a fully initiated member. It is in this stage where the candidates for initiation learn all the secrets and knowledge of the Tombuan society. When they return a celebration is held commemorating their official initiation.

Navunaram *Date Entered: June 2012*

Because Navunaram relies heavily on agriculture, all knowledge associated with it is passed down to each generation at an early age. As soon as they are able, children help with gardening and cultivation and parents and other family members pass on their knowledge and skills. However, Navunaram has a number of different educational centers as well. Community knowledge is shared at churches and community halls, while basic learning skills including reading, writing, and math are taught at community elementary schools. Along with these

traditional school subjects, the elementary school in zone two of Navunaram is teaching its students agricultural responsibility. The school recently acquired nutmeg seedlings and plans to include cultivation, maintenance, and harvesting of this and other crops into their curriculum. Not only does this provide the school with a means by which they can raise money, but it also prepares the students to be active members in their agriculturally centered community.

## Money

*"Modes of transmitting and recognizing value exchange using physical and virtual surrogates including currency, systems of credit and barter."*

Alakasam, Komgi, Matupit, and Raluana *Date Entered: June 2010*

The kina is the national currency for Papua New Guinea, and it is used in the mainstream marketplace. There is also a traditional form of currency used in the Tolai community called Tambu. Tambu is made from shells which were traditionally collected from a local snail. Their shells were gathered by leaving a piece of fruit on a coral reef and waiting for a few hours. After that time a significant amount of these small snails would have gathered on the piece of fruit. The snails are then collected and dried to isolate the shell from the snail. These particular snails used to be heavily concentrated along the entire coastline of East Britain, but the increase in water temperature in the area following the eruption of Tavurvur forced the snails to migrate elsewhere. They are now only found along the coast of West New Britain and New Ireland.

Once the shells have been dried and cleaned, a hole is made through the shell. The shells are then strung one by one onto a thin piece of cane roughly a meter in length. To accommodate those families who have an abundance of Tambu and very few Kina, the government has standardized an exchange rate between Kina and Tambu. One fathom of Tambu (a one meter strand) is equivalent to five Kina. While this has facilitated the use of Tambu in the economic sector, its use is more prevalent in Tolai ceremonies. The shells can be bought at different local markets in SP beer bottles which have a volume of 300 milliliters. A bottle of shells (worth about 25 Kina when placed on a strand) costs about 20 Kina, not including the cost of the cane.

When children are born they are given a particular amount of Tambu so they can begin their collection which grows throughout the course of their life. A child can acquire Tambu for completing various jobs around the community. For example, Eunice's son from Raluana was given a significant amount of Tambu from various members of the community for working at a cemetery. During major events in a young man's life, he usually receives some allotment of Tambu. For instance, initiation into manhood is an example of a major milestone when young men would receive fathoms of Tambu. Once the man has reached adulthood and is ready to find a spouse, he uses the Tambu he has collected over the years as his dowry. The families negotiate the amount of Tambu to be given to the bride's family.

Tambu is widely used among the communities to purchase goods and resources. Tambu can be used in transactions at local commodity markets as well as transactions for services between members of the community. As a result of the standardized conversion rate between Kina and Tambu, Tambu can now be used to pay school fees when Kina is scarce. To facilitate the transactability of the Tambu, the government has set up a special bank solely for the conversion and management of Tambu.

Navunaram *Date Entered: June 2012*

The main source of income for members of the Navunaram community is the sale of their agricultural crops. Every family in the community has a number of hectares of land where they grow subsistence and commercial products like peanuts, bananas, papayas, coconuts, tapioca, taro, and cocoa, which was their main cash crop. Due to the outbreak of the cocoa pod boar (CPB) many farmers are looking for new products since they can no longer rely on cocoa as a cash crop. Nutmeg has been introduced as a potential alternative to supplement the loss of cocoa sales. Nutmeg trees are relatively easy to manage, requiring only minor weeding in the first few months at which point the tree is left alone. Though it takes five years to mature and bear fruit, it bears fruit for a long time and produces two spices; the nutmeg itself and mace, the red flower that grows around the nutmeg nut. Navunaram's relationship with Amruqa, the local organic spices and essential oils company, guarantees them a market to sell their mace and nutmeg and provides them with an educational partnership to develop an agricultural strategy best suited to the needs and values of their community.

## Technology

*"Technology is the artifacts or schemes by which value-added experiences and production can be effectuated."*

Alakasam, Komgi, Matupit, and Raluana *Date Entered: June 2010*

The roads in and around the cities in East New Britain are paved; however, the majority of roads which are not in close proximity to the cities are generally packed dirt or ash. These dirt roads are susceptible to washouts and as a result are often rutted or impassable during rainfall as the 2009 H.I.T. team experienced. On these rural roads, a journey of 13 kilometers may take between five and eight hours, while other times they may simply be impossible to pass due to mud and washout. Communities accessed by these types of roads have developed a system of maintenance keeping the roads as passable as possible. Large logs are often placed in the ruts of the road or horizontally covering particularly muddy sections to provide vehicles with enough traction to make it up the steep hills and across the unstable mud. Ruts that are too deep for logs to be effective are usually filled in with rocks to provide traction. The weather conditions in higher elevations make road maintenance a nearly constant job, as the area is prone to frequent heavy rainfall. The road up to Komgi is an example of how this continuous upkeep can vastly improve the roads. Last years group of interns was only able to reach the lowest buying point on the road because of washouts and rough terrain. However, since the beginning of this year employees of Follywell No. 6, Ltd. and members of the Komgi community have been working on improving the road. They have filled in the ravines in the road and put rocks and logs where necessary making it possible to reach the very end of the

road, about a kilometer further than last year's group was able reach.

The communities in the highlands have also found ways to better utilize their rivers and streams. In Alakasam, nearly every river and stream has a waterfall which has a bamboo tube directing the water away from the river like a spout. This tube has one end in the pool at the top of the waterfall while the rest extends directly out over the edge. It is secured to another piece of bamboo or a small log positioned horizontally across the stream; these spouts are used as the main source of drinking water and as natural showers because there is less sediment in the water since the bottom of the stream has not been disturbed.

Dryers are used in both Raluana and Komgi to preserve crops before transport. In Raluana, we were shown coconut dryers, and in Komgi the dryers are used for cardamom. The dryers are raised buildings constructed with raised platforms where the product is distributed. Beneath the platform is a round metal barrel lain on its side. A fire is built in the barrel to evenly distribute heat through the building, drying the coconut or cardamom above.

Navunaram *Date Entered: June 2012*

Navunaram is a community with a population of two thousand. To manage such an expansive population, they have developed a unique social structure which acts as the technology by which the community functions. Navunaram covers enough land area to be determined as its own ward by the national government, but the community has organized itself even more to make it more manageable. Navunaram is divided into five zones, each covering a different section of the community. Each zone has an elected councilor whose job it is to address the needs of the people in that zone. Once a week all the councilors come together to discuss the needs of the community at large and to report on the status of each zone. All concerns by individuals are brought to the zone councilor, who then either addresses it or brings it to the attention of all the councilors before action is taken depending on the severity of the concern.

The physical layout of the community is yet another technology that keeps everyone in Navunaram connected. As mentioned in other sections of the document, Navunaram is situated along one of the main roads connecting Kokopo and Rabaul. During our visit to Navunaram, we were located solely in zone two and noticed that though a number of families live a bit farther removed from the main road, there are dirt access roads that extend off of the main road. There are also paths leading from the furthest houses to these access roads making it possible for everyone to access others in the community and meeting places with relative ease. While this accessibility has social applications for Navunaram, it is also the tool most used in commercial engagements; giving Navunaram a way to access local markets and exporters to generate income.

In terms of physical technologies, Navunaram functions on a needs basis. Many homes have generators which are used fairly infrequently because constant access to electricity is not essential to their ability to function. The sense of communal responsibility also makes it unnecessary for everyone to have their own generators, as is the case with vehicles. These technologies are shared amongst multiple members of the community and are not solely for individual use.

One technology that is necessary to sustain the population of Navunaram is the rain water collection systems they have developed to take advantage of the abundant rain during the wet season. Nearly every building in the community has a network of gutters and pipes that direct rain water from the roofs of the buildings into large collection tanks. Not only are there elaborate systems made with materials purchased at a hardware store, but Navunaram also has a roofing method that takes advantage of the natural curvature of bamboo and an angled roof to direct water. By splitting bamboo and positioning it on the frame of a house making a corrugated roof, they are able to facilitate water collection using sustainable resources.

## Well-being

*"Well-being is the capacity for any person or ecosystem to function at their optimal level."*

Alakasam, Komgi, Matupit, and Raluana *Date Entered: June 2010*

As discussed in the **Environment and Ecosystem** section, the highlands of East New Britain have no shortage of fresh water since it can be collected directly from streams and springs. However, the minimal amount of rainfall during the coastal dry seasons visibly impacts the lifestyle of those living in the areas, as is the case in Raluana and Matupit. During our stay in Raluana, it was necessary to regulate the amount of water we used for brushing our teeth and drinking because, as a result of the dry season, there was only one tank of drinkable water that was rapidly dwindling with the number of people using it. When there is a short supply of rainwater, shallow wells dug on or near the beaches provide a source of fresh water which can be used for bathing and cooking. For some areas in the community, the beach is a significant distance down the mountainside making the water not as accessible. To provide the community with fresh water, there is a truck that makes deliveries of fresh water to any family that has paid for the service. Just like the people of Matupit, many must travel for hours to get fresh water for drinking to bring back to the community.

Children generally enter into the education system at the age of seven, at which time they begin grade one of primary school. While attendance is strongly encouraged, there are school fees which increase with grade level. Elementary education fees generally begin at around 80 Kina. In most communities, there is a system in place that provides aid to families who may not be able to afford these school fees to ensure that as many children as possible can attend school. Once they have completed primary school and secondary school, some students continue on to take a standardized test, which they must pass to be admitted into high school. School fees for high school increase drastically and the facilities are located further away from the villages requiring the families to find accommodations for their children. The total cost of attending high school increases exponentially resulting in a decrease in attendance. While primary schools are generally located within a community, secondary schools and high schools are regionally based. For example, the community of Raluana has its own primary school, but once the children reach secondary school, they travel to a

nearby community where the school is shared between the surrounding villages. If the regional school is a long distance away or if there is no primary school in the community, children often stay with family or friends during the school week, returning home on weekends. Such is the case with the youth of Komgi.

Navunaram *Date Entered: June 2012*

Since Navunaram is reliant on agriculture, there is an abundance of food available to all members of the community throughout the year. While there are many crops grown in family gardens, fruit trees and vegetables grow around the community as well. There is an abundance of coconuts, oranges, bananas, cassava, and taro growing wild; all of which are key components of everyday meals. Navunaram also has a number of community owned chickens. Everyone cares for the chickens and each house usually has a place for them to roost and lay eggs, providing everyone in the community with a source of protein.

Navunaram is a community in which every member works to support other members as well as the community at large. Community meetings are a venue where individuals have the opportunity to voice their opinions on how to better the community. Each individual pitches in to help whenever there are projects requiring their specific skills, whether they are community-wide or for individual families. For example, members of the community with construction experience took shifts renovating the library at the elementary school in zone two while the interns were visiting and neighbors and friends came together to help a family put roofing on a new house. Family members and neighbors also take a collective approach to raising children and in everyday tasks like tending gardens or cooking meals. With a collectivist mindset the community is supported as well as every family and individual in it.

**General Community Engagement Observations**
*Date Entered: June 2010*

Direct communication with the communities provided us with an in depth view of their culture and values. The language barrier caused some difficulties in communication, but we were able to use other resources as a form of interaction. Through technology we were able to connect with the communities since access to technologies like digital cameras or video recorders is not common in the communities in East New Britain. Many of the people we interacted with enjoyed using the team's digital cameras and video cameras because many of them had never seen pictures or videos of themselves before. Connecting with the community using something as simple as taking pictures and videos helped to build trust between the team and the community and sparked their interest in learning more about our culture, thus creating an opportunity for a two-way interaction.

Games are another way to unite cultures. Teaching and playing various games allowed us to share different aspects of our own culture, easing some of the hesitation from community members by openly sharing and encouraging them to participate. By involving community members in our games, everyone was able to relax and connect on a deeper level. Of all the games to play, card games were most enjoyable for both children and adults. Card games are relatively simple to explain, learn, and play regardless of language, particularly when they involve high cards beating low cards, matching based on color, number, or shape, or sequencing and grouping.

Basic exercises were another way to interact with community members, specifically children. By teaching the children how to do certain exercises, having competitions to see who could do the most pushups or sit ups, or going on a run with some of the kids, the team was able to make connections by engaging in activities everyone could do. Making a connection first with the children, the team was able to slowly gain the trust of the adults who were generally more cautious. Once the adults were able to observe how the children trusted us and found themselves laughing at the team's efforts to keep up with the kids, they felt much more comfortable talking to and interacting with us.

Actively showing interest and participating in games or competitions the community values was another way the team was able to connect. In Alakasam, the team visited a school during a break time and all the teachers and students were outside playing a variety of sports. While we were able to connect with the community through the sports we have in common (soccer and volleyball), the whole community was engaged when we tried playing rugby. Allowing the children to teach us something allowed them to take on an expert role, giving them more confidence in their interactions with us. The camaraderie we built while playing a team sport with the students and teachers further aided the connection between the H.I.T. team and the community.

As the relationship between the group and the communities developed everyone became interested in learning as much as possible about the cultures present in the relationship. While there were many differences, the fact that there were so many similarities was interesting to all. Recognizing these similarities eased some of the feelings of unfamiliarity. The knowledge shared between the group and the communities created a cultural understanding allowing everyone to be more comfortable in conversations and interactions. We were able to build on this growing level of cultural awareness by actively taking part in the culture of the communities we stayed with. Whether it was something as simple as eating what was prepared for us, trying to learn the language or languages spoken in the area, or doing our best to participate in some of the more complex community activities, showing an acceptance and enjoyment of experience helped to solidify the bond between the group and the communities. The fact that we were showing respect and appreciation for the culture and customs of our hosts was the central reason why the group was able to establish such a strong bond with the communities.

Throughout our entire trip, we noticed the diversity of our group aided in opening the avenue for interaction as well. One of the interns was African American and shared a skin color similarity with the local communities. The level of comfort due to the assumed inclusivity of our intern allowed for more in depth conversations, relieving any awkward tension which could potentially have occurred. The initial assumption in every

interaction the group had was that this intern was from Papua New Guinea. Frequently, people would speak to him in Pidgin or their local language, confused because he did not seem to understand them. Once community members discovered this intern was from the United States and was part of an ethnic minority, there was a deeper sense of connection and integration. The pre-determined trust for our intern gave him the ability to interact and engage on a deeper level, often being invited into some experiences other interns were not. Finding a commonality and showing active interest in what someone values creates a basis for interaction, facilitating a deeper stronger relationship and bond.

**New Ireland, Papua New Guinea**
***Date Entered: August 2011***

**Environment and Ecosystem**

New Ireland is the northeastern-most province of Papua New Guinea. The province consists of the larger island of New Ireland and thirteen smaller islands, making a total landmass of 9,600 square kilometers to house a population of 118,350. While there are a few small urban centers on New Ireland, the majority of the population lives in rural villages scattered along the coasts of all the islands in the province. The New Ireland province has a climate very similar to the coastal regions of East New Britain discussed at length in the **Environment and Ecosystem** description found in the **East New Britain** section of this document. Temperatures reach between 26ºC and 28ºC during the day, persisting into the night. Though the actual temperature does not change much in the evening, the breeze off the sea and the drop in humidity make it feel much cooler. Like the rest of Papua New Guinea, New Ireland experiences only two seasons due to its proximity to the equator: a wet season from roughly August to February and a dry season lasting the remainder of the year.

Topographically, New Ireland is primarily flat. The area where this year's H.I.T. team was based is on the northwestern part of the island where the gradient increases toward the center of the island. In fact, the dominating mountainous region is found in the southern part of the island where peaks can reach up to 2,340 meters. There are also very few fresh water rivers and streams within close proximity to the village of Ngavalus. Like the mountains, rivers are concentrated in the southern part of the island so the people living in the northern areas must rely on wells for fresh water. The most prominent geographical feature of New Ireland is the reef that lines the northern coast. The reef, which extends off the coastline for roughly 91 meters, is teeming with fish, lobsters, coral, and a number of other creatures found in tropical waters all of which provide peoples living by the coast with both sustenance and a source of income. The environment on the coast is not conducive to large-scale subsistence gardening therefore; people rely heavily on the sea and fruit-bearing trees for the bulk of their diets.

**Integral Accounting**

The six aspects of Integral Accounting, commodity, custom and culture, knowledge, money, technology, and well-being, outline a system in which value is ascribed to every part of a society. Each part adds its own unique aspect of value, benefiting the group as a whole.

**Commodity**

*"Commodities are those elements present in communities which, through cultivation, production or value-add, can be used to generate means of social or commercial engagement."*

The people of Ngavalus live in close proximity and harmony with nature in a place where resources are abundant and the soil is fertile. The community's methods of interaction with the environment are passed down from generation to generation through oral tradition; it is through legends and folk lore that the community remembers and records the usage of the commodities found in their environment.

The community of Ngavalus is located on the coast of New Ireland, thus there is access to the South Pacific Ocean and its abundance of fish and shellfish species such as: flying fish, barracuda, parrot fish, sea shells, clams, brown sea urchins, lobster, jack, tuna, and shark. According to the fishermen of Ngavalus, fish from the reef in New Ireland are known for their distinct flavor throughout the provinces of Papua New Guinea. While fishing and lobster catching is often done by groups of three to five men, the harvesting of sea urchins, sea cucumbers, and other reef creatures is typically done by women.

When fishing, the people of Ngavalus must know how to navigate strong currents and the men must be able to dive and navigate at night since lobster hunting is done in the dark. They must be especially aware since lobsters are concentrated at the edge of the reef where the waves break, adding another factor to be considered when hunting at night. The practice of fishing and hunting for lobsters is a specialized job in the community meaning that only the people who have been trained do the fishing and hunting.

Fish and shellfish are not only used for consumption and as a trading commodity, but parts of the fish and shellfish are also used for making a number of different tools. Spines from puffer fish can be used as needles to mend torn clothing. Shells are also used for decorating wooden furniture, sculptures, bags, and necklaces. A very particular shell is used for making *mis*, the traditional money of New Ireland. The community also uses a conch shell to announce the start of community events.

Though fish and shellfish are a common element in many meals in Ngavalus, the every day diet consists primarily of starches, specifically cassava and sweet potato. Almost every meal the H.I.T. team had during our stay incorporated sweet potatoes or cassava. Most often, sweet potato was cooked in coconut cream or roasted directly on the fire, but they were also times when it was cut and fried. Cassava was a more common element of our diet. The tropical root crop was usually prepared with coconut cream in some fashion. The H.I.T. team participated in the preparation of two of the more common cassava dishes: cassava cakes and cassava balls. The cassava was peeled and grated, the juice squeezed out, and coconut milk added. The final mix was then formed in one of two ways. The cassava balls are generally boiled or steamed, giving the cassava the consistency of matzo. It can also be formed into cakes which are then fried.

The sago palm is another commodity found in Ngavalus with various uses. Sago palms grow in swampy, wet areas, so the trees are concentrated only in certain areas of the community. The sago palm reaches maturity 10-15 years after planting. When it has fully matured, the palm produces a large flower at which point the community knows it is ready to be cut and processed to make saksak. The men of the community work together to cut, clean, and turn the inside of the tree to mulch. This mulch is then mixed with water and squeezed to release the saksak which is then left to settle resulting in a very fine powder (similar to corn starch) that is used to make a number of dishes.

Not only is it an excellent source of food, but it is also used in construction material. Our hosts often joked that saksak is their "fast food" because it requires relatively little work and produces a significant amount of food that lasts for weeks.

Sago palms are also used for a number of different everyday purposes. Mats, roofing, construction materials, baskets, and food storage containers can all be made using sago palm leaves. Young, narrow leaves are needed for the weaving of mats and baskets, but older and wider leaves are used for the making of durable roofs because the leaves have thickened. The stalks found near the top of the sago palm can also be used to make the windows on houses and the thick layers of bark around the top of the palm are used to make the cleaning troughs used when making saksak. The community has a use for nearly every part of the sago palm tree.

There are a number of trees in New Ireland, with a very specific use, either in making tools, natural remedies or construction. Some of the hardwoods found in New Ireland are: kalapulim, pom, kuilan, malaren, and palm. Palm trees are known to produce a strong and durable timber; therefore, it is often used in the construction of buildings and furniture. Only the kalapulim, kainu, or kuilan trees are used to make the garamut, a drum used for various purposes through out the community. The type of hardwood used to make the garamut is chosen depending on the desired sound of the drum. Each of the hardwoods mentioned produce a drum with a unique pitch and tone and must be selected carefully. The head of the sapal, a tool used for pounding sago trees, is usually made from the malas hardwood but can be made out of any of the hardwood trees found in the area.

The kainu and kalapulim trees can be found along the coastline near Ngavalus. Many of these trees were planted a number of years ago and act as a natural wind and wave breakers. When the king tide of 2008 occurred in New Ireland, these coastal trees kept the community of Ngavalus from experiencing extensive devastation. The kainu and kalapulim trees grow to be quite large and are distinctive enough that fishermen use them as a point of reference while fishing and diving.

Coconut palms were planted in large numbers at the beginning of the 20th century, when Papua New Guinea was under the control of Germany. These palm trees are now 70-100 years old. For the community of Ngavalus, the value of a coconut palm does not only consist of its fruit or its use in construction. The juice, milk and flesh of the coconut fruit is commonly used for cooking. Coconut milk is also used as a bleach and preservative in basket weaving. Mixed with lemon juice, coconut milk acts as a natural hair conditioner, resulting in smooth hair. Palm trees are not very demanding, in fact, the people of Ngavalus have found that if one takes care of the trees in the first seven years, there is no need to look after them for the next 70 years. However, after 70-80 years, coconut trees gradually stop bearing fruit. Thus, over the past years there has been an increasing awareness in the community of the need to plant new coconut palm trees.

Oil palm cultivation is one of the sources of income that people in Ngavalus have. The fruit from the oil palm is sold to the New Britain Palm Oil company for the production of palm oil and is a growing industry in New Ireland. The fertilizer required to cultivate oil palms leeches the nutrients from the soil around the trees, preventing anything from growing under or in close proximity to the trees. Even when oil palm trees are cut down, it takes five to seven years for the soil to recover and be suitable for farming. It has become a trend that more and more landowners are allocating their land for the cultivation of oil palm, resulting in a decline in the availability of land to be used for subsistence gardening. All of which contributes to a growing food security concern for Ngavalus.

## Custom & Culture

*"Custom and culture are practices and expressions of individual or community held values and traditions which create a context for social interaction."*

The community at Ngavalus is a matrilineal society, meaning an individual's lineage is traced through their mother and the maternal ancestors. The definitions of the roles of men and women in the society span many generations. With the onset of modern times, there has been a blurring of the lines determining what men and women can or cannot do, but there are still distinctions of the roles played by either gender. Apart from being an important part of the family descent system and determining the inheritance of land, women primarily do the cooking, cleaning and washing, but often these chores are a combined effort by everyone in the community. The weaving of baskets, de-spining of Sago leaves in preparation for roofing, building of Sago troughs and washing of Sago are few among the many things done exclusively by women. The men, on the other hand, go out for shark calling, fish, dive for lobsters, build canoes, gather Sago leaves and sew them for roofing, cut down Sago trees and extract the pith. Men and women contribute equally in bringing up the children and their education as well as general maintenance of the village.

Children in the community are provided with a basic education at the school located across the street from the village. The school follows what they refer to as an outcome-based education curriculum, meaning the children are taught basic math, science, and language skills which are integrated into daily activities in the village teaching them social responsibility as well as school subjects. For example, math is taught while weaving to hone counting and math operation skills while at the same time passing down the knowledge of how to weave baskets and mats. The village leaders believe this will encourage the children to integrate all that they learn into responsibility in the community.

Community responsibility not only includes such things as maintaining the well-being of the community, but also in preparation and provisioning for ceremonies, festivals, and for families or individuals who need extra help providing for themselves. An example of this occurs when the community comes together to prepare for ceremonies. Usually, ceremonies and festivals in Ngavalus are centered around a feast and can end up being somewhat expensive, as is the case with funerals. So, when there is a death in a family, the entire community helps to organize the funeral providing the family with aid in anyway they may need it. Often times this includes either monetary

support to pay for the funeral or by offering to provide some of the food for the feast. When preparing the food for a large ceremony like a funeral, the community comes together to cut and wash sago, which takes a full day to process requiring as many sets of hands as can be found. Members of the community do this willingly because there is a deep understanding that, should the same thing happen in their family, the members of the community will do the same for them.

The leaders of the community are called Mai-Mais. Usually Mai-Mais are men, but there have been some instances where a woman has been given the title. The community of New Irelanders, the ethnic group the Tolai of East New Britain came from originally, consists of seven clans, each with its own Mai-Mai. All seven Mai-Mais make decisions in the community collectively. Before any individual does anything involving multiple clans, they must appeal to their own Mai-Mai and then get approval from the Mai-Mai(s) of the other clan(s). The selection of the lineal Mai-Mais is conducted through a consensus decision making process in which the entire family of each clan consults to choose their respective successors. All members of the family discuss at length who they believe is fit to become the next Mai-Mai and the successor is only announced when the entire family agrees on the choice. The family elects a successor based on the candidate's leadership qualities and level of individual integrity. The chosen individual then goes through a number of rituals which prepare them to take on the role of leader of the community. At the final ceremony, the village makes known its acceptance of the selected individual's authority, making the appointment official.

Every Monday morning, the community holds a community-wide meeting, called "line". This system of organization was introduced during the time of German occupation, but the community continues to hold the weekly meetings to make necessary announcements and to keep every member informed about what is going on around the community. Every member of the community is required to attend; those who do not attend must pay a small fine. At this gathering, various issues are discussed, ranging from the general welfare of the community to the preparations for a festival or special occasions. There is a set structure each meeting follows in which representatives of various committees get up to make announcements. These representatives head committees on health, youth affairs, education, law and order, as well as committees created to deal with planning specific events. At line, the representatives keep the community up to date on happenings, present proposed reforms and discuss general awareness of various concerns. Children are often encouraged to be part of this process to ensure their exposure to issues like hygiene and good morals.

The community of Ngavalus has a long-standing tradition of understanding and living in harmony with the sea. Many of the customs and legends of Ngavalus are focused specifically on the shark. In fact, their creation story is centered on the origins of the shark and one of their central customs is shark calling. Shark calling has been part of the customs of Ngavalus for the past 200 years. Russell explained how shark callers are required to do a great deal of preparation before actually doing the ceremony. Men must stay in the hausboi (the house in every village that is reserved for the education of the men and boys in the community) for an entire day before going out to sea. They should not eat food which has been prepared for a funeral feast or anything that has sadness or evil attached to it. They should not step in excrement and should have a dreamless sleep. These examples are just some of the many things the shark callers must do in preparation. These rules are followed very strictly because it is believed that the sharks are very sensitive to even the slightest deviation which may result in the sharks becoming violent or not responding to the calls at all.

The shark callers use an instrument made of dried coconut shells strung on a ring made of cane. Once out in the ocean, they shake the ring for roughly 20 minutes alternating between shaking it in and out of the water. Under water, the instrument sounds like a school of fish and above water, like a flock of birds, which attracts the sharks who mistake it for a feeding frenzy. Sharks up to 40 kilometers away can hear the sound and are attracted to it. Shark calling ceremonies generally occur during the months of September and October.

In Ngavalus, children are exposed to music at a very young age. There is a strong influence of gospel music and hymn singing resulting from the introduction of Christianity to the communities. Every Sunday morning, many members of the community go to the United Church service located a short distance from the school. There are fellowships and smaller Bible study groups held throughout the week where people read scripture verses, have devotions, and sing songs while someone strums the guitar. It is common for individuals in the village to gather around a table after dinner and sing gospel songs as well as songs composed by community members and popular Papua New Guinea songs as well as some popular songs from the United States.

### Knowledge

*"Knowledge is the information and experiential awareness which can be transmitted through language, art, or other expressions."*

In Ngavalus, there are many different places used for learning. There is a school run and sponsored by the provincial government, some private schools run by the villages themselves, and the hausboi. The men are brought up and taught the traditions and history of the community in the hausboi. They learn the role men play in the community and about all of the responsibilities they have for maintaining the well-being of the village. It is here traditions and customs are passed down through storytelling and participating in everyday activities and specialized projects. In schools, the children learn about the history of Papua New Guinea and the world, English, and basic arithmetic. The Australian curriculum is used in the provincial schools, but the village is teaching its students using the American curriculum. The main distinction between the two curricula is the version of English vocabulary, grammar, and spelling that is taught. In both instances students will have been exposed to at least three languages after their schooling: English, Tok Pisin, and their native language or dialect.

## Money

*"Money is the modes of transmitting and recognizing value exchange using physical and virtual surrogates including currency, systems of credit and barter."*

Kina is the currency used in the mainstream economy of Papua New Guinea. However, Ngavalus also uses a traditional form of currency called mis. Mis is primarily used within the community for various transactions or in local custom. The two primary uses of mis are in the purchase of community land and in ceremonies requiring a transaction of some kind. Similar to the Tolai tradition with Tambu discussed in the **Money** description in the **East New Britain** section of this document, children begin acquiring mis at birth and continue to accumulate it at milestones throughout their lives. As mentioned in the **Custom and Culture** section, funerals are relatively expensive, so members of the community contribute mis to help cover the funeral expenses.

Physical currency, whether it is kina or mis, is not the only item of value used in ceremonial transactions. Again using the example of the funeral, community individuals will sometimes provide the food, coffin, labor, etc. needed to prepare for the ceremony. When another family in the community must arrange a funeral, they know they will receive the same contribution from each family they provided for.

Because Ngavalus has an abundance of fish and lobster, fishermen often catch enough to provide for the community with enough to sell and export to other parts of PNG or in the Kavieng markets. On average, lobsters can be sold for 40 Kina (around US$17) per kilo. New Ireland also has an abundance of coconuts, which are gathered daily and sold them to copra companies for 80 Toea per kilo. Cultivation of oil palms has become another way for people in New Ireland to earn an income. All of the fruits from the oil palms are sold to the local palm oil manufacturer, New Britain Palm Oil Limited, which is a London-based company with a manufacturing facility in West New Britain, PNG.

## Technology

*"Technology is the artifacts or schemes by which value-added experiences and production can be effectuated."*

In Ngavalus, the supplies and tools for completing most everyday community tasks can be found in the surrounding forest. Trees, especially sago trees, are used for constructing houses, tools and roofing as well as a source of food. They also utilize every part of the tree. The actual tree is used for making saksak, which is their staple food, by beating the tree into small pieces which are washed and squeezed to release the saksak. The stalks are used to create the washing apparatus, which is a trough configuration with two levels, one for washing and the other for collecting the saksak. The stalks of the leaves are used as panels for the houses. The stalk is rounded on two sides and flat on the other two so the two flat sides must be cut off to be used as siding. Both of the sections cut from a single stalk must be usable; if they are not then none of the pieces from that stalk can be used. The two pieces from the same stalk are then positioned beside one another on the house and should fit together leaving minimal space between them.

In addition to the wood of the tree, the people also make use of the leaves of the sago tree. The leaves of mature sago trees are collected while they are still green and are sewn using maris, a bush vine, onto strips of bamboo, which are then secured to the rafters of houses using more maris. Because the supplies are located in the bush and must be transported back to the village, the men of Ngavalus have developed a bundling apparatus that allows them to carry all of the supplies at once. The men place six bamboo stalks in two parallel rows of three, creating a cage of sorts. As the leaves are gathered, they are placed between these stalks. When the cage is about half full, one or more bamboo stalks are placed on top of the leaves, leaving the two ends of the bamboo sticking out on either end. The men then continue collecting leaves on top of the bamboo stalk(s) until the cage is full. When enough leaves have been collected, maris is wrapped around the pile of bamboo and leaves at the gaps in the cage to secure it all together so it can be carried using the exposed ends of the bamboo. Due to the size and weight of this final bundle the men call it a "pig."

While sago is a staple food and tree used for a number of purposes, bamboo is another product of the bush also used for a wide variety of things. As previously stated, the bamboo shoots are cut into strips and used as the spine for sago leaf roofing. It is also used on the walls and windows of the house as well. Bamboo shoots found in the bush are cut into thin strips to be used for the frames of windows, the frames of panels and patches of the walls, and for the windows themselves. The men in Ngavalus use a weaving technique that involves bending the bamboo strips back and forth in a window in order to allow some light, visibility, and air flow to pass through the small openings while closing off the space in the wall.

With all of the techniques the people of Ngavalus have developed to complete everyday tasks, a few modern technologies have become more common in the village. On a very basic level, manufactured tools and utensils are more commonly used than traditional methods, the prime example of this being the widespread use of bush knives and metal bowls. Some members of the community have mobile phones and digital cameras. However, there is little accessibility to electricity except for gasoline-powered generators. Purchasing and fueling a generator ends up being a significant expense so they are used sparingly.

## Well-Being

*"Well-being is the capacity for any person or ecosystem to function at their optimal level."*

As is the case in many collectivist societies, well-being is a central focus of the Ngavalus community. The community as a whole puts an emphasis on cleanliness, hygiene, water and food security, and education among a number of other things maintaining the ability to function at its optimal level. As discussed in the **Custom and Culture** section, the greater Ngavalus community assembles each Monday morning to discuss communitywide issues and to make announcements. One of the announcements comes from the head of the health committee. This person addresses disease awareness, nutrition, hygiene, and basic first aid education among other health related subjects. The head of the committee also reviews the community procedure for dealing with injury or illness so everyone has the knowledge necessary to obtain treatment. The health committee includes information about modern medicine as well as natural

remedies in announcements, encouraging members of the community to utilize their knowledge of natural remedies before incurring the expenses of modern medicines. They work to educate the larger community about the abundance of health resources available to them instead of relying on manufactured products.

Nutrition and hygiene education is also an integral part of the school curriculum in Ngavalus. The students spend time in school learning about the benefits of washing their hands, bathing, brushing teeth, and eating healthy and take time in the morning to sweep and clean the school area. Sometimes they are required to clean up the beach, common areas, or other parts of the village later in the day as well. Not only is this initiative to keep the community clean focused on the school children, but it is also part of daily life for the adults of the community. Everyday the women of the community wake up early in the morning to sweep houses, kitchens, and the area surrounding their houses to keep it looking clean and eliminate insects. The men come together to repair roofs, windows, walls, and whatever else needs fixing to make sure every one in the community has sufficient shelter.

Collective responsibility extends into other aspects of the community's well-being as well. Similar to the Qaqet and Tolai communities of East New Britain, families or individuals in Ngavalus will take in and care for the widowed or elderly members of the community. Everyone works together to provide these members of the community with food, a well-kept shelter, and companionship. The communal mindset of maintaining well-being goes beyond those who are in need of help in the community. When a group of men have a particularly abundant haul from fishing, it is divided amongst all members of the community. The same goes for particularly large harvests of fruit or other foods. Often times, a surplus of food results in a community-wide feast at which all members of the community are provided with a portion of the abundance.

**Selenge Province, Mongolia**
***Date Entered: June 2011***

**Environment and Ecosystem**

Mongolia is the 19th largest country in the world with a total land mass of 1,564,116 square kilometers that is landlocked between two global giants, Russia and China. The majority of the country's land mass is found in the Gobi desert which has an area estimated around 1,295,000 square kilometers. Because of the harsh conditions of the Gobi Desert, the population of 3,133,318 Mongolians is concentrated in the other parts of the country, usually the urban centers. The capital city of Ulaanbaatar alone has a population of 949,000 people. Those who do not live in or near urban centers find them in the sparsely populated nomadic lands to the north and east.

Mongolia has a diverse terrain ranging from deserts to mountains and glaciers to lush hot springs. Elevations range between the lowest point in the country at 560 meters and the highest at 4,374. Temperatures vary widely depending on what region of the country you are in; however, there is a huge temperature shift from day to night as well. While staying in the northern-most province of Mongolia during the summer, the H.I.T. team experienced temperatures ranging from 21ºC to 24ºC during the day and 10ºC to 15ºC at night. These temperatures are roughly the average for the months of June, July, and August. There is very little foliage and much of the landscape of Mongolia is dominated by expansive grasslands and mountains, which do not contribute to heat retention allowing for the variability in temperature. Mongolia also experiences very little rainfall throughout the summer resulting in a scarcity of water in many of the regions. During the remainder of the year (September-May), temperatures average between -30ºC and 6ºC and the terrain is dominated by heavy snow and ice.

Despite the harsh climate and terrain, Mongolians have developed a living structure that can withstand both hot and extreme cold: the ger. Gers are round, collapsible homes used by nearly everyone in Mongolia. Gers can be found in cities, however, they are more commonly seen scattered across the countryside. The frame of a ger consists of a latticed frame used to support the walls and a central ring placed atop two poles at the center of the lattice circle. The central support is connected to the lattice using poles, which are inserted into the central ring, which are then secured by loops at the opposite end to the top of the lattice. The ger structure is then covered with multiple layers of wool, usually used in the winter, or felt, usually used during the summer. The circle at the top of the ger is generally left open to be used as a chimney. However, each ger has a cover that can be used to close the hole, keeping heat inside. Each ger usually has a stove that is placed in a central location for cooking and heat. The shape and materials of the ger allow it to provide shade and cross breezes by rolling up the bottom of the ger covers during hot days and to retain heat and keep warm when it is cold.

**Integral Accounting**

The six aspects of Integral Accounting, commodity, custom and culture, knowledge, money, technology, and well-being, outline a system in which value is ascribed to every part of a society. Each part adds its own unique aspect of value, benefiting the group as a whole.

**Commodity**

*"Commodity is those elements present in communities which, through cultivation, production or value-add, can be used to generate means of social or commercial engagement."*

The moderate temperature and dryness of the north make this area ideal for raising cattle, horses, sheep, and goats. The abundance of grass in this region allows families to let their herds roam and feed on their own during the day. Due to the latitude of the province, the extended daylight hours allow for ample light for herding, milking, and sheering when the herds return later in the day. No matter the type of livestock, there are many different products to be derived from the milk or fur of the animal as well as many uses for the animal itself. Sheep and goats provide wool that may be used for any number of things predominantly clothes to ger covers. Dairy products in particular are part of the sustainability of life in rural Northern Mongolia.

Milk is used to make several key components of the Northern Mongolian daily diet, including cheeses, butter, yogurt, alcohol, soup, and tea; all of which are consumed on a regular basis. Nearly every meal the H.I.T. team had while in the Selenge included the same assortment of ingredients. Soups are generally made using fats, water, vegetables and meat, but they also can contain milk, rice and raisins. The family we stayed with made both warm and cold desserts by adding sugar to various cheeses. Horses and cows produce milk that is used specifically for processing two types of alcohol. Horse milk is left in the sun to ferment from the heat. The longer the milk is exposed to the sunlight, the more potent the alcohol becomes. Shaking the fermented milk only increases the alcohol content further. Milk from cows goes through a distillation process resulting in an odorless, colorless liquor with a high alcohol content. Many of these processes and products have historical roots. For example, when Chinggis Khan was in power, he required his military forces carry a mixture of yogurt and water that would both hydrate and provide them with nutrients and calories. Nomads in the Selenge province still use this beverage today when following flocks of sheep and goats during the day or when travelling on long journeys.

Grass is a commodity for Mongolian nomads in the valleys of the north because it is one of the few types of vegetation found in the area. In the most basic sense, the grass serves as the food source for herds of livestock and, as a result of grazing, as an indicator of when the nomads should move to a new location. As the herds move up the mountains, the grass experiences fewer footsteps, so it is able to grow much taller creating the ideal feeding ground for goats, cattle, and horses as they roam. Nearer to the ger camp sites, longer grass is still available in small patches. These patches are used as needed to do things like dry clothes in the sun.

Rocks serve as more than mere pieces of landscape in Mongolia. Driving out of the capital city of Ulaanbaatar it is common to see extensive road construction projects in process. The road workers strategically place piles of rocks in order to block

oncoming traffic from merging into unsafe territory. Rocks are also used in cooking because of their ability to heat quickly and cook food evenly. Similar to Papua New Guinea, the rocks are placed in a fire until they are heated to the proper temperature. They are then placed into a pot containing all of the meat and vegetables to be cooked. Once the food is cooked thoroughly, the rocks are used as a way to sanitize hands before eating with them. Each person at the meal is given a hot rock that they must toss from one hand to the other for a few minutes before eating.

The cooking stones are heated using dried cow dung because it burns hotter than wood, which is scarce in the valleys of Northern Mongolia. Cow dung is a readily available form of fuel for fires since it is in abundance wherever there is a herd of cattle. While making high temperature fires is especially helpful for heating cooking rocks, cow dung is also used in cooking with the stove and warming gers when the temperature drops. Not only is it an abundant resource, but it also produces high temperature fires and acts as a mosquito repellant.

### Custom and Culture

*"Custom and culture are practices and expressions of individual or community held values and traditions which create a context for social interaction."*

Mongolia is a country that is landlocked between two super giants in the global community: China and Russia. While Mongolia has a rich history that dates back to the time of Chinggis Khan in the twelfth century, both countries have had a very profound and recognizable influence on the custom and culture of modern Mongolia.

Beginning in 1924 the Mongolian government was backed by the USSR and established itself under a communist structure. This communist system prevailed for much of the twentieth century up until 1990, when a democratic revolution ensued, bringing Mongolia into a new age of capitalism and more democratic government. This change has had a staggering effect not only on the economic and governmental environments, but also has influenced the ever-growing culture of the Mongolia.

A prime example of this new cultural hybridization lies in the country's main religion, which incorporates a newly revived form of Buddhism. Mongolian Buddhism takes most of its practices from Tibetan Buddhism, while incorporating elements of the ancient Shamanism that has existed for centuries in the nomadic regions of Northern Asia; this all in a developing environment of secularism and a capitalist economy. The result manifests itself in a community that on the surface exercises many Buddhist/Shamanistic practices in daily life as customary tradition, yet stays transfixed within the global culture and new development that has come about in recent years.

Examples of these religious customs can be seen first and foremost in the use of the Khatas, prayer scarves, which ornament the land and city-scape throughout the country. These prayer scarves are generally tied anywhere from the sun visors inside of cars to the bases of statues. The most customary place, however, is on prayer poles that sit along the sides of main roads, inside of urban centers and near monasteries. The ritual of attaching a new prayer scarf to a prayer pole begins by attaching it to the pole, then touching the pole while walking around it clockwise three times and making a wish or thinking positive thoughts. It is also customary to honk three times when driving passed any prayer pole.

In addition to the prayer poles, there are other highly visited sites that relate to both Buddhism and Shamanism. Among these are monasteries run by Buddhist monks as well as natural sites that are said to contain considerable amounts of energy and are related to the spiritual power of nature derived from the Shamanistic ideals. These manifestations of tradition go beyond religion, also showing up in the highly regarded history of the Mongolian people. The nomadic lifestyle and communal traditions of the past are still important to the people in Mongolia. The conqueror, Chinggis Khan is the most iconic national hero in all of Mongolia. The shared history with Chinggis Khan ties the people together into a group with a strong sense of nationalism and pride in their heritage and culture. Naadam, an annual festival held throughout the country, celebrates the history of the country through active participation in three national sports: wrestling, archery, and horse racing. The history lives not only in celebration, but in daily activities as well. Instances of this include the specific ways by which various foods are prepared, vodka salutations, as well as the location and orientation of gers.

The use of gers instead of immobile houses has been important to nomadic peoples in Mongolia in large part because of the environmental awareness that has been prevalent in the country for years. The gers in the countryside are moved frequently, usually every two weeks, to ensure the effects on the environment are minimal. In addition, the transportable homes are always placed in a location at least 50 meters from local water sources so contamination is less likely. This custom, like many others, has been practiced for centuries and is rooted in the county's rich history.

In the countryside the ger is the center of the community. Each family (including members of extended family) or small groups of families assemble gers in the same area, while tending and herding livestock together as well as carrying out various day to day tasks that have origins in the historical background of their ancestors. During the middle of the workday, free time comes up regularly because tending livestock is mainly in the morning and evening. This time is often filled with various card games, soccer, volleyball, basketball, or a number of other games. Recently, many nomadic people in the countryside have begun purchasing solar panels which have the capacity to power small televisions and lights inside of their homes.

Mongolian culture has been noticeably impacted by the rise of a democratic and capitalist society over the past 20 years. This change exhibits itself in the widespread use of the English language throughout the country (specifically in the capital city of Ulaanbaatar), as well as in the diffusion of primarily western entertainment throughout the country. Various cable and satellite television channels broadcast English language music that has been accepted by much of the younger generation and can be heard in nightclubs throughout Ulaanbaatar. This dynamic of culture has

had a significant influence custom and culture as a whole throughout the country. From a broader perspective, Mongolia has been greatly affected over the past generation; elements of history and tradition have blended together with those of a new popular culture creating a hybridized custom and culture in the country.

### Knowledge

*"Knowledge is information and experiential awareness which can be transmitted through language, art, or other expressions."*

One of the things Mongolians take a great deal of pride in is the basis of their traditions in their national history. Every custom or practice has a direct connection to a story in Mongolia's past and every Mongolian has a vast knowledge and respect for these national traditions. This knowledge and pride is present in all generations in society, children as young as age 10 have a deep-rooted respect for the origins of their practices. Many of these practices stem from the time of Chinngis Khan, one of Mongolia's most well known historical figures, which has fostered a strong sense of national pride for his accomplishments. This sense of historical significance is not limited to solely the most predominant components of Mongolian society, instead it includes things as common place as the positioning of a family's ger and the origination of components of every Mongolian's regular diet. For example, when families are selecting a location to set up their ger camp, they never settle on a location any closer than 50 meters to the primary water source. In this instance, not only is there an element of tradition, but there is also a level of consciousness for preserving well-being. By living in an environment that fosters the passing on of tradition, younger generations learn to understand the origins of traditions at a very young age.

While general knowledge of Mongolian tradition is apparent in all the regions of Mongolia, in the rural areas of the country, the youngest members of a community are also taught the information necessary to lead a nomadic and agriculturally based lifestyle. In the Selenge province, the vast majority of nomadic peoples are involved in either cultivation or herding, sometimes in both. Because the population density in the countryside is so low, the agriculturally based society relies heavily on large families to provide the manpower needed to complete all of the daily tasks. As a result, relatives often settle in small clusters of two to four gers. Whether it is something as basic as going to get water from a nearby stream or a task requiring more skill and experience like shearing sheep, children as young as age four are either participating in or observing and learning about every aspect of nomadic life. In fact, children as young as three, participate in horse races further emphasizing the early immersion into agricultural life and the skills required in such a lifestyle.

Not only do children learn how to effectively interact within their own environments, but they also begin developing global interaction tools and skills once they begin attending school. Mongolia as a country has always been very aware of their foreign interactions, a necessity stemming from the fact that they are surrounded by two global giants: Russia to the North and China to the South. The Mongolian government has even adopted a "60/40" foreign policy, meaning that they allocate 30% loyalty to China, 30% to Russia, and 40% to the rest of the world. This global mindset combined with the prevalence of Communism resulted in the integration of the Russian language, both spoken and Cyrillic, into elementary and middle school curricula up until roughly fourteen years ago. Though communism was replaced with democracy in 1990, the Russian language still dominates as the desired second language. It was not until recently when English began to replace Russian in use and in schools. As discussed in the **Custom and Culture** section, it is currently common to see restaurant signs and road signs among numerous other things in Mongolian and in English.

### Money

*"Money is modes of transmitting and recognizing value exchange using physical and virtual surrogates including currency, systems of credit and barter."*

Mongolia has been presented with the opportunity to build a unique framework for themselves both politically and economically as a result of their recent change in governmental structure. Building this foundation is proving to be a very complex process as two distinct parts define the Mongolian economy: the formal and informal sectors. The formal sector includes all businesses and organizations that are registered with a licensing authority and a tax commission while businesses and organizations in the informal sector are not. As a result of this registration, there is a clear record of the businesses included in the formal sector adding a level of efficiency to the search for desired commodities and services. The majority of the Mongolian economy, however, operates in the informal sector. Since this means businesses are not registered with a licensing authority or tax commission, there is no centralized record of all the operating organizations. Business relationships in the informal sector are developed and maintained over time into lasting partnerships. While it poses some obstacles for organizations attempting to enter into new business interactions in the informal sector, it facilitates the development of coalitions of commodity and service providers that end up working together for long durations of time. Operating in such an economy requires a great deal of patience and understanding that time is required to accomplish projects. Time must be allocated for research and inquiry into which businesses provide what commodities and services as well as relationship development with whichever organization is ultimately selected.

In a non-economic sense, value is assigned to two primary commodities in Mongolia: horses and vodka. In countless societies, past and present, horses are signs of fortune and success as well as a way to measure an individual or family's wealth. Such is the case across the entirety of Mongolia. Livestock is another way to measure a family's wealth, but individuals who own large numbers of horses are considered to be among the wealthiest in society, whether rural or urban. A great deal of importance is placed on national and local horse races and a family or individual can gain elevated prestige by winning these races. Ultimately, horses contribute to boosting an individual or family's asset value. While it is not used as a measure of wealth, vodka holds a significant amount of value in Mongolian society. The origin of vodka distillation in Mongolia is unknown, but distillation and consumption have quickly become widespread traditions in Mongolian culture. There is a great deal of national pride in Mongolian made vodka and it is presented as a gift to everyone an individual interacts with.

## Technology

*"Technology is the artifacts or schemes by which value-added experiences and production can be effectuated."*

Resourcefulness is a key characteristic of Mongolian life, whether in the city or the rural areas of the country. Electricity is a rare luxury hardly ever seen in the nomadic lands of northern Mongolia, as it is not necessary for completing everyday tasks, but some do make use of portable and renewable energies. Nomads make use of solar panels that are placed just outside of the ger, generally on a pole that is stuck into the ground and secure enough to survive some harsher weather. This technology is used to power other luxuries that require electricity such as television, radios, and lights. Due to the rarity of these technologies, Mongolians find other ways to entertain themselves, provide themselves with light, and complete necessary tasks with only what can be found in their surroundings.

Although electricity is rare in the countryside, the city must make efficient use of the electricity it has access to, because power outages are a common occurrence. This means that despite a general presence of electricity throughout the cities, such as Ulaanbaatar, Mongolians must be ready to make do without this aspect of urban life. In the summer months (June - August), electricity is more reliable than in the winter months when weather conditions become an obstacle. Professions such as construction use the consistency of electricity in the warmer months to complete as much work as possible. No matter the location, rural or urban, Mongolians must make use of several resources to accomplish the same jobs they would use electricity for. This makes electricity a luxury that is enjoyed, more often in the cities, but is not a necessity for life throughout the country.

## Well-Being

*"Well-being is the capacity for any person or ecosystem to function at their optimal level."*

As mentioned in both the **Commodity** and **Technology** sections, Mongolians are very good at using what resources they have presented to them by nature and circumstance. At ger camps, there is a customary placement of the gers and the pens for the livestock in relation to the water supply. Many tools the nomads use on a daily basis are used for secondary purposes that allow for the preservation of those tools and help to reduce the environmental impact on a location. Preservation of the environment in the nomadic lands is extraordinarily important. One of the reasons why nomads move from one site to the next, following their herds to new grazing areas, is to allow the grass in the previous location to replenish. The animals will have eaten and trampled much of the nearby ground so it is necessary to follow them to other grounds to provide them with a new supply of grass for consumption.

While preservation of the natural world is important, it is equally important for the nomadic peoples of Mongolia to protect themselves from illness. For this reason, Mongolians make use of bandanas and other clean garments for water filtration. Despite a fairly clean natural water source, the filtration allows for dirt and other larger pathogens to be kept out of the drinking water supply by running through a filter. This use of bandanas for water filtration is one example of how the team's hosts have multiple uses for the few objects they have. The nomads are also known for making use of yellow water (see Trust Items section) for several medicinal purposes. This is especially resourceful because this is an example of a byproduct that is not wasted after processing, but used to promote well-being by acting as a digestion aid and skin care product among other uses.

Communities of nomads often come together to complete everyday tasks. While, the same people do the same jobs everyday, almost everyone knows how to do everything if necessary. There are some jobs that are considered more appropriate based on gender, but all jobs must be completed and it generally does not matter who is doing them as long as they are done. The H.I.T. team was able to experience the community coming together on a day when all the sheep were to be sheared. On that morning, people from all of the surrounding gers came out to help our host family with the big job. There were some who were not strong enough to wrestle the sheep to the ground, so there were people whose job it was to move the sheep from the pen to the shearers. Others were very efficient at shearing so they focused solely on that task, while a few were teaching some of the children. There were still others whose job it was to mark the sheep once sheared. It was a whole community effort and took the entire morning. With larger herds, this job may take all day to complete, so it is essential that all members of the ger community work together to get the job done. There is no reason for one person to finish faster than the others, because everyone has the responsibility to help those who are still working.

Resourcefulness and a community mindset have developed in large part because of the environment that exists throughout much of rural Mongolia. Ger camps in the countryside are often situated more than 20 kilometers from towns and paved roads. This presents a struggle since it can take hours to travel on rugged dirt roads, limiting access to resources such as stores and medical care. Many communities situate themselves near natural water sources such as rivers, streams, and springs as noted above. In addition, they adapt not only to the remoteness, but also to the harsh environment that Mongolia presents.

The climate of Mongolia itself presents challenges that have required the people to adapt to a myriad of conditions. This can be seen in something as simple as the eating habits of the Northern Mongolian nomads. During the spring and summer dairy products are the staple of every meal and meat is seldom eaten. This changes in the fall and winter months when meat and fat are eaten in larger quantities in order to stay healthy during the cold winter. This adaption as well as a group mentality has enabled the rural Northern Mongolians to maintain well-being in spite of drastically changing environments.

# Trust Items

**Glossary of Terminology**

**Chronicler(s):** Specific Heritable Innovation Trust team member or set of team members responsible for the documentation of the item. All members of the team have experienced and are familiar with this knowledge this simply denotes the author or authors of a particular item entry.

**Explanation of Variation:** Documentation of the known variants in the process, artifact, practice, etc. in the item entry. Only information that has been shared about variations is documented here: no outside research was done to acquire this information. Variants are not limited to what is documented here.

**Global Market Consequence:** Suggested aligned and non-aligned market sectors where there is potential for utilization. Possibilities for utilization are boundless and are not limited to those found in this section.

**Local Name:** Item name used by the community from whence it came. Often times, the name listed under this heading is in a local language and may not necessarily be the national language of the country at large. All words usually expressed in a written language that does not use the modern Latin alphabet have been spelled phonetically by members of the community.

**Origin:** Location where a Heritable Innovation Trust team learned about a particular item. It in no way limits the process, artifact, practice, etc. to one location it is merely a documentation of where each item was acquired. As more information is gathered about where the item exists, this data will be amended.

**Source:** Person or group of people that told or taught a Heritable Innovation Trust team about the item. It in no way gives ownership to that person or specific group of people it merely acts as an identifier. All knowledge regarding the item is stewarded by the entire community that presented the item for documentation. The names provided are the names specifically given to the Heritable Innovation Trust team. Frequently last names are either unknown or non-existent, therefore only first names are provided. As this information is learned it will be amended.

**Notes of Clarification**

In 2009, the Heritable Innovation Trust team worked in close contact with an organic spices and essential oils company by the name of Pacific Spices. The following year the company underwent changes and was referred to in the 2010 document as Follywell No. 6, Ltd. After filing all the necessary paperwork, Follywell No. 6, Ltd. became known as Amruqa. All aliases found in the Heritable Innovation Trust documentation having to do with the company have been kept as they were at the time of documentation. All references to Pacific Spices, Follywell No. 6, Ltd., or Amruqa refer to the same organic spices and essential oils company owned and operated in East New Britain, Papua New Guinea.

## Agricultural Techniques

**Baby-Integrated Animal Milking Processes (Camel, Yak, and Horse)**

Animal milking in Mongolia starts with a unique process attribute. During the milking process, the animals are not immediately approached; instead, a baby is brought to the mother to start feeding. After the baby has started the milking process, the baby is led away and the manual milking process takes over. While this process is similar in all the communities, each community has different procedures for the manual aspect of milking their respective animal (see **Figure 1**).

***Origin:*** South Gobi Province, Arkahngai aimag (Mongolia)

***Source:*** Bud and Shinekhuu (South Gobi), Tuvshinjargal and Enkhbayar (Arkhangai)

***Chronicler(s):*** Kenneth Andrew Dabkowski

***Date Entered:*** August 2010

***How To:***

Camel Milking (South Gobi) and Yak Milking (Tuvshinjargal, Arkhangai)

After the baby is removed from the camel or yak, the milker approaches the animal from the side and uses their knees to support a bucket to collect the milk. The only variation between these processes is that the milker stands when milking the camels and sits with the yaks.

Horse Milking (Enkhbayar, Arkhangai)

After the baby is removed, the milker approaches the horse from the side. They then begin milking by placing one hand below the horse and one hand through its back legs (see **Figure 2**). This process is usually repeated five times per day.

***Global Market Consequence:***

Milking animals is very common world wide. Agribusinesses and individual farmers all use different techniques. With continued observation, value-add of the processes above may become more evident.

In terms of knowledge sharing, these techniques may add value to herding communities around the world. In a larger context, agribusinesses (large conglomerate companies focused in agriculture) such as Fonterra Co-operative, China Dairy Group, Unilever, Donegal Creameries Plc, Megmilk Snow Brand Co Ltd., may be interested in these techniques.

**Coconut Harvesting and Processing**

Pacific Spices has expanded their coconut oil processing to other areas of the East New Britain province. Currently they are transporting coconuts to the Vunakanau facility from the Induna plantation and various other locations across East New Britain. This involves shipping all of the organic material (husk, nut, and liquid) at considerable energy and transportation cost. To reduce costs of labor and to shorten the time between coconut de-husking and processing, processing facilities are currently being set up at the Induna Plantation. In earlier periods, the coconut was used primarily to produce copra (dried coconut), but now Pacific Spices is providing a value-add to the coconut by creating products, like extra virgin cold press coconut oil, which command far greater value on the international market.

***Origin:*** Pacific Spices (Papua New Guinea, East New Britain)

***Source:*** Pacific Spices Staff members

***Chronicler(s):*** Katherine Irene Martin

***Date Entered:*** June 2009

***How To:***

Preparation for Processing

Once a shipment of coconuts arrives, they are immediately de-husked. In order to produce a sufficient amount of oil, 2,500 coconuts must be prepared for processing per distillation run (see **Figure 3**). Coconuts are de-husked using a metal bar with a point on one end. The bar is put into the ground pointed side up. When it is securely in the ground, the coconut is thrust onto the point and turned to break the outer husk. It is repeatedly pierced and rotated until the nut has been fully removed from the husk (see **Figure 4**).

To ensure the quality of the oil, the de-husking process provides the first quality checkpoint. Before the coconuts are de-husked, they are separated depending on the quality of the coconut. If a shoot has begun growing from the coconut it is set aside to be used for copra. The team at Pacific Spices checks each coconut, and those that are not of good quality are ejected from oil processing (see **Figure 5**).

Once 100 coconuts have been de-husked they are loaded into a wheelbarrow and taken to a designated area for storage until processing begins. This process is repeated until every de-husked coconut has been moved into storage. The processing is done as soon as possible after the de-husking to ensure the quality of the oil.

Processing

When it is time for processing to begin, the coconuts are cracked open and go through another quality checkpoint (see **Figure 6**). The water inside is inspected for proper color and smell (clear with the scent of fresh coconut). Those that do not meet the standard are disposed of. Coconuts that are not of processing quality, but are not rotten can be used for copra. Rotten coconuts are ejected from the process altogether. If the nut itself looks rotten or damaged before cracking, it is immediately removed from processing.

The coconuts that make it past this checkpoint are then either finger cut (the flesh is cut out of the nut using a knife) (see **Figure 7**) or put through a de-shelling machine to separate the meat from the shell. When this is completed the coconut meat is weighed and recorded. Next, the coconut meat is washed in baths of water, which is changed every 500 coconuts to ensure cleanliness (see **Figure 8**).

Once the coconut gets to this point it is grated to provide maximum surface area and then weighed and recorded again (see **Figure 9**). Two buckets of hot water and one of the coconut water is then mixed in with the grated coconut to enable oil extraction (see **Figure 10**). The water and coconut must be mixed very thoroughly to ensure that all of the oil can be extracted (see **Figure 11**). Pacific Spices has been experimenting by using different water temperatures to determine which is best for maximum extraction. This must be done very carefully because too much heat changes the quality of the oil and risks spoiling the entire batch.

The coconut-water mixture is then put into a cold press (see **Figure 12**). Pacific Spices chooses to use a cold press rather than one that produces heat during operation to ensure top quality oil. The oil from the press is collected in buckets and poured into steel-drums (see **Figure 13**) where it sits for three hours. After this time, the water is removed from the bottom of the container by opening a valve under the drum (see **Figure 14**). The remaining liquid sits in a steel-drum container for 18 hours allowing it to separate. At the end of this step, the mixture has separated into four layers: "crud" at the top, oil, milk, and, finally, cream at the bottom. The "crud" is scooped off by hand and discarded (see **Figure**

**15**). Then, the oil is removed and placed in a separate container. Once the oil has been removed, it is weighed and recorded. The remaining two layers of milk and cream are disposed of.

The oil is set aside for three hours to allow for sedimentation. It is then poured through filtration bags to remove the sediment and is left to sit again. After the second sitting, it is poured through the filtration bags a second time to remove the remaining sediment (see **Figure 16**). After sitting a final time, the oil is poured through a separating funnel (see **Figure 17**). The funnel traps the water in the bottom and allows the oil to pass through the filters. This is an essential step because if water is left in the oil, it will cause spoilage. Once all of the oil passes through this filter, it is weighed in buckets and recorded before being put in containers for storage (see **Figure 18**).

***Global Market Consequence:***

Apart from the marketing Pacific Spices already does in producing and selling its products, we see many more opportunities for Pacific Spices to interact with the world market and with companies similar to itself internationally. Firstly, Pacific Spices is an expert and valuable source on all of the processing and farming techniques they have developed since 1996. Other companies seeking to enter into processing and farming similar to Pacific Spices should look to the company for guidance. Apart from the technical knowledge of farming and processing possessed by Pacific Spices, the company has developed an effective business model for working in communities and areas of difficult communication and access, such as Papua New Guinea. In addition to processing coconut oils Pacific Spices could look into turning that oil into fuel for vehicles to add another product to their inventory. There are a number of places which use a 20 to 1 ratio of diesel to coconut oil to run their vehicles and this could serve as an important energy source in the future. Kokonut Pacific currently promotes and manufactures this biofuel and Pacific Spices could contact them for more information.

In today's market, coconut milk is not only used for cooking, but also in natural skin care products. Eminence Organic Skin Care, The Body Shop, Organix, Fresh Body Market, Bath and Body Works, and Pure Fiji are just a few companies currently marketing organic, all-natural coconut milk lotions, creams, shampoos, and soaps. This could prove to be a great opportunity for Pacific Spices to utilize their unused coconut milk from processing to either produce organic skin and hair care products or sell it to manufacturers. With the current market for organic, eco-friendly products, this would be a great way to not only create a marketable product, but also use up the otherwise wasted coconut milk from processing. Pacific Spices is also an expert on ways to ensure ethical trade and production in areas where these factors have not historically been considered. Many companies seeking the products that Pacific Spices offers could also benefit heavily from forming business relationships with them. Pacific Spices provides quality unmatched by most facilities that produce similar products.

**Farming Techniques in the Coastal and Mountainous Regions of East New Britain**

Agricultural techniques vary along with the terrain of the coastal and mountainous regions of East New Britain. These variations in techniques relate both to the physical differences in terrain and also to the cultural differences of the people who traditionally inhabit these regions.

***Origin:*** Komgi, Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Various members throughout both communities

***Chronicler(s):*** Katherine Irene Martin

***Date Entered:*** June 2009

***Explanation of Variation:*** Due to widely ranging regional factors, cultivation techniques have developed to best suit each environment. The two primary crops, sweet potato (kaukau) and cassava, are used as an example of this general variance as both are present in coastal and mountainous areas.

***How To:***

Sweet Potato (Kaukau)

a. Coastal - commonly planted in small mounds generally 46 centimeters tall, two runners (leaves and root systems of kaukau) are planted directly into each mound

b. Mountains - multiple runners are planted into larger mounds or, more commonly, directly in the ground

Cassava (also acts as a natural insect repellent)

a. Coastal - planted diagonally into the ground in straight rows along the edges of gardens

b. Mountains - planted diagonally into the ground with the exposed ends pointing toward each other creating a triangular shape

***Global Market Consequence:***

There is a growing demand for all-natural insect repellents that do not contain chemicals like DEET (Diethyl meta tolumide) because of harmful environmental consequences. The properties of the cassava plant that make it a repellent are unknown but would be a great opportunity to market an eco-friendly, organic, renewable product as an alternative to the current conventional options. OFF!, California Baby, Repel, and Bull Frog are all companies manufacturing conventional insect repellent that may be interested in an organic alternative.

**Guayusa Cultivation and Processing**

Guayusa (family: Aquifoliacae; genus: Ilex) (also known as aguayusa, wayusa, wayus, huayusa, guañusa, waiyoosa, guayyusa, wausa, wais (Shuar language), wuís (Shuar language), emonteibiquime (Huoarani language), kopíniuk (Záparo language)) is a shade-grown, perennial Amazonian holly tree that grows as a shrub or small tree under the forest canopy of other native tree species from southern Colombia to northern Peru. In Ecuador, it is known to be present in the provinces of Sucumbíos, Napo, Pastaza, Morona Santiago, and Zamora Chinchipe, but has also been found up to 2000 meters along the Eastern foothills of the Andes. The plant grows naturally in the area and is (or was) cultivated by a variety of indigenous groups, including the following: Napo Runa (Quichua), Canelos Runa (Quichua), Quijos Runa (Quichua), Shuar, Achuar, Záparo, Shiwiar, Omagua, Kokama, Pánoba, Kaschibo, Koto, Pioché, Lamisto, Kichos, Kanelo, Aguano, Kandoschi, Sssabela, Chívaro, Mayoruna, Tshayahuita, Tschamakiro, Chebero, Omurana, Yagua, Auischiri, Ssimaku, Ikito, Yameo and Pintsche.

The tree generally grows to a height of 10 meters, has a diameter of 50-80 centimeters, and presents dense foliage. The trunk has white bark and a smooth texture. The branches are extended and flexible. The leaves are leatherback, olive-green, oblong-elliptical, serrated, 15-21 centimeters in length, 5-7.5 centimeters in width, with a short petiole of 1 centimeter in length. The fruit is a round green berry almost 1 centimeter in width. The flower has a white-green corolla, with obtuse petals, stamens in the same number as the petals, oblong anthers, and a sub global sessile ovary usually with 4-6 cavities.

Guayusa leaves have been eaten and/or boiled and drunk for centuries by a variety of indigenous groups, including the Kichwa people of Napo. The most common method of consumption is as a tea resulting from boiling the guayusa leaves in a pot of water over a wood fire, using the same set of leaves multiple times before replacing them with new ones. Guayusa tea is traditionally drunk in the early morning hours (between 2 and 5 o'clock) using a small, wooden, gourde-like bowl called a pilche, which is made from the fruit of a local tree species and believed to enhance the flavor.

The guayusa leaf, whether chewed or drunk as a tea, is believed to have a wide variety of uses. Such uses include use as a physical and mental stimulant, pain reliever, diuretic, aphrodisiac, fertility enhancer, and in the prevention of fly, wasp, and snake bites. Communities also believe guayusa provides a person with good luck or a successful day of hunting and fishing.

Guayusa trees can be found wild, but many indigenous peoples also grow the tree near their homes and keep it on hand for regular daily consumption. When guayusa is consumed, a variety of cultural activities take place. Often, stories are told, dreams are interpreted, and elders play the flute or the drums. During this time, the family also plans the work day, prepares instruments needed for hunting, fishing, and daily life in the jungle (nets, spears, etc.), and advises young people about proper behavior and family/community responsibilities.

Kichwa elder Vicente Francisco Grefa Salazar shared one of the prominent myths surrounding the origin of human consumption of the guayusa leaf in the Amazon. The story was told in Kichwa, translated into Spanish by Vicente's son-in-law and Runa technician, Patricio Andy, and translated here to English:

> *Guayusa was used long before the Spanish and Incan conquests. A long time ago, guayusa was unknown to anyone. At that time, the jungle was very aggressive with people, and people were always tired and couldn't do anything. They were sleepy all the time and had no strength. This was the biggest problem facing the first people in the Amazon. So, one day a man went into the forest, sat down next to a tree, and fell asleep. All of a sudden, the guayusa tree called his attention, telling him, "take my leaves and eat them." Again, it told him, "eat the leaves." The man got up and looked around, wondering who was talking to him. Once again, the guayusa tree said, "take my leaves and chew them." The man then realized it was the tree that was talking to him, so he grabbed a leaf and chewed it. He ate the leaf and immediately felt relieved, no longer sleepy, feeling energized and strong.*
>
> *After experiencing the effects of the guayusa leaf, he harvested the rest of the leaves and took them to his family. He first shared the leaves with his family, then told all the neighbors about his experience and urged them to consume it so they would not feel lazy or tired but have lots of energy. From this moment on, the Kichwa people began to chew the guayusa leaf, and later decided to cook it.*

Due to its varied applications, connections to native mythology and cosmology, and continuity of use among the Kichwa people in the Napo province, it serves as a central element of local cultural identity and lifestyle.

| | |
|---|---|
| ***Origin:*** | Napo Province (Ecuador) |
| ***Source:*** | Kichwa People and Runa Foundation |
| ***Chronicler(s):*** | Christopher Jarret |

***Date Entered:*** July 2010

***How To:***

Cultivation Process

*Traditional*

Archaeologists have discovered traces of guayusa leaves in tombs dating as far back as 500 B.C.E. Kichwa families have been transplanting guayusa plants into small garden plots near their houses and next to sources of water by wrapping them in leaves using a technique called maito (also used in the preparation of meat and fish to give it more flavor). Various Kichwa people have explained that families used to bring their guayusa plants with them when they moved their homes, and traces of guayusa leaves have been found a few centimeters below the soil near where houses used to be.

*Contemporary*

At the Runa Foundation, guayusa is most often transplanted from existing trees, although seeds are also available. From an existing guayusa tree, one either collects a number of branches that are neither hard nor tender or gathers young guayusa trees that have begun to sprout around the base of a mature tree. The collected cuttings look like sticks and are called "estacas" in Spanish. Essentially, they are small, rootless trees.

There are three preliminary stages a guayusa leaf goes through before reaching maturity.

1. A few centimeters of a cutting from an existing guayusa tree are planted in a nursery bed under shade. This requires a variety of other species of trees to be planted in the vicinity to provide the necessary cover for the young guayusa cutting to survive (for this reason, guayusa planting contributes to reforestation). The soil in which the cutting is planted should consist of black dirt, sand, and ashes all mixed together. This allows for oxygenation to occur. The cuttings stay in their shaded nursery for three months until they root and grow leafy offshoots 15 – 25 centimeters tall.

2. After three months in a plant bed, the budding guayusa cutting is transplanted into a small bag. Still under shade, the young plant adapts to life in its protective bag, continuing to root and grow leaves. This stage generally lasts one month.

3. After the third month, the guayusa, still in its bag, is then moved into the sun for one more month to prepare for its final destination.

Once the guayusa tree has reached the proper maturity, a hole is dug about 30 centimeters deep, and the guayusa tree is planted after the plastic bag is removed. The tree is placed in the hole and the hole filled with black dirt. After three years of growth, the leaves are ready to harvest. When harvesting, an entire branch is cut off the tree, rather than picking individual leaves. Using this technique, the tree recuperates quickly, sprouting more branches as it grows. Thick, dark-green leaves are selected to produce the most flavorful tea. After three months, the branches have regenerated and a second harvest can be gathered. Three harvests per year are possible.

Tea Production

Once the leaves have been purchased by the Runa Foundation, they are taken to the pre-drying building. Here, they are unloaded and spread out on racks so as not to get damaged by staying packed for too long. For 24 hours, the leaves are left to dry under a covered area. Discolored leaves are then separated from the highest quality leaves, again looking for thick dark leaves.

The best leaves are transported to the dryers. There are currently two dryers powered by natural gas at the Runa processing facility in Archidona - one with a single large section and another with two sections to fit a larger quantity of leaves. For five hours at 57.8ºC, 21.8 kg of guayusa can be dried in the big dryer. However, it takes roughly two and a half hours for 4.9 kg of guayusa to dry at the same temperature in the smaller of the two dryers. Once dried completely, the leaves are taken out of the dryers, off the drying racks, and put into half-barrels to get crushed into the appropriate size for tea.

The leaf pieces are then gathered into large bags with the Julian calendar year and the identification of the dryer technician responsible for each batch written on them. For example, if the leaves were harvested June 4 and the first dryer technician dried the leaves, then the technician would write 155.1 on the bag, because the leaves were harvested on the

155th day of this year and he is the first dryer technician of the day. Thousands of pounds of guayusa are transported by truck from the drying facility in Archidona to Quito to be exported to the United States.

***Global Market Consequence:***

There is a large market worldwide for organic teas and extracts. Guayusa beverages (warm teas and cold drinks, some with sugar, cinnamon, alcohol, and other additives) are widely sold in small cafés and restaurants in the Amazonian region of Ecuador. However, there are several companies that sell guayusa to a broader area. Such companies include HerbResearch, Maya Ethnobotanicals, Four Winds Botanicals, Garuda International, Divine Shaman, Amazon Therapeutic Laboratories, and of course Runa LLC. Guayusa's widespread use in indigenous communities suggests that there are a number of qualities of these leaves that provide health benefits. The plant itself contains guanidine, which has been found to lower blood pressure and blood sugar suggesting an organic treatment for those with high blood pressure or diabetes, the use of which may reduce side effects occurring from modern chemical treatments. Through study, other beneficial components can be discovered and applied to modern medical products.

**Hillside Farming**

Many of the communities of Papua New Guinea are located in mountainous regions with very little level land available. However, these communities have adapted their agricultural techniques to accommodate the existing terrain. This knowledge has been developed through centuries of experience living and farming the mountainous terrain of the country. Because working in the garden is an activity that involves the entire community, all community members have an understanding of hillside farming techniques. The community awareness of land management is propagated from an early age as children observe the older members of the community cultivating and tending their gardens.

| | |
|---|---|
| ***Origin:*** | Komgi, Raunsepna/Anesmetki (Papua New Guinea, East New Britain) |
| ***Source:*** | Ben Maraedi (Anesmetki) and Clement (Komgi) |
| ***Chronicler(s):*** | Taylor Lynn Starns |
| ***Date Entered:*** | June 2009 |
| ***Explanation of Variation:*** | We observed and asked about the techniques during our trips to the gardens in Anesmetki and Komgi. The provided information is a compilation of methods observed in a number of communities and can be generalized across the gardening methods in the region. |

***How To:***

Several strategies are used by the Qaqet to prevent erosion in hilly gardens:

1. When clearing space for gardens, farmers cut large trees, but leave their stumps, roots, and seedlings in the ground to prevent erosion (see **Figure 19**).

    a. The trunks of the trees which are cut are usually used to build fences around the garden.

2. When planting crops on hills, the plants are planted into the ground at an angle opposite that of the slope of the hill as opposed to being planted vertically into the ground. This allows each plant to have maximum soil on all sides for developing root systems. The root structure naturally resists the downward flow of water.

    a. Specific plants that are known to prevent erosion are planted throughout gardens and hilly areas. One such plant is Vetiver (see **Figure 20**).

3. Garden plots are usually rotated in and out of use. When a plot is out of use, it is allowed to overgrow for up to ten years so that the soil can be replenished with nutrients and natural growth.

***Global Market Consequence:***

There have been numerous efforts to understand the farming and erosion prevention techniques of Papua New Guinea. Though the communities are knowledgeable in preventing local erosion, recent studies performed by soil management scientists have observed that the runoff from East New Britain alone may exceed the entire erosion volume of the North American continent carried down the Mississippi River system. Outside investigations have had limited success in understanding the processes used and communicating them to the rest of the world. We experienced that this knowledge is quite accessible under a cooperative experiential environment. Major plant supply companies could benefit from the sale of Vetiver or similar plant in order to improve the results of hillside farming and erosion control for their customers. Companies that focus on publishing and distributing garden advice, such as Timber Press, could share the knowledge of the Papua New Guinean farmers with their readers. Gardening companies that study and sell soil could also look into the qualities of the soil in Papua New Guinea and attempt to replicate that quality in their own mixes. East New Britain's active volcano, Tavurvur, emits huge amounts of ash forming building-high piles within a few kilometers around its base. Because the volcanic ash contributes so heavily to the health of the soil, even this ash could be marketable to those looking to add nutrients to their soil.

**Lemongrass Cultivation, Harvesting, and Processing**

Lemongrass is grown and processed for its essential oil, which is sold between $15-$20 per kilogram and is commonly used in perfumes, air fresheners, and other fragrance products. The plant has a simple propagation process and is ready to be harvested three months after planting. The distillation process produces roughly two kilograms of oil from 300 kilograms of lemongrass after an hour and a half of processing. The scented water, a byproduct from the distillation process, is often collected and sold to hotels on the mainland, which use the water to wash their linens. Amruqa uses the distilled lemongrass as mulch in their blocks to prevent weeds. The H.I.T. team witnessed these steps using Dwarf Lemongrass; however, it can be used with any type of lemongrass.

***Origin:*** Amruqa Plantation, Vunakanau (East New Britain, Papua New Guinea)

***Source:*** Isaac, Karol, Bruno, Shorty, Ian Sexton, Conrad, Ken Maradei, Sharmayne Ryan, Chris, Essau, Tavilo, and Jeffrey

***Chronicler(s):*** Julia Elizabeth Craig, Hector Javier Feliciano-Ayala, and Michael Patrick Venable

***Date Entered:*** May 2012

***How To:***

Planting

The propagation of lemongrass was done through the technique of splitting. This was done by cutting an old lemongrass plant in half with a shovel and pulling it apart in sections of 2-3 stalks. This must be done carefully to ensure each section has roots. A rope is placed down the length of the block to be planted to create straight rows (see **Figure 21**). Holes 7-10 centimeters deep were made using a digging stick which was approximately 5 centimeters in diameter. The holes were made one meter apart down the row and each row was positioned one meter apart (see **Figures 22 & 23**). The sections of lemongrass were placed in each hole and the dirt around them was tamped down until the soil was packed (see **Figure 24**). Once planted, the lemongrass is ready to harvest in 3 months.

Maintenance and Harvesting

Lemongrass requires direct sunlight to grow and very little maintenance. Blocks of lemongrass are only weeded once during the growing process and are left to grow after that. After 3 months, the lemongrass is ready to be harvested. To harvest, a bush knife is used to cut the lemongrass making sure to cut above the stalks since all of the oil is held in the grassy part of the lemongrass bush.

Processing

Once it has been taken back to the processing facility, the lemongrass was weighed and spread evenly on a mesh platform so it could dry overnight (see **Figures 25-28**). During the drying process, about 25% of the lemongrass weight was lost due to water evaporation. The lemongrass was weighed again before distillation. Between 300 and 365 kilos of lemongrass was then loaded into the still. It must be loaded evenly so the steam can pass evenly through the grass. If more lemongrass is packed on one side of the still, the steam will become trapped and will not work its way through all the grass. While the still was being packed, the water boiler was turned on. Once steam emitted from the steam valve, the valve was closed and a hose that was first purged with steam was then connected to the bottom of the still directing the steam from the boiler to the still. When the steam started leaking out of the top of the still, the lid was clamped tighter. The lid has an outlet that directs the steam from the still to the condenser via another hose. The water and oil combination from the condenser is collected in the separator where the oil floated to the top. The water level was adjusted as needed by opening a valve on the bottom of the separator to release some of the water to avoid overflow. Flow readings were taken every fifteen minutes by collecting the runoff from the condenser hose into a graduated cylinder in fifteen second intervals. This was done 3 times to ensure there was a consistent reading obtained. The level of total flow and the level of oil from the flow readings were recorded to ensure the process and the equipment were running correctly. Every thirty minutes the oil was taken off the top of the water in the separator. This was measured and weighed and then placed in a container for storage. The entire process lasted for one and a half hours. From the 300-365 kilos of lemongrass, 1-2 kilos of oil was produced so this process was completed a number of times to produce adequate oil.

***Global Market Consequence:***

During the processing of lemongrass oil the H.I.T. team experienced the corrosive properties of the oil. The cylindrical, plastic tube transferring the water and oil from the condenser to the separator was deformed and appeared to be melting by the end of processing. We were later shown a pair of scissors that had been doused in lemongrass oil by mistake. The handles were deformed and corroding from the exposure to pure lemongrass oil. Though lemongrass oil in its pure form is very obviously corrosive, we were unable to find any current innovations utilizing the corrosive properties of this oil. It does, however, have many medicinal and household applications.

Lemongrass is most commonly used as a fragrance in various products. In fact, Colgate-Palmolive Co. and Lever Brothers Company use lemongrass oil as a fragrance in cleaning supplies. Other companies in the same innovation space that may be interested in the application of lemongrass oil in cleaning supplies include Halliburton Company; Procter & Gamble; Ecolab, Inc.; Church & Dwight Co., Inc.; Buckeye International, Inc.; Unilever N.V.; International Flavors and Fragrances; Kao Corporation; The Drackett Company; and S.C. Johnson & Son Inc. Lemongrass is also known to have insect repellant properties. Both Woodstream Corporation and Sterling International use lemongrass oil as an active ingredient in insect and wasp repellant. Novel Wares, Inc. takes it one step further and uses lemongrass oil's anti-bacterial and insect repelling properties in their agricultural tool maintenance fluid that both repels insects and prevents cross-contamination in organic farming. Other companies that may be interested in this type of innovation include Ecosmart Technologies, Inc.; Boston Scientific Neuromodulation Corporation; Alza Corporation; Alexza Pharmaceuticals, Inc.; Sumitomo Chemical Company Limited; The 54 Group, Ltd.; and 3M Innovative Properties Company. Kemin Industries, Inc. uses lemongrass oil as an anti-microbial agent to inhibit mold growth. Companies that may be interested in similar innovations include Kimberly-Clark Worldwide; Nucryst Pharmaceutical Corp.; The Clorox Company; Johnson & Johnson Consumer Products, Inc.; and Pure Bioscience.

Lemongrass has been said to be effective in a wide range of medicinal applications. It has use as a/an analgesic (pain reliever), anti-depressant, anti-microbial, antipyretic (fever reducer), antiseptic, astringent, bactericidal, carminative (gas reliever), deodorant, diuretic, fungicidal, and nervous system sedative among many other uses. Innovator John Alex Lopes has used lemongrass oil as the anti-microbial agent in cleaning and disinfecting the nasal tract and sinus cavity. Linda A. Anderson uses lemongrass oil as a component of a topical analgesic. Jeffery Alan Deane has the oil as an astringent agent in all-natural body wash. These innovators as well as Clematrix Corporation; Ninon Kohden Corporation; L'Oreal; NuSkin International, Inc.; Unilever PLC; Alwyn Company, Inc.; Resver Logix Corp.; Carrington Laboratories, Inc.; Nevada Medical Resources LLC; New Chapter, Inc.; and many more may be interested in exploring the other possibilities for lemongrass oil in the medical/medicinal industry.

**Patchouli Harvesting and Processing**

Patchouli is grown and processed for its essential oil. This oil is frequently used as the base for many perfumes. The processing of patchouli oil at Pacific Spices has produced a higher purity form of patchouli oil than is typically found in the market. In fact, Pacific Spices has been asked by their customers to "dirty up" their patchouli oil a bit because the high quality of their oil makes it unrecognizable and harder to use in perfume production. Both the distillation and separation process affords the production of two products, the oil and scented water.

***Origin:*** Pacific Spices (Papua New Guinea, East New Britain)

***Source:*** Ken Maradei

***Chronicler(s):*** Katherine Irene Martin

***Date Entered:*** June 2009

***How To:***

Planting

To start a new patchouli patch, a shoot of an existing vine is all that is required. The selected piece of vine must include the section of a runner incorporating the roots. This cutting is planted directly in the ground and requires virtually no soil preparation or maintenance. Patchouli requires partial shade and is typically planted as a ground cover.

Maintenance and Harvesting

Because it is such a good ground cover, there is very little weeding that needs to be done. However, there is a particular vine (similar to the Japanese and Chinese Pueraria lobata known as Kudzu in North America) that is highly invasive and must be removed from patchouli plots. Given its rapid growth pattern, this pest plant may be able to be domesticated to grow shade covers for plants which do not grow in direct sunlight, like patchouli.

Harvesting is done by hand or using clippers. Segments of the vine are harvested at the midpoint; cutting the vine too close to the roots can kill the plant. The harvested section is selected with ample leaves as these are the desired material.

Drying and Storage

Once the necessary amount of patchouli is harvested, it is placed in the solar dryer for three days. In order to ensure that all of the patchouli will dry correctly, the leaves are spread out evenly on screen trays. After three days, the tray is taken out of the solar dryer and placed on a metal rack outside to dry for one more day. This is done to cool the leaves to make sure they retain the oil. After the fourth day, the dried patchouli is baled using a wool baler. Once it is baled, the patchouli can be stored for months. Pacific Spices has found that the longer the patchouli sits in the bales, the better the quality of the oil. The reasoning behind this is unknown.

Processing

When the dried patchouli is ready to be processed, 120 kilograms is loaded into a large metal still. The patchouli still is one of the few processing technologies that has been purchased by Pacific Spices. The rest were designed and assembled by some of the people that work for Pacific Spices. Once the patchouli is loaded into the still, the operator starts the kerosene fueled boiler, which has previously been filled to the appropriate levels with water. It takes roughly an hour for the water to heat up to the correct temperature. All water used in the processing of any essential oil is rain water collected and recycled at Pacific Spices.

When steam starts coming out of the pressure indicator valve in a consistent stream, the hose coming from the heater is connected to the bottom of the still (see **Figure 29**). The valve is turned so that the steam is directed through the hose. From this point, it takes around half an hour for the steam to travel up through all of the patchouli (see **Figure 30**). When steam begins to come out from under the still's lid, the top is clamped down using a number of clamps until no steam is able to escape.

There is a pipe welded on to the top of the still so that, once the top is clamped, the steam travels up through the pipe to the condenser. The condenser is a large metal cylindrical container with two hoses connected to it. The first hose runs cold water into the bottom of the condenser while the second removes water from the top. The steam then travels through a straight interior pipe surrounded by the water, which condenses it.

Once the steam condenses, it flows into the separator where the patchouli oil present in the water rises to the top. The separator consists of a metal container that has been filled with a small amount of water. There is a tap on the bottom of the separator that can be opened to allow water to flow out and adjust the level of the oil and water in the separator. There is a glass tube connected to the top of the separator which allows the operator to monitor the level of the oil and adjust it as necessary. Because oil is less dense than water, it rises to the top of the separator where it is funneled into the glass tube.

When the oil level in the tube is satisfactory, the oil is siphoned off by a small metal pipe positioned in the glass (see **Figure 31**). This is done by opening a spout connected to the pipe allowing the oil to be collected without being contaminated by the water. The collected oil is then weighed and recorded.

Production recordings are taken every 30 minutes once the oil is flowing consistently. This record allows the operator to make sure the processor is working correctly; the amount collected should either increase or level out with every measurement. This removal process is repeated until the operator decides that a sufficient amount of oil has been collected. With a load of patchouli leaves weighing 120 kilograms, Pacific Spices can expect to produce three to five kilograms of oil. The oil is then packaged and stored for shipping (see **Figure 32**).

Throughout the process there is a checklist the operator goes through which includes tasks such as: boiler filled, first steam, consistent steam, first oil flow, consistent oil flow, etc. This must be done to ensure all equipment is working correctly and to keep track of the time spent in processing.

***Global Market Consequence:***

The processing of patchouli at Pacific Spices has produced a higher purity form of patchouli oil than is typically found in the market. Both the distillation and separation process affords the production of two marketable products. First, is the essential oil. In addition, the nature of the fluid management process allows for the production of scented water. A growing hospitality market is using this fragranced water for laundry and room fresheners. Companies like S. C. Johnson, manufacturers of Glade®, could be ideal partners for production of laundry detergents and air fresheners. The distillation process and knowledge from Pacific Spices should be shared with other producers around the world to increase the commercial quality of products in this market. Also, Pacific Spices uses the patchouli leaves, post-distillation, as an organic herbicide. The use of the patchouli for this broad-spectrum herbicidal property could merit further study and may serve as an organic alternative to glyphosate-based products. There is no company currently marketing patchouli as an herbicide. However, Monsanto, Summerset, Encore Technologies, and BioHumaNetics all market a conventional or organic herbicide along with other products.

**Peanut Harvesting and Processing**

In the community of Alakasam, the harvesting, drying, and selling of peanuts is the primary source of income. Generally speaking, peanuts are grown in gardens among other crops or between harvest seasons to replenish the nitrogen and other nutrients in the soil. Using the funds raised from peanut sales, the community of Alakasam has been able to purchase a Land Cruiser and another truck that are left at Malasaet, the closest community accessible by vehicles. As a result, the travel time to market from Malasaet is reduced to roughly a three hour drive. However, the community members are still required to carry large amounts of produce while trekking along a path leading down to a valley and up the side of mountains. This is the only path from Alakasam to Malasaet. The process of getting the peanuts to market is very time sensitive. There is a two day time period where the harvesting, drying, bundling, and sale must take place. If too much time passes, the peanuts will rot before they can be sold.

***Origin:*** Alakasam (Papua New Guinea, East New Britain)

***Sources:*** Community of Alakasam

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

When the peanuts are ready to be harvested, a few family groups (upwards of 14 people) will harvest an entire peanut garden and begin the processing. The peanuts are harvested by pulling them from the base of the plants and shaking the dirt from the peanuts. They are then collected into large bundles, and secured together by wrapping the stalk of one peanut plant in the bundle around the rest and tying it in place (see **Figure 33**). Using a bush knife, the tops of the peanut plants are removed. The peanuts are separated into smaller bunches, usually containing between 20 and 30 peanuts, to be dried and sold. The families work through the night drying and preparing the peanuts for sale as they will go into the markets the following day (see **Figure 34**).

***Global Market Consequence:***

Due to their rapid growth, peanuts are an effective way to generate income in areas with fertile soil. Currently, the community of Alakasam's peanut harvesting process limits the crop's window of opportunity for generating this income because of the time constraint for keeping the peanuts fresh. The process of harvesting and selling the peanuts must be done within about 2 days to ensure the freshness of the peanuts. One option that could be utilized is roasting the peanuts. Using some sort of roasting method would preserve the peanuts' freshness for a longer time extending the life of their product. Adding this process would not only extend the life of the product, but also allow a greater amount of peanut to be sold at a time. The peanuts are currently transported to market in their shells, which are still attached to a bit of the stalk. Roasting would eliminate the excess bio matter resulting in an increased quantity of the product making it to market. The community is also in relatively close proximity to the Komgi village, the producers of salt. The two communities could partner together to produce a viable and non-perishable product to be sold in bulk or at the local markets. Peanut oil is also a viable product in the world market. It provides some health benefits, as it is high in monounsaturated and polyunsaturated fats, which help maintain a healthy heart. This fact makes peanut oil a desirable ingredient in cooking. Not only is it useful when consumed, but peanut oil has also been found to relieve joint pain in arthritis patients.

There is a worldwide demand for alternative fuels. Rudolph Diesel, developer of the diesel engine, demonstrated a peanut oil engine at the 1900 Paris Exhibition. Peanut oil has been found to be an ideal biodiesel which has a cleaning function on engines. It can be a cost effective substitute for petroleum at certain price levels. With careful cultivation practices, peanut biodiesel yields can approach 120 gallons per acre. Because of their rapid growth and their ability to fix nitrogen in the soil in an appropriate crop rotation, peanuts should be an important contributor to a sustainable liquid fuel supply.

Currently the community of Alakasam transports their peanuts to market by walking to Malasaet, a two hour trek through the jungle. From Malasaet, they use the two communal trucks to transport their produce the rest of the way down the mountain. This drive can take anywhere from three to four hours on the dirt access road. To get the peanuts from point A to point B, the community members of Malasaet must carry the bags of peanuts, which can way up to 23 kilograms (50 pounds), the entire way. With the rough terrain and heavy loads, the community may benefit from the use of all terrain vehicles (ATVs). These vehicles are usually equipped with a bed and hitch to haul heavy loads. They are also compact and durable making them ideal for the narrow trails and mountainous terrain. ATVs have small gas tanks, but are very fuel efficient, making the cost of gas less of an expense. They are also simpler vehicles than cars or trucks, making them easier to repair when needed.

**Pepper Cultivation, Harvesting, and Processing**

Pepper is one of the products grown, processed, and exported by Pacific Spices. The methods used at all stages ensure the organic quality of the product.

***Origin:*** Pacific Spices (Papua New Guinea, East New Britain)

***Source:*** Pacific Spices Staff members

***Chronicler(s):*** Katherine Irene Martin

***Date Entered:*** June 2009

***How To:***

Nursery

Each pepper plant is planted in the nursery after it has been hand-collected from pre-existing pepper vines. A productive pepper branch is found and followed back to the original vine. The vine is then cut from the existing pepper plant. The resulting section is far too large to plant, so the branches are trimmed and the original vine is cut into sections 2 to 4 nodes in length.

Once enough sections are collected, they are taken back to the stage one nursery and planted in designated garden areas. The sections are planted sprouting-side up. The starters stay in this part of the nursery until they have shoots with one or two leaves. From here, the plants are moved into the stage two nursery where they are planted and nurtured until they have shoots with four or five leaves (see **Figure 35**).

Planting

Each pepper plant requires a support tree. To utilize unused space, Pacific Spices plants pepper seedlings at the base of palm trees planted for coconut production. An area around the base of each tree is cleared of weeds and overgrowth about two to three feet in every direction. This is usually done with machetes (bush knives), but can be done by hand. Once the area has been cleared, dirt from the cleared area is dug up and piled on one side of the tree until it is possible to dig a hole about 30.5 centimeters deep into the mound. A coconut husk containing the pepper plant is then planted into the hole and dirt is placed around it until the husk is completely covered (see **Figure 36**). Dry grass is then placed all over the mound as mulch. After about a day or two, once the dirt has had the chance to settle, coconut husks are placed all around the plant and on the mound to provide support and prevent erosion from the rain. The husks are then covered again with dry grass used as mulch. The area around the base of the mound is covered with processed patchouli leaves to kill all the grass and weeds surrounding it.

Maintenance and Harvesting

The pepper plants are frequently pruned because they grow so quickly. Pacific Spices prunes the plants to keep them no taller than the average man can reach. Once the plant reaches this height on its support tree, the top of the tree is chopped off to force the pepper to grow outward. This eliminates the need for ladders and reduces the risk of injury. The resulting shape of the plant is similar to a wine glass and will eventually connect with the one beside it to form a continuous wall or hedge of pepper. Since many of the pepper plants are grown on producing coconut trees, it is important to trim the top growth so the vine doesn't overtake the tree.

Harvesting is all done by hand and requires a large number of people because of the number of pepper plants. To check the pepper for ripeness two methods may be used. The first involves removing one of the pepper corns from a bunch and squeezing it to see if it pops (splitting open like squeezing a grape). If it pops, the pepper is not ready so it is left on the vine. If it does not pop, it is ready to be picked. This method is preferred as it is quite quick and highly reliable in determining the ripeness of the bunch. The second method involves scraping off a little bit of one of the pepper corns to see if the inside is brown. If it is then it is ready to be harvested. To save time sorting out the red and green corns during processing, red bunches are put in one bag while green are put in another.

Pepper Processing (see **Figure 37**)

*White Pepper*

After the bags of red bunches are weighed and recorded, they are poured onto a screen tray. All the red corns are taken off of the stems by hand and placed in a bucket while the remaining green ones are put in with the other green corns. Once all the red corns are removed they are soaked for three days to remove the skins. The water is changed

every day to make sure the resulting pepper corns are as white as possible. With each change, the pepper is stirred around a bit to help the skins come off. When the three days are up, the corns are dried and packaged to be shipped.

*Black Pepper*

The bags of green bunches are weighed, recorded, and then poured onto mesh-like fabric. This is then tied closed and placed into a metal drum of boiling water for three minutes to soften the corns. After being boiled, the bunches are poured onto screen trays where the corns are removed from the stems by hand. When all of the pepper corns are removed and the stems are picked out, the pepper is placed on a screen tray in the solar dryer (see **Figure 38**) where it will dry for three days. Once it is dry, the tray is placed in front of a fan that blows away all the dirt and the corns that are too small. It is then packaged and ready to be shipped.

***Global Market Consequence:***

The global market for pepper is one of the oldest in the world. The spice trade has included the selling of pepper since the earliest human records with the majority of the early uses documented in India. While we have not identified any particular new uses for pepper in our observations, it is noteworthy to observe the herbicidal use of processed patchouli leaves in the pepper farming methods at Pacific Spices.

Also, the use of coconut husks as an organic pot for pepper seedlings could easily be manufactured and marketed as a biodegradable pot. Enviroarc currently sells biodegradable pots made mainly from bamboo pulp and would likely be interested. Also, coconut husk peat is very commonly sold as a seed starter for plants. Gardens Alive and Peaceful Valley are just two of many companies currently marketing similar products.

**Planting Saksaul Trees in the Gobi Desert**

There are several globally significant purposes of the tree planting process at Gobyn Undur. The first is to reduce desertification. The second is to provide food to local grazing animals. The third is to produce local business and employment. All of these issues are being addressed with the planting of saksaul trees in the Gobi Desert.

Gobi/Saksaul Trees (*Haloxylon ammodendron*) are small to medium sized trees that can be found in the Gobi Desert and in other similar climactic regions of central Asia. The trees have very small, soft green needles (which are fleshy and succulent) and a grey, white or brown bark. The bark can be pressed to extract water since it has a high water content. In fact, camels and other animals eat the bark and needles as a source of water. The trees can grow to be anywhere from half a meter to 4 meters in height. Saksaul trees have horizontal and vertical root systems, which expand very densely in their search for water. This makes the tree ideal for erosion control as it keeps the desert soil in place. Over time, as the root system develops, it is able to withstand the large thermal shifts in the desert which can range from -51º C (-60º F) to well over 37º C (100º F). The roots also create an anchor that can withstand the very strong Gobi winds, which can reach 140 kilometers per hour. Once the trees are considered dead, the wood is dried and used for fuel. In order to plant the Saksaul trees Gobyn Undur use seeds (see **Figure 39**), water, and a plastic tube approximately two inches in both diameter and height.

***Origin:*** South Gobi Province, Gobyn Undur facility (Mongolia)

***Source:*** Batbayar and Jazei

***Chronicler(s):*** Kenneth Andrew Dabkowski

***Date Entered:*** June 2010

***How To:***

Preparation

The planting area is organized into rows of mounded beds. The beds are approximately 1 meter wide and between 10 and 15 centimeters high. The seeds in each bed are planted about 5 centimeters apart.

1. A small hole approximately 1 cm deep is made using the planter's index finger (see **Figure 40**).
2. Three seeds are placed into each hole.
3. Soil is then gently pushed over the hole to cover the seeds and flatten the surface.
4. After a full bed is planted, a watering can is used to soak the whole area. The soil composition makes it difficult for the water to sink in so this is done a few times.
5. After the seedlings emerge, a plastic cylinder, 5 cm in diameter, is placed around the sprout to protect it from wind (see **Figure 41**).

***Global Market Consequence:***

Oyu Tolgoi's mine is relatively close to the tree farm. Planting trees on the mine site could potentially reduce fine dust and erosion as well as provide aesthetic value to an otherwise barren landscape. Since the term of the mine operation is 50 to 70 years, they will reap the benefits during operations and will also create a permanent fixture in the landscape. Oyu Tolgoi's procurement office has been contacted and is interested in acquiring seedlings.

Korea and China may be interested in the planting process as well. As the Gobi desert expands, dust from the desert blows into both countries. It also continues to blow across the Pacific Ocean changing the environments of the air and the sea. Reduction of pollution and fine dust would be significantly improved if trees such as the saksaul trees were planted in the Gobi Desert. Reducing desertification is of national interest to both Korea and China. Health care agencies wishing to reduce respiratory disease could work with forestry counterparts as prevention may be cheaper than treatment.

Many Non-Governmental Organizations (NGOs) dedicated to reforestation may also be interested in the planting process. Some of these NGOs include but are not limited to the Organization for Industrial Spiritual and Cultural Advancement (OISCA), Rural Forestation and Progress Network Corporation (CRACYP), American Forests, Northeast Asian Forest Forum, and Reforestation or Northern Khentii.

# Images for Agricultural Techniques

## Baby-Integrated Animal Milking Processes (Camel, Yak, and Horse)

**Figure 1:** Tuvshinjargal milking a yak.

**Figure 2:** After the baby horse has started feeding, it is led away and the milking begins.

## Coconut Harvesting and Processing

**Figure 3:** 2,500 coconuts are required to produce a sufficient amount of oil, so each shipment is counted and sorted into piles before processing begins.

**Figure 4:** Sharpened metal stakes are used to dehusk the coconuts. The outer layer of the coconut is pierced and the coconut is turned to pry the husk off. This is done repeatedly until the husk is fully removed.

**Figure 5:** Coconuts with sprouts or other growths or less than three "eyes" are deemed unsuitable for processing and are discarded after dehusking.

**Figure 6:** Coconuts suitable for processing are cracked open over a bin to collect the water inside. If the water is not the proper color or smell, the coconut is discarded from processing.

**Figure 7:** The meat of the coconut is then removed from the shell with either a deshelling machine or using knives (as depicted above).

**Figure 8:** The coconut meat is then washed to remove any fibers or dirt before being grated. To ensure cleanliness, the water is changed every five batches of coconuts.

**Figure 9:** The coconut meat is shredded finely in a grater to optimize oil extraction. The shredded coconut is weighed before being pressed.

**Figure 10:** One bucket of coconut water and two buckets of hot water are added to the shredded coconut to facilitate the release of the oil.

**Figure 11:** The coconut and liquid are mixed very well to ensure optimal oil extraction.

**Figure 12:** The mixture of shredded coconut and liquid is put in the funnel-like piece at the top of the machine and the oil is collected in buckets while the pressed coconut is collected in bags to be sold as feed for livestock.

**Figure 13:** When filled, the buckets of coconut oil are emptied into containers where the oil will be left to separate for three hours.

**Figure 14:** After settling for three hours, a valve at the bottom of the separation container is opened allowing the water on the bottom to flow out. The remaining liquid is then left to settle for 18 hours.

**Figure 15:** After 18 hours the liquid has separated into four layers: "crud" at the top, oil, milk, and cream at the bottom. The "crud" has a consistency of oatmeal (depicted above) and must be removed by hand.

**Figure 16:** The oil is set aside and left to settle for three hours. After this time, the oil is poured through filtration bags to remove any sediment. This process is done twice.

**Figure 17:** The oil is then poured through a separation funnel to remove any water. If water remains in the oil it will cause spoilage while it is in storage.


**Figure 18:** Once the oil has been completely separated, it is packaged and put in storage containers like the one above until shipping.

## Hillside Farming

**Figure 19:** Stumps are left in the ground of hillside gardens to prevent erosion.

**Figure 20:** Vetiver is commonly found in hillside gardens as it is effective in preventing erosion.

## Lemongrass Cultivation and Processing

**Figure 21:** A rope is strung between two sticks running the length of the block to be planted. This will act as a guide when planting the new lemongrass plants. Once finished, the sticks and rope are moved one meter over and the process begins again.

**Figure 22:** A stick is placed in last hole dug and a meter long measuring stick is used to determine the placement of the next hole.

**Figure 23:** A sharpened stick is used to dig each hole. The ground cover is removed from each hole location and the digging stick is forced into the ground until the hole is roughly 11cm deep.

**Figure 24:** Two or three stalks of lemongrass are placed in each hole and dirt is packed firmly around it.

**Figure 25:** Harvested lemongrass is loaded into the back of the truck and transported to the processing area.

**Figure 26:** As the lemongrass is unloaded it is piled in batches on a tarp so it can be weighed.

**Figure 27:** Each batch is weighed and recorded so Amruqa can keep track of projected production figures.

**Figure 28:** Once it has been weighed, the lemongrass is spread out on mesh to dry overnight. The grass loses roughly 25% of its water weight during this process.

## Patchouli Harvesting and Processing

**Figure 29:** Rain water is heated in the boiler (on the left) until steam emits from the valve at the top at which point a hose is connected to the first still (in the center) directing the steam up through the patchouli inside.

**Figure 30:** Once steam escapes from the top of the left still, the top is clamped closed and a hose is attached to a valve at the top, connecting the still to the condenser (in the center), ultimately cooling the steam.

**Figure 31:** As the steam condenses, the patchouli oil separates from the water since it is less dense. The water level in the collection tank is adjusted as needed to siphon off the oil using the metal pipe in the middle of the glass cylinder.

**Figure 32:** After processing, the patchouli oil is packaged and stored in containers like the one above until it is shipped.

## Peanut Harvesting and Processing

**Figure 33:** Once the peanuts have been harvested, they are bundled together and tied using the stems of one of the peanut plants.

**Figure 34:** After the crop of peanuts has been harvested, they are grouped into smaller bunches to be dried and taken to market.

## Pepper Cultivation, Harvesting and Processing


**Figure 35:** Individual pepper plants are potted in discarded coconut husks that are bound with natural rope and tended in the nursery until ready to be planted.

**Figure 36:** Pepper plants require a support tree, so young pepper plants are planted at the base of trees and pruned to grow no taller than the average male to make harvesting more efficient.

**Figure 37:** Green peppercorns are boiled and dried to produce black pepper while red peppercorns are soaked in water until the skins are removed producing white pepper.

**Figure 38:** Once the green peppercorns have been boiled, they are evenly spread on screen trays that will be placed in the solar dryer to dry for roughly three days.

## Planting Saksaul Trees in the Gobi Desert

**Figure 39:** Saksaul trees are being planted in the Gobi Desert to reduce desertification.

**Figure 40:** A small hole is made in the dirt using the pointer finger. Three seeds are then added to each hole.

**Figure 41:** Plastic cylinders are placed around the saksaul seedlings to prevent wind damage as they grow.

## Construction

**Bamboo Blind Weave**

Woven bamboo walls are cost effective due to the immense supply of bamboo and the willing community of laborers. Once woven, the walls are secured to a house frame using either nails or rope. The house frames are constructed using trees from the surrounding environment. The blinds are usually applied to the walls in double-layers. This and the tight-weave of the blinds result in the walls being completely watertight. The H.I.T. team was able to observe and participate in blind weaving in Anesmetki, a small village near Raunsepna. There were around 25 men splitting, pounding, and weaving the bamboo (see **Figure 42**). They had all four walls done in a matter of hours.

| | |
|---|---|
| ***Local Name(s):*** | Arlanget |
| ***Origin:*** | Raunsepna/Anesmetki, Komgi (Papua New Guinea, East New Britain) |
| ***Source:*** | Ben Maraedi (Anesmetki and Raunsepna) |
| ***Chronicler(s):*** | John Walter Barber |
| ***Date Entered:*** | June 2009 |
| ***Explanation of Variation:*** | Different variations in weave and staining or painting the bamboo different colors adds individuality to each home. In villages near the coast, the bamboo (once split) is soaked in seawater before it is woven. This prevents mites from destroying the plant material and weakening the wall. |

***How To:***

1. The bamboo used in the weaving is cleaned of shoots and leaves, making the stalks smooth all the way around. The bamboo used usually ranges from 5 to 10 cm in diameter. The bamboo is then split the down the middle using a bush knife making two halves (see **Figure 43**).

2. The halves are then smashed at the notches to flatten them using a club-like stick, a hammer, or a rock (see **Figure 44**). This is done carefully to make sure the section is still connected.

3. The wall dimensions are measured and laid out on the ground to be used as a guide. Nine to twelve strips are laid parallel to each other, diagonally across the boundary. Another piece of bamboo is woven over three pieces and then under three pieces in the opposite direction of the first strips, creating an "X" (see **Figure 45**). With every subsequent piece the "over-three-under-three" pattern shifts over one strip, giving the weave a jagged diagonal look. Every new strip is pulled tight against the pieces that have already been woven and hit with something to tighten it further. Once enough of the blind has been woven, another person begins weaving the opposite side.

4. Step 3 continues until the woven portion of the blind covers the boundary of the wall measurements. The excess bamboo is then trimmed using a bush knife to make the blind the proper dimensions (see **Figure 46**).

5. Once another blind of the same dimensions is finished, the pair can be attached to the frame. The pieces are set with the smooth part of the bamboo facing away from the frame (see **Figure 47**).

6. The blinds are attached to the frame by nailing another piece of bamboo along the support beams inside the structure. The nails are often hammered through pieces of tin before they go into the bamboo so that the bamboo does not split.

***Global Market Consequence:***

There is a rapidly growing market for bamboo building materials ranging from handcrafted fencing, decking, and matting to structural poles. Because of the growing concern for the environment and many peoples' desire to "go green", bamboo's unique qualities have already been recognized by a number of companies looking for eco-friendly solutions. Cali Bamboo, Forever Bamboo, and Green Home Building are just a few of the companies promoting alternative products made from renewable resources such as bamboo. Another possible market product is the manufacturing of bamboo razor blades. The team was told frequently to be cautious when weaving the bamboo because the edges of the bamboo strips are very sharp. In fact, we were told that Qaqet men used to shave with bamboo razors because it can be made very sharp. Using 100% organic razor blades would reduce the environmental consequence of throwing away metal and plastic ones that are currently on the market. This would be an opportunity for razor manufacturing companies, such as Shick, Gillette, Noxzema, and Braun, to market an eco-friendly shaving razor.

**Bamboo Roofing**

Bamboo roofing takes advantage of the natural curvature of halved bamboo and a slight downward angle of the roof to direct rain water similar to a traditional gutter system. The bamboo lasts for up to 5 years if it is properly maintained and is conveniently replaced since bamboo is an abundant resource in the area.

***Origin:*** Navunaram (East New Britain, Papua New Guinea)

***Source:*** Anton

***Chronicler(s):*** Julia Elizabeth Craig, Hector Javier Feliciano-Ayala, and Michael Patrick Venable

***Date Entered:*** June 2012

***How To:***

1. Bamboo stalks are collected and split in half down the length of the stalk with the dividers at each joint removed except for one on an end.

2. The halves are placed on the house frame concave side up (see **Figure 48**), with the sealed end at the highest point of the roof. Leaving the low end open allows the water to flow off the roof (see **Figure 49**).

3. The halves are secured to the frame by tying them with rope or using nails. The nails are hammered through a piece of aluminum and the bamboo onto the frame. The aluminum piece helps prevent the bamboo from cracking and keeps the nail from slipping through the bamboo when it does crack.

4. More bamboo halves are placed concave side down covering the seams between the bamboo secured to the roof, preventing any leaks (see **Figure 50**). Those pieces are then secured to the frame. The result is similar to corrugated metal. (See **Figure 51**)

***Global Market Consequence:***

Bamboo is not currently being used as a roofing material, but it is a very common material in construction. Its use on roofing in Papua New Guinea suggests that bamboo is a durable and sustainable roofing material that can be utilized in many other parts of construction than flooring. EVG Entwicklungs-u Verwertungs-Gesellschaft m.b.H uses bamboo canes in cement-bound compressed boards for insulation. Innovator Jay Plaehn has developed bamboo reinforcements for building materials. Japan Blower Ind. Co. uses bamboo pieces to form hollows in sound insulating material in floor plate used for sound-proofing. Other companies that may be interested in using bamboo for sustainable, eco-friendly construction materials include Martin Marietta materials, Inc; H.K. Composites, Inc.; Oldcastle Precast, Inc.; Hunter Douglas Inc.; Life Shield Engineered Systems, LLC; Georgia-Pacific Corporation; Huskey Manufacturing, Inc.; United States Gypsum Company; Bay Corrugated Container, Inc.; Bridgeshire Packaging Limited; Unlin Beheer B.V.; Triangle Pacific Corporation; NOVA Chemicals Inc.; The Dow Chemical Company; Robbins, Inc.; and DuPont among others. Not only is bamboo used in construction but Agritec, Inc. has used bamboo ashes in fire retardant insulation as well. Other companies that may be interested in looking into this kind of bamboo utilization include The Dow Chemical Company, Shenzhen Futaihong Precision Industry Co., Ltd.; FIH (Hong Kong) Limited; LG Electronics; Continental Oil Company; and Guardian Fiberglass, Inc.

Bamboo has also been found to be a lignocellulosic biomass, which is commonly used as feed stock for the paper industry and as a source of biofuel (particularly critical to the production of ethanol). In fact, Xyleon, Inc. uses bamboo in their paper-making pulp. Companies in the same innovation space that may be interested in using bamboo in their processes include Kimberly-Clark Worldwide, Inc.; The Proctor and Gamble Company; Weyerhauser Company; Masonite Corporation; Anderson Corporation; General Electric Company; and Crane Plastics Company, LLC. Bamboo is also used by the University of Massachusetts as the lignocellulosic material fermented to make ethanol. Other companies that may be interested in this application of bamboo include Mobil Oil Corporation; RPC Waste Management Services, Inc.; UOP, Inc.; Zimpro Passavant Environmental Systems, Inc.; Chematur Engineering AB; Institut Francais du Petrole; and VerTech Treatement Systems, Inc.

**Roof Thatching**

Thatched roofs are the main method of roofing found in the communities of Papua New Guinea. They are made from layered bundles of cane, grass, and leaves tied onto roof supports. This directs rain water off the sides of the roof (see **Figure 52**). The fires made inside the house play a vital role in preserving the roof thatch. Eventually, the entire inside of the roof is preserved by the smoke, preventing decay. A space is left between the roof line and the top of the walls to allow for ventilation (see **Figure 53**). Firewood is stored in the support beams that run the length of the house so that it can be dried by fires built underneath. This type of roof is used primarily because it utilizes materials that are readily available can easily be repaired.

***Local Name(s):*** Amaran

***Origin:*** Pacific Spices, Komgi, Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Sharmayne Ryan

***Chronicler(s):*** John Walter Barber

***Date Entered:*** June 2009

***How To:***

To make the bundles for thatched roofing, different types of grass, cane, and leaves are collected depending on what is available. The leaves and grasses are bundled and tied so that all of the stems are at one side of the bundle and the leaves are at the other. These bundles are then tied to the roof supports using bush vines and layered so that there are no open spaces visible from within the house or outside.

***Global Market Consequence:***

The market for thatch roofing and similar all-natural, eco-friendly construction materials is expanding. Thatch is already being sold by many companies, mainly for outside structures such as gazebos, tiki huts, tiki bars, and awnings. Cali Bamboo and Forever Bamboo currently market 1m x 1m thatch panels for more than $20 a panel. This provides the opportunity for the stewards of this knowledge to share their expertise with the rest of the world. Thatch roofing is a 100% organic, renewable, and sustainable product. The preserving properties of the smoke should be researched and explored so that thatch normally lasting only three to five years will last as long as it does in the Qaqet communities. A single roof there can last around 70 years if cared for properly.

**Sago Roofing**

The sago tree is a central component of everyday life in Ngavalus, with every part of the tree being used in some way. The leaves of mature sago trees specifically are used to make roofing because they have become thicker and more durable over time. Roofs made using sago leaf "shingles" can last any where from one to three years, depending on the location of the house. If the house is positioned under trees, the roof will last up to one year simply because it begins to deteriorate with prolonged exposure to heavy branches or falling fruits. If it is positioned in an open area, the roof lasts between two to three years. After the roof has been secured to the rafters, a fire is built inside of the house to smoke the roof, preserving the leaves making them last longer. Once all of the supplies have been brought back to the community, the community as a whole will come together to complete various stages of the process.

***Origin:*** Ngavalus (Papua New Guinea, New Ireland)

***Source:*** Rocky, Danny, and Russell

***Chronicler(s):*** Rodriques Lamar Jackson and Roger Lynn Bohon

***Date Entered:*** August 2011

***How To:***

Bundling

1. Nine sections of bamboo are cut, all roughly one and half meters in length. Three sections are laid on the ground, parallel to each other with a space between each. The remaining six bamboo sections are stuck in the ground in two parallel rows of three with each section stuck in the spaces between the bamboo on the ground. The parallel rows are placed leaving space in between to collect sago leaves.

2. As the sago leaves are removed from the fronds, they are piled between the parallel rows of bamboo. The leaves are stacked in alternating directions (some are concave side up and others are concave side down) to maintain the balance of the stack.

3. Once the leaves are stacked half way up the bamboo "cage", another bamboo section roughly one and a half meters in length is placed on the leaves. The rest of the leaves are piled on top of the bamboo section.

4. Once enough leaves are collected the men cut a vine (maris) from a tree and tie it around the pile of leaves at each of the spaces in the bamboo "cage". Using the bamboo in the middle, the men lifted the sago leaves and brought them back to the village. All of the materials used in the bundling of the leaves are used for the sewing of the roofing.

Deboning (**Pignat**)

1. Once the leaves are brought back to the community, the process of removing the central "bone" from the sago leaves, called *pignat*, begins. The central bone must be taken out of each leaf so it can be easily folded over the bamboo spine and sewn.

2. To remove the bone, a leaf is held with the concave side facing away from the body and carefully bent until a spot on the central bone is snapped (see **Figure 54**).

3. Using one hand, the bone is pulled back toward the individual's body while the leaf is carefully pushed away from the individual with the other supporting the leaf from the opposite side. This must be done very slowly to ensure that the leaf does not rip in half (see **Figure 55**).

4. This process is done with every leaf collected.

Sewing

1. While some members of the community are deboning the sago leaves, others are cutting the bamboo sections lengthwise creating strips of bamboo 8 cm wide and 1 ½ m long and stripping the maris (see **Figure 56**) to make thin pieces of the vine, sharpening one end so it could be used to sew the leaves (see **Figure 57**).

2. A sago leaf is then folded around the bottom of one strip of bamboo and secured by sewing the maris through the leaf next to the central bone. The maris is then tied around the bottom of bamboo strip and knotted to secure the leaves (see **Figure 58**).

3. The sago leaves are added onto the bamboo strip one at a time and are lined up with the central vein of the leaf before it (see **Figure 59**). The maris is pushed through the top of each leaf on the left of the central line and back up through the leaves on the right side of the bone line. This process is repeated until the bamboo is completely covered.

4. The maris is then looped around the bamboo strip and knotted to secure the leaves (see **Figure 60 & 61**).

Placement on roof

1. Strips of maris are tied on the left side of each rafter (when looking into the house) on the support beam at the edge of the roof (see **Figure 62**).

2. A sago shingle is then positioned roughly 15 cm from the edge of the roof. Then, someone stationed inside the house begins securing the shingle to the rafter.

3. The long end of the maris is taken over the spine of the shingle and threaded through the leaves on the left side of the rafter. This is done a second time (see **Figure 63**).

4. After the maris is looped the second time, the long end of the maris is threaded through the two loops on the right side of the rafter and pulled tight toward the top of the roof (see **Figure 64**).

5. Steps 3 and 4 are done at each rafter down the length of the shingle.

6. Once the entire shingle is secured, the next one is positioned 15 cm up the roof from the first and Steps 3-5 are repeated. If the maris gets too short, another piece is tied to the end. This process is done until the roof is covered (see **Figure 65**) or the damaged area is repaired.

# Images for Construction

## Bamboo Blind Weave

**Figure 42:** Many members of the community gather to construct the frame of the house and the materials needed to weave the walls.

**Figure 43:** The stalks of bamboo are split in half to make the thin strips used for weaving.

**Figure 44:** The bamboo strips are smashed at the joints so they lay flat and can bend, but are still connected.

**Figure 45:** Bamboo strips are laid diagonally across the frame of the wall. New strips are woven in an over-3-under-3 pattern crossing the previous strips. The weave pattern shift one strip as each new strip is added, locking the others in place.

**Figure 46:** When the weave covers the necessary area, it is trimmed to size. Frequently, a log is placed beneath the edge to ensure a straight edge.

**Figure 47:** One of the finished blinds is positioned on the outside of the wall and one on the inside. Usually the blinds are secured to the supports on the frame with nails.

## Bamboo Roofing

**Figure 48:** Halved bamboo is placed concave side up on the frame of the house.

**Figure 49:** One end of the bamboo is opened so water can flow freely off of the roof.

**Figure 50:** Once the whole roof is lined with bamboo, halves of bamboo are placed concave side down on the seams in the first layer.

**Figure 51:** The corrugated design of the bamboo roof is completely waterproof with just one layer.

## Roof Thatching

**Figure 52:** Fires are built inside of houses with thatched roofs so the smoke preserves the grasses. If properly maintained, these roofs can last for up to 70 years.

**Figure 53:** Houses with thatched roofs have a small triangle at the apex of the roof open to allow air to flow throughout the house and for ventilation.

## Sago Roofing

**Figure 54:** The central stalk is removed from each sago leaf so they can easily be folded around the bamboo support.

**Figure 55:** One hand holds the central stalk while the other carefully pulls the leaf away from the stalk, making sure the leaf does not rip.

**Figure 56:** Maris is the vine that is stripped for sewing the sago leaves to the bamboo support.

**Figure 57:** Thin strips of the bark of the maris vine are peeled off of the vines. The end of these strips are then sharpened so it can pierce the sago leaves.

**Figure 58:** The maris is sewn through the first two leaves on the bamboo support and tied in a knot, securing the leaves.

**Figure 59:** As new leaves are added, the maris is sewn across the line left by the stalk of the leaves.

**Figure 60:** When the end of the bamboo support is reached, the maris is sewn around the edge of the final leaf and secured in a knot.

**Figure 61:** When the end of the bamboo support is reached, the maris is sewn around the edge of the final leaf and secured in a knot.

**Figure 62:** Strips of maris are tied to edge of the roof frame beside each of the supports. The first sago shingle is positioned near the edge of the roof and some hold the shingle in place while others sew it to the rafters.

**Figure 63:** The maris is sewn over the edge of the shingle, through the leaves on the other side of the rafter, then looped and sewn again.

**Figure 64:** When the maris is sewn the second time, the end is threaded through the first loop and pulled tightly.

**Figure 65:** Sets of shingles are positioned on the roof and sewn to the rafters until the entire roof is covered.

## Cooking Techniques

### Aigir

In the Tolai communities Aigir is one of the main ways to cook Ibika, a leafy green vegetable similar to collard greens. A large pot and hot rocks are used as a pressure cooker or slow cooker to cook all the ingredients in 10-20 minutes. The method of cooking aigir varies from community to community.

***Origin:*** Tinginagalip (East New Britain, Papua New Guinea)

***Source:*** Josephine Maradei & Josephine and Jodi Vinivel & family

***Chroniclers:*** Julia Elizabeth Craig, Hector Javier Feliciano-Ayala, and Michael Patrick Venable

***Date Entered:*** June 2012

***Related Item(s):*** *Using Cooking Stones in Metal Pots (Aigir Technique)* (p.65)

***How To:***

1. Cooking stones were pre-heated in a fire as all of the preparations were taking place. Coconuts had been split, scraped, and squeezed to gather coconut milk, which was then set aside to be used later. Josephine Maradei and Josephine added spring onions, ginger, two crushed tomatoes, and a pinch of salt to the pot of coconut milk. Ingredients added to the aigir vary depending on personal preference.

2. Once the cooking stones were ready, they were removed from the fire, dipped in water to be cleaned, and wrapped in gorgor leaves (see **Figure 66**). The stones were wrapped to keep the food from sticking to the stones. The wrapped stones were then placed in the large pot, covering the bottom of the pot entirely (see **Figure 67**).

3. Half boiled pieces of chicken were placed on top of the wrapped hot rocks at the bottom of the large pot (see **Figure 68**). Meat and hearty vegetables are generally placed directly on top of the rocks so they are able to cook more thoroughly.

4. Ibika that had been soaked in coconut milk and other greens were layered on top of the chicken (see **Figure 69**). Clean cooking stones were then placed into the layer of greens to ensure everything was cooked evenly. Then the pot of coconut milk was poured into the large pot (see **Figures 70 & 71**).

5. The stems from two banana leaves were removed and the leaves were folded in half and placed on top of the large pot (see **Figure 72**). The stems from the leaves were tied together, wrapped around the lid of the pot, and tied in a knot to secure the leaves onto the pot (see **Figure 73**). The lid of the pot was placed on top of the banana leaves and a large hot rock was placed on top of it to help hold in the steam (see **Figure 74**). The pot was then left to cook for 10-20 minutes. (See **Figure 75**)

***Global Market Consequence:***

The gorgor leaves used to keep the food from sticking to the hot rocks when cooking aigir are of particular interest due to their apparent non-stick quality. There were no applications of gorgor leaves in any current innovations; however, they have chemical components that apply to numerous industries. After researching, it was discovered that gorgor leaves come from a wild ginger plant and contain a relatively high concentration of monoterpenoids. In nature, monoterpenoids facilitate cloud condensation and work to cool the climate. Michelman, Inc. has used them as a major component in their water-borne resin used to treat fibrous materials, protecting them against wet, humid conditions. Other companies that may be interested in using ginger plant leaves as a source of monoterpenoids for various products are Hercules Incorporated; International Paper Company; Kimberly-Clark Corporation; and Minnesota Mining and Manufacturing Company among many others.

Because of its apparent non-stick properties, gorgor leaves could be utilized as an organic, renewable source of Teflon-like substance. Teflon (tetrafluroethylene) is the synthetic non-stick surfacing commonly used on cooking surfaces and in plastics, but it has a number of other uses as well. Xerox Corporation uses it in electrophotography technology. Researchers at Regents of the University of Michigan use it in surgical tools and C.R. Bard, Inc. uses Teflon as a coating for prosthetics. BASF Fuel Cell GmbH uses Teflon in technology used to conduct electrical currents. Horizon, LLC uses Teflon in sealants for aero- and astro-nautic technologies. It has even been used by Applied Elastomerics, Inc. in gels and gel-composites in bedding. These companies along with Pall Corporaion; Hybrid Plastics, Inc.; Canon Kabushiki Kaisha; Kimberly-Clark Worldwide, Inc.; Semiconductor Energy Laboratory Co., Ltd.; Bridgestone Corporation; Covidien AG; ArthroCare Corporation; Ethicon Endo-Surgery, Inc.; Medtronic, Inc.; Boeing; General Electric Company; Advanced Cardiovascular Systems, Inc.; Cordis Corporation; Boston Scientific Scimed, Inc.; Abbot Cardiovascular Systems, Inc.; Applied Medical Resources Corporation; General Surgical Innovations, Inc.; ExxonMobil Chemical Patents, Inc. may be interested in researching the possibility for a non-synthetic lubricant or non-stick surface from ginger leaves.

**Cooking in Bamboo Shoots**

Bamboo is a readily available resource that serves many functions in Qaqet society, including use as a cooking container. The bamboo provides moisture for steaming and adds a sweet flavor to the dish. Cooking in bamboo shoots reduces the need for villagers to use synthetic cooking containers to cook their food. This resource provides them with a free and highly available alternative to metal pots and pans. It is common to see children or men who are away from home for the day carrying a shoot of bamboo that holds either prepared or unprepared food. This allows them to transport meals that are either already cooked or that can easily be cooked on a fire when needed.

***Local Name(s):*** Arlinga

***Origin:*** Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Christmas Maraedi

***Chronicler(s):*** Taylor Lynn Starns

***How To:***

1. Bamboo is gathered and cut along the joints into sections. Each segment of bamboo should have one open end and one closed end (see **Figure 76**). The inside of the segments are then cleaned using water and grasses to scrub out all of the sediment.

2. Vegetables, fruits, or meat are put in the open end of the shoot until it is filled almost to the top. Salt and cooking oil are often added to give the food some flavor (see **Figure 77**).

3. A tight layer of non-edible leaves is pushed into the open end of the shoot to act as a cork, sealing the shoot. When corked, the shoots are placed directly on top of a fire to cook (see **Figure 78**). Once the bamboo has begun turning brown, it is removed from the fire. The contents of the shoots are then poured onto a serving dish and eaten.

***Global Market Consequence:***

Although the technique of using individual sections of bamboo as cooking containers is not evident in the global commercial market, bamboo is a prominent material in many cooking supplies. Steamers used in cooking Asian-inspired dishes are often made of bamboo. Cooking utensils, such as spoons and spatulas, are also commonly made out of bamboo. Both of these are internationally marketed products that use dry bamboo instead of fresh. Dozens of cooking-supply companies produce these products and could consider the use of natural pieces of bamboo in their product lines. The bamboo shoot itself could also be useful as a container for pre-packaged meals, such as those made by Amy's and Applegate Farms. Because cooking on open fires is not common in most societies, cooking in bamboo containers, as in the Arlinga process, could easily be done on grill tops. Bamboo packaging would also be effective for companies that produce pre-packaged soups and stews for outdoor activities. Used this way, bamboo would not actually be cooked but would merely serve as a container for the dry ingredients. This again would reduce the need for synthetic packaging.

**Cooking Directly on Fire, Ashes, or Embers**

A lot of cooking, particularly cooking of foods such as meats and root vegetables that are able to withstand direct contact with high heat, is done directly on prepared fires, embers, or ashes. Often times tough roots or vegetables will be buried in the hot ashes of a pre-existing fire before leaving the house for a few hours so that the food is ready to be eaten upon return. Vegetables and roots such as spring onions and taro, a staple food of Papua New Guinea, are placed directly onto flames or embers.

***Local Name(s):*** Arlut

***Origin:*** Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Christmas Maraedi

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

***How To:***

Though methods of cooking directly on fire, ashes or embers vary, the example observed involved Singapore or Chinese taro, a very common starch in Papua New Guinea (see **Figure 79**). Periodically, the taro is removed from the fire and scraped using a tool made of wood and metal to remove the char from the outside layer of the taro (see **Figure 80**).

## Cooking Stones

### Cooking with River Stones

River stone cooking is used to distribute heat evenly through the cooking process. In many areas of Mongolia, there is limited access to clean water so once the cooking is complete; the extracted stones are passed around to everyone at the meal. The stone is passed between their hands for 30 seconds purifying and disinfecting their hands.

***Origin:*** Arkhangai Aimag (Mongolia)

***Source:*** Enkhbayar and his family

***Chronicler(s):*** Kenneth Andrew Dabkowski

***Date Entered:*** August 2010

***Related Item(s):*** **Cooking with Volcanic Stones** (p. 64), **Khorkhog** (p.66)

***How To:***

1. A fire is built in a wood-burning stove. Volcanic river stones are layered on top of the initial layer of wood in the stove. Then another layer of wood is added, covering the stones. Layers of stones and wood are added until the stove is full.

2. After approximately 30-45 minutes of heating, the stones are ready. The food is placed in a pot. Usually, potatoes, carrots, onions, and meats are cooked using hot stones. Once the food has been prepared, the stones are removed from the fire and added to the pot.

3. The pot is then covered with a tight fitting lid and placed over the fire. The contents are periodically checked until the food is soft.

4. When the food is finished cooking, the stones are removed and handed to each guest. The guests pass the stone from hand to hand to sanitize their hands for roughly 30 seconds.

### Cooking with Volcanic Stones

Hot cooking stones are often used in order to heat and cook food without directly exposing it to the heat of the flames, embers, or ashes of a fire. The stones selected for cooking have very specific thermal and density characteristics. The average cooking stone is about the size of a grapefruit or a large orange. It is typically smooth like a river stone and is generally brown or gray in color. This allows for a low-maintenance cooking process that can occur without constant supervision. Stones are usually set aside and saved for the sole purpose of cooking, so they are reused as often as needed.

***Local Name(s):*** Adulka

***Origin:*** Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Christmas Maraedi

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

***Related Item(s):*** **Cooking with River Stones** (p.64), **Khorkhog** (p.66)

***Explanation of Variation:*** The cooking stones are used in a variety of ways to effectively cook and heat food evenly.

***How To:***

Heating Stones For Cooking

1. A layer of cooking stones is placed in the ashes of a pre-existing fire. New, slow-burning wood is placed on top of the first layer of stones. Then, another layer of cooking stones is placed on top of the layer of new wood (see **Figure 81**). The fire is lit from below the new wood and left for several hours to heat the stones to cooking temperature.

2. Once stones are at cooking temperature, they are removed from the fire using tongs made from wood that has been split but is left attached at one end. These tongs are also used in other instances for removing hot items from the fire.

Cooking Food on Hot Stones and Covered (The Mumu or Abrlumga Technique)

1. A layer of pre-heated cooking stones is arranged on the ashes. Uncooked food is placed directly on top of the first layer of stones (see **Figure 82**). This is usually a combination of vegetables and meats. Another layer of hot stones is placed on top of the uncooked food. If desired, uncooked quicker-cooking foods can be placed on top of the second layer of hot stones (see **Figure 83**).

2. Large leaves are placed on top of the final layer of the mumu until no steam escapes (see **Figure 84**). Then, a layer of fabric, varying from burlap to synthetic fabrics, is placed on top of the leaves, entirely covering the mumu in order to ensure that the mumu is sealed (see **Figure 85**).

3. The mumu is left to cook for several hours. This process is often done at night to prepare food for the next day, or is prepared before another task is begun so that the food will be prepared upon return.

4. After the food is cooked, the layers of fabric and leaves are removed (see **Figure 86**), the stones and prepared food are removed with tongs, and the cooking stones are set aside for reuse.

Using Cooking Stones in Synthetic or Natural Cooking Containers

Cooking stones can be placed into cooking containers to evenly heat and cook food. These containers vary based on intention. Included are examples of cooking stones used in natural and synthetic cooking containers.

*Using Cooking Stones in Metal Pots (Aigir Technique)*

1. Cooking stones are placed in a metal pot that contains some kind of liquid, generally coconut milk or water, to steam food. Meat and/or vegetables are then added to the pot and briefly tossed. A metal lid is put on the pot once the ingredients are mixed.

2. After 15 minutes, depending on ingredients, the lid is removed to check the progress of the food. The food and hot stones are removed from the pot with tongs when finished.

*Using Cooking Stones in Natural Bark Cooking Containers (Aluiska)*

1. Thin sheets of bark from slow-burning wood trees are folded into a cylindrical shape and sewn together with vines or other ropes. Both ends of the bark cylinder are left open, and one end is placed directly on a thick layer of leaves that will not be eaten to seal off the bottom (see **Figure 87**).

2. A layer of pre-heated cooking stones is placed into the cylinder and another layer of non-edible leaves is placed on top of the hot stones. Then, a layer of the food (usually edible greens) to be cooked is placed on top of the layer of leaves. A layer of distinguishable, non-edible leaves is placed on top of the food to be cooked in order to provide a separator between the first and second levels. Layers of stones, leaves, and food are added until the cylinder is filled (see **Figure 88**). Throughout the entire process, the contents of the bark are regularly compressed by the stones to ensure it is cooked evenly. A thick, final layer of distinguishable, non-edible leaves is added and a "lid" of these non-edible leaves is placed on top of the cylinder to seal the steam inside. This same layering process can be done in metal cooking pots as well.

Another common method of cooking in natural containers is cooking in large leaves, such as banana leaves. Contents are simply wrapped in the leaves and then placed in the embers of a fire. Not only are these natural containers organic, but they are also disposed of after a single use which reduces cross-contamination that occurs more commonly with reusable, synthetic containers.

**Khorkhog**

*Khorkhog* is a Mongolian dish made by utilizing heated stones to sear meat and various vegetables in a metal container. The exact process by which Khorkhog is made begins by gathering smooth, rounded stones and a fuel for burning (wood, cow dung, etc.), as well as a metal bowl or pot with a lid.

| | |
|---|---|
| ***Origin:*** | Selenge Province (Mongolia) |
| ***Source:*** | Budhand, Amarsahan, Tungalaghuu |
| ***Chronicler(s):*** | Riley Scott Little |

***Date Entered:*** June 2011

***Related Item(s):*** **Cooking with River Stones** (p.64), **Cooking with Volcanic Stones** (p.64)

***Explanation of Variation:*** A variation of this dish called *Boodog* is the method of cooking using the skin of an animal as a cooking container instead of a metal bowl or pot.

***How To:***

1. Cooking stones are heated in a fire for approximately 30-45 minutes. Meat and vegetables, which may include potatoes, carrots and onions are put into a metal pot or bowl. Once heated, the cooking stones are added to the pot along with some water and the pot is covered with the lid (see **Figure 89**).

2. The container is then covered with stones and placed atop the fire (see **Figure 90**). The food is checked periodically and water is added as needed. Once the meat is brown and the vegetables are tender, it is done cooking.

3. The stones are removed from the pot and given to each person (see **Figure 91**). Each person moves the stones quickly from hand to hand to sterilize them before eating.

***Global Market Consequence:*** (for all stone cooking entries)

Although still a relatively popular technique, the process of cooking with hot stones has reduced in practice in recent years. Many companies, however, market cooking stones and baking stoneware internationally. Cooking stones are most often used in baking processes, such as in preparation of breads and pizzas. Companies such as Hot Stone market flat, usually marble cook-tops that are heated in the oven and kept warm by direct flame. Companies such as Old Stone Oven also produce stone cooking surfaces on which baked goods can be prepared to produce a crispy crust. What these and other cooking supply companies have not considered is the use of cooking stones outside of baking applications. The ability to use stones for time controlled cooking (like a Crock Pot) seems to have considerable untapped potential. One of the main purposes of using cooking stones in Qaqet societies in Papua New Guinean and Mongolian communities is that the heat source is less volatile and direct therefore dishes need little to no maintenance in the cooking process. Cooking stones also provide an easy way to cook food evenly as the heat is distributed over a larger surface area. In this way, cooking stones relate to modern slow-cookers produced heavily by companies such as Crock Pot. These products rely on electric heat sources and are often left on for multiple hours. Techniques such as mumu employ the same slow-cooked, low-maintenance logic but cook foods in a more energy-efficient way. Commercial entities could consider the use of heated stones or other objects to provide the heat in slow-cooked dishes as opposed to relying on a constant stream of electric heat. The growing evidence showing that the meat exposed to direct fire can develop carcinogenic properties also makes cooking stones an avenue for exploration into other cooking methods.

Additionally, it was important to observe that a particular leaf in Papua New Guinea (waxy on one side and quite porous on the opposite side with a honey-comb like vein structure) was used in between cooking layers. At the completion of cooking, these leaves were dry and easily removed despite the moistness of the food that was being prepared. It appears that there is a novel, non-stick property, similar to Teflon, together with a direction hydration property to these leaves which could be used for other forms of food preparation.

**Cooking with Coconut Milk**

Where broths, water, or other cooking liquids are used in other cultures for cooking food, coconut cream or milk is often used in the Qaqet culture. This is largely due to the availability of the coconut and its nutritional value and flavor. Coconut cream is often used as the base ingredient for soups and as a cooking liquid for rice, greens, taro, and other vegetables.

***Local Name(s):*** Aingsedem

***Origin:*** Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Theresa Arek, Ben and Christmas Maraedi

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

***How To:***

To prepare coconut cream, coconuts are opened and the flesh is shredded on a grater and then placed into a dish. Water is added to the shredded coconut which is then squeezed repeatedly until enough cream is collected. In some areas, no water is added to the grated coconut. The coconut is put directly into the fabric or leaves and then squeezed in order to remove the coconut cream.

***Global Market Consequence:***

Coconut is well known for its health values. Coconut water itself is used as an intravenous fluid replacement because it is a natural form of saline. Every edible part of the coconut is healthy, and the market would benefit from greater research and use of these parts because they are so readily available in many areas of the world. Due to these health properties, cooking in coconut milk also adds nutrients to a dish where water or other broths may be less nutritional. Also, coconut milk adds creaminess to soups and stews without using heavy dairy products and could potentially be a replacement for milk and cream in lactose-free recipes. Grace Foods and Celebes Coconut Corporation currently market coconut milk products including cream, charcoal, juices, and powders. A great deal of marketing investment has been made in promoting coconut water as an organic alternative to sports drinks such as Gatorade or PowerAde. ZICO has been promoting pure coconut water as “Nature's Sports Drink” and is selling single serving containers in health food and grocery stores.

**Nermel Arhi**

Nermel Arhi is a traditional vodka made from fermented yak milk from the Arkhangai aimag. Nermel Arhi is a favorite drink of the people in the city and is an expected gift from anyone who travels to the countryside. It has a taste that can be compared to Saki. Nermel Arhi (also spelled "airag") is one of the premium dairy products of the yak herders. The heated leather strap at the top of the still is used for the treatment of back and kidney pain. Immediately after removal from the still, the strap is wrapped around the waist to provide heat treatments to the lower back region.

| | |
|---|---|
| ***Local Name:*** | Nermel Arhi |
| ***Origin:*** | Arkahngai aimag (Mongolia) |
| ***Source:*** | Tuvshinjargal |
| ***Chronicler(s):*** | Kenneth Andrew Dabkowski |
| ***Date Entered:*** | August 2010 |
| ***Related Item(s):*** | **Milk-based Alcohol Distillation** (p.144) |

***How To:***

1. Once a fire was built in the wood burning stove, yogurt was ladled into a curved pan on the stove and brought to a simmer.

2. Once the yogurt began simmering, a cylinder was placed inside the first curved pan. A small pot was suspended in the middle of the cylinder by string tied to the pot and the outside of the cylinder (see **Figure 92**).

3. A second curved pan was placed on top of the cylinder making sure that the middle of the curvature was over the hanging pan.

4. A leather strap was used to seal the edge of the cylinder by wrapping it around the edge and tied tightly so no steam could escape.

5. Cold spring water was added to the top curved pan (see **Figure 93**) to condense the steam off the boiling yogurt. The condensed steam containing alcohol ran down the curved pan and dropped into the hanging pot.

6. When the yogurt started boiling hard the leather strap, pan and pot were removed. The boiling yogurt was taken off of the get stove and left to cool.

***Global Market Consequence:***

Because of the resemblance of Saki, companies who make Saki may be interested in the vodka, along with other alcohol production companies. Some of these companies include but are not limited to Hakutsuru Sake Brewing Company, SakeOne, Gekkeikan, Koshino Kanbai, Toshimaya. Russian brewing companies may also be interested in the process or the product. Some of these companies include Stolichnaya, Zyr, Russian Standard, and Moskovskaya.

Cleaning product or wound disinfectant companies may also be interested due to the high alcohol content. Companies that focus on disinfectants include Prime Middle East LLC, Ningbo Fercy Personal Car Products Co., Davao Bioskin Tech Laboratories.

**Slaughter of the Sheep**

As is the case with everything in nomadic society, animals which are slaughtered for protein must be cleaned in a way that preserves the entirety of the animal for consumption. The people in the Northern Province of Mongolia have developed a method of slaughtering animals that lets nothing go to waste.

***Origin:*** Selenge Province (Mongolia)

***Source:*** Amarsahan, Tungalaghuu, Norjmaa

***Chronicler(s):*** Roger Lynn Bohon

***Date Entered:*** June 2011

***How To:***

When preparing a sheep to be eaten, the first step is to slaughter it allowing as little blood as possible to be spilled in the process. There is a vein that runs parallel to the spine that, when pinched, sends the blood to the stomach of the animal where it is preserved to be used later in making sausages and other products during the cooking process. A knife is used to cut a hole in the center of the underbelly of the sheep just long enough to fit a hand inside the animal to reach in and pinch the vein which bleeds the sheep to death (see **Figure 94**). After a few minutes, the blood has pooled in the sheep's body, allowing it to be cut open from neck to crotch with diagonal cuts made down the legs in order to break the legs, allowing full access to the meat surrounding the bones of the legs and the organs within the abdomen of the sheep.

Once fully cut, the skin is pulled back (see **Figure 95**) and used to set aside any organs that need to be removed and prevent any contamination. The organs that are removed are placed together in bowls that will later be used to clean them properly and hold them during the cooking process (see **Figure 96**). After the organs have been carefully removed, the ribcage is cut at the sternum and hung to dry (see **Figure 97**). The ribs are later cut in sets of three and cooked. Every part of the animal is cooked in some way so it is vital that everything is preserved.

**Yak Yogurt Production**

Yak milk is in abundant supply for the herding communities of Central and Western Mongolia. While there is limited caloric diversity in many communities, multiple products are derived from milk for their flavor, texture and digestive properties. One of the most prevalent foods is yogurt. Yogurt production in Mongolia does not involve the industrial denaturing of bacteria common in industrial cow milk yogurt production. Why this step is avoided was not discussed, but could be an area for future inquiry. While commercial yogurt production includes a controlled culture of bacteria for fermentation, the local production involved use of cultures from previous batches.

We observed that, during the preparation and storage process (which has no need for refrigeration) there appeared to be little to no spoilage. It is noteworthy to realize that the production involves relatively deep barrels and vats which limits the exposure the yogurt medium has to airborne contamination. Additionally, the climatological conditions in which this yogurt is prepared – relatively arid – may be associated with little or limited bacterial lode.

***Origin:*** Arkhangai Aimag (Mongolia)

***Source:*** Tuvshinjargal

***Chronicler(s):*** Kenneth Andrew Dabokowski and David Earl Martin

***Date Entered:*** August 2010

***How To:***

1. A 30 gallon plastic barrel was filled to 2/3 capacity with yak milk.

2. Roughly a cup of active culture yogurt was added.

3. Using a wooden stirring paddle (with a rake-like appearance), the entire mixture was stirred 3,000 strokes per day. The stirring motion was a full depth stir in a figure-eight pattern (see **Figure 98**). Care was taken to insure all sides and bases were covered. We were told that each child in the family was encouraged to stir a minimum of 200 stirs per day with the adults finishing the remaining strokes during food preparation or socialization.

5. We were informed that the yogurt was ready for use when it was the appropriate taste and thickness. We were not told how many days or weeks this process entailed.

6. Once completed, the yogurt barrels were fitted with a tight-fitting lid and stored for consumption in the coming weeks and months.

***Global Market Consequence:***

The bacterial and food storage dynamics of the yak milk yogurt production bear considerable amounts of information for further inquiry. The capacity to make, store and eat yogurt produced and preserved for extend periods of time without refrigeration is noteworthy.

Researchers at Kansas State University have examined ways to accelerate production of yogurt for the reduction of incubation times for bacteria colonies. Clemson University has looked at ways to limit or inhibit the growth of unwanted bacteria – a concern that appears to present limited or no challenge for the Mongolian process. The nature of production (open and exposed to the environment) would merit closer examination – including a review of natural airborne bacteria, the role of the wood selected for the paddle, the stirring frequency and other related items.

The lead proprietary holders of technologies in the field of yogurt production include Martek Biosciences, Nestec S.A., Abbott Laboratories, General Mills, Hayashibara Seibutsu, North Carolina State University and Kraft Foods.

# Images for Cooking Techniques

## Aigir

**Figure 66:** Hot stones are wrapped in Gaga leaves before being placed in the pot to prevent the food from sticking.

**Figure 67:** The first layer of cooking stones is placed covering the bottom of the pot.

**Figure 68:** Chicken and root vegetables are placed directly on top of the cooking stones so they can cook thoroughly.

**Figure 69:** A layer of Ibika (a green leafy vegetable similar to collard greens) and other greens is placed on top of the chicken and root vegetables.

**Figure 70:** Coconut milk is added to the pot once all of the vegetables have been added. In this instance, the coconut milk is mixed with ginger, spring onions, and tomatoes.

**Figure 71:** Cooking stones are placed throughout the vegetables to ensure that all the food cooks thoroughly. More coconut milk is squeezed into the pot as needed.

**Figure 72:** The Aigir is then covered with a banana leaf to lock in the steam as it cooks.

**Figure 73:** The banana leaf is secured around the lip of the pot with a string or, in this case, the center stalk of a banana leaf.

**Figure 74:** The lid is placed on the pot and a cooking stone on top of the lid to add heat and keep the lid in place.

**Figure 75:** After twenty minutes, the lid and banana leaf are removed and the Aigir is ready to be eaten.

## Cooking with Bamboo Shoots

**Figure 76:** Bamboo sections are cut with one end sealed and the other open. The sections are filled with an assortment of greens and vegetables to each individual's liking.

**Figure 77:** Salt and cooking oil are added occasionally for flavor. The bamboo alone gives the contents a sweet flavor.

**Figure 78:** When filled, the bamboo shoots are placed directly on the fire until they have turned brown, indicating they are done cooking.

## Cooking Directly on Fire, Ashes or Embers

**Figure 79:** Taro is placed directly on a fire and is periodically turned to ensure it cooks evenly.

**Figure 80:** When the outside of the taro is covered with char, it is removed from the fire and the char is scraped off using a curved metal tool. The taro is then placed back on the fire to continue cooking.

## Cooking with Volcanic Stones

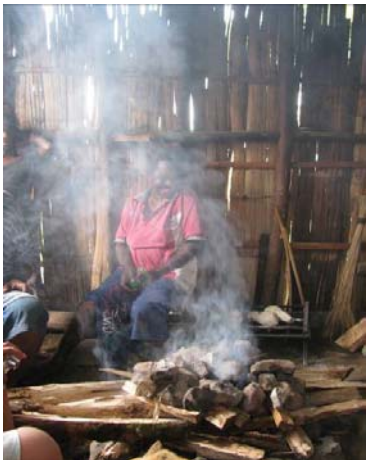

**Figure 81:** The stones are heated over a fire built with new wood. Layers of stones and wood are alternated to evenly distribute the heat.

**Figure 82:** Root starches like sweet potatoes and taro are placed directly on the stones in the ashes of the fire and more cooking stones are layered on top using tong like sticks.

**Figure 83:** Less hearty vegetables like these cheko vegetables are layered on top of the second layer of stones.

**Figure 84:** The stones and vegetables are covered with taro leaves until no steam escapes, sealing in the heat.

**Figure 85:** The mumu is then covered with burlap or other fabrics to further seal in the steam.

**Figure 86:** The mumu is left to cook for a number of hours, often over night. When finished, the leaves and fabric are removed and the cooking stones are washed and set aside to be used again.

**Figure 87:** A cylinder of bark is placed on top of a broad leaf to seal the bottom. Heated cooking stones are then layered on the bottom of the cylinder.

**Figure 88:** Layers of non-edible and edible leaves are stacked in the cylinder then another layer of hot rocks is added.

## Khorkhog

**Figure 89:** Hot cooking stones are added to a curved pan filled with meats, vegetables, and some water.

**Figure 90:** The lid is placed on the pan and the whole thing is placed in the hot embers of the fire used to heat the rocks.

**Figure 91:** Once the food is cooked, the hot rocks are removed from the pan and given to each guest to sanitize their hands before eating.

## Nermel Arhi

**Figure 92:** A small pot is suspended in the metal cylinder by strings tied to its handles and the outside of the cylinder. This pot will collect the condensed alcohol.

**Figure 93:** Cold spring water is added to the pan on top of the cylinder to condense the steam.

## Slaughter of the Sheep

**Figure 94:** After the vein has been pinched, all of the blood pools in the cavity of the sheep, keeping it from spilling when the animal is finally opened.

**Figure 95:** Once the blood has pooled, the skin is carefully removed. Cuts are made in a "Y" shape on the belly of the sheep and the fist is used to separate the skin from the muscle lining.

**Figure 96:** Once the skin is removed, the stomach cavity is opened and the internal organs are carefully removed individually so as not to contaminate or waste them.

**Figure 97:** The muscles and bones are then cut in sections to be either cooked or smoked. The ribcage is cut into sections of three and set out to dry before being cooked. Every part of the sheep is used in some way.

## Yak Yogurt Production

**Figure 98:** Yak milk was poured into plastic containers to be churned using a rake like tool. It is stirred 3,000 times per day.

## Food Items

### Aartes

The remaining dairy product from the alcohol distillation process is called "boz". This is poured into a cheesecloth bag to allow the water or shar to drain from the mixture, which can then be dried to make various kinds of cheese. It generally takes 2-3 days for all of the shar to drain from the boz. The remaining solid in the bag is a cheese with a similar consistency and taste to feta cheese. This product is called aartes (see **Figure 99**).

***Local Name(s):*** Aartes

***Origin:*** Selenge Province (Mongolia)

***Source:*** Norjmaa, Ganerdene

***Chronicler(s):*** Katherine Irene Martin

***How To:***

It is fairly common for aartes to be cut into small pieces and left in the sun to dry for a number of hours (see **Figure 100**). Once dried, aartes can keep for weeks on end without refrigeration. Sometimes the aartes is mixed with sugar (see **Figure 101**) and formed into small patties called aaruul. Once the aartes and sugar is mixed well and formed, it is left to dry in the sun until hard (see **Figure 102**). Before dental hygiene was a widespread practice in the Mongolian countryside, aaruul was consumed to strengthen and clean teeth.

***Global Market Consequence:***

This solid cheese product is mixed with sugar and left to dry until hard. It can be kept without refrigeration for weeks once fully dried. Traditionally, this was used by the nomads of Northern Mongolia as a means of maintaining dental hygiene. Aartes could be researched to find the elements useful for cleaning and maintaining teeth and could be used by dental hygiene companies in products for both animals and people. There are several companies in the canine, teeth-cleaning treat industry and aartes is a product with a low cost of production and could be a natural alternative to some other products that are currently on the market. Planet Dog Toys, Nylabones, Greenies, Petstages Chew Toys and Kong Toys are all companies and products that could potentially benefit from such a technology.

### Arak

Similar to goat and cow milk, horse milk is used to make several dairy products such as cheeses, yogurt, butter, and arak. Arak is fermented milk that becomes alcoholic when exposed to sunlight over a period of time. Adding sugar and shaking speed up the fermentation process.

***Origin:*** Selenge Province (Mongolia)

***Source:*** Norjmaa, Budhand, Erdenebaatar

***Chronicler(s):*** Roger Lynn Bohon

***Date Entered:*** June 2011

***How To:***

The milk is poured into translucent bottles so that sunlight can pass through the bottles to maximize fermentation (see **Figure 103**). The milk is shaken periodically to speed up the process by exposing more of the milk to sunlight. The longer the milk is left in the sun and the more that it is shaken, the stronger the alcohol content is in the final product. The final product is known informally as horse milk beer and is poured into cups and bowls for drinking (see **Figure 104**).

***Global Market Consequence:***

The fact that horse milk ferments when shaken and exposed to sunlight suggests the milk itself contains a photophilic bacteria, meaning the bacteria thrives in strong direct light. The use of ultraviolet light and the shaking processes in fermentation is common in the chemical and pharmaceutical industries and is utilized by such companies as Eli Lilly, Pfizer, and CJ Cheiljedang Corporation. CJ Cheiljedang Corporation is using such methods to produce J-arginine, an amino acid which has been found to improve heptic and brain function and is used as a salt substitute in many food products. The horse milk used to make arak could be studied to identify the photophilic bacteria reacting to the ultraviolet light which could then be used in alcohol fermentation processes as well as pharmaceutical and chemical production.

**Ku**

Ku is a common food product found in Tolai communities of East New Britain. It is made using pure coconut milk that is steamed until all the water has evaporated and the coconut cream remains. The final product has the consistency and appearance of oatmeal and is often used as a sauce or consumed by dipping food in it. In Tavuiliu, ku is often cooked using cooking stones. It produces an oil by-product that is used for body wash and cooking, most often in frying. In Tinginagalip, the shredded coconut is combined with crushed leaves prior to squeezing giving the ku a different texture and taste. The ku is cooked in a pot over the embers of a fire. During our short visit to Navunaram, we also saw a large quantity of ku that had been made for a wedding, suggesting it has a role in special occasions.

***Origin:*** Tavuiliu (East New Britain, Papua New Guinea)

***Source:*** Abby, Niuyia, Freda, Simon, Freda, Pita, Watabar, Rosina, Jacklyn, Jacklyn, Edwick, Joe, Bertha, Michael, Sharon, and Simon

***Chroniclers:*** Julia Elizabeth Craig, Hector Javier Feliciano-Ayala, and Michael Patrick Venable

***Date Entered:*** June 2012

***Related Item(s):*** **Cooking with River Stones** (p.64), **Cooking with Volcanic Stones** (p.64), **Khorkhog** (p.66), and **Cooking with Coconut Milk** (p.67)

***Explanation of Variation:*** The number of coconuts used varies depending on how much ku is needed.

***How To:***

1. 30 coconuts were de-husked, split, and scraped into two bowls (see **Figures 105 & 106**). The number of coconuts used may vary depending on the amount of ku required.

2. Six banana leaves were collected and two of the leaves were prepared over a fire by holding them over the flame until they turned dark green. The leaves were then dragged across the fire until the whole leaf was dark green and shiny. Using this method to prepare the leaves prevents them from burning and sterilizes them before they come in contact with the food.

3. Coconut husks were arranged in a ring on the ground with the leaves layered on top so that the two prepared leaves were on top. The pile of leaves was then bent to form an indention in the center.

4. Two wooden stakes, each one meter in length, were stuck in the ground on either side of the ring of husks. A third stick was nailed to the middle of the two stakes horizontally (see **Figure 107**).

5. In the meantime, the cooking stones were prepared (see **Figure 108**). A layer of cooking stones was placed in the ashes of a pre-existing fire. Slow-burning wood and coconut husks were placed on top of the first layer of stones. Layers of cooking stones and wood or husks were stacked as needed. A fire was then lit beneath the pile. Once the stones were the appropriate temperature and color, they were removed using tongs.

6. An empty ten-kilogram rice bag was opened on both sides and turned inside out (see **Figure 109**). Two handfuls of grated coconut were placed in the center of the rice bag long-ways. The rice bag was then folded around the pile of coconut. The two ends of the rice bag were tied around the horizontal stick making sure that the coconut hung above the indentation in the leaves (see **Figure 110**).

7. Another stick, about 30 cm long, was placed in the loop. Using this stick, the rice bag was twisted until all the coconut milk had been released into the leaves below. While one person twisted the stick as tightly as possible, another held the loop together around the horizontal stick. Steps 6 and 7 were repeated until all the coconut had been squeezed. (See **Figure 111**)

8. Once the grated coconut had been squeezed, approximately 15-20 hot rocks were cleaned and added to the milk. The rocks were left in the milk until it was no longer steaming and only ku and oil remained. (See **Figures 112-115**)

9. The rocks were removed and the oil was carefully spooned out into a bowl to be used later (see **Figure 116**). A pinch of salt was stirred into the ku. It was then left to cool before being eaten. (See **Figure 117**)

***Origin:*** Tinginagalip (East New Britain, Papua New Guinea)

***Source:*** Michael Maradei, Josephine Maradei, Peter, Michael, and Henry

***Chroniclers:*** Julia Elizabeth Craig, Hector Javier Feliciano- Ayala, and Michael Patrick Venable

***Date:*** June 2012

***How To:***

1. 24 coconuts were de-husked, split, and scraped into two bowls. The number of coconuts used may vary depending on the amount of ku required.

2. Kuripelapele (the local name for a bush vine) leaves were rubbed until shredded and added to the grated coconut which was then mixed evenly (see **Figure 118**). Then, eight ounces of water was added to the grated coconut and mixed.

3. Next, a metal rod was stuck in the ground and a gaga leaf tied to the middle of the rod to act as a spout (see **Figure 119**). A bowl was placed underneath the leaf to catch the coconut milk.

4. An empty ten kilogram rice bag was opened on both sides, turned inside out, and bunched together to make a loop. Two handfuls of grated coconut were placed in the center of one side of the loop (see **Figure 120**). The edges of the rice bag were then folded around the coconut.

5. The two ends of the rice bag were held and twisted in opposite directions forming a figure-eight. The loop at one end of the twist was slid on to the metal rod. A stick, about 30 cm long, was slid into the loop at the other end of the twist. The stick was turned until coconut milk was released (see **Figure 121**). The squeezed coconut was removed from the rice bag and set aside to be used as pig feed. Steps 4 and 5 were repeated until all of the coconut had been squeezed.

6. Once all of the coconut had been squeezed, the rice bag was flattened out and placed on top of an empty pot. The coconut milk was poured into the pot using the rice bag as a filter.

7. Both coconut shells and coconut husks were used to build a fire and the pot of coconut milk was placed on a grate over the flames (see **Figures 122 & 123**). Typically, it is cooked over hot embers instead of an open fire, but to save time, the ku was cooked over an open flame.

8. Once the mixture had started simmering, 3 pinches of salt were added to the pot and it was stirred slowly as it continued to cook (see **Figure 124**); evaporating all of the water. It was then left to cool before being eaten.

***Global Market Consequence:***

Coconut oil, cream, husks, and shells are used in a number of applications across multiple markets. Coconut cream and oil often appear in hygiene and beauty products; however, they have many applications in the food industry as well. Because coconut cream and oil have a creamy flavor and texture, they are often used as dairy substitutes in traditional dairy products. Kraft Foods uses coconut oil in their cheese for grilled cheese sandwiches and Frito-Lay, Inc. uses it as a component in their cheese flavored products. Unilever Bestfoods uses coconut oil in their squeezable cheese condiment. Rich Products Corporation and Unilever Patent Holdings B.V. use coconut oil in their low-fat whipped spreads and non-dairy whipping cream respectively. Other companies that may be interested in the use of coconut cream and oil are Wm. Wrigley Jr. Company; Nestec S.A.; General Mills, Inc.; The Pillsbury Company; Procter & Gamble; Nabisco Brands, Inc.; Arco Chemical Technology, L.P.; Borden, Inc.; Durkee Industrial Foods Corp.; Leprino Foods Company; Opta Food Ingredients, Inc.; Alpine Lace Brands, Inc.; Lever Brothers Company; Unilever N.V.; Societe des Produits Nestle S.A.; Lipton; General Foods Corporation; Van den Bergh Foods Co.; Meiji Milk Products Company Limited; Asahi Denka Kogyo Kabushiki Kaisha; Edward Mendell Co., Inc.; Fuisz Technologies Ltd.; Danisco A/S; and Good Humor-Breyers Ice Cream among many others.

Coconut shells and the fibers from the coconut husks are frequently used across a broad spectrum of industries. The fibers and ashes after burning the shells are used by the University of Central Florida Research Foundation, Inc.; Renewable Fibers, LLC; and Design Technology and Innovation Limited in innovations pertaining to water purification and management as well as wastewater filtration. Other companies that may be interested in utilizing this renewable filtration material include Procter & Gamble; Kimberly-Clark Worldwide, Inc.; DuPont; Baxter International, Inc.; ALZA Corporation; Warner-Lambert Company; WaterRide Concepts, Inc.; Siemens Water Technologies Corp; Zimpro/Passavant, Inc.; Global BioSciences, Inc.; Sharp Kabushiki Kaisha; Linde Aktiengesellschaft; Occidental Chemical Corporation; Abtech Industries, Inc.; Dharma Living Systems, Inc.; Wolfgang Behrens; Contech Stormwater Solutions, Inc.; Ibiden Co., Ltd.; Corning Incorporated; GEO2 Technologies, Inc.; Donaldson Company, Inc.; and NGK Insulators, Ltd. Coconut shells have also been used as biological material to filter waste gases (Council of Scientific and Industrial Research), an organic conditioner to neutralize soil toxicity and prepare soil for vegetation growth (Universidad Juarez Autonoma de Tobasco), and as an active carbon source for lead-acid batteries (Hitachi, Ltd.). Companies in a similar innovation space as these companies include AeroGrow International, Inc.; Errcive, Inc.; Shell Oil Company; Embro Corporation; Alko, Ltd.; Sorce, Inc.; EMC Services' Cooper Equipment Company; Canon Kabushiki Kaisha; Mycotech Corporation; C&T Company, Inc.; Matsushitu Electric Industrial Co., Ltd.; NEC Tokin Corporation; Japan Storage Battery Co., Ltd.; and Aerovox Incorporated.

Coconut shells and fibers also have applications in the plastics industry. SABIC Innovative Plastics IP B.V. mentions coconut as a preferred cellulosic material in their composition of flame-retardant resins. PolyOne Corporation uses coconut as a thermo-plastic biofiber in the color concentrates for plastics. Other companies that may be interested in the application of coconut byproducts in plastics include E. Khashoggi Industries, LLC; General Electric Company; Clarient GmbH; Polysar Limited; Warner-Lambert Company; Extrutech International Inc.; Cyclics Corporation; BASF Aktiengesellschaft; Bayer Aktiengesellschaft; Shell Oil Company; and Landec Corporation among many others.

Just like bamboo, coconut shells and husks are lignocellulosic, making them a viable material in ethanol production. In fact, Danisco Sweeteners Oy has found that coconut husks are a lignocellulosic biomass that also contains xylan making it useful in the production of ethanol and xylitol, a sweetener used as a sugar substitute. Companies that may be interested in this information include UOP Inc.; Institut Francais du Petrole; Xyrofin Oy; Ajinmoto Co., Inc.; The Amalgamated Sugar Company; and Union Carbide Corporation among others.

Coconut fibers and husks can also be found in the household supplies industry. Unilever Home & Personal Care USA uses coconut husks or fibers as a disintegration-promoting material in cleaning and bleaching tablets. Lever Brothers Company; Henklel AG & Co.; Takemoto Yushi Kabushiki Kaisha; Reckitt Benckiser N.V.; and The Clorox Company are among the companies working in a similar innovation space as Unilever. In a much more general application, Nippon Sheet Glass Co., Ltd. has used coconut fibers as packaging material for their glass products to prevent breakage. PPG Industries, Inc.; Cardinal IG Company; Libbey Owens Ford Glass Co.; TruSeal Technologies, Inc.; and Helmut Lingemann GmbH & Co. are just a few of the companies that may be interested in integrating coconut fibers into their processes or products.

**Mumu Tapiok Na Minmin**

Mumu Tapiok Na Minmin is a food made from tapiok (the Pidgin name for cassava roots), minmin (the Tolai name for ripe, sweet eating bananas), coconut, and salt. The cooking process can take up to eight hours so it is common for many people to prepare it before going to sleep so that it can cook overnight and be ready to be taken to school or work the next morning. Once cooked, the Mumu Tapiok has a consistency similar to a very dense cake. While it is still hot it can be quite sticky. The color of the mumued tapiok varies depending on the type of banana used. Often times it is made with cooking bananas so the cake is a deep purple. Mumu Tapiok Na Minmin is not only rich in starches and calories, but is also sold in markets as a means of generating income.

| | |
|---|---|
| ***Local Name:*** | Mumu Tapiok Na Minmin |
| ***Origin:*** | Amruqa Plantation, Vunakanau (East New Britain, Papua New Guinea) |
| ***Source:*** | Michaeline Niaring and Dambie Maradei |
| ***Chronicler(s):*** | Julia Elizabeth Craig, Hector Javier Feliciano-Ayala, and Michael Patrick Venable |
| ***Date Entered:*** | May 2012 |

***How to:***

1. Approximately eight large roots of tapiok were peeled, washed, and grated (see **Figures 125-127**). In the meantime, twelve coconuts were de-husked and cracked open (see **Figure 128 & 129**). The water from these coconuts was drained into a bowl which was set aside for later and the coconuts were grated (see **Figure 130**). While the coconuts were prepared, a fire was built and cooking stones were placed in the fire to pre-heat.

2. Six banana leaves were collected and prepared by dragging them slowly over the fire until they became heavy and flexible with a dark green, shiny appearance. This was done to not only sterilize them, but to make them somewhat heat resistant so they would not burn as the mumu cooked and more supple so they do not rip or tear when used to wrap the food.

3. The center stems of the banana leaves were then removed (see **Figure 131**). A knot was tied in the skinny end of four of the stems which were then split in half, creating thin ropes (see **Figure 132**). Two of these were laid out in an "X" with the other two laid in a cross on top of the "X". The banana leaves were then laid out on top of the thin ropes in an "X".

4. The grated tapiok was placed in the middle of the banana leaves (see **Figure 133**). Approximately, twelve bananas were peeled, squeezed, and mixed into the grated tapiok (see **Figure 134**). A pinch of salt and some of the coconut water were mixed into the grated coconut. Handfuls of the grated coconut were placed in a burlap cloth and wrung over the tapiok and banana mixture until the consistency was like soft bread dough (see **Figure 135**).

5. The banana leaves were then folded over the mixture alternating between each leaf (see **Figure 136**). Once all of the leaves were folded, the corners were turned up to prevent leaks and the strings made from the banana leaf stems were tied at the top to secure the leaves (see **Figure 137**).

6. Once the flames of the fire heating the stones died down heating the cooking stones, the burned coconut husks and wood were removed leaving only the hot rocks. The large rocks were set aside and the tapiok was placed on the smaller rocks in the fire pit (see **Figure 138**). The large cooking stones were placed on top of the tapiok (see **Figure 139**). Banana leaves were placed on top of the tapiok and cooking stones until no steam escaped (see **Figure 140**). After five hours, the tapiok was cooked, the leaves and stones were removed (see **Figure 141**), and the tapiok unwrapped, allowed to cool and eaten (see **Figure 142**).

***Global Market Consequence:***

After preparation over a fire, the banana leaves containing the tapioc and banana mixture are resistant to burning. This is evidenced by the fact that the mumu can be left to cook for hours without catching fire. While there are many factors that may contribute to this, the leaves themselves are surprisingly unaffected by the long duration of exposure to heat. After researching, we were unable to uncover any current innovations taking advantage of banana leaves in general including their resistance to burning after preparation. There are endless possible applications of banana leaves across multiple industries that are currently untapped. One thing that was discovered about banana leaves was that they have high concentrations of polyphenols and EGCG (two antioxidants) as well as polyphenol oxidase (a chemical often used in the treatment of Parkinson's disease). Xel Herbaceuticals, Inc.; SOLAE, LLC; and Conopco, Inc. all produce tea, drinks, or foods with polyphenols and EGCG in them. They along with General Foods Corporation; Procter & Gamble; Unilever PLC; The Coca-Cola Company; Ajinomoto Co. Ltd.; The Nutrasweet Company; Cadbury Adams USA LLC; Bioresearch, Inc.; Warner-Lambert Company; Nestec S.A.; Mars Incorporated; Mitsui Norin Co., Ltd.; Indena S.p.A.; Tata Tea Ltd.; and many others may be interested in utilizing banana leaves in someway.

**Saksak**

Saksak, the staple food of Ngavalus, is a fine powder that is extracted from the sago tree. There is a great deal of work that goes into the processing of saksak because an entire sago tree must be processed at one time. When saksak processing occurs, the whole community comes together to get all the work done.

***Origin:*** Ngavalus (Papua New Guinea, New Ireland)

***Source:*** Apet, Ashley, Danny, Dorcas, Enoch, Maeve, Maliki, Miscarona, Peter, Rocky, Russell

***Chronicler(s):*** Roger Lynn Bohon

***Date Entered:*** August 2011

***How To:***

The process begins with the selection of the tree. There are two types of sago trees: one that is short and wide, which is a very hard tree, while the other is tall and thin, which is much softer. In order to preserve the forest around the selected tree, the ground where the tree will fall is covered with brush and leaves to cushion the fall of the tree and prevent it from sinking into the mud. Once the area around the tree is prepared, an axe is used to chop the tree down. Once the tree is down, it is left in the sun so the bark and the brush can dry before it is removed. In the meantime, the washing station is set up (see **Sago Washing Troughs** and **Figure 143**).

The next day, the brush and growth are cut off of the tree using a bush-knife. Once cleared, the bark is pried off of the tree, using two sharpened sticks, in strips so it can be used to cover the bench the men use while beating the tree. Two stalks of bamboo are cut so the tops formed a "U" and are placed in the ground with roughly two meters between them. A bamboo stalk, roughly two meters in length, is placed horizontally on the two bamboo stalks in the ground, forming a "Π" (see **Figure 144**). Ten stalks of bamboo are then put in the ground at an angle so they rest on the horizontal stalk. The number of angled bamboo sections and the length of the horizontal bamboo stalk vary depending on how much of the tree is being beaten, the result of which is called mumut. The angled bamboo is then covered with palm fronds and the strips of sago bark were then placed beside each other, completely covering the palm fronds (see **Figure 145**). Woven mats made from sago fronds using the same method found in the **Woven Mat** entry, are placed on top of the bark (see **Figure 146**). The sharpened sticks used to pry off the bark are placed at either end of the bench and secured with maris to keep all of the things piled on top of the ten bamboo stalks in place.

After completing the bench, the men sit side-by-side, with their feet braced shoulder-width apart on the tree (see **Figure 147**). To protect each others feet from getting hit by the sepal, a tool used to beat the sago that looks similar to a pick axe, each of the men places one foot over their neighbor's. Using the sapal, the men then work together to beat the sago tree until it has all been turned to mumut (see **Figure 148**). The mumut is collected on another woven sago mat, transferred in small loads to curved pieces of sago bark and taken to the washing station (see **Figure 149**).

The bark carrying the load of mumut is placed at the back of the washing trough known as the mase (see **Figure 150**). Mumut iss added to the trough until the mase is a third of the way full. Water is then added to the mumut (see **Figure 151**) which is kneaded and squeezed (see **Figure 152**), releasing the water and saksak from the mumut (see **Figure 153**). Each batch of mumut is kneaded and squeezed until the water running out is clear, on average the mumut is washed six times. The runoff is then left to settle for a number of hours (see **Figure 154**), after which the water is allowed to drain off, leaving the saksak behind (see **Figure 155**). This is then collected in rice bags which allows the rest of the moisture to drain. At this point, the saksak is wrapped in sago leaves which are sewn shut; if this is done properly, the saksak can last for a number of months.

***Global Market Consequence:***

Saksak, the powder extracted from the sago tree, has a plethora of uses both as a food product as well as a number of non-aligned applications. One of the interns on the 2011 team is from Chennai, India and, throughout the process of extraction, she informed the team and community that sago is a key ingredient in baby formula in India. It is one of the ways that mothers ensure their children are getting the proper nutrition after they have stopped breast feeding. Companies like Similac®, Enfamil®, and Gerber® may be interested in researching the nutritional benefits of sago and incorporating it into their products.

Sago also has potential in the carbonated beverage industry. Carbonated drinks have a wide market and numerous opportunities for new innovative refreshments. Studies have shown that sago drinks are an alternative to carbonated energy drinks. Carbonated drinks typically have a number of chemicals as ingredients, often including high fructose corn syrup, to create a desired taste or to lower the cost of production. Carbonated sago drinks are an alternative to others because they provide the energy boost without the added chemicals, which are potentially harmful to the body. A few companies that may be interested in using sago to develop alternative energy drinks are FRS Health Performance, Steaz, and Vemma Verve.

Sago not only provides an opportunity to develop an alternative energy drink but also to develop an alternative energy source, a growing concern as we seek more sustainable ways to access energy. Sago is rich in ethanol and research has shown that it holds more ethanol per hectare than any other bio-fuel crop. Recently, automakers have increased their production of flex-fuel vehicles, vehicles that run on a mixture of gasoline and ethanol. Currently, Brazil is processing sugar cane into ethanol and has been able to export as much as they import, reducing their dependency on foreign oil. Research has also shown that sago biomass can be used to produce heat thereby generating thermal power, proving sago to be a sustainable alternative to fossil fuels. The byproduct of the ethanol process could be reintroduced to the system by producing the power to run the process again. Necfer Corporation has begun research on extracting ethanol from sago trees and companies like Verasun Energy Corp or Archer Daniels Midland (one of the largest ethanol producers in the world) could be partners for ethanol production.

International packaging companies and businesses have become dependent on plastics for packaging or manufacturing their products and research shows that sago has properties that can be used in the development of biodegradable plastics. Currently plastics are photodegradable, meaning they breakdown into smaller fragments, but they never fully decompose. Many companies are being forced to regulate their production of photodegradable plastics, creating an opportunity for sago plastics to fill a commodity need. Guangdong Shangjiu Biodegradable Plastic is a large manufacturer of biodegradable plastics and Co Symphony Environmental Technologies Plc is a world leader in degradable plastics; both would benefit from the research and development of sago-based plastics.

**Shar tos (Yak Milk Yellow Oil) and Khailmag (Roux)** (see **Figure 156**)

Khailmag is a food item made with yak milk, flour, and sugar. While the khailmag cooks on the stove, it produces shar tos which is often used in cooking or is added to yak milk vodka.

***Origin:*** Arkhangai aimag (Mongolia)

***Source:*** Tuvshinjargal

***Chronicler(s):*** Kenneth Andrew Dabkowski

***Date Entered:*** June 2010

***How To:***

1. A fire is made in a ger stove to heat a curved cooking pan before adding the yak milk. A few cups of yak milk are dispensed into the pan and brought to a boil.

2. Once the milk begins to boil, flour is added until the mixture thickens(see **Figure 157**) to a consistency similar to a very thick yogurt or sour cream. The mixture is continuously stirred to keep it from sticking to the bottom or burning.

3. The mixture is allowed to simmer until it starts producing dark yellow oil (shar tos) (see **Figure 158**). It is then stirred more rapidly while roughly 6 ounces of sugar is added.

4. After around 3 minutes, the pan is removed from the heat and the oil skimmed off the top of the khailmag. The oil is set aside to be used in cooking or to flavor yak milk vodka.

***Global Market Consequence:***

Shar tos oil may be an oil that can withstand very low temperatures. While we do not know the properties of the oil once extracted, it stands to reason that since the oil can be formed in a very cold environment, it may also be viscous in a cold environment. Oils that maintain viscosity in the cold could be useful for lubrication of cold machine parts. High value applications, such as cold weather lubrication on space shuttle machinery, or machinery operating in cold climates may be possible.

***Companies of Interest***

NASA (U.S. Space Agency), Virgin Galactic (Private space flight company), Caterpillar, John Deere & Company, Mitsubishi Heavy Industry, Northrop Grumman, Boeing, Lockheed Martin, US Military (heavy equipment manufacturers and procurement companies and agencies)

**Tseedum**

One of the many products made with milk is tarak, a mixture of milk and sugar. When tarak is mixed with water, it is thinned into a drink known as a tseedum (see **Figure 159**). Tseedum is consumed much like sports drinks are consumed in the United States. It is a common beverage used to both refresh and replenish nutrients in people when traveling long distances or when they have spent a great deal of time in the sun. In the past this drink has been preserved in a thermos made of leather (*tashmug*) that keeps the drink cool.

***Origin:*** Selenge Province (Mongolia)

***Source:*** Norjmaa, Tsendjaw

***Chronicler(s):*** Roger Lynn Bohon

***Date Entered:*** June 2011

***Explanation of Variation:*** The ratio of tarak to water in the solution is subjective to the preference of the drinker: adding more water for a lighter drink and more tarak for a thicker drink. Sugar is added to provide a sweeter taste.

***Global Market Consequence:***

Tseedum presents a research opportunity for sports drink companies because it is used for the same purpose but involves fewer chemicals; it is simply yogurt, water, and sugar. It also has potential to be utilized by companies like Dannon® and Yoplait®. It is common to see the youth in the Selenge province drinking Tseedum for refreshment, much like Dannon® Danimals drinks or Yoplait® Gogurt. Each of these drinks and drinks like Gatorade® and Powerade® are used as a way to rehydrate and replenish nutrients exactly like Tseedum is utilized in Selenge. Since there is much debate in the sports drink industry as to the effects of products like Gatorade® and Powerade®, they may be interested in researching the components of Tseedum that make it effective.

**Yak Milk Fat Separation**

Yak milk is in abundant supply for the herding communities of Central and Western Mongolia. While there is limited caloric diversity in many communities, multiple products are derived from milk for their flavor, texture and digestive properties. A common delicacy is the clarified fat separated from milk. This process (which is associated with the production of a flour based roux) is used for consumption of milk fat at mealtime and was not observed to be used for food storage.

| | |
|---|---|
| ***Origin:*** | Arkhangai Aimag (Mongolia) |
| ***Source:*** | Tuvshinjargal |
| ***Chronicler(s):*** | Kenneth Andrew Dabkowski, David Earl Martin |
| ***Date Entered:*** | August 2010 |

***How To:***

1. Milk was poured into a ger stove bowl and placed over a hot fire. **Note:** we saw this done over an existing fire and did not see the practice done when a fire was just lit or in its starting phase.

2. After the milk began to steam, it was stirred constantly to insure that no scalding or burning took place. The milk was cooked over heat for 30 to 45 minutes.

4. The bowl was removed from the heat and the milk poured into a cooling container. Once cooled to room temperature, separated fat was removed from the surface of the milk while gently separating the contents by hand (see **Figure 160**). Usually, the fat is served plain.

***Global Market Consequence:***

While domestic and industrial cooking applications for milk fat are well known, there are significant efforts undertaken to use mammal lactation products for vaccine production, medicine production, and other chemical processes. The top proprietary actors in industrial use of milk fats (both for production and for industrial intermediating) include Human Genome Sciences, Genentech, Abbott Laboratories, Pfizer, ZymoGenetics, and Nestec S.A. These firms could examine both the chemistry and metabolic dynamics of this fat for a variety of medicinal, nutritional and industrial purposes.

Given the fat content of yak milk, there are several common uses for milk fats which could also be considered. Milk fats have been used for cosmetics, soaps and creams for millennia. Producers of organic cosmetics and soaps could be viable partners for collaboration in understanding alternative uses for this abundant product.

# Images for Food Items

## Aartes

**Figure 99:** After all of the water has drained from the boz, it is removed from the bag and cut using a string. The aartes has a consistency much like feta cheese.

**Figure 100:** The aartes is cut into pieces and laid out in the sun to dry. In the arid climate of Northern Mongolia, the aartes dries in a matter of hours.

**Figure 101:** Sometimes, sugar is added to the aartes to make a sweet cheese.

**Figure 102:** The aartes and sugar are mixed and formed into small patties and left to dry. The finished product is called aaruul.

## Arak


**Figure 103:** Horse milk and sugar are put into clear, plastic bottles, left in the sun and periodically shaken to produce arak.

**Figure 104:** It is common to see people carrying bottles of arak with them throughout the day.

## Ku

**Figure 105:** Coconuts are dehusked and cracked open to be grated.

**Figure 106:** The coconuts are grated using a scraper attached to a stool.

**Figure 107:** While the coconuts are grated, the squeezing station is set up. An "H" is made with sticks over 6 banana leaves which will catch the coconut milk.

**Figure 108:** As all of the preparations are going on, the cooking stones are heated in a fire made primarily with discarded coconut husks.

**Figure 109:** A rice bag is opened at both ends so it can be bent and tied. Two handfuls of grated coconut are wrapped in the middle of the rice bag.

**Figure 110:** The rice bag is tied around the horizontal stick with the coconut hanging directly above the banana leaves.

**Figure 111:** The rice bag is held in place while a stick is placed through the loop and twisted until all the coconut milk is released. This is done with all the grated coconut.

**Figure 112:** The cooking stones are removed from the fire with tongs and beaten with coconut husks to remove the ash.

**Figure 113:** Using tongs, the hot rocks are placed in the coconut milk.

**Figure 114:** 15-20 cooking stones are added to the ku, making sure they are placed evenly.

**Figure 115:** The cooking stones are left in the ku until it stops steaming at which point they are removed one by one.

**Figure 116:** As the stones are removed, the oil on top of the ku is removed with a spoon and set aside to be used for bathing or cooking.

**Figure 117:** The final product looks much like oatmeal. Generally, pieces of fruit, primarily bananas, are dipped into the ku.

**Figure 118:** Kuripelapele leaves are crushed and added to the grated coconut to add flavor and to help the ku solidify as it cooks.

**Figure 119:** A gorgor leaf is tied to the middle of the metal rod to direct the coconut milk into the bowl below.

**Figure 120:** Two handfuls of grated coconut are placed in one side of the rice bag loop. The bag is then folded around the coconut, twisted into a figure-8 and slipped onto the metal rod.

**Figure 121:** A stick is slipped into the other opening of the figure-8 and twisted until all the coconut milk has been released. This is done with all of the grated coconut.

**Figure 122:** The coconut milk is placed over a fire to cook. Usually the ku is cooked over the embers of a fire instead of open flames.

**Figure 123:** As the ku cooks, it begins to boil off all of the water in the milk, eventually leaving behind only the cream and oil.

**Figure 124:** As the ku begins to thicken, it is stirred slowly and consistently until all the water has boiled off.

## Mumu Tapiok Na Minmin

**Figure 125:** Roots of tapiok are cut into small sections and peeled by making a cut down the length of the root and prying the thick skin off.

**Figure 126:** Once the skin has been completely removed, the tapiok is washed before it is grated.

**Figure 127:** Using a piece of metal with holes that have been made by hammering a nail through it, the roots of tapiok are grated.

**Figure 128:** While the tapiok is prepared, the coconuts are dehusked. The husk is pierced on a sharpened metal rod and pried from the nut inside.

**Figure 129:** Using a bush knife, the coconut is cracked open. The coconut is rotated and hit until the nut has cracked. The water is collected in a bowl to be used later.

**Figure 130:** The coconut meat is scraped from the coconuts using a scraper attachment on a stool.

**Figure 131:** After the leaves have been prepared over the fire, the stem is removed.

**Figure 132:** A knot is made in the skinny end of the peeled stem. The stem is then split in half, creating a long string.

**Figure 133:** Once the strings and leaves have been properly arranged, the grated tapiok is placed in the center.

**Figure 134:** Bananas are peeled and squeezed into the tapiok.

**Figure 135:** While the bananas are being added, the grated coconut is wrung to release coconut milk into the tapiok as well. Coconut milk is added until the mixture has the consistency of soft bread dough.

**Figure 136:** Once the mixture is done, the leaves are folded on top alternating with each fold.

**Figure 137:** The corners of the leaves are turned up to prevent leaks and the whole thing is secured using the strings.

**Figure 138:** Once the fire dies down, the large stones are removed and the tapiok is placed in the fire pit.

**Figure 139:** Using tongs, the large stones are placed evenly on top of the tapiok. In this case, pieces of metal were also used.

**Figure 140:** Banana leaves are laid over the cooking stones and tapiok, insuring that no steam escapes to seal in the heat.

**Figure 141:** Once it has finished cooking, the leaves and cooking stones are removed from the tapiok. It is then removed from the pit and left to cool.

**Figure 142:** The cooked tapiok is then unwrapped and cut into pieces.

## Saksak

**Figure 143:** While the sago tree is being cleaned and the men set up their work bench, the women assemble the washing station.

**Figure 144:** A bamboo support is set up beside the sago tree to support the bench used when beating the tree.

**Figure 145:** Strips of bark from the sago tree are positioned on top of the palm fronds on the bench.

**Figure 146:** To avoid splinters, mats made of sago leaves are placed on top of the strips of bark.

**Figure 147:** The men sat side-by-side on the bench and worked together to beat the sago tree into mumut.

**Figure 148:** The sapal had to simply graze the sago tree to ensure the mumut pieces were small enough to produce saksak.

**Figure 149:** The mumut is collected on another sago leaf mat on the opposite side of the tree.

**Figure 150:** The mumut is collected in a piece of sago bark and positioned at the end of the mase.

**Figure 151:** Small amounts of mumut are moved toward the filter and water is added until all of the mumut is soaked.

**Figure 152:** The mumut is then squeezed and kneaded until no more water ran out of the batch.

**Figure 153:** The water released from the mumut is cloudy because it is saturated with saksak. A new batch of mumut is added when the water from the previous one runs clear.

**Figure 154:** The water and saksak collects in the oko and is left to settle for a few hours.

**Figure 155:** After it has settled, the water is drained out of the oko leaving behind the saksak. This is then collected in rice bags so any residual moisture drains. The saksak has a consistency much like cornstarch and water.

## Shar tos (Yak Milk Yellow Oil) and Khailmag (Roux)

**Figure 156:** Shar tos and Khailmag are often eaten with a spread much like this one.

**Figure 157:** Flour is added to boiling yogurt, producing Khailmag, a Mongolian roux.

**Figure 158:** Shar tos is the oil produced in the process of making Khailmag.

**Tseedum**

**Figure 159:** Tseedum is a beverage composed of yogurt and water. It is used much like sports drinks are used in the United States.

**Yak Milk Fat Separation**

**Figure 160:** The fat skimmed off of boiled yak milk is often eaten on bread and occasionally with sugar.

## Household Items

### Amut Rope

Amut rope is a type of rope made primarily in the Wain Mountains in the Morobe Province of Papua New Guinea. This particular type of rope is relatively easy and inexpensive to make because it is made directly from the fibers of a common cactus plant and does not require a complicated weaving process. The rope is used in organic farming at Pacific Spices and has proven to be a durable alternative to nylon rope.

***Origin:*** Pacific Spices (Papua New Guinea, East New Britain)

***Source:*** Cathy and Theresa Arek

***Chronicler(s):*** Caitlin Elizabeth Boyd

***Date Entered:*** June 2009

***How To:***

To remove the fibers from the cactus, which looks similar to the agave, cut a section of the plant and strip off the outer layer. To do this, hold one end of the section while scraping a knife along the outer skin. Continue scraping until the fibers are cleaned of all of the coating. Then, roll the fibers together as follows:

1. Put the fibers together and make them even at one end. Tie a knot at this end to secure the fibers.

2. Split the strands into two equal sections. Roll each section individually down your thigh then back up. When both sides are independently rolled, roll the sections together down and up your thigh again (see **Figure 161**).

3. Where the rolled rope begins to naturally loosen, divide the two sections again. Roll these sections separately and then together.

4. Continue Step 3 until the rope reaches the desired length. The amount of fiber and resulting size of the rope is up to the weaver. To make the rope longer, add more fibers when dividing the sections and roll them into the rope.

5. When the final length is reached, tie a knot in the unsecured end.

***Global Market Consequence:***

Amut rope is durable, 100% organic and is easier to manufacture than nylon. It could accompany hemp and cotton as an important organic material. The fibers could be used to make natural clothing, fabrics, shoes, jewelry, and even toys. Companies such as Natural Clothing Company, J. Jill, and Eco Mall who sell environmentally friendly products to their consumers should consider possible uses of natural rope or fibers in their accessories and products. The rope could also replace synthetic ropes used as tools in construction and other industries. Producers such as Construction Equipment and Contractors Rope that currently provide synthetic rope to their customers could consider the cost and environmental benefits of natural fibers. Also, as the market grows for "green" construction materials and techniques, organic ropes will become a necessary part of ensuring that all processes are completed using environmentally sound tools and procedures. Biodegradable ropes can also be used for gardening and ground control applications in seeding.

**Woven Ball**

The woven ball is used by the children of the community in various games. They are relatively easy to make and are made from the leaves of a palm frond. Most children know how to make these because they are simple and the materials are easily accessible. A completed ball will end up being roughly the size of a toddler's fist. The total time it takes to make one of these balls is generally around three minutes.

| | |
|---|---|
| ***Origin:*** | Raluana (Papua New Guinea, New Ireland) |
| ***Source:*** | Addy |
| ***Chronicler(s):*** | Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin |
| ***Date Entered:*** | July 2010 |

***How To:***

1. Two leaves were stripped from a palm frond, and the veins of those leaves were removed, making sure that the green strands were still connected at the end.

2. Next, the strands were fitted together making a 90º angle to the left with the strands from each pair alternating, starting with a horizontal strand on top. They were then held in a "V" shape (see **Figure 162**).

3. The strands were spread out so that all four were visible; pulling the bottom left strand and the top right strand to the outsides. The outside left strand was twisted and crossed over the inside left strand (see **Figure 163**). Then the outside right strand was twisted and crossed under the inside right and then over the new inside left. As this continued, the weave began curling under and into itself, creating the ball shape.

4. The strands were then threaded through the existing weave (see **Figure 164**). This was repeated until the desired size was achieved (see **Figure 165**). The excess leaf strands were tucked into previously woven pieces to secure them and keep the ball from unraveling. Extra strands were removed using a small knife (see **Figure 166**). (see **Figure 167**)

**Bamboo Water Bottle**

Bamboo water bottles are used mainly for personal hydration when traveling. They are easy to make and are extremely effective at keeping water cool due to the insulating properties of the bamboo. A bottle can sit in the sun for a number of days before the water inside warms at all. The bamboo material is also tough enough to hold up to wear and tear.

***Local Name(s):*** Akanaqi

***Origin:*** Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Alois Nguinga

***Chronicler(s):*** John Walter Barber

***Date Entered:*** June 2009

***How To:***

1. A stalk of bamboo was cut just above and below two of its nodes. This created a cylindrical piece of bamboo that was closed on both ends.

2. A hole was made in one of the two ends so that the container can be filled with water. The hole was less than an 2.5 cm across so that it could easily be sealed. The container was then submerged in water or filled under a waterfall.

3. A leaf was rolled, starting at the end with no stem, into the shape of a cone. The stem was then pushed through the large end of the cone and pulled through the bottom. The leaf served as the "cork" or stopper. If desired, a spout can be made by rolling a similar leaf around one finger and then inserting the tube halfway into the opening in the bottle (see **Figure 168**).

***Global Market Consequence:***

Many conventional water bottles on the market contain Bisphenol A (BPA), a component in many plastics that has been found to be harmful to humans. With this information comes a demand for clean, non-toxic water bottles. With the bamboo water bottle, there is no need for double wall vacuum insulation or stainless steel and plastic. These bottles are BPA-free and will not leach chemicals or toxins into the beverage. Unlike many water bottles on the market today which require accessory purchases such as bottle sleeves and carrying cases in order to maintain bottle insulation, the bamboo water bottle has all of these things included in its design. The natural fibers of the bamboo act as an effective insulator able to keep liquids cool for days. Along with its insulation qualities it has a higher strength to weight ratio than graphite, making it incredibly strong and resilient to damage. The open end of the bottle could be easily adapted to fit ice cubes, frozen fruit, and soups. Another possibility for prospective companies could be to research the insulation properties of the bamboo to possibly expand its use to include water cooler insulation, house insulation, and refrigerator insulation. These bottles are 100% organic, sustainable, and renewable. Thermos, Nalgene, Klean Kanteen, and Sigg are just a few producers of water bottles interested in creating safe, eco-friendly, sustainable products.

These bottles are made in all different sizes depending on the needs of the carrier and the size of the bamboo and could be easily made to fit into a cup holder or similar holder. The two that were observed in Papua New Guinea carried over 40 ounces (1.183+ liters) of water at a time. Even the top of the bottle could be made into a lid with a simple seal and lock or carved to make a screw-on top. Another benefit of bamboo bottles is that they are biodegradable and would reduce the waste of the current bottling system if used. Because of its natural insulation and toughness, bamboo could even be considered as a shipping container for temperature-sensitive products. There are many possibilities for how bamboo could become an integral part of the food and liquid storage system.

**Bilums**

Bilums are carried by all members of the communities and can be seen throughout cities of Papua New Guinea as well (see **Figure 169**). They are used by women to transport crops from the field to the home or market, by men to carry hunted game, by children to carry school supplies, and by all to carry personal effects on journeys.

| | |
|---|---|
| ***Local Name(s):*** | Arlon |
| ***Origin:*** | Raunsepna/Anesmetki (Papua New Guinea, East New Britain) |
| ***Source:*** | Christmas Maraedi and the women of Raunsepna and Anesmetki |
| ***Chronicler(s):*** | Caitlin Elizabeth Boyd |
| ***Date Entered:*** | June 2009 |
| ***Explanation of Variation:*** | There are two main weaving techniques that can be used to make a bag. Both are effective in creating sturdy, long-lasting bags, but each has a distinct look. Deciding on a technique depends on the style of weave the wearer is most attracted to, as the shape and size capability of the bag does not change with the type of weave. In fact, if woven tight enough, bilums can even hold water. |

***How To:***

Starting a Bilum

Regardless of the weave, all bilums begin in one of two ways: from the bottom of the bag or the top. The bottom of the bag is started by tying a piece of vine or string around the weaver's big toe. The top of the bag is started by tying a piece of vine or string around the weaver's thigh. In both cases, the extra vine is then cut off. Weaving from the top and bottom uses the same technique, so the weaver's preference decides which end to start from. Once the beginning loop is made, one of the two weaving techniques is started on the loop of string.

1. Pull the end of the string through the circle toward you. By placing the rest of the string in your lap, a loop is created with the first bit of string. Holding the starting end of the string on the outside of the loop, adjust the size to about 2.5 cm.

2. While still holding on to the first loop, take the string's other end and pull it through the circle toward you. This creates a second loop. Once that is done, push the end through the back of the first loop, away from your body. Pull the string to the right between the second and first loop, creating a twist where the two loops meet. Adjust the second loop so that it is the same size as the first.

3. Repeat Step 2 until the weave reaches all the way around the beginning circle, paying close attention to maintaining size uniformity.

4. Once the weave is completed around the entire circle, secure the end by stringing it down and away from you, through the first loop's outer side. Pull the end from the middle of the first loop around the back and up through the beginning circle toward you, as if you are continuing the weave. This makes a twist in the string connecting the two loops.

5. Once the string is threaded through the beginning circle, weave it through the last loop one more time, the same way the rest of the layer has been woven. The end of the string is now up at the top of the weave. Tie it with the beginning end of string in a double-knot at the top of the weave. Cut the extra string ends.

Steps for Weaving Technique 1 (Traditionally called Arekmoska)

The first type of weave is the starting weave continued in multiple layers:

With the first layer complete, repeat all of the steps in Starting a Bilum for four to six more layers, depending on the desired size. The size of the loops can be altered in the consecutive layers to achieve a tighter or looser weave. (To finish the bag, refer to Finishing the Bilum below)

Steps for Weaving Technique 2 (Traditionally called Arekminga)

After completing the steps in Starting a Bilum, a new type of weave, smaller in height, is done to complete the remaining layers.

1. Push the piece of string through one of the top loops of the first layer. Twist the end around the strung piece once, to help it while you continue the weave.

2. Pull the other end of the string through the next top loop toward you. Push the end away from you through the loop you just created. Continue this step until you reach the beginning point of the layer. This weaving technique creates a square shaped loop.

3. To continue the weave after the second layer, the string is pushed through the loop in the weave that connects the first and second layers. This weave is continued for seven-twenty layers, depending on how big the weaver wants the bilum. Once the last layer is ready to begin, the steps in Finishing a Bilum should be followed.

Finishing a Bilum

Both weaving techniques finish the bag in the same manner, with a type of running stitch securing the opening and woven handles at the top. The finishing touches begin with the last layer or weave.

1. The last layer of the bag calls for a second circle of string. Whether the bag is completed at the top or the bottom does not matter, except in the size of the piece of string. To measure how much you need for closing the bag, wrap a piece of string around a big toe or thigh twice (thigh for closing at the top of the bag, toe for closing at the bottom). Cut the string to the length needed and unwrap it from the toe or thigh.

2. Double over the string and weave it into the top of the last layer by making the top of each new loop go over the string once (when you make each new loop in the weave, just make sure you loop the string over the doubled string).

3. When the last layer has 2.5 cm or so left to weave, push the loop tops together on the doubled string. This tightens the finishing loop. Once the loop tops are together, pull the two ends through the fold of the doubled string and tie a double-knot. This secures the bag's shape and finishes the actual weave.

4. Take another piece of string and tie it in a knot around the double string, so it also encompasses one of the loop tops. The new string runs around the top, outside of the ending layer. Every two or three weaves, loop the string through one of the weave tops from front to back. With the end facing away from the body, pull the string up and toward you through the loop you have just made at the top of the last layer and doubled string. Repeat this step around the entire top layer. Once you reach the starting point, tie the string beginning and end together in a double-knot and cut the extra string off.

5. To create loops for the bag's handle, take a piece of string and tie it in a knot around one of the top loops and doubled string at the bag's opening. Make a loop to the desired size and weave the string's end through the top loop and doubled string wherever desired. Wrap the string around the same place again to ensure the handle's strength and return the string back to the beginning side, making the handle-loop doubled.

6. Twist the string around the handle-loop in a single layer. Once the other side of the loop is reached, weave the string through the same doubled string and top loop where the string was doubled before. Double-knot the string again.

7. Repeat steps 4 and 5 on the exact opposite of the bag's top to create the other handle-loop. Then, connect the two handle-loops using the desired material for the handle.

***Global Market Consequence:***

Bags made of natural fiber are popular in most countries around the world. Novica and Gaiam are examples of two companies who manufacture and sell natural fiber handbags. The concept of conscience-driven consumption is also growing in the minds of many consumers in the world, especially in the current economic system. Companies like the Body Shop have shown that incorporating causes and human stories into products and marketing techniques is conducive to product success. Items such as the Papua New Guinea-made bilums, sold by companies with emphasis upon eco-friendly products could be another way of bringing the products from more remote parts of the world to international attention. Conscience-driven consumption aside, interest in clothing made of natural fibers is on the rise in the fashion world. As "being green" becomes more and more trendy, clothing, and accessories made of natural materials follow suit. Handbag companies considering natural materials as opposed to leather or plastic in their production would undoubtedly receive a warm reception from consumers. Eco Bags, Malmo, Eco Mall, and Envirosax are all companies promoting and marketing organic carrying bags.

**Breadfruit Bark Cloth**

Bark cloth is used for a number of purposes, however, the H.I.T. team was taught its use in the making of a women's basket, called *ruai*. In the process of making the ruai, the cloth is used as a covering for the woven portion of the basket, the handle, as well as the thread used to sew it. When used as thread, small strips of the bark are rolled to make them more like a rope or string. The branch is taken into the ocean when the bark is being removed because the salt water helps to soften the inner bark of the tree and helps preserve the cloth. The section of the breadfruit must be cut from a young tree that has a great deal of white still on the bark. The color of the outer bark determines what color the cloth will be once it has dried.

| | |
|---|---|
| ***Local Name(s):*** | Pinpin Ina Veko |
| ***Origin:*** | Ngavalus (Papua New Guinea, New Ireland) |
| ***Source:*** | Dorcas Kamis |
| ***Chronicler(s):*** | Antonia Berki |
| ***Date Entered:*** | August 2011 |
| ***Explanation of Variation:*** | The length of the breadfruit branch used to make the cloth varies depending on how many baskets are being made and, more generally, depending on what the cloth will be used for. The length of time needed to dry the bark depends heavily on the weather. If it is sunny and dry, it can take as little as one day for the bark to completely dry. However, if it is rainy or cool it can take up to a week. |

***How To:***

1. Using a bush knife, the brown, outer-bark of a branch of a young breadfruit tree was carefully scraped off (see **Figure 170**).

2. Once the brown bark had been completely removed, the branch was taken into the salt water. Starting at one end of the branch, Dorcas began beating the branch using the blunt side of a bush knife to loosen the inner bark of the branch (see **Figure 171**). This was done on all sides of the branch making sure not to beat too hard, causing tears in the cloth, or too soft, not loosening the bark enough.

3. As the bark came loose from the branch, it was folded back so that the loosened bark continued to be beaten while the next bit of bark was being loosened (see **Figure 172**). This was done down the length of the branch until the inner bark had been completely removed.

4. Once it was completely removed, the cloth was hung up to dry before being added to the ruai (see **Figure 173**).

***Global Market Consequence:***

It has become quite common to see natural fibers utilized in a number of products including linens and clothing. Beech, birch, and bamboo fibers are some of the most popular examples of this adaptation. The bread fruit bark cloth has the same potential since it has been proven relatively durable by the communities of New Ireland and is currently being used as such. Similar to the cloth used in the **Qaqet Male Dress** entry, breadfruit bark cloth is thin enough to allow light through and moderate air flow while keeping out larger debris making it a potential material in window construction or as natural ventilation in houses as well.

**Broom**

In Raluana, brooms are made by bundling the vein of the leaves from a palm frond in bunches of around 50. Each broom is roughly one meter long and is used for both indoor and outdoor cleaning.

***Local Name(s):*** Noko

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

1. The green parts were removed from each leaf using a small knife, leaving only the center vein. This was repeated until the desired amount of strands was reached.

2. This bundle was tied together near the top of one end using bark string. (see **Figure 174**)

**Buluur (Butter Churning Tool)**

The buluur is the tool used to churn milk into butter (urum). The tool itself is designed in such a way that butter is churned completely in three hours of continuous churning. A buluur is carved from two pieces of wood: a stick roughly one meter in length (used as the handle) and a smaller rectangular piece of wood.

***Origin:*** Selenge Province (Mongolia)

***Source:*** Altantogos

***Chronicler(s):*** Riley Scott Little

***Date Entered:*** June 2011

***How To:***

1. A meter long stick was stripped of bark and made smooth (see **Figure 175**). The stick was shaven to a diameter of 2.5 cm about 10 cm from one of the ends (see **Figure 176**). A hole 2.5 cm in diameter was then carved into the center of the rectangular wooden block so it would fit onto the end of the meter long stick.

2. Next a section 4 cm wide and 5 cm long was cut 2.5 cm from the top of the long side of the rectangular wooden block on the left. Another section of the same dimensions was cut 2.5 cm from the bottom of the right side. (see **Figure 177**)

3. Two more cuts were made on the shorter side of the rectangular block. These cuts were 1 cm wide and 2.5 cm long, again 2.5 cm from the left side on the bottom and the right side on the top.

4. The rectangular block was then fitted onto the end of the meter long stick. A cylindrical cut was made through the center of the stick (see **Figure 178**) and fitted with a wooden pin to hold the rectangular block in place on the stick. (see **Figure 179**)

***Global Market Consequence:***

In order for Mongolian nomadic communities to make many of their butter-like products, they engineer a buluur which is used to churn the milk. While this tool is made completely out of notched wood, its shape is something that butter manufacturers may find useful as an attachment for churning machinery. Its comb-like head has a shape that could potentially maximize the amount of milk that is churned at one time. Companies such as Creamery Hollow U.S.A. Inc and Dairy Research Inc deal in spreadable butter and butter-like products. Perhaps the shape of the tools used in Mongolia could produce a more efficient method of churning. Even companies that deal exclusively in organic milk products, such as Organic Valley, Pastureland, Horizon Dairy and Earth Balance Natural provide market or research opportunities for adaptation of the buluur for making yogurts and other milk-based products.

**Bush Rope**

Bush-rope is made from very thin strips of bark, tightly woven to create a strong, wide length of material with many possible uses.

| | |
|---|---|
| ***Local Name(s):*** | Amalasiqa |
| ***Origin:*** | Raunsepna/Anesmetki (Papua New Guinea, East New Britain) |
| ***Source:*** | Christmas Maraedi and the women of Raunsepna and Anesmetki |
| ***Chronicler(s):*** | Caitlin Elizabeth Boyd |
| ***Date Entered:*** | June 2009 |
| ***Explanation of Variation:*** | The weave can be as wide and long as the weaver desires, both aspects depending on the amount of bark used. A length of rope can begin in the middle or at one end. The basic practice is the same for both, so the starting point is at the weaver's discretion. The example here uses 13 strands of stripped bark. |

***How To:***

1. Tie the bark strands in a knot, either at one end or in the middle. Flatten out the strands as much as possible so that they arranged side-by-side.

2. Starting from the right side, weave the outer-most strand over the strand to its left and under the next strand. Continue this over-under pattern until you reach the middle of the strands.

3. Once the center is reached, do the same weaving technique with the outer-most strand on the left side, making sure to weave over the strand to the right and under the next strand (see **Figure 180**).

4. With both of the "outer-most" strands in the center, repeat Steps 2 and 3 until the rope is completed to the desired length (when completed to the desired length it is then called "amlenga"). If the rope needs to be longer, more strands of bark can be tied to the ends of each original piece in the weave. The weave then continues as normal. If the weave was started in the middle of the strands, stop weaving when half of the final length is reached. Tie the ends of the woven rope. Untie the beginning knot, turn the rope over so that the loose strands now face downward, and continue the weave until the other half of length is reached.

5. After reaching the desired length tie the loose ends in a knot to secure the weave.

***Global Market Consequence:***

Bush-rope is strong, 100% organic and is easier to manufacture than nylon. It could accompany hemp and cotton (although stronger than cotton) as an important organic material. The fibers could be used to make natural clothing, fabrics, shoes, jewelry, and even toys. Companies such as Natural Clothing Company, J. Jill, and Eco Mall which sell environmentally friendly products to their consumers should consider possible uses of natural rope in their accessories and products. The rope could also replace synthetic ropes used as tools in construction and other industries. Producers such as Construction Equipment and Contractors Rope that currently provide synthetic rope to their customers could consider the cost and environmental benefits of natural fibers. Also, as the market grows for "green" construction materials and techniques, these organic ropes will become a necessary part of ensuring all processes are completed using environmentally sound tools and procedures. Biodegradable ropes can also be used for gardening and ground control applications in seeding.

**Bushlamps**

Most homes in rural areas of East New Britain do not have access to electricity, therefore, the people have found that the sap from candle trees can be collected and used in creating long lasting candles called bush-lamps. These lamps are used as lighting to homes as well as an insect repellent.

***Local Name(s):*** Amadumgi

***Origin:*** Komgi and Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Clement (Komgi) and Paul (Raunsepna)

***Chronicler(s):*** John Walter Barber

***Date Entered:*** June 2009

***How To:***

Cuts are made in the side of the candle tree to release the sap. Older trees are preferable for collecting because they release more sap. After one to two months, enough sap has been released from the cut to be collected and made into a lamp. The sap is scraped off of the tree and wrapped in a layer of dry leaves followed by a layer of new, green leaves in order to prevent the lamp from burning too quickly. The leaves and sap are secured with rope. Once the leaves on the outside become dry, new leaves replace them to sustain the life of the lamp. The sap is left exposed at one end of the lamp. This end is lit (see **Figure 181**). Bushlamps produce a pine-like aroma and can be used to keep bugs away. The duration of use for one bushlamp varies based on size and frequency of use. The sap from candle trees can also be collected into natural dishes such as seashells. This is usually done when the lamp will be presented as a gift or used as decoration.

***Global Market Consequence:***

The resin from the candle tree has a very high value in the essential oils market. It is a long standing cultural tradition that the youth in the Qaqet community collect this resin and make bushlamps to sell to the mothers in the village. Pacific Spices, on principle, will not market it unless the communities decide to grow the trees and produce the resin commercially.

**Camel Wool Rope**

There are multiple uses for braided camel wool rope. Usually it is used as binding for ger construction as well as harnesses, tethers and leads for animals.

***Origin:*** South Gobi province (Mongolia)

***Source:*** Buud and Shinekhuu

***Chronicler(s):*** Kenneth Andrew Dabkowski

***Date Entered:*** August 2010

***How To:***

1. After the camel is shorn, the wool is detangled (see **Figure 182**). This is done by pulling the wool until it is straightened. Once the wool has been detangled it is divided into two bundles.

2. The end of the wool is usually held by someone so the braider can make the rope tight. The wool is stretched so the bundles are at the end of two straight sections (see **Figure 183**).

3. The sections are crossed (see **Figure 184**) and then rolled between the braider's hands (see **Figure 185**). They should not be rolled onto each other, but individually. This is continued until all the wool has been rolled.

***Global Market Consequence:***

The finished product of the camel wool braid could be used in the boating industry. Because the tightly bound hair is thick and semi-water resistant it would be suitable for marine applications such as sailing rigging. Companies that produce marine products may be interested in alternative technologies. These companies include, but are not limited to, WestMarine, Novatec Braids Ltd, FSE ROBLINE, and Marlow Ropes.

**Cane Chain-links**

Chain-links are made of very tightly woven cane rings. Chains made with these links are commonly used for bundling heavy loads and securing hanging objects. Long chains are even used for decorative purposes, and individual chain links can be worn as bracelets or rings. Any type of vine or strong fiber can be used, however cane strips are most common because of their strength. The strips used to weave chains are called amgalan. Weaving can get complicated with the small scale of the rings but the resulting chain is so strong that no knots are required to fasten the ends.

| | |
|---|---|
| ***Local Name(s):*** | Aragas |
| ***Origin:*** | Raunsepna/Anesmetki (Papua New Guinea, East New Britain) |
| ***Source:*** | Ben, Christmas, Paul, Joe, John, Christine, and Eddie Maraedi |
| ***Chronicler(s):*** | Caitlin Elizabeth Boyd |
| ***Date Entered:*** | June 2009 |

***How To:***

1. Hold one end of the stripped cane between your thumb and forefinger, making sure to hold it so the end is pointing toward you.

2. Loop the long end of the cane around your fingers so that the loop is to the left of the end between your thumb and fingers. Make another loop that sits to the right of the end in your fingers. At the back of your fingers (the side facing away from you) it should look like three pieces of cane are looped side-by-side.

3. Once the cane is positioned this way, turn your fingers toward you so that your palm is facing down with your thumb holding the loops in place. On the side of the ring facing away from you there should be an "X". Weave the loose end of the cane under the left loop, before the "X" (in the section before where the cane crosses, closet to you).

4. While holding the loops in place, carefully slide your fingers out of the cane. Hold the "X" together and push the left-most loop through the inside of the right-most loop without moving any other parts of the weave. This will trap the beginning end in the twist.

5. Hold the ring where the loops are twisted together, turn the circle over and find the "X" again. Weave the loose end over the left side of the "X" and under the right side of the "X" on the other side of where the cane intersects. Roll the ring toward you and find the next-closest "X". Weave the long end as before but over the right side of the "X" and under the left side of the "X".

6. Continue this weave at the consecutive "X's", until it is too tight to fit the loose end through the opening and trim the excess.

7. To add a link to the chain, follow Steps 1 and 2, but thread the cane through the first chain link. The steps are then carried out the same, with the new link getting woven through the opening of the first. Each consecutive link is woven through the one before it until it reaches the desired length. The chain can be left with two ends or woven together with a final link connecting the two ends links, making a circle.

***Global Market Consequence:***

Woven chains could be used elsewhere in the world the same way they are used in Papua New Guinea. Construction companies interested in eco-friendly tools and processes could use the chains as ropes. These chains could also serve as a novelty item of Papua New Guinea. Companies such as Ten Thousand Villages that focus on the sale of community-produced goods could bring these suggestions into fruition. Additional uses of chains could include decorative door and window coverings.

**Curved Pan Ger Stove**

The majority of gers are equipped with a wood stove in the center for cooking and heating purposes. A flat round plate on top of the stove serves as a covering for heating purposes (see **Figure 186**) and when the plate is removed it leaves a circular hole with a direct opening to the fire. For cooking purposes, Mongolians take different sized round curved pans and place them into the round holes creating a seal between the pan and the stove. This seal helps to conserve a large amount of heat that would otherwise escape to the sides around the pan. The curved part of the pan sits below the seal line and touches directly into the fire (see **Figure 187**).

***Origin:*** Arkhangai and South Gobi Provinces (Mongolia)

***Chronicler(s):*** Kenneth Andrew Dabkowski

***Date Entered:*** June 2010

***Global Market Consequence:***

There are many cookware companies that may be interested in offering a new way of cooking to their consumers. Some of these include but are not limited to Meyer Corporation, ProCook, and Supor.

**Woven Fan**

As a result of the hot temperatures in East New Britain, palm fans are often used as a cooling mechanism because of the accessibility to the necessary materials.

***Local Name(s):*** Taptap

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Addy

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

1. A section of a palm frond containing about 12 leaves (six on each side) was cut from the top of the frond. The weaver held the stalk in his or her lap with the leaves pointing away from them.

2. The bottom right leaf was crossed over the stalk in between the first and second leaves on the left side of the stalk. The same was done when crossing the leaves from the left side to the right. This process continued up the length of the stalk (see **Figure 188**).

3. Starting from the end closest to the weaver, the outermost leaf (leaf A) on the right side was twisted up and woven over leaf B, under leaf C, over D, and under E (see **Figure 189**). This was repeated until all the leaves were woven on the one side. The weaver then completed the same process on the opposite side at which point all the leaves were pointing up.

4. At the top of the fan, the process in Step 3 was executed horizontally starting on the left side. It was then repeated starting from the right side until the weave met at a point in the center.

5. The ends of the leaves were then folded over the edge of the fan and tucked into the woven part of the fan (see **Figures 190 & 191**). Excess leaves were then trimmed off (see **Figure 192**).

***Global Market Consequence:***

The fan is easy to make and effectively displaces air. Although the fans are generally small and hand-held, the design could be adapted to make larger versions. The larger versions would be optimal for the design of ceiling fans and other related fixtures. The broad fan and interesting weave would add a unique dynamic to the traditional ceiling fan. Companies which manufacture fans include but are not limited to, The Modern Fan Company, Casablanca, Hunter Fan, Matthews Fan Company, American Fan Company, Laurelhurst Fan Company, and The California Ceiling Fan Company.

**Felt Making**

Felt has many uses throughout the world and particularly in Mongolia where it is used for clothing and for insulation of gers.

| | |
|---|---|
| ***Origin:*** | Hos Huruuvch Khorshoo in Dalanzadgad (Mongolia) |
| ***Source:*** | Hos Huruuvch Khorshoo staff |
| ***Chronicler(s):*** | Kenneth Andrew Dabkowski |
| ***Date Entered:*** | August 2010 |

***How To:***

1. To begin the process, camel or sheep wool was placed onto a two drum carding comb machine (see **Figure 193**). The machine consisted of a crank that was attached to a large cylinder drum that was approximately 15 cm in diameter covered with 1 cm metal spikes and a small cylindrical drum 8 cm in diameter also covered with the spikes. Once the wool was placed on the large drum, the drum was spun using a crank on the side. The wool travelled around the surface of the drum, was detangled by the spikes of both drums, and was aligned and separated.

2. Once the wool had gone through the carding process, it was arranged on a table into a square shape, making sure it was of equal thickness (see **Figure 194**). Wool was added until the square was fully opaque.

3. A silk screen was placed over the square (see **Figure 195**) and a sponge was dipped into a bucket of water and dabbed onto the square through the silk screen. This was done until the entirety of the square was wet. Soap was then used to create a soapy lather which was applied to the square on top of the silk screen. This lather was used to bind the wool fibers together.

4. The felt maker then put on plastic gloves and rubbed their hands back and forth over the square, applying pressure (see **Figure 196**). This back and forth movement was done approximately 20 times with special attention given to the edges of the square.

5. The silk screen was taken off and the wool was flipped over. The corners of the square were folded to re-create the shape of the square and the silk screen was placed back on the square. The process in Step 4 was repeated on this side of the square.

6. After a third cycle of Steps 4 and 5, the silk screen was removed and the square was wrung out to remove water. The square was then unrolled, covered with the silk screen and rolled again. The fibers were squeezed together tightly (to remove more water) and then unrolled. The square was then rotated 90º rolled, squeezed and unrolled again.

7. The silk screen was removed, the felt rolled into a ball and thrown against the table five times. The ball was then placed in the silk screen and thrown against the table 54 times. The ball was then unrolled and left to dry.

***Global Market Consequence:***

There is a significant local and national market for felt in Mongolia. Felt clothing was present in almost every shop countrywide. Hats, gloves, shirts, vests, pants, blankets, insulation, bags, and game boards were also demonstrations that we were able to observe. Textile production companies who may be interested include but are not limited to, Super Felt Industries (Delhi, India), Milliken & Company, Buckeye Technologies Inc., Brookwood Companies, Inc., Tintoria Piana U.S.Inc., Sutherland Felt, Aetna Felt, US Felt.

Natural fibers will grow in importance again as petroleum-based fibers become less desirable. In addition to traditional apparel uses, there uses for felt materials as part of industrial processes including insulation, printing and imaging, and catalysis. Felt can also be used for water filtration or insulation. General Ecology, Seldon Technologies, and The Garland Company are all examples of companies who may be interested in using the felt product to filter water or air. Other large felt companies may also have an interest in a felt product which is completely organic. Some of the companies in this category include, Tex Tech Industries, Buffalo Felt, Hardy & Hanson, and Lydall Inc. Alternatively, felt could be used as billiard tablecloth for a completely organic way of playing the popular sport of pool or billiards. Companies such as Legacy Billiards, American Heritage, and Brunswick could all be companies with interest.

**Food Packets**

The community of Raluana utilizes the prevalence of Gaga leaves in the preservation of their food. Often times at meals, individual servings will be encased in the leaves and tied tightly to prevent insects from contaminating the food. Any leftovers are rewrapped and stored in the Gaga leaves.

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

The food was placed in the middle of the Gaga leaf and the two long sides were folded over top of the food. The ends of the leaf are then folded on top of the food one at a time fully encasing it. Another Gaga leaf is folded in half around the packet of food. The ends are bundled at the top and tied using cocoa branch twine. (see **Figure 197**)

***Global Market Consequence:***

When transporting or keeping food away from insects and other creatures, Eunice would wrap it in food packets. The multiple folds and layers in the design of the packet were effective at preventing anything from getting inside and reaching the food as well as preventing leakages. It can also be composted, so when the meal was over and all the food was gone, the packet was simply tossed aside. This could be useful for cookouts, picnics and any other meal eaten outdoors. By wrapping up the food in a food packet, the worry about bugs or contamination before eating would be eliminated. One picnic kit made by Picnic Time, offers utensils for transporting, serving, and eating food, and costs roughly US$94. The food packet covers all these areas, but is more compact. The packet could be made using other material, if large leaves are not available. Anything that was water proof, disposable or easily cleaned, and capable of being folded into the necessary shape could be used in creating a personal food packet. Military units, disaster relief groups, exporters, and even everyday hikers could benefit from this type of biodegradable packaging.

**Fruit and Nut Basket**

This basket is used by men and women when harvesting fruits, nuts, and other produce. Unlike some of the other weaving techniques, the leaves of the palm frond were flattened out allowing the weaver to make a larger basket.

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Addy and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

1. A section approximately 45 cm in length was cut from the middle of a palm frond. The weaver held this section at the end of the stalk with the leaves pointing away from them.

2. Ensuring the leaves of the frond were unfolded and flattened, the first leaf on the left was crossed over the first leaf on the right, creating an "X" (see **Figure 198**). The second leaf on the left was then woven under the left side of the "X" and over the right side. The second leaf on the right was then woven over and under the two leaves on the right side of the "X". As this pattern continued, the weave began to rise vertically (see **Figure 199**). This was done until all but two leaves on each side of the stalk were woven (see **Figure 200**). When this was completed a knot was tied using the ends of the woven leaves to secure the basket (see **Figure 201**).

3. The remaining four leaves were braided toward the opposite side of the basket (see **Figure 202**). A knot was tied in the end and the braid was secured to the woven side of the basket, creating a handle (see **Figure 203**).

***Global Market Consequence:***

This bag is woven using nothing more than a palm frond. It has a handle and a basket which is roughly the size of a basketball. The shape and size of this bag, along with the handle, would make it ideal for use as a hanging flowerpot. The weave is tight and strong allowing it to hold large quantities of matter, but has enough space between strands to allow air and water to get through. The unique aspect about using this design as a flowerpot is that it is completely organic. When the weave begins to deteriorate, it can simply be placed into the ground, plant and all. Companies such as GaiamLife have already incorporated organic flowerpots into their product lines. Although the materials and design do not resemble the Fruit and Nut Basket, the design could be adapted and incorporated into their production of organic planting materials.

**Gers**

In Mongolia, gers are the traditional style of home and are found throughout both urban and rural areas. By providing housing, warmth, and a location for food preparation, there are many traditional rules and structures of ger operation as well as a specific way of construction.

***Origin:*** South Gobi, Tuvshin Shankhat LLC Ger Camp, Arkhangai aimag (Mongolia)

***Source:*** Bud, Batbayar, Enkhbayar, Tsend Enkhtuya

***Chronicler(s):*** Kenneth Andrew Dabkwoski

***Date Entered:*** June 2010

***Structure of Ger Living***

All activities inside a ger follow a protocol. Once inside the ger, there are specific locations for dwellers to walk based on gender. Women walk around to the left near the kitchen equipment while men are required to walk around to the right to help keep order in the food preparation process. Most of the kitchen utensils, food storage and stove and fuel access is near the door of the ger. There are also special procedures for guests. If a guest enters the ger, the guest is invited to sit on the chairs or bench opposite the door. This seat is reserved for the guest of honor.

***Construction of Gers***

While we did not witness the complete assembly of a ger, we were taught the process and saw a number of gers in various stages of assembly, disassembly, use and transport (see **Figure 204**). We frequently saw ger roofs being used as tethering anchors for heavily loaded trucks with sizable loads. Gers can be assembled in approximately 30 minutes with two people. We witnessed these processes in the South Gobi Desert, at the Tuvshin Shankhat LLC ger camp, in the camel and horse herding communities.

Ger frames are traditionally made of wood. The solid door and frame are the principle wall support structure. To this frame, a collapsible wooden cross-hatch fencing type structure is tethered and pulled into the circular shape of the building. The walls are approximately 1.3 meters in height and the building as a diameter of approximately six-seven meters. A variable amount of wooden dowels (conventionally 81 struts) protrude up from the walls and come together in a wooden circle, approximately the dimension of a wooden wagon wheel frame, to create the highest point in the ceiling. Two wooden support beams support the central wooden circle. Based on our measurements, ger roofs are angled at 30° (see **Figure 205**).

Ger walls are insulated using felt made with animal hair (camel, sheep, or yak predominantly). During the summer, a single layer of felt is used primarily as a dust filter and wind insulator. During the winter, an additional two felt layers are added for insulation. The outer shield from rain is typically a tight woven canvas. In the middle of the ger, there is a small woodstove which is used for heating the ger and for cooking. The stove includes a straight pipe which directs smoke through the top circle of the ger. A canvas flap on the ger roof allows more light or air to come in through the top circle. Floors in a ger ranged from dirt to carpet and linoleum. In Arkhanghai, the flooring included an eight piece wooden floor which kept the carpets off the ground while in the Gobi, the linoleum was placed directly on the ground.

**Ger Assembly (2011)**

The *ger* is a living structure that is used widely throughout Mongolia in both the metropolitan centers as well as outside, but especially in the vast rural regions outside of the urban environment. The ger has been used by Mongolians for hundreds of years and has its roots in the nomadic culture that existed even before the time of Chinggis Khan during the early 1200s C.E. The use of the ger has prevailed in large part due to the high versatility and transportability that it provides in the various physical environments that the country supports. The structure itself is generally seven-ten meters in diameter and is supported by a wooden door frame, five wooden lattices, an average of seventy-five wooden roof poles, two center poles (*uni*) and a crown or center compression ring (to sit atop the structure holding the roof poles in place known as *toono*).

***Origin:*** Selenge Province (Mongolia)

***Source:*** Tungalaghuu, Amarsahan, Ganerdene

***Chronicler(s):*** Riley Scott Little

***Date Entered:*** June 2011

***How To:***

1. First, the door and frame were erected and positioned so it faces south.

2. Two sections of the lattice walls were placed and tied on either side of the door frame using ropes with enough slack to weave around the door frame and the holes of the lattice walls from top to bottom.

3. The other three sections were then fitted together (see **Figure 206**). While there is no specific order in which the sections are to be placed, the construction of the lattice walls required some adjusting to fit all sides together effectively to be tied together properly.

4. Once the sections of the walls were fitted together in the proper places, they were tied together by weaving a rope from top to bottom through the adjoining pieces. A rope was woven through the lattice around the top and bottom of the wall to support the structure, preventing it from collapsing (see **Figure 207**).

5. Once all walls are fully constructed and secured, the center ring was secured to the center support poles (or the mother and father poles) by a rope that was tied around both poles and the center ring. The next two steps required one person to hold the center support until the remainder of the frame was put together.

6. Once constructed and secured with the ropes, the central support was positioned in the center of the ger (see **Figure 208**). While one person continued to hold the central support in place, the others placed the poles for the roof support in the holes around the center ring and secured them to the top of the lattice support. The roof support poles rested in the "V"s at the top of the lattice while the rope loop at the end of each pole was twisted and put around one side of the "V", holding it in place (see **Figure 209**). The ger structure is then completed and supported by this compression ring.

7. A cotton ger cover with a hole cut in the middle was draped over the skeleton (see **Figure 210**). This cover is generally one piece that is constructed to cover the whole ger. Then, a layer of felt was placed around the structure (see **Figure 211**). This layer is usually in multiple pieces and must be situated to cover the whole structure. Two felt pieces were then placed to cover the roof of the ger which were held down by ropes that were tied to the walls. These felt pieces used to cover the roof are cut leaving a semicircle at the top to leave the center open.

8. Occasionally, a layer of plastic is draped around the ger to prevent leaks in case of rain before the final layer is put on the ger (see **Figure 212**). Then, a final layer similar to a down comforter made with cotton and stuffed with wool was placed over the entire ger (see **Figure 213**). Once placed, the layer was secured by tying ropes around the walls of the ger. Usually three ropes are secured at the top, middle, and bottom of one side of the door frame, wrapped around the ger, pulled tight, and secured to the other side of the door frame (see **Figure 214**).

9. After all the layers were positioned and secured, a small triangular piece was positioned to cover half of the hole at the top of the ger. This was held in place by three ropes securing it to the ropes on the side. One side is left untied so the cover can be opened and closed as needed. (see **Figure 215**)

***Global Market Consequence: (2010)***

Gers have inherent advantages in markets for low cost mobile or interim shelters. Applications can include alternative housing options for a range of situations including favelas and townships like in Brazil or South Africa, or even in refugee camps. Gers can be assembled quickly using a few people and therefore could be used as emergency shelters in the event of natural disasters (e.g. Haitian earthquake, Southeast Asian Tsunami). Their durability is optimized for wind and temperature extremes and they are easily transportable making them globally relevant. Using felts as the primary roofing and wall structures provides a dust control and air filtration mechanism as well.

Companies and organizations that may be interested include Intershelter, World Shelters, Inc., Wingroup, Coleman, Environmental Structures, Inc., Emergency Shelters International LLC, Pacific Yurts, Inc., USAID, and The Red Cross. These companies and agencies each procure, deploy or research emergency shelters.

**Woven Mat**

Woven mats are used in a number of communities across East New Britain and serve various purposes. Some of these uses include house construction and seating, but most commonly they are used for sleeping. These are woven using fronds collected from palm trees. A regular sized mat (Kubin) only requires one palm frond; however, larger mats (Kupa) can be made using two. Mats tend to last around six months depending on how often they are used. Once the mats are no longer usable for anything else, they are used for kindling and maintaining fires.

| | |
|---|---|
| ***Local Name(s):*** | single – Kubin, double – Kupa |
| ***Origin:*** | Raluana (Papua New Guinea, East New Britain) |
| ***Source:*** | Eunice |
| ***Chronicler(s):*** | Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin |
| ***Date Entered:*** | July 2010 |
| ***Explanation of Variation:*** | The length of the mat varies from person to person because it is measured according to their height. The width of the mat is determined by the size of the frond. |

***How To:***

Single Mat (Kubin)

1. Palm fronds were gathered and cut to size by measuring the frond to the height of the person who would be using the Kubin. Once the length was determined, the top, thinner part of the frond was removed (see **Figure 216**).

2. The weaver sat with the middle stalk of the palm frond in their lap. The weaving began at the thicker end, which was on the left.

3. The first leaf on the side closest to the body was crossed over the stalk and placed between the first and second leaves on the opposite side of the frond. The second leaf on the opposite side was crossed on top of the leaf that was just bent over and under the first leaf on the opposite side. The weaver made sure the vein of the leaf was facing away from the stalk. This process continued moving to the right until the final leaf on the opposite side was woven. If leaves were remaining on the closer side they were removed.

4. The outer most leaf (leaf A) on the right side was twisted and woven over leaf B, under leaf C, over leaf D, and under leaf E moving to the left. Then, the first leaf pointing to the right was woven over the closest leaf pointing to the left, under the next, and over and under the next two (see **Figures 217 - 219**). This process was continued moving to the left until the end was reached (see **Figure 220**).

5. Step 4 was repeated, in reverse when working from left to right and as stated when working from right to left, until the leaves were about 15 cm in length.

6. The Kubin was then secured by braiding together the ends of the leaves. Beginning with three strands, the outside leaf was crossed over the center leaf while keeping the three strands separated. Then the inside leaf was crossed over the now center leaf (see **Figure 221**). As this process is repeated, one leaf that points to the right was added when crossing over from the outside (see **Figure 222**) and one leaf that points to the left was added when crossing over from the inside (see **Figure 223**). This style of braiding is similar French braiding.

7. After all the leaves were braided, the end of the braid was tied into a knot to prevent it from unraveling (see **Figure 224 & 225**).

Double Mat (Kupa)

1. Two palm fronds were measured and cut in the same way as Step 1 of the *Single Kubin*. For each frond, the two sides with the leaves were split off of the center stalk leaving a thin strip on each piece. These pieces were put in stacks of two with the leaves pointing in the same direction. The four pieces were then tied together at either end and in the middle using bark string. This resulted in a central support with two layers of leaves on either side pointing in the same direction.

2. The weaver started at the end of the support with all the leaves pointing away from them. The first leaf on the bottom layer of the left side was crossed over the support to go between the first and second leaves on the top layer of the right side (see **Figure 226**). This step was inversed for the right side and repeated alternating from left to right down the length of the support (see **Figure 227**).

3. Once the end was reached, the weaver stood on the end of the support facing the right side. Starting on the right, the second leaf on the bottom layer was crossed on top of the first leaf on the top layer and woven under the first leaf on the bottom layer. The third leaf on the bottom layer was woven over the second leaf on the top layer and under the leaf directly to the right. This continues moving from right to left until the row is completed.

4. Steps 4-7 of the Single Kubin were done until the entire side was completed.

5. The double mat was flipped over horizontally and Steps 3 and 4 were repeated until the unwoven side was complete.

***Global Market Consequence:***

The Kubin is traditionally woven into a flat mat that is generally used for seating, sleeping, and walling. The broad flat surface is roughly the size of the average human and although it is extremely thin, it is durable and the weave is tight enough that nothing can pass through it. This makes them very effective for wall siding or partitions because the weave blocks anyone from seeing through and would block most wind and dirt from passing through the mat.

The mat design could be adapted for use in other things like furniture, blinds, shutters and wall hangings. The weave on a Kubin resembles some wicker patterns, and could be used as a substitute for chairs and tabletops. They could also be used as organic blinds or shutters. Though they are not extremely flexible, the design can be easily adapted. Kubins could also be used in their original form as natural yoga mats and sold at Holistic Health stores.

**Men's Woven Basket**

This form of woven basket is generally made and used by the men of the Tolai community. They are generally used much like a backpack or satchel, to hold personal items. Some individuals add straps or handles for convenience.

***Local Name(s):*** single – Rat kekene, double – Rat na ding

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

1. Two palm fronds were cut into segments, with sixteen leaves on each side (see **Figure 228**). The frond sections were then split off of the center stalk leaving a thin strip on each piece (see **Figures 229 & 230**).

2. The pieces were stacked in piles of two, with the central support of both pieces aligned. The leaves of the top piece pointed to the left while those of the bottom piece pointed to the right (see **Figure 231**). The weaver held them with the leaves pointing away from their body. Starting on the left end, the leaves on the top piece were woven individually over and under the leaves on the bottom piece, moving from left to right until completed (see **Figures 232 & 233**). The result resembled a woven triangle (see **Figure 234**).

3. Step 2 was repeated with the other set of palm pieces.

4. After both sides were completed, they were stacked on top of one another with the triangles on each side matching up. They were then tied together at the ends and middle of the central support using bark string (see **Figure 235**).

5. The weaver then opened the basket and held one end of the central support facing him or her. The resulting shape resembled a diamond with the central support splitting it vertically down center.

6. The two sides were then woven together. Starting with the end of the central support closest to the weaver, the first leaf on the left was crossed over the first leaf on the right, creating an "X". The second leaf on the left was then woven under the left side of the "X" (resulting in two leaves on the right side of the "X" and one on the left). The second leaf on the right was woven over then under the leaves on the right side of the "X" (see **Figure 236**). As this pattern was continued, the weave began to rise vertically (see **Figures 237 & 238**). This over-under technique was repeated until the sides of the basket were brought together (see **Figure 239**).

7. Step 6 was repeated on the other end of the central support. The resulting basket had open spaces still needing to be woven together. The ends of the leaves continued to be woven in this over-under pattern until all the open spaces were filled and the woven sections met at the bottom (see **Figures 240 & 241**).

8. The excess leaves were then braided (see **Figure 242**). Beginning with three strands, the left leaf was crossed over the center leaf while keeping the three leaves separated. Then the right leaf was crossed over the now center leaf. As this process was repeated one leaf was added from the left when crossing to the center from the left and one leaf was added from the right when crossing to the center from the right (see **Figures 243 - 246**).

9. Once the bottom is secured, the ties holding the central support together were removed creating an opening for the basket (see **Figure 247**). Depending on personal preference the weaver can add a strap or handle to the basket for convenience. (see **Figure 248**)

***Global Market Consequence:***

This basket is made exclusively from palm fronds, and is used to carry personal items. It is a little larger than most purses, but maintains a similar basic structure. NOVICA offers a variety of handbags and purses made by crafters from around the world. Styles and sizes vary, and are unique to each region. The woven basket is created in such a way that incorporating different designs and additional decorations would not be difficult.

**Woven Plate**

The woven plate is generally lined with a leaf so it remains clean and can be reused. They are made using a section of a palm frond that was about 30.5 centimeters long. After cutting away the tip of the frond, the section was taken from the thinner end and used to construct the plate. The plate is curved, similar to a bowl, which holds the food in place.

| | |
|---|---|
| ***Local Name(s):*** | Gep |
| ***Origin:*** | Raluana (Papua New Guinea, East New Britain) |
| ***Source:*** | Eunice |
| ***Chronicler(s):*** | Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin |
| ***Date Entered:*** | July 2010 |

***How To:***

1. A section about 30.5 cm in length was cut from the smaller end of a palm frond. The weaver held this section at the end of the stalk with the leaves pointing away from them.

2. To begin the weave, the first leaf on the left was crossed over the first leaf on the right, creating an "X". The second leaf on the left was then woven under the left side of the "X" (resulting in two leaves on the right side of the "X" and one on the left). The second leaf on the right was then woven over and under the two leaves on the right side of the "X". As this pattern continued, the weave began to rise vertically (see **Figure 249**). This was done until all the leaves were woven.

3. The ends of the leaves were gathered at the top and tied in a knot to secure the weave.

4. The stalk of the palm frond was then split down the middle, separating the two sides. (see **Figure 250**)

**Ruai**

A ruai is a basket that is woven from a palm frond and covered in bark cloth, called pinpin ina veko. The design is originally from Namatanai, an area not far from the Ngavalus village, though it has a different name. Over time, the people of Ngavalus adopted the design as well and called the finished product "ruai". Though the end result is essentially the same, the people in Ngavalus have a different method of making the basket.

Coconut cream is sprayed on the palm fronds prior to weaving to bleach the basket as it dries in the sun. The coconut cream also acts as a preservative, making the baskets last longer. The dried baskets can also be soaked in salt water and left to dry which also works to preserve them.

***Origin:*** Ngavalus (Papua New Guinea, New Ireland)

***Source:*** Dorcas Kamis

***Chronicler(s):*** Katherine Irene Martin

***Date Entered:*** August 2011

***Explanation of Variation:*** The number of leaves selected for this section can vary depending on the desired basket size.

***How To:***

1. Two sections of palm frond (pangana nik) were cut with 12 leaves on either side of the central stalk.

2. Using a knife, the leaves on either side of the stalk were trimmed to make them all the same width. The leaves are generally cut in half long-ways. This is done so the leaves fit together snugly once unfolded.

3. Once the leaves were prepared, the fruit from two coconuts was shredded and squeezed to produce a thick coconut cream. This cream was then spit onto the leaves evenly covering both sections of palm frond, a process called tipi tana ki poso. The coconut cream acts as bleach and preservative for the basket as it dries in the sun.

4. The two sections that had been covered in coconut cream were slowly dragged over the glowing embers of a fire. The leaves were dragged slowly enough to start steaming without burning, a process called vuvungi. This was done until the leaves on either side of the stalk became very flexible and hung limply on either side of the stalk.

5. The leaves were then split in half and adjusted so they were criss-crossed, six pointing down and six pointing up on either side of the stalk (see **Figure 251**).

6. Starting from the center, the leaves were then woven in an under-over pattern. As they were woven, the leaves were unfolded so they lay flat and adjusted as needed to ensure the weave was tight. This was done until all of the leaves were woven, resulting in a woven triangle (see **Figure 252**). The process of weaving is called usi.

7. When one side was finished, the section was flipped over and the other side of the stalk was woven in the same way.

8. Once two leaf sections were woven up to this point, they were positioned so the points of the weave touched. The stalks of each section served as the sides of the basket. The sections were then woven together continuing the same over-under pattern until the sides are completely connected.

9. The weave was then continued until the two sides were woven together creating the bottom of the basket. Once one side was closed off, the ends of the leaves sticking out of the weave were woven through the open sections of the basket to fill in the remaining holes.

10. At the top, the leaves were bent down in the direction they were pointing and woven through the open sections at the top of the basket. Once this was done with all the leaves on both sides, it created an edge at the top of the basket.

11. The leaf ends, now concentrated in the same area at the sides of the basket, were tied into a knot to secure the weave (see **Figure 253**). The finished, woven part of the ruai is called a lapa.

12. The baskets were left to dry in the sun for one day. Because the baskets expand with the heat, creating holes in the weave, they were left to dry during the night as well so the cooler temperature could shrink the baskets to close the holes (see **Figure 254**).

13. A length of bark cloth (see the **Breadfruit Bark Cloth** entry) was cut length-wise so it could be unfolded to a single layer. One end of the cloth was then lined up and secured to the top of one of the stalks at the side of the basket using a thin strip of the bark.

14. The cloth was then opened up and wrapped around the bottom of the basket to the opposite side. At this point the cloth was covering half of both sides of the basket and the entirety of the bottom (see **Figure 255**).

15. The cloth was then brought up to the top of the other stalk at the opposite side of the basket and folded back down. The fold was then secured to the stalk just like in Step 13. The cloth was then opened up and wrapped around the bottom of the basket to the first side (see **Figure 256**).

16. The remaining length of cloth was then secured, again, at the top of the first stalk and measured to create a strap or handle. Once it was measured to the desired length, the other end of the cloth was tied securely to the second stalk.

17. Using a needle and thread, the cloth was then hand-stitched at the sides and all of the places where it crossed to keep the cloth together around the woven part of the basket (see **Figure 257**). (see **Figure 258**)

***Global Market Consequence:***

Coconut milk and oil has been widely used in a number of beauty products because of its moisturizing properties. However, the use of coconut milk as a bleach and preservative in this basket making process suggests that the components of the coconut have potential for use in a wide array of applications. Coconut oil itself is a component of soaps, hair conditioning treatments, hair coloring products and a number of other beauty products made by companies like Henkel AG & Co. KGaA, L'Oreal, and Revlon Consumer Products Corporation (who actually use it in one of their hair bleaching products). These companies along with St. Ives, Colgate-Palmolive Company, The Gillette Company, Lever Brothers Company, Unilever NV, Procter & Gamble, Anheuser-Busch, Incoporated and Johnson & Johnson Baby Products Com. among many others may be interested in utilizing the other components of the coconut in their products as well.

Chemical elements of the coconut also appear in a number of other household products as well. Coll Partners Ltd. uses coconut oils in their dental hygiene and teeth-whitening products and may be interested in researching the bleaching elements of coconut to use in their products in lieu of harsh chemical bleaching agents. Coconut oils are also used by Goldschmidt, AG in their detergent concentrates and in an anti-foaming component of dishwashing detergents made by Lever Brothers Company, Division of Conopco, Inc. Many other companies use the acids found in the coconut in laundry bleaching products as well.

Coconut oil is also an ingredient in many pharmaceuticals. It is a component of a product made by Tec Laboratories, Inc. that removes oils of poison ivy from skin while soothing redness and irritation of the affected area. It is also used as an active anti-inflammatory ingredient in a solution used to control the respiratory effects of inhaled pollutants and allergens developed by Global Life Technologies Corp.

The alcohols found in the coconut are used by the Shell Oil Company to form the alcohol ethoxylate deinking agents used to remove the ink from recycled paper. As the recycling and conservation movement continues to grow, companies like Kimberly-Clark Worldwide, Inc., Kao Corporation, Weyerhauser Company, Nalco Chemical Company, Kemira Chemicals, Inc., Nippon Paper Industries Co. Ltd., and Du Pont may be interested in incorporating coconut fatty acids into their processes as well.

**Sapal**

The sapal is the tool used to beat a sago tree, making the mumut used in the process of extracting saksak. Once made, the head of the sapal is reused for years while the handle is changed for each use.

***Origin:*** Ngavalus (Papua New Guinea, New Ireland)

***Source:*** Russell and Apet

***Chronicler(s):*** Roger Lynn Bohon

***Date Entered:*** August 2011

***How To:***

1. One long piece of a hardwood tree limb, usually from the malas tree, was cut into three sections, two of which were approximately 30 cm long and one that was measured to the length of the users arm from shoulder to palm.

2. The two pieces of equal length were shaved down so they were smooth on all sides using a bush knife or any other sharp knife.

3. Once the two equal pieces were completely smooth, two pieces of metal pipe were cut, both roughly 7 cm long (see **Figure 259**). The metal pieces were then positioned at the ends of the smooth malas sections and a cut was made marking the length on the wood. Using a bush knife, the malas sections were shaved down to this mark until it was small enough to fit pieces of metal pipe on the end (see **Figure 260**).

4. The pipe was placed onto the shaved end of both malas sections and beaten against a rock until securely in place (see **Figure 261**). The opposite ends of the malas sections were tapered down to create a space for the handle (see **Figure 262**). Once tapered, the two malas pieces were tied together using maris. The maris was wound around the two equal pieces several times just above the metal and pulled as tightly as possible (see **Figures 263 & 264**). The maris was then secured with a knot.

5. Once the two pieces were secured, the longer section was positioned between the two equal sections at a 90º angle. The maris that was wrapped around the two equal pieces was then looped around the middle of the handle twice (see **Figure 265**). This allowed for adjustments to be made as necessary.

6. The handle is further secured by cane which was looped in a figure 8 pattern and tied in a knot (see **Figure 266**). (see **Figure 267**)

***Global Market Consequence:***

A sapal is a tool that closely resembles a pick axe or an ice pick. It is similar in shape, but it is easily disassembled or adjusted since it is simply tied together and held together by well placed knots and proper tension. Thought the sapal is not made of metal or welded together, it does not lack any of the strength of a manufactured pick axe. While the actual artifact of the sapal may not be an effective substitute in heavy machinery, its design suggests a possibility for machine parts that are easily replaced, maintained, or adjusted. Hammer mechanisms can be found in almost every machine including impact wrenches, drills, and a number of other heavy-duty machines.

**Tambu** (see **Figure 268**)

Tambu is the traditional form of money in the Tolai community. To make it, large numbers of a specific snail shell are collected, dried, and strung on a very thin piece of cane. At one time, these snails were prevalent along the coast of East New Britain. The people of Raluana would simply anchor a rotten piece of fruit in the shallows of the reef, leave it for a few hours and could expect to collect hundreds of these snails. However, following the volcanic eruptions of 1994 and 2006, the temperature of the water in the area rose causing these shelled animals to relocate to cooler waters. Now, the shells are found primarily on the coasts of West New Britain and New Ireland.

Though the Tolai communities have adapted to the cash economy of East New Britain, Tambu is still used on various occasions. Tambu is amassed throughout a man's life, starting when he is a young child. As a boy reaches certain stages in life, he is presented with varying amounts of Tambu depending on the milestone he has achieved. Tambu is also given in exchange for the completion of various odd jobs around the community or in recognition of certain actions. Though it is most commonly the men who receive it, there are certain times when Tambu is distributed to all the members of the community. For example, when a member of the community passes away, the family will host a gathering to allow the other community members to pay their respects. It is the responsibility of the family to distribute a small length of Tambu, ranging from 15 to 30 centimeters long, to every person who attends this gathering as a symbol of gratitude.

A system has been set up between the Tolai communities and the government which has assigned an exchange rate between Tambu and Kina. At the most basic level, 1 meter of Tambu is equivalent to 5 Kina. These single strands are generally organized into bunches of 10, which would be equivalent to 50 Kina. If a Tolai family does not have enough Kina to cover their expenses, like school fees, they are able to use the Tambu in day-to-day transactions.

Usually a collection of Tambu consists of fragments varying in length. Before the process of making Tambu can begin, all of the individual shells must be removed from the cane strips so they can be re-strung on new ones.

| | |
|---|---|
| ***Local Name(s):*** | Tambu |
| ***Origin:*** | Raluana (Papua New Guinea, East New Britain) |
| ***Source:*** | Eunice, her children, and other members of the community |
| ***Chronicler(s):*** | Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin |
| ***Date Entered:*** | July 2010 |
| ***Explanation of Variation:*** | There are two types of tools used in the removal of the shells. The traditional tool the team used was half of a coconut shell with one of the three holes carved out. The coconut tool was put on the ground with the open side down so the individual shells would not scatter once removed. The modern tool the team used was a piece of thin metal piping 12.7 cm in diameter and 10 cm high (dimensions vary based on the piping used) with notches cut along the rim. The piping was nailed to a piece of wood to create a cup where the shells would be collected as they were removed. |

***How To:***

1. The shells on a strand of Tambu were removed by hooking each individual shell in one of the notches along the rim of the modern tool or the edge of the hole in the traditional tool and gently pulling back on the strand, sliding the shell off of the cane (see **Figures 269 & 270**). This was done until all the shells were removed (see **Figure 271**).

2. Strips of cane measured to a meter in length were shaved as flat as possible while still maintaining enough width to hold the shells securely on the strip.

3. The shells were then strung on to the cane strip. The shells began about 5 cm from one end of the strip and the strand was finished leaving roughly 5 cm at the opposite end. The person stringing the shells made sure that they were all facing the same direction and a small space is left between each shell (see **Figure 272**).

4. Once ten or more strands were strung, they were connected to form a long string of Tambu. One end of a strip was split in half up to the first shell while the end of another strip was placed between the halves. The shells on the split end of the first strip were wedged down to cover the 5 cm gap, thus holding the strip together. This process was repeated until all ten strands were connected. This long string of Tambu was then looped five times and tied using some type of string. This bundle is equivalent to 50 Kina.

5. When a number of these bundles had accumulated, they were wrapped around a cane hoop. The hoop 60 cm in diameter (size varies based on available materials), was wrapped in fern leaves secured to the hoop with nylon string wrapped around the hoop (see **Figures 273 & 274**). Strands of the Tambu were aligned along the hoop, covering the fern layer

entirely. This was secured to the hoop by wrapping the nylon string around the hoop again (see **Figure 275**). Gaga leaves were then aligned along the hoop, completely covering the Tambu. The gaga leaves were secured by wrapping wide strips of pandanus leaves around the hoop (see **Figure 276**). This pandanus layer was secured by tucking the ends into the wraps. Some of these hoops can contain up to 5,000 strands of Tambu. (see **Figure 277**)

***Global Market Consequence:***

Tambu, consists of shells strung onto long strands of cane. The strands are relatively uniform and can be easily manipulated into circles or rings. The method used to string the shells and join strands together could be used in the making of jewelry, garland and other decorative pieces. It is not uncommon to see jewelry made out of seashells being sold in stores, especially around coastal regions. Ocean Splendors Jewelry focuses on unique pieces of jewelry made predominately from shells.

The strands of Tambu would also be ideal for things like garlands and wreathing. They can be wrapped around a wreath, much like they are wrapped around the hoop in the Tolai community. It could also be used as a border or fringe on things such as frames or around lampshades. Brand name craft stores, such as Michael's, Ben Franklin, ACMoore and Joann Crafts may be interested in using the shells for decorative purposes.

**Umbrellas**

Members of the Qaqet communities use two types of umbrellas. One type is used for protection from the elements. Often times, while walking, they are faced with inclement weather or intense sunlight. Since the umbrella is made with readily accessible materials (leaves and bark string), they are able to quickly assemble the umbrella as needed. The other type of umbrella is commonly used for marking and protecting personal property. The preparation of this particular umbrella involves the speaking of customary phrases that are unique to each Qaqet family group in order to ensure the protection of the designated object.

| | |
|---|---|
| ***Local Name(s):*** | weather - Ararlatki, customary - Puripuri |
| ***Origin:*** | Alakasam (Papua New Guinea, East New Britain) |
| ***Source:*** | Lukas |
| ***Chronicler(s):*** | Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin |
| ***Explanation of Variation:*** | The materials for both umbrellas are similar; however, the weather umbrella has an added broad leaf for extra protection against the sun and rain. Depending on the accessibility, the type of leaf will vary. |

***How To:***

Weather Umbrella (Ararlatki)

1. Six of the same leaves, generally frond type leaves, along with one broad flat leaf were collected. The leaves were large enough to provide adequate cover for the user.

2. The six identical leaves were stacked into piles of three. The broad leaf was placed on top of the first stack, and the second stack was put on top of the broad leaf.

3. The bundle was tied together at the stems using a piece of bark string (see **Figure 278**). Lukas then held it above his head and adjusted it as necessary (see **Figures 279 & 280**).

Customary Umbrella (Puripuri)

1. Six of the same types of leaves, generally frond types, were collected and put into a bundle. They were then tied together at the stems using bark string.

2. The umbrella was then secured with a vine rope to the object or plant that the user intended to mark. The customary phrase was spoken to ensure the spiritual protection of the object or plant. Crushed limestone (Kaban) was blown on the object and again periodically as the user backed away, heading down wind to avoid self-contamination with the limestone.

***Global Market Consequence:***

The umbrellas used by the Alakasam community are functional, easy to use and easy to create. The overlapping of the leaves effectively prevents the majority of rainfall from drenching the holder. The idea of placing a broad leaf between the stacks of other thick leaves makes the umbrella more effective by stopping any other rain that might have gotten through the other leaf layers. This idea can be used in the design of other structures that are intended to prevent the flow of water or other substances. The design concept can be adapted into water filtration systems or drainage systems. The frond type leaves catch matter while the water runs off of the broad leaf. This is a fairly simple design that could be translated into a water filtration system.

When considering the benefits of the indicator umbrella it is important to observe the fact that it is easy to create. Any type of leaf that is readily available can be used in this design. Since leaves are abundant in this environment, finding the supplies for the umbrella is simple. This technique can be related to almost any environment. Creating an indicator or marker out of readily available materials is easier and more cost-effective. Organic products like the umbrella itself or those developed using the method or concepts of the umbrella could be distributed in specialty stores for Eco-friendly products and stores like World Market and 10,000 Villages. Both types of umbrellas could be adapted for use as fans or sheltering at tropical spas or resorts similar to the way that many now use thatch roofing.

# Images for Household Items

## Amut Rope

**Figure 161:** Each section of the rope is rolled individually then together, up and down the leg.

## Woven Ball

**Figure 162:** The two green strands are interlocked forming a "V" shape.

**Figure 163:** The outside left strand is woven over the inside left, beginning the weave (as it continues the ball will curl around itself).

**Figure 164:** Once the weave has curled in on itself, the strands are threaded under the existing weave continuing to shape the ball and securing the weave.

**Figure 165:** The previous step is repeated until the strands can no longer be woven.

**Figure 166:** The remaining ends of the strands are cut off using a small knife.

**Figure 167:** The finished product should look like this.

## Bamboo Water Bottle

**Figure 168:** A leaf is coiled and inserted into the hole at one end of the bamboo section. Another leaf is twisted and used as a stopper.

## Bilums

**Figure 169:** Each new layer of the bilum is woven into the top loops of the layer before it.

## Breadfruit Bark Cloth

**Figure 170:** Using a bush knife, the brown outer bark of the breadfruit tree branch is carefully scraped off revealing the soft green bark underneath.

**Figure 171:** The branches are then taken into the ocean and beaten with the blunt side of a bush knife. The branch must be turned so all of the bark is loosened.

**Figure 172:** As the bark loosens, it is folded back and the beating continues on the fold. This is done until the sleeve of bark is completely removed.

**Figure 173:** The cloth is then hung to dry. It takes anywhere from a day to a week to dry depending on weather conditions.

## Broom

**Figure 174:** The veins of palm fronds are bunched together in varying amounts depending on the desired size, which are bound together with a piece of bark string.

## Buluur

**Figure 175:** Using a pocket knife, the meter long stick is smoothed to eliminate splinters.

**Figure 176:** One end of the stick is whittled down so the head of the buluur can be fitted securely.

**Figure 177:** After a hole is made in the center of a block of wood, sections are cut into the top and bottom. Sections will be cut out of the left and right sides as well.

**Figure 178:** A small hole is made in the skinny end of the stick so a pin can be used to secure the head to the stick.

**Figure 179:** The finished product is used to churn yogurt and milk to make butter.

## Bush Rope

**Figure 180:** The strands of bark are woven from the outside to the center until the desired length is reached.

## Bushlamps

**Figure 181:** The sap from a candle tree is collected and wrapped in leaves. As the outer leaves dry out, fresh leaves are added to prolong the life of the lamp.

## Camel Wool Rope

**Figure 182:** Camel wool is separated and detangled by hand and made into bundles.

**Figure 183:** A bundle of camel wool is separated into two sections.

**Figure 184:** To start the braid, the two sections are crossed over each other.

**Figure 185:** The sections are then rolled together in the braiders hands.

## Curved Pan Ger Stove

**Figure 186:** Ger stoves have a hole in the top with a pan that fits into that hole.

**Figure 187:** The pan is fitted into the hole and comes in direct contact with the flames, requiring less fuel to do the cooking.

## Woven Fan

**Figure 188:** The leaves of the frond are crossed over the center stalk to begin the weave.

**Figure 189:** Once the leaves have been woven all the way up the stalk, each leaf is twisted upwards and woven over and under the other leaves.

**Figure 190:** After all of the leaves have been woven together, the ends are folded over the fan to the opposing side and tucked into the weave as shown.

**Figure 191:** The previous step is repeated until all of the ends are woven as such.

**Figure 192:** The remaining ends of the leaves are removed with a knife.

## Felt Making

**Figure 193:** The sheep wool is put through a carding machine to detangle and straighten it.

**Figure 194:** The carded wool is then formed into a square and made even in thickness.

**Figure 195:** A silkscreen is placed on top of the wool square.

**Figure 196:** The wool is pressed with soap and water to bind the wool fibers together.

## Food Packets

**Figure 197:** Cooked food is wrapped in gaga leaves providing a way to store food while protecting it from contamination.

## Fruit and Nut Basket

**Figure 198:** The weave starts by crossing the first two leaves over each other.

**Figure 199:** Each leaf is woven under and over the existing leaves, making a cone-shaped weave.

**Figure 200:** The weave stops when all of the leaves have been used.

**Figure 201:** The ends of the leaves are tied together to hold the basket's shape.

**Figure 202:** The remaining leaves on the stalk are twisted or braided and then secured to create a handle.

**Figure 203:** The finished product is frequently used for harvesting nuts and small fruits.

## Gers

**Figure 204:** Some gers have wooden floor pieces that are assembled prior to erecting the frame.

**Figure 205:** It is customary to position gers with the doors facing to the south.

## Ger Assembly

**Figure 206:** The sections of the lattice walls are positioned together and secured to the door frame.

**Figure 207:** Each of the lattice sections is tied together with ropes wound through the holes.

**Figure 208:** The central support is tied together and positioned in the middle of the lattice walls.

**Figure 209:** Roof poles are inserted into the holes in the central ring and secured to the tops of the lattice walls.

**Figure 210:** Once the frame is built, the cotton ger cover is draped over the roof and walls.

**Figure 211:** The felt pieces were then positioned on the walls and the second cotton cover was positioned on the roof.

**Figure 212:** Frequently, a layer of plastic is added to keep water from leaking into the ger.

**Figure 213:** The final cover is then positioned around the ger.

**Figure 214:** All of the covers are secured to the ger frame by ropes tied to the doorframe.

**Figure 215:** The final ger looks like this.

## Woven Mat

**Figure 216:** The palm frond is measured to the desired size starting from the end of the frond.

**Figure 217:** Leaving the first top leaf down, three leaves on the top layer are lifted up while keeping one leaf down between each.

**Figure 218:** The next bottom leaf in the series is then lifted and placed over the first top leaf.

**Figure 219:** The leaf is then placed under and over the remaining leaves, locking the previous leaf in place.

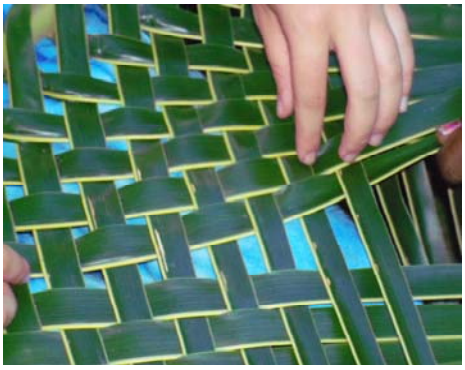

**Figure 220:** The existing weave is then pulled tight.

**Figure 221:** Once the kubin has been completed, the remaining ends are braided together to secure the weave.

**Figure 222:** When the outside bunch is crossed over to the center, one leaf pointing to the left is added.

**Figure 223:** When the inside bunch is crossed over to the middle, one leaf pointing to the right is added.

**Figure 224:** Once all of the leaves have been added into the braid, it is knotted to secure the kubin.

**Figure 225:** When finished, the kubin is used as a mat for sitting or sleeping.

**Figure 226:** The first leaf on the bottom left is crossed over the support between the first and second leaves on the top right.

**Figure 227:** The previous step is repeated alternating between left and right until the end of the support is reached.

## Men's Woven Basket

**Figure 228:** A palm frond is cut containing 16 pairs of leaves.

**Figure 229:** Using a knife, slices are made on either side of the stalk.

**Figure 230:** These slices are pulled, removing the leaves from the stalk while maintaining a central support.

**Figure 231:** The sets of leaves are then piled in stacks of two with the leaves of one set pointing to the right and one pointing to the left (as shown).

**Figure 232:** Holding the pair with the leaves pointing away from the body, the weaver begins weaving the leaves in an over-under pattern.

**Figure 233:** This over-under pattern is continued until there are no more leaves to weave.

**Figure 234:** Once completed, the side should resemble a triangle.

**Figure 235:** The two sections are then tied together by the central support (as shown).

**Figure 236:** The two sides are then woven together using the same over-under type of weave.

**Figure 237:** As the weave continues, it will begin to rise vertically.

**Figure 238:** Once the sides of the basket are woven together, a knot is tied to hold them together until the ends are braided at the very end.

**Figure 239:** The remaining leaves are woven together in the over-under pattern.

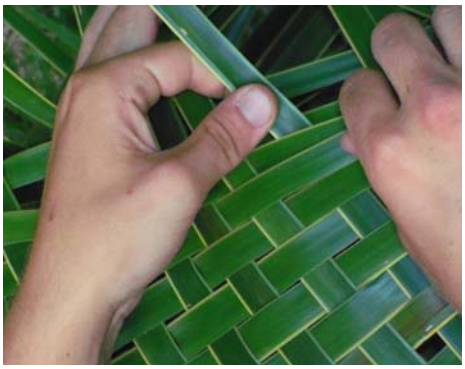

**Figure 240:** The weave is tightened as needed until it is even all the way around the basket.

**Figure 241:** The weaving is finished when all the sides are at the same level.

**Figure 242:** The excess leaves are then grouped into three bunches and are braided together.

**Figure 243:** When the right bunch is crossed into the middle, a leaf pointing to the right is added to the bunch (this and the previous step continue until there is nothing left to braid).

**Figure 244:** When the left bunch is crossed into the middle, a leaf pointing to the left is added to the bunch.

**Figure 245:** A knot is tied at the end of the braid to secure the basket.

**Figure 246:** The end of the braid is then pushed to the inside of the basket.

**Figure 247:** When the basket is completed, the ties on the central support are removed allowing the basket to have an opening.

**Figure 248:** The finished product should look like this. If desired handles or straps can be added.

## Woven Plate

**Figure 249:** Once a small section has been cut from a palm frond, the leaves are woven together in an over-under pattern.

**Figure 250:** After all the leaves have been woven, a knot is tied at the top and the stalk is split.

## Ruai

**Figure 251:** A section of palm frond is cut with 12 pairs of leaves. Six pairs of leaves are repositioned to point up and six remain pointing down.

**Figure 252:** Starting at the center of the section, the leaves are woven in an over-under pattern until all the leaves have been woven.

**Figure 253:** Two woven sections of palm are positioned and woven together. When all the sides have been woven together, the excess is bunched at the sides and tied in a knot.

**Figure 254:** The basket is then left to dry for one day and one night. After drying, the basket on the right will look like the basket on the left.

**Figure 255:** The breadfruit bark cloth is bunched and secured to one side of the basket then wrapped around the bottom to the opposite side.

**Figure 256:** The cloth is then adjusted and secured to the other side and wrapped around the bottom again.

**Figure 257:** Using a needle and a strip of the bark cloth, the cloth is sewn together along the seams.

**Figure 258:** When finished the ruai looks like this.

## Sapal

**Figure 259:** Two sections of metal piping are measured to equal length.

**Figure 260:** The metal piping is used to measure how far the malas pieces need to be shaved. This is done until the metal piping can fit over the end snugly.

**Figure 261:** The metal piping is then fitted on the end of the malas.

**Figure 262:** The opposite end of the malas pieces are shaved so that, when put together, they form a "V".

**Figure 263:** The malas pieces are then secured by maris wrapped tightly starting at the end of the metal piping.

**Figure 264:** The long end of the maris is tied off and used to secure the handle to the head of the sapal.

**Figure 265:** The long end of the maris is wrapped tightly in a figure-8 around the handle and the malas pieces.

**Figure 266:** Another piece of maris is secured further down the handle and connected to the end of the malas pieces, again, in a figure-8 pattern.

**Figure 267:** The finished product looks similar to a pick axe.

## Tambu

**Figure 268:** The different stages of Tambu from beginning to end (right to left).

**Figure 269:** Individual shells are removed from the cane using a metal tool as shown; the shell is removed by placing it as such and pulling back the strand, sliding the shell off the end.

**Figure 270:** The shells were also removed by making a hole in a coconut shell (currently, the metal tool is more common for this step) and following the same process as mentioned before.

**Figure 271:** Once they are removed from the cane, the shells are collected and cleaned as needed to be restrung into meter long strands.

**Figure 272:** The individual shells are restrung onto new strands of cane leaving a space between each and all facing the same way.

**Figure 273:** When a large amount of Tambu is collected, it is secure to a cane ring with string after it is covered in young ferns.

**Figure 274:** The string is wound around the ferns until the ring is entirely covered.

**Figure 275:** The strands of Tambu are then positioned around the ring and secured by wrapping a string of some kind around it similar to the ferns.

**Figure 276:** The Tambu is then covered with Gaga leaves which are wrapped in Pandanus leaves.

**Figure 277:** The finished product looks like the picture above.

## Umbrellas

**Figure 278:** The leaves are stacked on top of one another and the stems are bound using bark string.

**Figure 279:** The weather umbrella can be held as shown to protect the user and his or her belongings from the rain.

**Figure 280:** The weather umbrella can also be adjusted to shade the user from the sun.

## Hunting Techniques

### Fish Trap

In Raluana, small fish traps are used for fishing on coral reefs. They are made using organic materials such as cane, cocoa branch twine, gaga leaves and some type of anchor (generally a small stick roughly 2.5 cm in diameter and about 15 cm long). Often times, these traps are baited using fruits like coconuts and papayas, and the anchor is buried or secured to the coral to keep it from moving in the current. The fish are lured into the traps and are stuck by the thorns of the cane stalks preventing them from escaping. When the fish attempts to get out, the anchor is dislodged and the trap floats to the surface. Modern fishing techniques requiring fishing rods and hooks have replaced daily use of these traps, but they are still used on some occasions.

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

1. A ring about 8 cm in diameter was created using a strip taken from the stalk of a palm frond. This was secured by winding cocoa branch twine around where the two ends meet.

2. Six or more cane stalks, depending on the size of the ring, were then secured to the inside of the ring with the thorns pointing down. Each stalk was evenly spaced around the ring and secured at the middle using the same twine that was used for securing the ring. The twine was wrapped around each cane stalk in a criss-cross pattern two or three times. Once all the stalks were attached, the twine was knotted to ensure that they did not come undone. (see **Figure 281**) At the bottom (the side the thorns were pointing at), the ends were brought together and tied using a piece of twine to form a cone.

3. Gaga leaves were then placed around the cone tip until it was completely covered (see **Figure 282**). The leaves were folded down at the level of the ring and secured around the tip of the cone with another piece of twine. The excess length of the leaves was wrapped around a stick that was 2.5 cm in diameter and 25 cm long and tied with twine.

4. At the open end of the cane, a knot was tied around one cane stalk and looped around each consecutive stalk, creating a circle to hold the shape of the cone (see **Figure 283**). The trap was then adjusted to ensure that the leaves covered the ring. (see **Figure 284**)

***Global Market Consequence:***

The fish traps used by the fisherman of Raluana are completely organic and are found to be more productive than the more common rod and reel fishing styles. Fish are lured into the trap using either pieces of fruit or the remains of freshly caught fish, and trapped within the organic trap by the cane thorns. Everything from the anchor to the binding can be found in the natural environment. SuperMarketo is a company that has some interesting variations of fishing techniques already present on its website. It features unique designs from around the world that could be placed in the same category as the Tolai Fish Trap.

The fishermen of Raluana explained how using live bait allows for them to catch a large number of fish in a short amount of time. They throw the unused parts of the fish from the previous catch into the trap as bait. Just five minutes after throwing the trap back into the water, it is full of fish. We were told that the trap can be refilled with bait two and three times in one hour and yield a large catch each time. Take me Fishing is a company that focuses on the use of natural bait. They describe which type of natural bait will attract certain types of fish and could partner with the Raluana community to make their fishing methods known globally.

**Megapode Egg Gathering**

In the community of Matupit, the Megapode egg serves as a primary source of food and income. Each day men from the village travel to the nesting grounds of the Megapode birds to gather the eggs. Because Matupit is the only place to find Megapode eggs, most customers come to Matupit to collect their orders. While some individuals sell their eggs at a market, it is more common for transactions to be made in the village itself. Each individual egg is priced at 2 Kina (just under US$1); however, the eggs are generally sold in groups of four (see **Figure 285**). The eggs are roughly 50% larger then a normal chicken egg and have a thinner shell and bigger yolk.

The Megapode birds live and nest at the base of Mount Tavurvur, one of the volcanoes in the Rabaul Caldera. They dig holes into the ash, and bury their eggs roughly two meters down until they reach the ground underneath (see **Figure 286**). Although the birds only lay around 3-6 eggs at a time, multiple Megapode birds may use the same hole resulting in a nest of between 10 and 15 eggs. Once the eggs are laid, the Megapodes fill in the two meter holes with the ash. When the eggs hatch, fully developed baby birds must dig their way out of the nest. In the past, the birds would roost in the tops of the coconut trees; however, as a result of the volcanic eruptions in 1994 and 2006, there are no more of these trees at the base of the volcano. Now, the birds can be found perched on top of piles of lava rock fulfilling their preference for elevated areas.

***Origin:*** Matupit (Papua New Guinea, East New Britain)

***Source:*** Oxy and Brian

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

A nest can be spotted by observing the Megapode footprints found around the top of an ash mound. The diggers use shovels to dig into the ash until they reach the hard ground underneath (see **Figure 287**). The birds do not dig into the harder ground beneath the ash, so the diggers can expect to find eggs nearby once they have reached the hard ground. From this point on the digger will use his hands to dig in the ash, feeling around for the eggs (see **Figure 288**). Ash enclosing the tunnel made by the Megapode will be less packed than the surrounding ash, thus indicating to the digger the general location of the eggs in the nest (see **Figure 289**). Since the nests are close in proximity and the holes can be quite deep, the likelihood of cave-ins is very high, adding a level of risk to the process.

***Global Market Consequence:***

Megapode eggs are an important aspect of the lives of villagers in Matupit. The people sell the eggs and rely on them as a primary food source. The eggs are similar to chicken eggs, but are often about 50% larger and have a thinner shell. Another difference between the two is that the yolk of the Megapode egg is larger than the yolk of a chicken egg.

Research on the possible benefits of an egg that is predominantly yolk could be beneficial to areas that are facing vitamin deficiencies. The yolk is known for the important nutrients it provides, including protein, calcium, zinc, iron and vitamins A, E, D and K. Megapode eggs, which have more yolk per egg then a chicken egg, might be helpful in getting some of these nutrients to places that might not have access to them otherwise. Pharmaceutical companies, (companies focused on producing chemical substances for medical diagnosis, cure, treatment, or prevention of disease) which could be interested in the product include but are not limited to VitaPurity, Vitamin Power, Naturally Vitamins, Puritan's Pride Vitamin, GNC and Centrum.

Megapode eggs are buried roughly two meters underground. Regardless of the fact that the shells of the eggs are thin, the eggs remain unbroken despite the large amount of ash that is piled on top of them and the pressure applied by the diggers themselves. Further research could be done to gain a better understanding of how it is possible that this seemingly fragile egg has proven to be so resilient against the pressing weight of two meters of ash. The shock absorption properties of the ash should also be looked into for packaging purposes and other similar uses. Companies which may be interested into packaging purposes include but are not limited to DHL, UPS, Pilot Freight Services, Vitran, USF Holland, FedEx, and Maersk.

**Qaqet Bandicoot and Cassowary Traps**

Traps are used by the Qaqet people to catch wild animals for consumption. There are a number of different traps for different types of prey, however, the two most commonly used are Bandicoot and Cassowary traps. Both utilize materials found in their immediate surroundings and are therefore the most common method of hunting. Usually a large number of traps are set at once, which are then periodically checked by the hunter, sometimes being left for days at a time.

| | |
|---|---|
| ***Local Name(s):*** | Bandicoot trap – Amungem, Cassowary trap - Avadimgi |
| ***Origin:*** | Raunsepna/Anesmetki (Papua New Guinea, East New Britain) |
| ***Source:*** | David, John, and Joe Maraedi |
| ***Chronicler(s):*** | John Walter Barber |
| ***Date Entered:*** | June 2009 |
| ***Explanation of Variation:*** | Cassowary trap – the length of the rope and sizes of the sticks and trees is dependent upon the type of animal the hunter wants to catch. |

***How To:***

Bandicoot Trap (see **Figure 290**)

1. A log was cut from a nearby tree which was heavy enough to kill the bandicoot and was between 60 cm and 1 m long. Once the location of the trap was found, the ground beneath the trap was flattened by dropping the log a number of times on the spot.

2. A skinny tree or stalk of cane was into sections between 45 and 60 cm long. These sections were then pushed into the ground side-by-side to create a wall about 60 cm long. Another wall was created parallel to the first, leaving about 30 cm of space between the two.

3. A small stick no bigger than 2.5 cm in width and 1 m in length was stuck into the ground on the outside of one of the walls. Both ends were pushed into the ground to form an arc.

4. A vine was loosely looped twice around one end of the log. The slack of the vine loop was then twisted to form another loop at the top of the circle, creating a figure-8 shape with the end of the log secured in the bottom section. The top section of the figure-8 was then secured tightly around a smaller stick that was about 2.5 cm in width and between 60 cm and 1 m in length.

5. Another stick was cut a bit longer than the stakes making up the walls. This stick was forked, making a “Y”. This was pushed into the ground on the same side of the trap as the arc mentioned in Step 3 and close to one end of the wall. The log was then positioned between the walls and the stick attached to the log was placed in the "Y" close to where the vine was tied. This was then held in place until it was secured.

6. A thinner piece of vine or rope was then tied onto the free end of the stick fastened to the log. The loose end of the vine was then tied around a small twig, about 1 cm thick and 2-3 cm long. The vine was long enough to reach the arc on the outside of the wall and remain taut.

7. One end of the small twig in Step 8 was then put under the top of the arc, making a "V" with one side being the twig and the other being the rope or vine. The small twig was then held in place by a longer stick that reached from the end of the twig that was pointing down, through the trap, to the opposing wall. The stick generally has a banana or some other type of fruit attached to it as bait. This stick was then placed carefully, until it was perfectly set to hold the small twig in place. When the bandicoot enters the trap and begins to eat the bait, the trap is triggered, dropping the heavy log.

Cassowary or Other Small Animal Trap (see **Figure 291**)

1. A rope or vine about 60 cm-1 m long was tied to the end of a green (or young) tree. The tree was able to bend and snap back upright when the trap was triggered. For smaller traps, a pliable stick or branch could be cut and stuck securely in the ground instead of using a tree.

2. A slip knot was tied in the loose end of the rope or vine. This was then set aside while the rest of the trap was set up.

3. A small, pliable stick about 1 cm in diameter and 15 cm long was stuck securely in the ground about 30 cm from the base of the tree or stick. Both ends were pushed into the ground to form an arc.

4. An even smaller stick about 1cm in diameter and 5 cm long was stuck into the ground about 15 cm from the center of the arc created in Step 3.

5. The rope attached to the tree was then wound around the middle of a small twig, about .6 cm in diameter and 5 cm long, about 8 cm above the loop at the end. The tree or stick was then bent and the small twig was placed at the top of the arc and secured in the same manner as Step 8 of the Bandicoot Trap with a longer stick securing the trap between the twig and the smaller stick of Step 4.

6. The loop at the end of the rope was then carefully placed on top of the stick holding the trap in place and bait was placed around the loop. When the animal begins to eat the bait, its leg will kick the longer stick, triggering the trap. Its foot will then be caught by the loop made with the slip knot and the animal will be held in place by the tension created by the pliable tree or stick.

***Global Market Consequence:***

Traps and their various parts have the potential to enhance the way environmentalists, biologists, and ecologists go about restraining animals in field research. Although many conventional traps are considered humane, animals frequently hurt themselves trying to escape. Many traps, especially big game traps, use a metal snare to trap their prey. The traps used by the Qaqets not only eliminate prolonged pain for the animal but also utilize natural materials. Havahart, Pest Products, Tomahawk Live Trap, Tru-Catch, Humane Way, and Safeguard are just a few of the many companies trying to promote and market humane animal traps. Although the bandicoot is killed by the falling log, the trap could easily be modified. A cage or bars could fixed on either end of the log so that once the trap is triggered the log falls creating a cage and the animal is trapped inside. The actual trigger mechanism could be adapted for use as a remote trigger device for cameras, video cameras, radios, recording devices, and detonation devices.

## Tolai Bandicoot Traps

### Bludgeon Trap

There are two types of bandicoot traps in Navunaram. This one is designed to stun or bludgeon bandicoots or other small animals. Frequently, a number of these traps are set and checked periodically. Since it is triggered by the prey, it does not require constant supervision or maintenance. Though there are specific materials mentioned in the ***How To*** description, this trap can be made from any materials available.

| | |
|---|---|
| ***Origin:*** | Navunaram, East New Britain, Papua New Guinea |
| ***Source*** | James Wartovo |
| ***Chronicler(s):*** | Julia Elizabeth Craig, Hector Javier Feliciano-Ayala, and Michael Patrick Venable |
| ***Date Entered:*** | June 2012 |
| ***Related Item(s):*** | Bandicoot Trap (p.136) |
| ***Explanation of variation:*** | Depending on the location where the trap is made, the resources used to build the trap may vary. The bait used to attract the prey may also differ depending on what is available and what prey the trap is for. This particular trap is designed to hunt bandicoots; however, the size of the trap can be adjusted as needed depending on the type of prey. |

***How to:***

1. 14 stakes, each approximately 60 cm long, were placed in the ground in pairs forming two parallel rows, with one meter between each pair and 13 cm between the rows.

2. 11 gorgor stems were stacked horizontally between the pairs of stakes in each row to create walls. Since the stems were uneven, the end where the gorgor stems were stacked highest was the front of the trap to keep prey from escaping. Strips of banana bark were wrapped around each pair of stakes just above the gorgor stems to secure the walls.

3. A log, 15 cm in diameter and 2 m long, was laid horizontally between the two gorgor walls. A stick, roughly 1 m long and forked to form a "Y", was stuck in the ground at an angle with the "Y" above the trap. The ends of a strip of cane were tied together making a loop (see **Figure 292**). It was adjusted to ensure the log would hang just above the gorgor walls.

4. One end of a rope measuring 60 cm long was tied to the end of a stick that was one meter long. A 15 cm twig was tied to the other end of the rope. The meter long stick was placed in the cane loop at the end of the log and placed on the "Y" stick, lifting the log off of the ground. One person held the stick in place while another set the trigger.

5. Another 15 cm twig was stuck through the gorgor stems two from the top on both walls. The stick was placed in the middle of the trap. The rope with the twig was placed into the trap on the right side of the log (see **Figure 293**) and the twig was hooked under the twig that lay across the walls (see **Figure 294**). Another 15 cm twig was then wedged between the two walls below the twig already in place and behind the twig tied to the string, keeping the trigger set with the tension on the rope (see **Figure 295**). Once triggered, the rope released and the log fell to the ground. (See **Figure 296**)

### Slip-Knot Trap

This bandicoot slip-knot trap is designed to ensnare bandicoots or other small animals. Frequently, a number of these traps are set and checked periodically. Since it is triggered by the prey, it does not require constant supervision or maintenance. Though there are specific materials mentioned in the ***How To*** description, this trap can be made from any materials available.

| | |
|---|---|
| ***Origin:*** | Navunaram, East New Britain, Papua New Guinea |
| ***Source:*** | James Wartovo |
| ***Chronicler(s):*** | Julia Elizabeth Craig, Hector Javier Feliciano-Ayala, and Michael Patrick Venable |
| ***Date Entered:*** | June 2012 |
| ***Related Item(s):*** | Cassowary or Other Small Animal Trap (p.136) |

***How to:***

1. Four 15-centimeter stakes were placed in the ground in pairs. The two pairs were placed 12 cm apart (see **Figure 297**). The skin from the top of a Buai palm tree was placed between each pair of stakes forming an arc. Two 20-centimeter sticks were then placed at the top of the pairs of stakes that one stick was in front and the other behind (see **Figure 298**). Using banana tree bark, the perpendicular sticks were tied to the stakes forming a "Π" (see **Figure 299**).

2. A 1.3 m stick, green enough to bend but strong enough not to break, was placed in the ground 1-1.3 m from the open end and angled toward the trap slightly (see **Figure 300**). A string, 1.5-2 m long, was then tied around the top of the 1.3 m stick. A 10-centimeter twig was then tied to the middle of the string. The rest of the string at the opposite end of the 1.3 m stick was then tied into a slip knot.

3. A small slit was then made in the middle of two leaves from a palm frond, each leaf roughly 30 cm long. The two leaves were put in the ground directly inside the stakes with the slits facing inward (see **Figures 301 & 302**). The 1.3 m stick was then bent downward toward the front of the trap just enough so the twig attached to the string could fit vertically between the two 20-centimeter sticks.

4. The top of the twig was then hooked to the front stick (see **Figure 303**). A 15 cm twig was placed across the front of the stakes and behind the bottom end of the vertical twig. The pressure of the green stick pulling up on the string held the trigger in place. The string can also be placed behind both sticks instead of between them (see **Figure 304**). When the trap is triggered it will fling the bandicoot out of the trap instead of suspending it in the trap.

5. The sides of the slip knot were fitted into the slits of the palm leaves to hold it open. (See **Figure 305**) When the trap is triggered the bandicoot is snared in the slip knot and suspended in the opening of the trap.

***Global Market Consequence:***

There are a number of traps of varying design and material on the market already. However, the Tolai Bandicoot traps and Qaqet traps provide an all-natural, sustainable trap design that may be of interest. There are a wide-range of designs out there already, the owners of which may be interested in the information provided in these trust items. Woodstream Corporation developed an animal trap with a door that closes when triggered by the animal stepping on a pedal. Innovators Lian Hing Teo of Singapore and Kurt D. Beauregard have designs for a collapsible crab trap and force lever for a foothold trap respectively. Other companies and innovators that may be interested in this information include Quickturn Design Systems, Inc.; BASF Corporation; Axis Systems, Inc.; Octopus Technologies PTY Ltd.; Synopsys, Inc.; Charles Ponzo; Roger H. Morton; VM Products, Inc.; Robert E. Wyman; Robert J. Rhodes; Ignacio L. Ruiz; Oneida Victor, Inc., Ltd.; Edward J. Medvetz; Leonard C. Johnson; and Donald R. Lee.

One of the more versatile aspects of the traps is the triggering mechanism. The information found in these items could have numerous applications in the field of remote triggering. Remote triggers are not just used in traps. James M. Powers developed a firework launcher with a cartridge advancer that utilizes remote triggering. Illinois Tool Works, Inc. uses remote triggering in their extended arm trigger for power tools. It is also found in breaking mechanisms for movable electronics (Thyssen Krupp Aufzugswerke GmbH), devices used in spinal surgery to correct scoliosis (SpineCore, Inc.), and security devices (Motedo Co., Ltd.). Other companies that may be interested in the information provided include Hilti Aktiengesellschaft; Krauss-Maffei Wegmann GmbH & Co. KG; Oerlikon Contraves AG; BIC Corporation; Milwaukee Electrical Tool Corporation; Black & Decker, Inc.; Umagination Labs, L.P.; Baker Hughes Incorporated; Mitsubishi Denki Kabushiki Kaisha; Inventio AG; Otis Elevator Company; Westinghouse Electric Corp; Kone Corporation; Hitachi, Ltd.; Warsaw Orthopedic, Inc.; St. Francis Medical Technologies, Inc.; DePuy Spine, Inc.; Spartek Medical, Inc.; Zimmer Spine, Inc.; Archusorthopedics, Inc.; Spinal Concepts, Inc.; Intrinsic Therapeutics, Inc.; Hi-G-Tek Ltd.; Terahop Networks, Inc.; Savi Technology, Inc.; Francotyp-Postalia GmbH.

# Images for Hunting Techniques

## Fish Trap

**Figure 281:** Once the ring of cane has been secured, small cane stalks are tied around the ring with the thorns pointing downward.

**Figure 282:** Gaga leaves are added to the outside of the trap and folded down to create a cone shape.

**Figure 283:** A thin piece of bark string is tied around the tops of the cane stalks to maintain the trap's shape.

**Figure 284:** The stick on the bottom is used to secure the trap on coral reefs so it does not float away.

## Megapode Egg Gathering

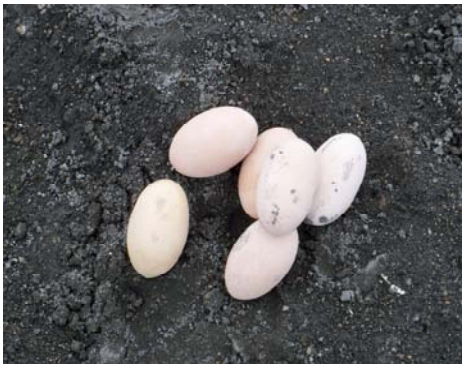

**Figure 285:** Generally, Megapode eggs are sold in groups of four at 2 Kina each.

**Figure 286:** At the base of the volcano, there is no shortage of Megapode nests making egg hunting a sustainable operation.

**Figure 287:** After locating a nest, the diggers use shovels to clear out the majority of the ash.

**Figure 288:** Once they reach hard ground, they begin to dig slowly using their hands.

**Figure 289:** When found, the eggs are carefully removed, cleaned, and set aside while the diggers continue hunting.

## Qaqet Bandicoot and Cassowary Traps

**Figure 290:** The triggering mechanism is located inside the trap. Once it has been triggered, the log is released.

**Figure 291:** When the horizontal twig is disturbed, the pliable branch springs back capturing the animal's leg in the slip knot at the end of the rope.

## Tolai Bandicoot Traps

**Figure 292:** A loop of cane is positioned around one end of the log and hooked onto the meter stick to suspend the log just above the gorgor walls.

**Figure 293:** A string is tied to the end of the meter long stick and put into the trap on the right side of the log.

**Figure 294:** A twig is put through the gorgor walls to hold the trigger in place. The twig on the string is hooked behind the twig across the trap.

**Figure 295:** Another twig just long enough to reach across the trap is placed in front of the twig on the rope to set the trigger. When the prey enters, it is this twig that springs the trap.

**Figure 296:** Once triggered, the log will fall to the ground stunning or bludgeoning the prey.

**Figure 297:** Two pairs of stakes are put in the ground 15 centimeters apart. The skin from the top of a betelnut palm was placed between the pairs, forming an arc.

**Figure 298:** Two sticks are tied parallel to each other at the top of the pairs of stakes.

**Figure 299:** The sticks must be tied together very well as they are what keeps the trap together and holds the trigger in place. The sticks and stakes must be as stable as possible.

**Figure 300:** A green stick is stuck in the ground at an angle about a meter in front of the entrance of the trap. A string is tied to the top of it with a twig tied in the middle and a slip knot on the other end.

**Figure 301:** Two leaves from a palm frond are placed inside the stakes with the veins outward.

**Figure 302:** Slits are cut in the palm leaves to hold the sides of the slip-knot open, making it possible to catch the bandicoot or other small animal.

**Figure 303:** The string is threaded between the sticks at the top. The twig in the middle of the string is hooked on the front stick and a small twig is placed across the entrance behind the twig on the string, holding the trigger in place. The edges of the slip-knot are placed in the slits on the leaves.

**Figure 304:** The trigger can also be set on the back stick. Instead of suspending the prey in the opening of the trap, this configuration flings the prey out of the trap.

**Figure 305:** When finished, the slip-knot trap should look like the above image.

## Industrial Processes

### Milk-based Alcohol Distillation

Distilling alcohol from milk products is a long-standing tradition in the Selenge province as well as many other parts of the Mongolian countryside. While goat milk is used most often, cow or sheep milk can also be used. Horse milk, however, is not distilled, as the resulting product is green.

***Local Name(s):*** Erech

***Origin:*** Selenge Province (Mongolia)

***Source:*** Norjmaa, Budhand, Ganerdene

***Chronicler(s):*** Katherine Irene Martin

***Date Entered:*** June 2011

***Related Item(s):*** **Nermel Arhi** (p.68)

***How To:***

1. The curved metal pan on top of the central stove was filled with the yogurt remaining from the butter making process (see **Figure 306**). A fire was then built in the stove using dried manure as fuel. The yogurt was left to heat and stirred occasionally until it boiled.

2. Once the yogurt began to boil, a metal cylinder, called a burcher, about 45 cm in diameter and 60 cm in height, was placed in the curved metal pan and boiling yogurt. A small pot was suspended in the middle of the cylinder by securing it to the outside with strings (see **Figure 307**).

3. Another curved metal pan, called a jileuch, was then placed on the top of the metal cylinder with the concave side up (see **Figure 308**). A length of cloth was wrapped around the edges of this second curved metal pan to create a seal keeping steam from escaping (see **Figure 309**). The cloth was secured by tying a rope tightly around the outside (see **Figure 310**).

4. Cold water was poured into the curved metal pan on the top and changed when it started to get hot. The cold water caused the steam from the boiling yogurt to condense and drip from the bottom of the curve on the pan ultimately dripping the alcohol into the pot suspended just under the curve. Usually, the water needs to be changed three or four times before the process is finished (see **Figure 311**).

5. After 15 to 20 minutes, the process was completed and the top curved metal pan was removed as well as the suspended pot containing the alcohol (see **Figure 312**). All of these steps were then repeated with the remainder of the yogurt.

6. If desired, the alcohol distilled from this first processing can be mixed back into the boiling yogurt and distilled for a second time to create a much stronger alcohol, called “hortz”.

***Global Market Consequence:***

The Mongolian nomadic tradition of distilling milk-based alcohol is reminiscent of the processes used to distill other spirits, but it is a process that can also be used in the desalination and sanitation of water. The distillation process utilizes metal pots and covers to heat milk as well as cold water to condense the steam making it possible to collect the alcohol. If salt water replaced the yogurt in the process, it would result in fresh water from a salt water source. This process could be utilized by people living in areas where clean water sources are scarce or those who have been affected by natural disasters. Since the heat source is simply fire and the only materials required are metal containers, this method is easily reproducible in any area.

Aquamove is a mobile water treatment systems company that could great benefit from this technology. The nomadic lifestyle is one that is constantly on the move, so they must be able to take these resources with them. The same principle can be applied to what Aquamove does. If they were to aid a disaster area in need of water, they would have a system that works anywhere. Biwater and Sirco Industrial are two water and wastewater treatment companies that could make use of the separation that happens during the evaporation process of the milk distillation. In dealing with wastewater, they could renew the water by separating the water from the pathogens of the waste.

**Solar Dryer**

The solar dryer at Pacific Spices is constructed similarly to a green house and utilizes the heat from the sun to dry the contents (see **Figure 313**). All of the products that need to be dried at Pacific Spices are dried in the solar dryer.

| | |
|---|---|
| ***Origin:*** | Pacific Spices (Papua New Guinea, East New Britain) |
| ***Source:*** | Pacific Spices Staff |
| ***Chronicler(s):*** | Katherine Irene Martin |
| ***Date Entered:*** | June 2009 |
| ***Explanation of Variation:*** | The drying time depends on the materials being processed and on the sunlight exposure in the area. This variability requires flexibility of the processing schedule. |

***How To:***

Frosted glass panels were placed on a wooden frame to create the actual building of the dryer. The drying racks inside are metal frames which are stocked with trays made with a metal frame covered with a mesh material.

***Global Market Consequence:***

Alternatives to external heat source drying techniques are necessary as countries seek to contain the use of combustion as one strategy to limit greenhouse gas emissions. A number of solar dryer techniques are known and sold in the commercial market. Arjun Energy Corporation, Solsen Solar, Ensemble Systems, Kotak Urja Private Limited, Shiv Jyothi Enterprises, Planters Energy Network, and Pathak Aditya Solar Shop are just a few of the companies currently marketing similar products. One item that could be considered both for external and solar heat source dryers is the condensing opportunity to extract pure water from the exhaust from the dryers.

# Images for Industrial Processes

## Milk-based Alcohol Distillation

**Figure 306:** The yogurt left after churning is poured into a curved pan to boil.

**Figure 307:** A small pot is suspended in the middle of the metal cylinder by strings tied to its handles and the outside of the cylinder.

**Figure 308:** Another curved pan is placed on top of the cylinder.

**Figure 309:** A cloth is wrapped around the edge of the cylinder and curved pan. This is wrapped tightly so as to seal the steam inside the cylinder.

**Figure 310:** The cloth is held in place by a rope tied around the edge as well.

**Figure 311:** Cold water is poured into the top pan to condense the steam. The condensed water will drip into the pot suspended in the cylinder. The water is changed whenever it starts to get warm.

**Figure 312:** When the alcohol is collected from the pot, it is poured into copper or silver drinking bowls.

## Solar Dryer

**Figure 313:** Batches of spices and plants for processing are distributed evenly on screen trays and left to dry in the solar dryer.

## Natural Remedies

### Anuknuk (Elephant Grass)

As an indigenous plant of Papua New Guinea, anuknuk can be found in abundance in personal gardens and the wild. It is a leafy plant that grows about 20 centimeters tall and has circular leaves about 5 centimeters in diameter (see **Figure 314**). It is used to sharpen memory. Frequently, parents add a few leaves to their children's lunches to help with brain function.

***Origin:*** Ralauana (Papua New Guinea, East New Britain)

***Source:*** Eunice and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

The leaves of the anuknuk plant are either consumed directly or steeped in hot water which is then drunk as a tea.

***Global Market Consequence:***

The Raluana community uses the Anuknuk plant to help sharpen memory. There were no formal tests performed on the Anuknuk plant; however, further research may find that this plant could prove to be an effective medicine for treating and preventing memory loss. Alzheimer's disease is a disease that effects aging adults and causes them to progressively lose their memory. The first symptoms generally involve memory loss regarding common issues. Anuknuk could help those suffering from Alzheimer's by providing a medicine that could potentially slow or prevent memory loss especially during the early stages of the disease. Since Anuknuk is naturally grown and processed, the side effects may be less severe or even non-existent as opposed to current medications that aid memory.

### Arlatka

Arlatka is a tree that grows in the mountain ranges of East New Britain. (see **Figure 315**)

***Origin:*** Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Alois Nguinga

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

***Related Item(s):*** **Artilka** (p.148)

***How To:***

The bark from the interior of the tree can be collected and combined with water to form a paste-like substance (see **Figure 316**). The bark substance itself can be applied directly to the affliction or dressings can be soaked in the water produced from the bark mixture. The solution usually treats the ailment within a matter of days. The fumes from the combination of bark and water can also be inhaled to treat internal illness.

***Global Market Consequence:***

There is much to be learned from the traditional healers in Papua New Guinea and more research could be done to further understand these unique medicines. The two medicines with anti-inflammatory properties should be researched and explored as a possible treatment for lymphedema, edema, and general swelling. As maintained in the provisions of the Trust, anyone seeking to use this knowledge must be given permission and any research and findings must be shared with the original stewards of this knowledge.

**Artilka**

Artilka is a tree that generally grows in higher elevations that is used to reduce swelling, pain, and to treat illness. (see **Figure 317**)

***Origin:*** Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Alois Nguinga

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

***Related Item(s):*** **Arlatka** (p.147)

***How To:***

The white sap and interior bark from the tree is collected and mixed with water to form a mixture roughly the consistency of paste. This mixture can be applied to swollen or painful areas or its fumes can be inhaled to cure illness.

***Global Market Consequence:***

There is much to be learned from the traditional healers in Papua New Guinea and more research could be done to further understand these unique medicines. The two medicines with anti-inflammatory properties should be researched and explored as a possible treatment for lymphedema, edema, and general swelling. As maintained in the provisions of the Trust, anyone seeking to use this knowledge must be given permission and any research and findings must be shared with the original stewards of this knowledge.

**Betelnut**

Betelnut is chewed in social situations in Papua New Guinea. It acts as a stimulant and is exchanged when greeting people, whether they are new acquaintances or old friends.

***Local Name(s):*** Buai

***Origin:*** Pacific Spices, Komgi, Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Pacific Spices

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

***How To:***

Traditionally, the interior portion of the nut is chewed with either mustard stick (dakka) or leaf as well as a limestone compound produced from ground coral or sea shells. Neither of these factors contributes to the stimulant or effect the nut, but they produce the traditional, bright red mixture. Apart from its stimulant properties, Betelnut is also useful as a gastric cleanser. The lime is known to cause mouth and stomach cancer and leads to acid-caused stomach ulcers, especially if swallowed. It is also quite effective at preventing bad breath. The reason for this is unknown.

**Buabua**

Buabua is a plant that can be used to treat constipation and stomach aches. (see **Figure 318**)

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

The leaves of the Buabua plant are ground up and the juice is squeezed into cool water. This is drunk as a cold tea.

***Global Market Consequence:***

Buabua is used to treat constipation and stomach aches. The fact that it is a natural remedy could suggest that it has fewer side effects than mainstream medicines. Some side effects from these other medicines are hearing loss, ringing in the ears, severe constipation, severe allergic reactions like outbreaks of hives, and vomiting. Although no tests were found regarding the Buabua plant, its observed effectiveness and simple administration imply a less aggressive treatment of constipation and stomach aches.

**Daval Na Lotu (Holy Plant)**

Daval Na Lotu grows around one meter tall and has oval shaped leaves that are about two and a half centimeters wide and five centimeters long (see **Figure 319**). Frequently, the people of East New Britain use Daval Na Lotu for headaches, internal body aches, and sore muscles.

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

Daval Na Lotu can be used in one of two ways. For headaches or internal body aches, the leaves of the plant can be steeped and made into a hot tea to drink. For external body aches like sore muscles, the leaves can be pulverized, mixed with limestone, and rubbed onto the affected area.

***Global Market Consequence:***

Daval Na Lotu is an effective remedy for headaches and muscle aches. The muscle relaxing properties found in Daval Na Lotu, can be used in physical therapy and massage therapy treatments. It could also be beneficial in sports creams, similar to Icy Hot, that help relax sore muscles. Typically headache treatments are administered in a pill form. Drinking Daval Na Lotu as a cold tea provides an alternative method for the treatment of headaches.

**Guava**

Guava is a common fruit in Papua New Guinea with several different strains. Apart from being sweet and useful in cooking, it also has been know to treat gastrointestinal problems and is a natural antioxidant.

***Origin:*** Pacific Spices, Komgi, Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Theresa Arek

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

***How To:***

Guava can be eaten directly or its leaves can be dried or boiled then consumed to treat gastrointestinal and respiratory problems. The leaves can also be added to a warm bath to treat a variety of skin disorders.

***Global Market Consequence:***

There are a number of companies that currently manufacture guava extract (Psidium guajava) and the market demand is growing for all-natural medicines.

**Kaia**

Kaia is used to help heal wounds. (see **Figure 320**)

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

For fresh cuts, a leaf off the Kaia plant is crushed and rubbed on the wound. This method is commonly used as a natural antiseptic. Frequently, Kaia will be used to clean the wound before other actions can be taken to dress it.

***Global Market Consequence:***

Kaia is used to aid in the healing of open cuts. Studies identifying the active property in Kaia have not yet been conducted, but its use suggests it as a viable medicinal source. Kaia works in a similar way to an antiseptic. The leaves of this plant could be processed to produce antiseptic oil, making it a product that can be shipped efficiently. The oil of the Kaia plant could also be used in antibacterial creams serving a similar purpose as Neosporin.

**Kar-Akar**

Kar-Akar is a meter tall plant with reddish-purple leaves (see **Figure 321**). It is used to cleanse the gastrointestinal system and relieve stomach aches.

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

The leaves of the Kar-Akar plant are crushed, usually by rubbing them between the hands, and then squeezed into a glass of cool water, which is then drunk.

***Global Market Consequence:***

Kar-Akar is an indigenous plant of East New Britain, and is said to be beneficial in relieving gastrointestinal problems. Though studies were not found on Kar-Akar, its widespread use in the Raluana community suggests it has been an effective treatment. Peptic ulcers are open sores, which can form on the esophagus, upper small intestine, or inside lining of the stomach and cause extreme abdominal pain. It is highly recommended when a person has a peptic ulcer not to take any painkillers, as it will make the symptoms worse. Kar-Akar, which is drunk as a cold tea, can be an effective alternative to treating peptic ulcers. Because Kar-Akar is a natural remedy to stomach problems, it is less likely to contain the harsh chemicals found in many painkillers that can irritate ulcers and damage stomach lining. This will allow for the discomfort to be relieved without generic painkillers.

**Karangon**

Karangon is often planted near homes or communal buildings to repel snakes. (see **Figure 322**)

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

Community members plant Karangon near their front gates or around their homes, as the smell of the plant serves as deterrent for snakes. In Raluana, it is customary to rub Karangon leaves on objects to ward of bad energy. When demonstrating how to make the large fish traps, the pulverized leaves were rubbed along the outside of the trap after it was completed, with the explanation that if this was not done, the fisherman would not have been able to catch any fish.

***Global Market Consequence:***

Karangon is often planted around houses to ward off snakes. Although the repellent property in Karangon is yet unidentified, it seems to be similar to camphor, a compound found to be an effective plasticizer, insect and snake repellent. Karangon could be converted into oil, which could then be used in products similar to snake repellants made by companies such as Terminix® and Liquid Fence®.

**Noni**

Noni, although somewhat well-known on the international scale, is a common remedy in Papua New Guinea used to treat ulcers, corns, and warts.

***Origin:*** Pacific Spices, Komgi, Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Theresa Arek

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

**Other Remedies**

We were made aware of a bush that grows on the coast that is used as a cure for hypertension. We were also made aware of a series of remedies used as cures for oral and gastrointestinal cancers. We were told of an algae bloom found in the sea that, when taken, results in 24-48 hours of extreme gastrointestinal distress but is a prophylactic for malaria. All of these were mentioned but the precise nature of the remedy and its source was not shared. It is important to note in this section that healing remedies are communally held and, as such, ethnobotanists who seek to expropriate knowledge by exploiting an individual arrangement with an individual person - regardless of "informed consent" or "compensation" nature of an individual agreement - does so in explicit violation of community values and in implicit violation of the Convention on Biodiversity and other standards protecting local knowledge.

***Origin:*** Papua New Guinea

***Chronicler:*** Taylor Lynn Starns

***Date Entered:*** June 2009

**Papaya**

Papaya is a common fruit in Papua New Guinea and is sometimes used for medicinal purposes. The seeds possess properties that can treat a patient suffering from symptoms of malaria.

***Origin:*** Pacific Spices, Komgi, Raunsepna/Anesmetki (Papua New Guinea, East New Britain)

***Source:*** Theresa Arek

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

**Papu**

Papu is a plant that is used to help mend broken bones. (see **Figure 323**)

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

The leaves of this plant are crushed up and squeezed into water to make a cold water tea which is then drunk. It speeds the process for recovering from the injury.

***Global Market Consequence:***

Papu is used to speed up the recovery process for broken bones. There have not been studies conducted to discover the active ingredient in Papu, but its use suggests this as an effective treatment. However, it could help reverse the effects of osteoporosis, the decrease in bone density that leads to fragile bones. Papu could be used to help stabilize and build bone density. In athletics, broken bones occur frequently and players are expected to make a quick recovery. In these cases, Papu may be utilized in a form similar to a cortisone shot, to speed up the process of mending the athlete's bones.

**Purkut**

Purkut is used to treat intestinal problems like dysentery. (see **Figure 324**)

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

Leaves from the Purkut plant are squeezed and mixed into water to form a cold water tea, which the infected person then drinks.

***Global Market Consequence:***

Purkut is used in the treatment of dysentery. There have not been any tests done to identify the property in Purkut that treats this disease, but its widespread use in the community of Raluana suggests it is an effective treatment. Dysentery is a disease that results in severe diarrhea. The property found in Purkut may be useful in the development of natural medicines similar to Pepto Bismal, a medicine used to treat a wide range of gastrointestinal problems.

**Rolina**

Rolina is a fruit produced from the cross between a custard apple and sour sop. The fruit itself is not indigenous to Papua New Guinea and exists as the result of lab research.

***Origin:*** Pacific Spices

***Source:*** Theresa Arek

***Chronicler(s):*** Taylor Lynn Starns

***Date Entered:*** June 2009

***How To:***

The seeds from the Rolina fruit are ground and mixed with oil to create a natural pesticide.

***Global Market Consequence:***

The natural properties of the Rolina seed that make it an organic pesticide are unknown. Researching and identifying what makes it so effective could be a solution to the world-wide issue with harmful conventional pesticides containing toxic chemicals. Arbico Organics is a company committed to promoting, producing, and supplying natural pest control products. This organic product could be a valuable addition to the market of effective, all-natural pesticides.

**Shar**

One of the byproducts from the cheese making process is the water that is strained from the liquid mixture, referred to simply as "yellow water" (see **Figure 325**). This yellow water drips out of the bag used to make cheese as it dries and also is a byproduct of the distillation of milk to make erech (a dairy based vodka) (see **Figure 326**). The water itself is a pale, translucent-yellow color, has the strong smell of yogurt, and a mild flavor with a slight bitter taste similar to that of the water that separates when refrigerated yogurt is left to sit.

***Origin:*** Selenge Province (Mongolia)

***Source:*** Ganerdene, Tsendjaw, Norjmaa

***Chronicler(s):*** Katherine Irene Martin

***Date Entered:*** June 2011

***How To:***

Shar is used for two main purposes. Often times it is consumed as is to help flush the digestive tract, however, it must be ingested in moderation because ingesting too much often leads to diarrhea. Secondly, young children are often bathed in the water because it helps to protect the skin from dryness during cold weather and reduces the appearance of scars. It is also believed to be a good preventer of the common cold.

***Global Market Consequence:***

While yellow water has many uses, it is most commonly used as a laxative. There are a wide range of materials used in the manufacturing of pharmaceuticals and yellow water could be an addition to prescription and over-the-counter drugs used to address digestive health. Yellow water would be most efficiently used by pharmaceutical companies such as Commonwealth Scientific and Industrial Research Organisation, Salix Pharmaceuticals, Ltd, Ganeden Biotech Inc, and E-Z-Em, Inc which all deal in either laxatives or multi-use digestion aids. Yellow water also has the potential for use in the beauty product industry as well as the cold and flu pharmaceutical sector because it is also used in skin rejuvenation and cold prevention.

Commonwealth Scientific and Industrial Research Organization is a company that deals with several different schools of scientific thought, but has several patents on bowel health specifically. They have utilized wheat starch to improve bowel health, but could potentially research the pros and cons of the effects that yellow water has on bowel movements and at the same time investigate its usefulness as skin protection and cold prevention. It could do the necessary research to find out if there is a specific solution that the yellow water comes out as that can be mass produced or reproduced synthetically in pill form to give relief to many who find themselves constipated for any reason. Each of the companies listed above could provide the same opportunities for the use of yellow water as a laxative or other medicinal uses.

**Sohor Khar**

Sohor Khar is the medicinal use of a beetle found in the Arkhangai province of Mongolia (see **Figure 327**). The knowledge of this beetle had been passed down within Dr. Aruinna's family. It is a rectal pain reliever.

***Origin:*** Arkhangai aimag (Mongolia)

***Source:*** Dr. Aruinna

***Chronicler(s):*** Kenneth Andrew Dabkowski

***Date Entered:*** August 2010

***How To:***

To prepare the treatment, a live beetle is placed into 100 grams of Ariuna (pronounced Ar-hi). Immediately before the bug dies, it "explodes" and releases a foam. This foam, mixed with Ariuna becomes a medicine. It is to be drunk three times per day slowly until the solution is gone.

***Global Market Consequence:***

There has been ongoing global research and development in the area of cures for cancer. Hemorrhoids and rectal pain have current treatments, but this could provide another option for treatment. Companies which may be interested in this product include but are not limited to pharmaceutical companies such as Pfizer, Johnson and Johnson, Roche, GlaxoSmithKline, Novartis, Sanofi-Aventis, AstraZeneca, Abbot Labs, Merck&Co., Bayer HealthCare, Eli Lilly, Bristol-Myers Squibb, Genzyme, Genetech, Proctor and Gamble, Gilead Sciences, and Sinopharm.

**Sour Sop**

The Sour Sop is the fruit found on a Graviola Tree and is a natural cancer cell killer. The juice itself is all natural and has little to no negative side effects.

| | |
|---|---|
| ***Origin:*** | Papua New Guinea |
| ***Source:*** | Henry Kila |
| ***Chronicler(s):*** | Caitlin Elizabeth Boyd and Katherine Irene Martin |
| ***Date Entered:*** | February 2010 |
| ***Explanation of Variation:*** | It can be used for the treatment of cancer. Besides being a cancer remedy, the fruit is a broad spectrum antimicrobial agent for both bacterial and fungal infections, is effective against internal parasites and worms, lowers high blood pressure and is used to treat depression, stress, and nervous disorders. |

***How To:***

The fruit on the Graviola tree is large and the white pulp is eaten out of hand or, more commonly used to make fruit drinks and sherbets.

***Global Market Consequence:***

The principal interest in this plant is its strong anti-cancer effects. Although it is effective for a number of medical conditions, it is its anti-tumor effect that is of most interest.

Research shows that with extracts from this tree it may be possible to:
* Attack cancer safely and effectively with an all-natural therapy that does not cause extreme nausea or weight and hair loss.
* Protect the immune system and avoid deadly infections.
* Help patients feel stronger and healthier through treatment.
* Boost patients' energy and improve their outlook on life.

Extracts from the tree were found to effectively target and kill malignant cells in 12 types of cancer including colon, breast, prostate, lung, and pancreatic cancer. Various parts of the Graviola tree-- including the bark, leaves, roots, fruit and fruit-seeds have been used for centuries by medicine men and native Indians in South America to treat heart disease, asthma, liver problems, and arthritis.

**Tavan Salaa**

Tavan Salaa is a small weed like plant that grows in the Arkhangai province in Western Mongolia (see **Figure 328**). The only part of the plant that is used medicinally is the leaves found at the bottom of the plant. The seeds and top portions of the tavan salaa plant are not harmful if ingested, however, there is no known medicinal benefit derived from these parts of the plant.

| | |
|---|---|
| ***Origin:*** | Arkhangai Province (Mongolia) |
| ***Source:*** | Bat-Erdene .B |
| ***Chronicler(s):*** | Katherine Irene Martin |
| ***Date Entered:*** | June 2011 |

***How To:***

The leaves can either be boiled into a tea and ingested to relieve severe stomach and joint pains as well as tonsil infections or applied directly to a cut, abrasion, or laceration to act as a bandage and speed up the healing process.

***Global Market Consequence:***

This is a weed that is used exclusively for medicinal purposes. It can be ingested and placed onto the skin as a natural remedy. It is boiled into tea or ingested in its solid state. It helps relieve and treat joint pain, stomach pain and tonsil infections. There are several pharmaceutical companies and vitamin companies that could benefit from researching this plant and potentially incorporating it into their products. GNC is a company that sells and develops products for joint health. Remedies such as Instaflex™ and TriFlex™ are vitamins taken to promote joint health. Companies who manufacture and develop dietary supplements could utilize teas and other liquid applications that allow the vitamins to be absorbed without swallowing a pill.

**Tilivuva**

Tilivuva is used to treat skin fungi. This particular plant is similar to a creeper plant that grows low to the ground with leaves growing out of either side of the stalk. The leaves are oval shaped and can grow to be around 2.5 centimeters wide and 8 centimeters long (see **Figure 329**).

***Origin:*** Raluana (Papua New Guinea, East New Britain)

***Source:*** Eunice and Leba

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

The leaves are ground up and massaged onto the area affected by the fungus.

***Global Market Consequence:***

No studies could be found that identified the active ingredient in Tilivuva, however, it is used to treat a wide range of fungal skin infections. Tilivuva leaves are ground up and massaged on the affected area, suggesting the fluids in the leaf have some compound that is effective for fighting these infections. After uncovering what this compound is, it could be used as an ingredient in creams like Lotrimin, which treats athlete's foot. The oil extracted from the Tilivuva leaves could also be used as an ingredient in anti-fungal powders like Tinactin Super Absorbent Powder, which is also used to treat athlete's foot.

# Images for Natural Remedies

## Anuknuk

**Figure 314:** Anuknuk is eaten raw to sharpen memory.

## Arlatka

**Figure 315:** Arlatka tree bark is used to treat swelling and infection.

**Figure 316:** Scrapings of Arlatka bark are mixed with water and applied directly to the affliction which will heal in a matter of days.

## Artilka

**Figure 317:** Cuts are made in the Artilka tree and the sap collected to be mixed with water and used in treatments.

## Buabua

**Figure 318:** Buabua is crushed to make a cold water tea and used to treat constipation.

## Daval Na Lotu (Holy Plant)

**Figure 319:** Daval Na Lotu is used to relax sore muscles and to relieve body aches.

## Kaia

**Figure 320:** Kaia is crushed and rubbed on fresh cuts or wounds to speed the healing process.

## Kar-Akar

**Figure 321:** Kar-Akar is crushed and made into a cold tea to be drunk to relieve stomach aches.

## Karangon

**Figure 322:** Karangon is planted around homes or other common areas to ward off snakes. It is also used customarily as a way to ward off bad energy from an object.

## Papu

**Figure 323:** Papu is made into a cold tea and drunk to expedite the healing of broken bones.

## Purkut

**Figure 324:** Purkut is used to treat conditions like dysentery.

## Shar

**Figure 325:** Shar is collected from the cheese making process. People ingest it directly to alleviate digestive problems and bathe in it to moisturize skin and prevent colds.

**Figure 326:** The milk remaining from the distillation process is poured into a cheesecloth bag so the liquid can drain off.

## Sohor Khar

**Figure 327:** The beetle is dropped into vodka and drunk to relieve rectal pain.

## Tavan Salaa

**Figure 328:** Tavan Salaa is used to relieve severe stomach and joint pain as well as tonsil infections. It is also used as a treatment for cuts, abrasions, and lacerations.

## Tilivuva

**Figure 329:** Tilivuva is used as a treatment for skin fungi.

## Traditional Items

### Bamboo Comb

This particular comb is made by carving a piece of bamboo with a knife. The whole process takes about three-four hours to complete a single comb. As a result of this as well as increased access to modern hygiene materials, the use of the bamboo comb is not a common practice.

***Local Name(s):*** Aqirkasingi

***Origin:*** Alakasam (Papua New Guinea, East New Britain)

***Source:*** Lukas

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

1. A section of bamboo about 12 cm in diameter, open on both ends, was cut to around 25 cm long. This section was then split in half vertically using a bush knife. Then one of the halves was cut in half again. Only one of these pieces was used for the comb.

2. Using a small knife, the piece of bamboo was shaved along the grain to make it as flat as possible while still maintaining the thickness of the bamboo.

3. A cut was made horizontally in the middle of the piece of bamboo. Lukas made sure to carve into the bamboo but not completely through (see **Figure 330**).

4. On one side of the cut, the white part on the inside of the bamboo piece was removed. To do this, the tip of the knife was wedged into the top of the bamboo piece to split the white part away from the outside layer. This was then pulled down to where the cut was made across the middle of the piece of bamboo and removed. Steps 3 and 4 were repeated until the entire white part on the top half was gone.

5. On the thinner side, cuts were made vertically from the top to the middle (about .3 cm apart) (see **Figure 331**). These sections were then made into the teeth of the comb by using a knife to shave down both sides of each cut, peeling away the resulting sections, to create a space between each tooth (see **Figure 332**).

6. On the thicker side, a handle was made by whittling in the sides to reduce the width, creating a tapered handle for a better grip.

7. All the edges of the comb were smoothed out, using a knife, to remove the sharp edges.

8. The tips of the teeth were hardened by holding them in a flame until they were browned. (see **Figure 333**)

***Global Market Consequence:***

The traditional comb serves as an example of how to make a number of environmentally friendly hygiene products. Stores like World Market, Eco Shop, and 10,000 Villages could be potential partners for the direct sale of the comb itself. The design could be adapted on a larger scale to create bamboo gardening tools. At the same time, the pronged design could be modified to make smaller utensils like forks, silverware, salad tongs, and other such kitchen utensils. Companies like Green Garden Tools and Peaceful Valley Farm & Garden Supply are manufacturing environmentally friendly gardening tools and could incorporate the use of organic gardening tools into their product lines. The comb design and materials could also be adapted for use as a comb used on looms for weaving.

**Fire Starting**

When other resources are unavailable, this technique provides a way to start fires for warmth, cooking, and various other purposes. Because of access to lighters and other materials, this technique is not commonly used, but the knowledge is still maintained. This method only requires two materials: a log that is well dried and a bush knife. A sharpened piece of wood cut from the log is used to create friction against the log thus starting the fire. Most often, a specific type of wood is used called Aremacha (wild cocoa), which ignites more rapidly than others.

| | |
|---|---|
| ***Local Name(s):*** | Akguinggi |
| ***Origin:*** | Alakasam (Papua New Guinea, East New Britain) |
| ***Source:*** | Elias Kalunas |
| ***Chronicler(s):*** | Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin |
| ***Date Entered:*** | July 2010 |
| ***Explanation of Variation:*** | The type and size of the log varies depending on the types of wood available and desired size of the fire. However, the type of wood is inconsequential as long as the sharpened piece is the same type as the log. |

***How To:***

1. A flat surface, roughly 20 cm long and about 8 cm wide, was shaved on a log about 1 m long and 15 cm in diameter using a bush knife. The resulting wood shavings were left attached at one end of the flat surface to be used as kindling. (see **Figure 334**)

2. A bush knife was then used to cut a piece of wood (between 20 - 25 cm long) from the same log with one end sharpened to a point.

3. The fire starter got into a position and held the sharpened piece of wood in a way that allowed him to generate the most friction. This varied from person to person based on comfort. (see **Figure 335**)

4. The fire starter then pushed the pointed end of the piece of wood in a back and forth motion toward the end of the flat surface that had the wood shavings, applying pressure to create friction (see **Figure 336**). This generated heat and wood particles, which were gathered and placed with the existing wood shavings. This process was continued until a fire was ignited.

5. Once started, more wood and kindling was added to build the fire (see **Figure 337**).

***Global Market Consequence:***

One of the benefits to starting fires traditionally (with wood instead of modern technology) is that it does not require the use of lighters, which are often times made out of plastic and filled with lighter fluid. The natural technique lessens the trash build up of materials in association with beginning a fire including bags of charcoal, cans for lighter fluid, etc. This type of fire starting could also be integrated into programs like the Boy Scouts as an alternative way to start a fire. According to the Qaqet, the Wild Cocoa wood is said to be the easiest to ignite, suggesting there is some property inherent in the wood that gives it this flammability. After testing, this knowledge could be used in the manufacturing of fire starting materials, replacing lighter fluid for example. The wood itself could be manufactured as starter logs (generally synthetic bricks made using flammable materials used to begin fires) similar to the product distributed by companies like Starter Stikk, Rutland, Jarden Firelog, and Lightstone.

**Qaqet Male Dress**

As a result of access to cities and Western perceived modesty influences introduced by the Catholic Church, Qaqet communities predominantly wear modern clothing styles. Currently the traditional dress for men in Qaqet communities is only used for ceremonies and special occasions. This form of dress is made from Qaqet traditional cloth and rope made from wild cocoa bark.

***Local Name(s):*** Malo

***Origin:*** Alakasam (Papua New Guinea, East New Britain)

***Source:*** Gabrielle

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

1. A piece of cloth was cut to roughly 1 - 1.5 m in length and about 30 cm wide (see **Figure 338**).

2. The rope was measured to fit around the wearer's waist and cut leaving enough on the ends to tie securely. This length will vary based on the size of the person wearing it (see **Figure 339**).

3. The cloth was folded over the middle of the measured rope so that the front flap hung down about 60 cm with the design facing out.

4. A very thin piece of bark was then used to sew across the width of the cloth about 2.5 cm from the top of the fold.

5. The front flap was then fitted to the person, with the short side facing away from the body. The long end was brought between the legs and tied to provide comfort to the wearer.

6. The remaining cloth was then brought up the back and folded over the rope, which was then tied around the wearer's waist, leaving about 60 cm of cloth hanging over the buttocks (see **Figure 340**).

***Global Market Consequence:***

The Qaqet traditional dress uses a tree bark cloth as the material. The bark is beaten until soft and thin, then left to dry in the sun. It takes around three hours to soften the bark, but the drying time varies based on the availability of sunlight. The material is strong, but seems to be thin enough to allow air to flow through the material. The material could be used as a form of natural ventilation for the construction of houses. Because it is thin yet durable, the material may provide an organic way to wall houses in warm regions as it would allow air to pass through while blocking out dust, insects, and other airborne contaminants.

Often times the cloth is decorated with the traditional Qaqet design, which is painted using the seeds of a particular flower that is a natural red paint and charcoal mixed with water (a natural black paint). The traditional dress uses beautiful designs and some members of the community use pieces of the cloth as wall decorations. There are two companies who are already manufacturing all natural wallpaper and wall hangings. Mod Green Pod is a company that primarily uses organic cotton materials to make wallpaper and Cava Company is a company that uses organic, hand-pounded bark material to produce wall coverings, furniture, or lampshades. This bark cloth could also be utilized by artists as an organic type of canvas.

Recently, the bark from the Birch tree has been used to make bed sheets. The bark used to make the traditional cloth could be tested for its usefulness in these sorts of products as well. To make it even more marketable for use in bedding and potentially clothing, the bark could be tested for colorfastness, which would add a level of versatility to the product.

**Sago Washing Troughs**

Sago is a starch extracted from the pith (mumut) of sago palm trees. This starch is a major staple food for the people in New Ireland. A sago palm can be harvested from its 6th year up to the 15th, and generally the older the tree, the more saksak it will produce. The tree is split length wise and the mumut is removed using a tool called the Sapal. The mumut looks like a fine mulch. The saksak is then extracted by kneading and washing the mumut in traditional troughs.

| | |
|---|---|
| ***Local Name(s):*** | Washing – mase, collection – oko |
| ***Origin:*** | Ngavalus (Papua New Guinea, New Ireland) |
| ***Source:*** | Yosis, also known as Joe Mangilang |
| ***Chronicler(s):*** | Sharadha Ramakrishnan |
| ***Date Entered:*** | August 2011 |

***How To:***

There are two main parts to the apparatus; the Oko (the Sago collection trough), and the Mase (the Sago washing trough).

Making the Oko:

1. A section of the soft bark found where the sago fronds attach to the trunk of the tree was removed from the trunk. One end of the section was roughly half a meter wide and tapered off toward the top. The section was cut just over a meter in length.

2. A cut was made half way through the section about 30 centimeters from the edge of the wide end on the convex side (see **Figure 341**). Layers of the bark on the wide end were carefully removed using a bush knife. This was done carefully and evenly until this end was thin enough to fold but not thin enough to break at any point (see **Figure 342**).

3. The thin end of the section was then held over a fire until it was soft enough to fold easily (see **Figure 343**).

4. The thin end was then folded up from the middle and the sides were folded in, sealing off the end of the trough so water would not flow out (see **Figures 344 & 345**). The fold was held together using a green piece of the sago tree that could easily be bent in half around the fold and secured by tying (see **Figure 346**).

5. Because the section cut from the tree naturally forms an arc, cuts were made on the convex side where the bend began (see **Figure 347**). The section was straightened by pushing down at the point opposite the cut on the concave side until it leveled out (see **Figure 348**). This was done so the water and sago would not flow out of the other end of the trough.

Making the Mase:

1. A section of the soft bark found where the sago fronds attach to the trunk of the tree was removed from the trunk. One end of the section was roughly half a meter wide and tapered off toward the top. The section was cut just over a meter in length.

2. A cut was made half way through the section about 30 centimeters from the edge of the wide end on the concave side.

3. Using a bush knife, the bark on the short side of the cut made in Step 2 was shaped to a point at the middle. This was done to direct the water flowing to the Oko.

4. Because the section cut from the tree naturally forms an arc, cuts were made on the convex side where the bend began. The section was straightened by pushing down at the point opposite the cut on the concave side until it leveled out. This was done so the water and sago would not flow out of the other end of the trough.

Assembly: (see **Figure 349**)

1. Supports for the Oko were made using three sections of the curved sago tree bark. The top of the supports was cut in a "U" shape to hold the oko. All of the supports were put in the ground (the biggest at the big end of the oko, the smallest at the opposite end, and another in the middle) with the concave sides facing in different directions. This was done so that the oko did not slide off the supports.

2. On a slight incline, two sections of bamboo were placed in the ground roughly 30 centimeters apart, both cut into a "U" shape at the top. A third bamboo section was then placed on top of the two vertical sections, making a "Π". The support "Π" was placed over the skinnier end of the Oko. A cut was then made in the convex side of the pointed end of the Mase to keep it from sliding off the support. The tail end of the Mase was supported by two sticks put in the ground and secured together forming an "X" or by a tree branch forming a "Y". The Mase was then placed on the supports so the pointed end was over the Oko.

3. A pliable stick roughly one meter long was stuck in the ground beside the part of the Mase with the cut made 30 cm from the pointed end. A bit of silk lap-lap or coconut palm fiber, called niknikis and found where the fronds attach to the trunk, was attached to the end of the mase creating a filter, called the nukit. The bit of fiber or lap-lap was secured to the Mase by using a knife or other thin instrument to push it into the cut. The loose end of the nukit was then tied to the end of the pliable stick so it would pull the filter taut.

4. A second filter made of woven frond-type leaves was placed where the water flowed into the Oko through the filter to catch any small pieces of mumut that may have gotten passed the nukit.

***Global Market Consequence:***

The sago trough system is similar to many water purification systems. There are multiple "tanks" or troughs connected to each other, each filtering the material passing through. While Papua New Guineans use this method for cleaning sago for food production, it's design could be adapted for water purification in areas where fresh water is scarce. Companies such as The Clorox Company, Conair Corporation, 3M, General Electric Company, and PUR produce in-home water filtration products whose methods could adapted to use the design of the washing troughs to develop a more substantial water purification system that utilize materials abundant in various locations.

**Salt Making**

The practice of salt processing within the Komgi community begins with water collection in Lassul Bay, a body of water in the Qaqet region of East New Britain. Traditionally, water was collected in sections of bamboo, but now plastic containers are more commonly used to transport water up to Komgi. Currently, access to packaged salt has reduced the usage of traditional salt making techniques.

| | |
|---|---|
| ***Origin:*** | Komgi (Papua New Guinea, East New Britain) |
| ***Source:*** | Clement Daramum |
| ***Chronicler(s):*** | Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin |
| ***Date Entered:*** | July 2010 |
| ***Explanation of Variation:*** | There are numerous varieties of salt that can be used for anything ranging from cooking to medicine, all of which utilize the resources of Lassul Bay. |

***How To:***

Cooking salt is generally made by pouring the salt water into a section of bamboo, filling it 2/3 of the way. About a tablespoon of freshwater is added, leaving some room for evaporation (see **Figure 350**). Leaves are used to seal the open end of the bamboo. The bamboo is then placed on the embers of a fire and left until brown or until the water has evaporated (see **Figure 351**). In the case of a bamboo section 5 cm in diameter and 25 cm long, the amount of time kept on the fire was roughly four hours. However, the length of time that the bamboo remains in the fire varies based on the size of the bamboo, sometimes needing to be left overnight. (see **Figure 352)**

***Global Market Consequence:***

Natural sea salts are becoming very popular for use in seasoning and as ingredients in exfoliating scrubs. Saltworks is an example of one company that utilizes natural sea salt. One of their products is Cyprus Black Lava Salt which combines salt from a local water source with charcoal produced by volcanic eruptions. The addition of the charcoal adds color, taste, and has been found to detoxify the body. The water from Lassul Bay is not only abundant in salt, but the salt is also very pure as the water is predominantly pollutant free. There are many volcanoes, both active and inactive, in close proximity to the bay. By utilizing the natural salt in the area and partnering with companies like Follywell No. 6 Ltd., Lassul Bay can supply jobs as well as generate an income for the region, from selling salt.

The group also noticed the large amount of salt produced from a very small amount of water. The high salinity of the water was apparent when examining the water in Lassul Bay as well. The ability to extract large amounts of salt from small amounts of water would allow for simpler and environmentally friendly extraction processes. These processes would make it easier to generate an income without over-using resources or using an environmentally destructive means of extraction. The bamboo itself should be studied for its conductive properties and potential use in filtration processes.

**Sling**

Short slings about 30 centimeters long were traditionally used for warfare and provided the user with more accuracy. The short length enables the thrower to get shots off more quickly as less of a wind up is required. On the other hand, longer slings around 60 centimeters in length were commonly used for hunting and distance shooting. This required the thrower to swing it around his or her head multiple times to gain momentum before releasing it on the upswing.

***Local Name(s):*** Elatlatka

***Origin:*** Alakasam (Papua New Guinea, East New Britain)

***Source:*** Michael Guniarik

***Chronicler(s):*** Shannon Jean Augustine, Rodriques Lamar Jackson, and Katherine Irene Martin

***Date Entered:*** July 2010

***How To:***

1. Three sections, 13 cm long and 8 cm wide, were cut from a dried pandanus leaf. When looking at it horizontally, one of these sections was cut 1 cm in from the top and bottom on both ends and 2.5 cm in from either side. This left a 2.5 cm square tab on either end.

2. One un-tabbed section of pandanus was then unfolded. The tabbed section was placed inside of the unfolded section, which was then refolded enclosing the tabbed section entirely (see **Figure 353**). The remaining section was then wrapped around the two sections in the same manner.

3. A knot was tied at one end of each of the two lengths of rope (see **Figure 354**). The knotted ends of the ropes were secured to each side of the pandanus pocket using a small piece of bark string, which was wrapped around both the rope and one side of the pandanus pocket cinching it together. The same process was performed on the other side of the pocket.

4. A loop was tied at the free end of one string to be placed on the thrower's finger to keep it from flying with the projectile. (see **Figure 355**)

***Global Market Consequence:***

The sling is a device that takes practice to achieve proficiency. Mastery of the technique is required to effectively aim and use this weapon. Like nunchucks, Escrima sticks, bo staffs and even rifles, the sling is an example of a weapon that is intriguing because of its level of difficulty. It is not uncommon for people to spend years perfecting the use of these instruments. The introduction of the sling into this genre would add a new and interesting challenge to the world of traditional fighting forums and competitions.

The sling design itself could be adapted for use as a medical sling either for mass production and use or for use in emergency areas where medical supplies are scarce. The rope strings attached to either side of the sling could also be used as an organic shoelace or something of that sort as they are thin but strong enough to be pulled tightly without breaking. On a larger scale, the string technology can be adapted for use for hammocks or similar products.

**Vodka Salutation**

The vodka salutation is a symbolic gesture of friendship between strangers or friends. It is a significant tradition which is done at every first meeting and not participating in the gesture has traditionally been considered disrespectful. Over time, a social conundrum has emerged. It has always been considered honorable to present the first serving of vodka to the guest of honor. The host is expected to pour the serving and hand it to the guest and the guest is obliged to take this gesture of kindness. At times, however, nefarious hosts use this sense of obligation to serve their guest poison. Quite conveniently, as the host does the pouring and the guest of honor does the first drinking, a social convention emerged which blends respect with self-preservation. By developing the blessing described below, divinity and the earth were honored but, with the last blessing of the three, the vodka rolled down the recipient's finger and came in contact with the silver ring that was customarily worn. If the ring discolored, the drinker knew that the vodka was contaminated and potentially poisoned presenting an opportunity to elect not to drink their demise.

| | |
|---|---|
| ***Origin:*** | South Gobi Province (Mongolia) |
| ***Source:*** | Tsend Enkhtuya |
| ***Chronicler(s):*** | Kenneth Andrew Dabkowski |
| ***Date Entered:*** | June 2010 |

***How To:***

1. The vodka was accepted with the right hand (see **Figure 356**). The thumb and ring (3rd) finger were placed together and the ring finger was dipped into the vodka.

2. After dipping, the ring finger was flicked into the air to offer a drop to the blue sky. (see **Figure 357**)

3. Step 2 was repeated but the vodka was flicked out to offer a drop to the land.

4. The ring finger was dipped again and the vodka was allowed to drip down the finger until it reached the silver ring. This was used as a quality test. If the substance discolored the silver or tarnished the ring, the substance was not vodka and could have been poison. If there was no discoloration, it was safe to drink.

5. If it was safe, the wetted finger was touched to the forehead and the vodka consumed.

6. Optional: Say the Mongolian word for "Cheers" which is Эрүүл мэндийн төлөө! : (Erüül mehdiin tölöö) (see **Figure 358**).

***Global Market Consequence:***

Consequence in this particular item can be best seen using the values of integral accounting. Culture sharing and relationship building are a direct result of the interchange. The drink 'purity test' contributes directly to self-preservation and well-being.

Depending on specific reactive properties, poison detection using silver substrates could be possible. While expensive, there may be mobile testing applications that use thin silver strips instead of rings for example. The basic testing principles would transfer however and would be applicable to test for traditional poisons in liquid sources. The most likely candidates for such testing would be outdoor supply companies, particularly water testing outfits such as Katadyn, Aquamira, First Need, Polar Pure, Chlor-Floc, Portable Aqua, MSR, Abotex.

# Images for Traditional Items

## Bamboo Comb

**Figure 330:** A horizontal mark is carved in the middle of the bamboo segment.

**Figure 331:** Cuts are made vertically one centimeter apart across the top of the bamboo segment.

**Figure 332:** Using a smaller knife, either side of the vertical cuts is whittled to make the individual teeth of the comb.

**Figure 333:** Once the handle and teeth have been smoothed, the tips of the teeth are hardened in a fire to eliminate splintering.

## Fire Starting

**Figure 334:** Using a bush knife, a flat surface is cut into the log, leaving the wood chips at one end. A sharpened piece of wood is also cut from the log.

**Figure 335:** The sharpened piece of wood is pushed back and forth on the flat surface of the log to generate friction.

**Figure 336:** Continuous pressure generates more heat and friction resulting in smoke. The smoking particles created by this rubbing are pushed toward the wood chips at the end of the flat surface.

**Figure 337:** Once the log begins generating sufficient smoke, wood chips are placed on the smoking to generate flames.

## Qaqet Male Dress

**Figure 338:** The cloth is measured to the proper length and folded over the rope. The cloth is then sewn together over the rope, holding the front fold in place.

**Figure 339:** The rope is then measured around the wearer's waist, the cloth fitted between the legs and the cloth folded over the rope in the back.

**Figure 340:** The rope is then tied securely around the waist and the cloth is adjusted as needed.

## Sago Washing Troughs

**Figure 341:** A cut is made into, but not through, the wide end of the sago section.

**Figure 342:** Using a bush knife, sections of the bark are carefully removed down to the cut. This is done until light passes through the end of the sago.

**Figure 343:** The thin end of the sago is held over a fire until it has softened and begins to curl. The outside of the sago is darkened but not burnt.

**Figure 344:** The softened sago is carefully folded up, making sure it does not rip at the fold. This trough will be used to collect the water and saksak during washing so it must not leak.

**Figure 345:** The sides are then folded toward the center to seal off the corners of the trough.

**Figure 346:** A skinny piece of sago is folded around the end of the trough and tied together with vine. This is done to hold the fold together.

**Figure 347:** A cut is made where the sago bark section begins to curve drastically.

**Figure 348:** The trough is carefully flattened out by pushing down where the cut was made. This must be done carefully because the trough must be as flat as possible, not bent in any direction.

**Figure 349:** Sections of sago are placed in the ground to act as supports for the trough. The curves at the top of these sections are set in alternating directions to keep the trough from sliding.

## Salt Making

**Figure 350:** The bamboo shoot is filled three-quarters full with a mixture of salt water and fresh water.

**Figure 351:** The bamboo shoot is then corked with leaves and placed on the embers of a fire until dry.

**Figure 352:** After the heating process, the bamboo shoot is split open revealing the salt left after the water has evaporated.

## Sling

**Figure 353:** The segments of Pandanus leaf are unfolded and wrapped around one another.

**Figure 354:** Once each strand of the rope has been rolled down the leg, they are all rolled back up the leg securing them together.

**Figure 355:** Once the sling is finished, the rock or other object is placed in the pocket as shown (this sling used for short distances).

## Vodka Salutation

**Figure 356:** The vodka is presented to the guest with the right hand and the guest accepts the vodka with the right hand.

**Figure 357:** The vodka salutation begins with a blessing given to the sky. The ring finger is dipped into the vodka and a droplet is flicked to the sky.

**Figure 358:** Before the vodka is consumed, the guest says "Erüül mehdiin tölöö", the equivalent of "Cheers" in English.

# Appendix A
# 2009 Papua New Guinea Heritable Innovation Trust

The 2009 Papua New Guinea Heritable Innovation Trust document represents the ever important first step in the development of the documenting process. As such, the executive summary is displayed here in its original wording so as to preserve the integrity of its contents. All of the items documented by the 2009 H.I.T. team have been included in the Trust Items section of the main document.


**Heritable Innovation Trust**

The World's First Heritable Innovation Trust under the Stewardship of

The Communities of East New Britain

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**Executive Summary**

Current global systemic failures in the economic situation have provided the world with numerous opportunities to experiment with new, integral value exchange and economic models. Engaging this unique period in history affords communities the opportunity to explore new options of creating value exchange networks that challenge many consensus assumptions. Society, in general, needs to consider the humanity of new models of engagement so that previous injustices are not repeated. One new model available for consideration is that of the Heritable Innovation Trust, the framework for which is presented by Dr. David E. Martin in the International Bar Association's journal *Convergence* ("Heritable Knowledge Framework and the Development of Communal Innovation Trusts: An Ethical Framework for Development, Stewardship, and Trade." Volume 5, Number 1, pages 106-112). Heritable knowledge is summarized in four dynamics. The first maintains that the knowledge has been used or maintained by past generations and is utilized and adaptable for present and future generations. This is especially important because the heritability of the knowledge is derived from its ability to synthesize the environmental changes and technological advances of each generation. The second component contends that the knowledge is passed down and remembered through cultural customs, as opposed to strictly formatted documentation. Unlike knowledge "property" concepts like copyright, there is neither "creator" nor "created work" in a fixed temporal sense. Rather all are simultaneously stewards and adaptors. This knowledge is recorded through various forms of expression including, but not limited to, paintings, ceremonies, carvings, song, dance, and storytelling. Thirdly, heritable knowledge is animated through constant consideration of its original intent. Without consideration, the knowledge loses its value within the community and is increasingly vulnerable to misuse. When the values of the community take a backseat to individual aspirations the knowledge is no longer fulfilling its original purpose - serving the community. As much of this knowledge is based in cultural traditions, respect for the community inextricably assumes engagement within communal values which are celebrated when engaged and shunned when disrespected or circumvented. Finally, the knowledge cannot be owned by an individual or generation, rather it is stewarded by the community as a whole. This precludes exploitation or monopolization of the knowledge, as it cannot be sold because it lacks a single creator and therefore a legal transferring counterparty (Martin 107).

The aforementioned knowledge is protected under the framework of the Heritable Innovation Trust – a perpetual executory contract which exists in dynamic perpetuity. As the name of the trust suggests, the nature of this knowledge allows it to be considered innovation as it is constantly changing and growing as the need arises. The Trust is a compilation of the knowledge present in a community in a fluid document form, meaning that, like the knowledge itself, the document can be expanded and adapted as needed. Since the Trust creates a visible accreditation to a specific community or region, the knowledge cannot be monopolized by external constituents because it can now be traced back to the area from which it came. The Trust provides a community and an outside party the framework for opening a two-way flow of information and to create a positive, lasting working relationship. Regardless of the extent to which the information is used, it is the outside party's immediate responsibility to reciprocate the flow of information. If the outside party desires to utilize a specific method or practice, for example, they must first obtain permission from the stewards of the Trust. If authorization is granted, information provided in the Trust flows to the outside party while its external use, including such things as its involvement in production processes or any discovered properties, flows back into the community, enriching both parties. To launch this new model, M·CAM and Pacific Spices collaborated to form the Heritable Innovation Trust Internship of 2009. The purpose of the internship was to deploy the Heritable Innovation Trust program in an inaugural environment which integrates social, ecological and historical context diversity. East New Britain, Papua New Guinea was chosen for this location because of its abundant natural resources that provide multiple options within varying world-markets and its deeply rooted and celebrated cultural heritage. Four university students from the United States were sent to document heritable knowledge and customs in order to establish the world's first Heritable Innovation Trust. They were based at the Pacific Spices plantation in Vunakanau to record their unique processing techniques and farmer-community empowerment strategies. Their first week was spent in meetings observing the provincial and national government systems. They then spent two weeks in and around the village of Raunsepna, and four days in the Komgi village with the keepers of Qaqet (pronounced "cock-ĕt") customs[2]. In both villages they lived with different families, participating in everyday activities in order to experience firsthand the interplay between community, business and government. These specific locations were selected because of their pre-existing working relationships with Pacific Spices, a company already utilizing the reciprocal, socially responsible business practices outlined in the Heritable Innovation Trust framework.

***Pacific Spices***

Pacific Spices was developed in 1997 by Theresa Arek and Ian Sexton. The company is a real world example of the principles of the Heritable Innovation Trust in action. The majority of the practices of the company are in alignment with maintaining the sanctity of the heritable knowledge and upholding the requirements of the Trust. Instead of going into the community and changing its structure, Pacific Spices adapts itself to the existing constructs. The people work within a system with which they are comfortable and know very well resulting in smoother, more productive business transactions. To insure that their business practices

[2] The term "Qaqet" is a name that we have chosen to use in lieu of the more conventional term "Baining". While both describe the same community, we have been made aware of some deep sensitivity to the ethnic history of the Baining term and, as such, we seek to honor the heritage of those about whom this report has been prepared and with whom this first Trust was compiled.

are working in alignment with the existing structure, Pacific Spices' principals including Arek's daughter, Sharmayne, interact with and live in the villages to acquire a deeper understanding of the communities and their customs. Because she knows these communities inside and out, Sharmayne has become a key factor in Pacific Spices' success. This dynamic enables the communities to remain a key part of the process because there is no middleman to confuse engagement or intent optimizing the preservation of communal values.

Pacific Spices also recognizes and utilizes the naturally abundant resources, such as cardamom in the mountains and coconut in the coastal regions, and employs the farming techniques known by the communities instead of introducing new crops and methods. All water used for commercial processing of products is collected from rain and requires no ground water extraction. Because the company and the communities work in direct contact, Pacific Spices is able to observe their partner's actual needs and helps satisfy them in return for the product provided by the community. In exchange for the raw materials, Pacific Spices is currently reciprocating knowledge by educating their colleagues in the processes used to create their finished products and making efforts to install the equipment necessary to move the processing operations into the communities. Knowledge on end-market use and principles of "value-adding" are central to their active processes and educational engagements with the communities in their network. For example, cardamom dryers have been installed in the Komgi area and a coconut oil processing system has been installed in the coastal area of Induna, which is scheduled to open July 22, 2009. The process has been localized in hopes of inspiring individual innovation. In the future, Pacific Spices hopes to install a cardamom processing facility in Raunsepna along with a government funded technological school. The close proximity of the two will facilitate the incorporation of the processing into the curriculum.
Pacific Spices acts as a conduit for remote areas like Raunsepna and Komgi to interact with the world market. The roads to both village buying points are treacherous at best and in inclement weather impassable. The vehicles used on these roads are in constant repair and often must be pushed or pulled up and down the mountainside. However, Pacific Spices, frequently Theresa Arek herself, makes weekly efforts to reach these areas in order to maintain their business relationships. These relationships are not dictated by Pacific Spices, rather they are at the discretion of each individual farmer. At any point in time an individual can choose to sell their product elsewhere, but the relationship formed between the company and supplier motivates continued cooperation.
As a rule, Pacific Spices incorporates human needs into their business practices. For example on a routine cardamom run, the usual bags of spice were replaced by a sick child needing immediate medical attention. Though it meant there would be no cardamom from that area for that week, Theresa Arek made the decision to care for the child with the community's consent. It is not uncommon for Pacific Spices to engage in resource sharing with its employees, including educational and health care resources. These are the types of things that keep the relationship strong and motivate a continued partnership.

Arek's tenacity and persistence are critical to Pacific Spices' success and also are one of the company's single-point-failures. If her determination and drive were removed from the business model, the company would cease to thrive, as she is the principal driving force representing the usual conglomeration of numerous executives. Arek's flexibility when faced with adversity, such as washed-out roads, broken-down trucks, and capricious profits, is what keeps the company moving forward. The company's business would be unimaginable without it. Many companies worldwide have an executive directorate to delegate tasks in hopes of ameliorating this single-point-failure situation. For Pacific Spices to perpetuate its success, Arek's position and spirit will need to be assumed by multiple people later down the road, as there are few individuals who manifest the same level of determination and resolution.

Adaptability and personal resilience are necessary parts of entrepreneurship in Papua New Guinea and its Western counterparts. Mutual recognition of cultural differences, like values, relationships, and customs, ensures smooth working interactions. Businesses must take into account such things in order to effectively function within the unique environmental context of Papua New Guinea. The personal, community and political facets of the environment require local businesses to use different models than those commonly seen in Western based businesses. In order to effectively collaborate, each business must invest time to understand, consider and embrace these differences to achieve success.

***Environmental Context***

**Personal**

Humility is the ultimate personal value we, the interns, observed in East New Britain. At every level of human interaction, the individual must always show humility. Leaders are not chosen because it is their aspiration. Rather, they are chosen based on merits seen by others. For example at Pacific Spices, Rodney, their innovative engineer, was put in charge of constructing the company's Induna project because of his character and ingenuity. He made their first coconut oil press out of a washing machine showing his creativity and resourcefulness. Though he has the ability to accomplish great things, he remains humble thus maintaining the trust and respect of his peers.

In a culture where heritage and family engagement is an inseparable part of one's identity, it is uncommon for leaders to come from outside. However, in Raunsepna, Ben Maraedi has become a village leader despite being adopted into the Qaqet society. His humility and character make him an attractive leader to the people around him. Often times it is not clear whether or not he is leading until after the fact. At no point during the process does he seek recognition. The same can be said about Ian Sexton at Pacific

Spices. Though he is originally from the United Kingdom, he has gained the respect of the people he works with due to the fact that he does not place himself above his colleagues choosing instead to work beside them. In any type of interaction, be it political, social or business related, having any sort of ego is intolerable. The only partnerships that endure are based on pure humility. At one meeting in Vunapope, the president of the Qaqet local level government, Andrew Kusac, was present. He did not, however, assume a position at the head of the circle; rather he sat on the ground amongst those in attendance. The same situation occurred with the elders of the Komgi village. In our discussions with the elders, they too sat with us on the ground without assuming any position of leadership. When they would travel into town with us, they did not choose to sit in the cab of the pick-up truck; they sat with us in the truck bed thus not placing themselves on a higher level.

Our interactions also opened our eyes to the absence of hierarchy, not only between people but between humans and nature as well. Before people walk into the forests they must ask permission from the ancestral spirits that reside within as a sign of respect to the forest. On our first attempt to trek into the Komgi village, we could not proceed past the starting point because we were informed the spirits had denied us entrance. We later learned that there had been a death in the village the day before and the spirits were unable to protect us on our way as they were helping the village heal. On our next attempt they granted us permission and we began our trek. Our guides throughout the experience informed us when we could speak and what rivers to drink from in accordance to the will of the ancestors.

In their everyday practices no person steps over anything on the ground as a sign of respect and humility. Regardless of what it is, one always walks around it. Showing appreciation toward all objects and people by stepping around them is one of the many ways that people equate themselves to inanimate objects and nature. Typical human arrogance puts humans at the top of an ecological hierarchy. However, in Papua New Guinea, such is not the case; humans are on an equal level with all things. Society without hierarchy, like that of Papua New Guinea, maintains equality between nature and humanity as well as members of the community. Walking around objects on the ground is also an act of removing obstacles in person-to-person interaction. Direct contact relationships are the primary type of human connection in Papua New Guinea. Technology is not as reliable on the islands as in other parts of the world; therefore, all relationships depend on maintaining this direct contact. In the communities we lived in putting objects between you and another is one way of cutting off this contact. For example, it is offensive in the Qaqet community to point cooking tongs at a person while you are holding them. If this occurs, the tongs must be broken, thrown into the fire, and replaced by the offender. By pointing this utensil at another person, an object has hindered the ability to have direct contact with that person. Not only is there a physical object between the two parties, but also a threatening air has been allowed to enter the interaction limiting the desire to continue socializing.

For an outsider, it is very easy to place objects in the way of communication without even realizing it, especially in the use of technology. In Papua New Guinea it is common to see people with cell phones; however they do not hold the same attachment to them that is seen in a technology driven world. They do not sign long-term contracts for phones; they instead pay for minutes as they need them. When Theresa Arek lost her phone, the four of us went into panic mode but later realized it was of no consequence because she could simply buy a new one. Due to the fact that relationships do not depend on cell phone conversations and texting, getting a new phone number was not detrimental to her life. In contrast to Western culture, there is a sense of technology detachment in Papua New Guinea. Showing a strong dependence on technology, like taking a call during a meeting or event, is not just considered rude, it is not done at all. It is not just a personal offense but a complete disregard of the importance of these face-to-face interactions. At the Climate Change Conference in Vunapope, we witnessed a representative of an Australian aid organization take a call in the middle of the singing of the national anthem. We were not able to fully experience the performance because we were so taken aback by the fact that she would not only answer her phone but continue her conversation throughout its entirety. Gatherings like this conference are a celebration of the culture's utilization of direct contact relationships and therefore are taken very seriously. Information is passed and decisions are made through close, personal interactions in venues like Sunday gatherings where the whole community comes together.

### Community

It is a cultural phenomenon in the United States that many people separate aspects of their personalities, only showing certain aspects in specific places. Work personality stays at work, spiritual characteristics are shown at church on Sunday or in religious practices, and the family personality only shows up at home. These three aspects of a person's life are kept very separate. For example, when a person comes home from his or her job, he or she does not usually share what he or she did throughout the day in detail. Business is kept separate from home-life. In Papua New Guinea, this phenomenon does not exist. A person acts the same way in business, spiritual and home situations.

The lack of compartmentalization throughout the society is present everyday of the week but is most notable in Sunday's activities. The religious ritual, social interactions and business dealings are not separate entities in the Qaqet society. On Sundays the whole community takes a break from their weekly activities and comes together to enjoy each other's company, discuss news, and make plans for the following week. When we stayed in Raunsepna, we had the pleasure of experiencing two Sundays. Each one began with a Catholic mass, followed by a community meeting and finished with a series of rugby games. Every part of the day was fully integrated. The idea of acting differently in each arena simply does not make sense as all three things occur in the same place.

Where people in the United States physically go to different locations to participate in community business, spirituality or family life, the people of Raunsepna go to one location and participate in all these activities. Imagine, on Sunday, going to church, a parent-teacher conference for your child and the Super Bowl all at the same time. For many people this is a difficult concept because they would act so differently in each situation, especially in the recreational arena.

In the United States, there is a tendency to get very competitive at sporting events. The focus becomes beating the other team instead of enjoying the game itself. In Raunsepna, spectators at the rugby games support their team by attending the games. When we went and cheered on the players we knew, it was surprising to many because they do not usually do that. Even the players showed respect for each other by not heckling on the field and, instead, congratulating and encouraging each other between plays.
This same level of mutual respect exists in family dynamics as well. "Family" is not defined as a nuclear family instead it extends to include everyone in the community. Acquaintances are considered family by default; it is not earned nor aspired but assumed. For example, wherever we were, whether it was Raunsepna, Komgi, or Vunakanau, we were considered family. Frequently, Theresa Arek would refer to us as her children and by the end of our stay in Raunsepna we were given household responsibilities, like setting the table or cooking, like our "brothers" and "sisters". Whether or not a person is actually a relative, many people refer to them using familial titles. Our father figure in Raunsepna was introduced to us as "Uncle Ben", his wife as "Mama Christmas", and one of the elders from Komgi as "Papa Clement". These titles are not used by a specific group or person, everyone who comes into contact with them uses these names. The familial designation is granted to anyone based on the existence of a mutual respect. This designation is only lost if this respect is seriously violated. Within the communal family, age and gender are irrelevant factors. Mutual respect is granted to each person proportionally, meaning you receive as much respect as you give.

The strong communal value to care for each other results in a high level of respect for one another. It is understood that if you care for others, you will be cared for in return. If someone lacks the resources to have food or shelter the community works together to provide for that person. While we were in Raunsepna, we met a widow, who was the sister of a family friend that lived directly behind Ben Maraedi's house. Her husband had passed away before the completion of their home. David Maraedi, the eldest son of Ben and Christmas, took it upon himself to become her caretaker. He worked in the garden to provide food for the widow and her children and oversaw the completion of her home with help from other members of the community. The fact that a 19-year-old became the primary caretaker of an elderly widow shows the strong sense of communal responsibility devoid of generational gaps. Not only does the community provide for the physical needs of its members, but also invests in the well-being of every child. The community of Raunsepna, for example, has put together a scholarship system to help families with school fees and health care costs. Their communal goal is to send every child to school and to be able to cover the immediate health care needs of everyone. Money is used more for the betterment of the community than for individual benefit. In Western society, money is used as an indicator of character strength and personal ability. Such is not the case in the communities we engaged. People with less money are not considered inferior to those with more. The community acts as a unit to care for itself.

This phenomenon is visible in the concept of adoption. Adoption is a social agreement reached between two families devoid of a legal framework. No money is exchanged nor contract signed. Many times adoptions occur because one family is more capable of providing school fees and shelter than the birth parents. Unlike in the United States, a child's ties to their birth parents are not dissolved – they simply live in a different house. Because the community acts as one family and the families involved in the adoption are often close friends, the relationship between birth parents and the child is not strained or awkward. We witnessed the strong familial ties when two adopted children of Ben and Christmas stayed with their birth parents in order to make room for us. For us the situation was confusing because many United States adoptions are closed, meaning the child often does not even know the identity of their birth parents let alone where they live. They found our confusion puzzling because it is such a normal situation for them. Adoptions are not uncommon and are extremely casual transactions on a procedural level while deeply impactful to the well-being of the child and the community. There is no intensive investigation of a couple's parenting ability. It is understood that if you take on the responsibility, you will fulfill your parental obligations. Only families with a high level of trust with each other enter into these agreements making investigations unnecessary. Because it is a social arrangement that occurs within the community, the government has no involvement in the adoption process.

### Political

Community autonomy in the majority of decisions is reinforced by the remoteness of communities – many of which are not conveniently accessible by vehicle and therefore infrequently visited by political representatives. It requires a minimum of a 6-hour hike to access many of the communities in the region when the mud conditions are optimal. In Papua New Guinea, the government is set up with a provincial system made up of numerous local level governments. Each province is broken down into districts, each with its own president and cabinet. The role of these representatives is to connect the communities to the political center in Port Moresby, however often times this connection is not present.

One official that provides the community with this bridge to the government is the president of the Qaqet local level government, Andrew Kusac. At our meeting in Vunapope, David Martin was presenting new information on abuses in Carbon Trading schemes that have been promoted in the region. Kusac did not attend this meeting alone to gain information advantage. Instead, he brought with him the elders of the Qaqet communities, allowing them to hear the information first hand instead of having it

relayed to them through his perspective. Rather than assuming to act on the communities' behalf, he made it a point to include them in the political process. Andrew Kusac is currently the youngest member of the government and is becoming an example, not only for future representatives, but also his current colleagues. On our final day in Papua New Guinea, the communities at Vunakanau and Raunsepna put together a farewell ceremony for us at the Pacific Spices plantation. Kusac made a point to attend to interact with the communities he represents and spend time talking to us about our experience. He was extremely apologetic that he had not been more involved in our stay, but expressed great pride in the communities he represents. He interacted with everyone as part of the group not some one removed from it and the community did the same. The fact that the people treated him as an equal and not a celebrity shows the lack of hierarchy existent among politicians and constituents.

The sensationalism of politicians in the Western world creates the illusion of status over their electors. As a result, politicians require constant security wherever they go. Government buildings have endless security checkpoints; personal contact information of the politicians is kept secret and high-level officials go nowhere without an entourage of security guards. Throughout our stay in Papua New Guinea we saw none of these. The government building in Kokopo is accessible to everyone. There are no metal detectors or security guards restricting access. The gatekeeper of the building is there to do just that, tend the gate. Regardless of who wishes to enter or exit, he is there to simply facilitate access. It was not necessary to make appointments through a secretary. We simply showed up at the building and walked right in. As we were driving around Kokopo one day, we saw the personal vehicle of a high-level government official at the local grocery store. In the West, an official's car would not be identifiable simply because that information is not common knowledge as a security measure; knowing the home address of any politician would be out of the question. However, in Papua New Guinea, addresses and phone numbers are widely known making the politicians highly accessible. Accessibility extends to all facets of the government in Papua New Guinea displaying the necessity of transparency within every interaction. We were given the opportunity to have a meeting with Deputy Governor Boniface Setavo at his home. He led us to his office, which was a tree he had named the "Moses tree" in his front yard. This office is where he meets with everyone, from the Prime Minister to his constituents. For the duration of the meeting his family joined us as we sat on the benches underneath the tree. The office had no walls or doors and was completely open to the outside allowing nothing to go unseen. The presence of his family did not limit the subjects discussed at the meeting, which began as friendly conversation and evolved into the telling of a parable. This parable segued into the meetings main purpose. Keeping the meeting casual in nature allowed it to be understood by everyone present, including the children, increasing its level of transparency. Because all government activity is influenced by outside sources, maintaining a level of transparency throughout every communication is exceptionally important.

The influence from the outside world on the government is far greater than the government's influence on the communities and other parties with which it interacts. Internationally, the government of Papua New Guinea deals primarily with aid organizations and natural resource extractors. These organizations wind up providing Papua New Guinea with aid in areas they believe Papua New Guinea needs it the most. However, the country's true needs are not adequately reviewed and assessed. Foreign government agencies funded a road in Kokopo littered with traffic circles. As it turns out, the road requires more maintenance than it is worth to the city. Had the organizations taken the time to properly assess the area, they would have found that the money and work would have been more beneficial to the country had it been used to pave roads leading up to the communities in the highlands. Providing this access to the rest of the province would enable the communities to have much more influence on government actions and to get involved personally instead of relying on representatives.

The same lopsided assessment went into the funding of a medical post in the Komgi village. During our stay in the village we lived in the old aid post. It was paid for, built, and supplied, but, when the time came, no one showed up to run it. Again, with some amount of observation, it could have been concluded that a medical aid post is not the most effective way to aid the community. In a community where there are specific people who care for different ailments, asking the community what they needed and providing that instead of providing an unfamiliar solution would have enabled the aid to be more effective.

Though often times there is an insufficient amount of research done to assess the needs of Papua New Guinea, it is also the case that extensive research is done to determine the needs of a community without taking into account the cultural traditions of the community. Matupit Island was devastated, along with the old city of Rabaul, in the 1994 eruption of Tavurvur and its neighboring volcanoes. Even to this day the island is covered in meters of debris; the air is polluted with the constant flow of ash and thousands of people live there without fresh water. Global aid organizations have spent a few million dollars to send in researchers and assess the situation only to conclude that the area is unlivable. What they did not take into account is the extremely deep rooted ties the people have to the land. No matter what anyone tells them, the people of Matupit will not leave regardless of the living conditions. For a fraction of the cost of the research, $500,000, the aid organizations could have installed a water purifying system. These kinds of aid efforts force the government to feign gratitude for actions that do not benefit their constituents creating a "helplessness" response that has similarity to the Stockholm Syndrome where the "recipient" is compelled to appreciate abusive actions and be deferential to the abuser. Unfortunately, throughout the Pacific Island nations, even well-meaning leaders fear speaking their mind on illogical aid propositions out of a genuine concern for reprisals and being ostracized. Such has been the case for years in Papua New Guinea. As a result, many of the actual needs of the population are being unmet.

### *Recommendations*

When engaging in social or commercial activities in the communities of Papua New Guinea all aspects of the environment must be taken into account. Everything from the strong ties to land to the necessity of humility in business transactions must be considered before any deals are consummated. The transparency of interactions and the unity found in the community structure should minimize the chances for any business malpractice to occur. The importance of the collective over the individual makes any deal made with an individual improbable based on the fact that the community is the driving force behind the decision making process.

Specifically, we propose:

1. The ratification of the Heritable Innovation Trust as the first volume of an on-going effort to transform the engagement between East New Britain and the rest of the world;
2. The establishment of a Global Registration office (not unlike the World Intellectual Property Office in Geneva) based in Rabaul, East New Britain, Papua New Guinea, to serve as the official registrar of, and adjudication facilitator for, Heritable Innovation Trusts;
3. The promotion of East New Britain's existing and future models of Heritable Innovation Trusts as a model of communal stewardship of Commons resources, knowledge, and Custom;
4. The establishment of knowledge sharing educational programs which allow for international understanding enhancement on ecological, social, and political dynamics drawing from the community assets of the region; and,
5. The annual review, audit and updating of this document for the benefit of all of its community.

## Appendix B
## 2010 Ecuador Heritable Innovation Trust

The 2010 Ecuador Heritable Innovation Trust document is the first example of a H.I.T. document compiled by a remotely trained documenter. Christopher Jarrett and the staff at Runa in the Napo Province of Ecuador worked in partnership with M·CAM, Inc.'s H.I.T. staff to produce the first Ecuadorian Trust document. The executive summary is displayed here in its original wording so as to preserve the integrity of its contents. The item documented in this trust has been included in the Trust Items section of the main document.

### Heritable Innovation Trust

A Heritable Innovation Trust for Guayusa


In Collaboration with Kichwa Communities of Napo, Ecuador

runa
AMAZON GUAYUSA

Documented by Chris Jarrett and the Runa Foundation

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**Introduction to the Heritable Innovation Trust (Source: Heritable Innovation Trust Founding Document)**

Current global systemic failures in economic organization have provided the world with numerous opportunities to experiment with new, integral value exchange and economic models. Engaging this unique period in history affords communities the opportunity to explore new options of creating value exchange networks that challenge many consensus assumptions. Society, in general, needs to consider the humanity of new models of engagement so that previous injustices are not repeated. One new model available for consideration is that of the Heritable Innovation Trust, the framework which is presented by Dr. David E. Martin in the International Bar Association's journal *Convergence* ("Heritable Knowledge Framework and the Development of Communal Innovation Trusts: An Ethical Framework for Development, Stewardship, and Trade." Volume 5, Number 1, pages 106-112).

Heritable knowledge is summarized in four dynamics. The first maintains that the knowledge has been used or maintained by past generations and is utilized and adaptable for present and future generations. This is especially important because the heritability of the knowledge is derived from its ability to synthesize the environmental changes and technological advances of each generation. The second component contends that the knowledge is passed down and remembered through cultural customs, as opposed to strictly formatted documentation. Unlike knowledge "property" concepts like copyright, there is neither "creator" nor "created work" in a fixed temporal sense. Rather, all are simultaneously stewards and adaptors. This knowledge is recorded through various forms of expression including, but not limited to, paintings, ceremonies, carvings, song, dance, and storytelling. Thirdly, heritable knowledge is animated through constant consideration of its original intent. Without consideration, the knowledge loses its value within the community and is increasingly vulnerable to misuse. When the values of the community take a backseat to individual aspirations the knowledge is no longer fulfilling its original purpose - serving the community. As much of this knowledge is based in cultural traditions, respect for the community inextricably assumes engagement within communal values that are celebrated when engaged and shunned when disrespected or circumvented. Finally, the knowledge cannot be owned by an individual or generation, rather it is stewarded by the community as a whole. This precludes exploitation or monopolization of the knowledge, as it cannot be sold because it lacks a single creator and therefore a legal transferring counterparty (Martin 107).

The aforementioned knowledge is protected under the framework of the Heritable Innovation Trust – a perpetual executory contract that exists in dynamic perpetuity. As the name of the trust suggests, the nature of this knowledge allows it to be considered innovation as it is constantly changing and growing as the need arises. The Trust is a compilation of the knowledge present in a community in a fluid document form, meaning that, like the knowledge itself, the document can be expanded and adapted as needed. Since the Trust creates a visible accreditation to a specific community or region, the knowledge cannot be monopolized by external constituents because it can now be traced back to the area from which it came. The Trust provides a community and an outside party the framework for opening a two-way flow of information and to create a positive, lasting working relationship. Regardless of the extent to which the information is used, it is the outside party's immediate responsibility to reciprocate the flow of information. If the outside party desires to utilize a specific method or practice, for example, they must first obtain permission from the stewards of the Trust. If authorization is granted, information provided in the Trust flows to the outside party while its external use, including such things as its involvement in production processes or any discovered properties, flows back into the community, enriching both parties.

This model was first applied by M·CAM to communities in East New Britain, Papua New Guinea in the summer of 2009. After this first trust was completed, the director of the Runa Foundation, Tyler Gage, and members of the Heritable Innovation Trust team at M·CAM began discussing the application of this model to communities in the Ecuadorian Amazon. At this time, the Runa Foundation had been working for a few months developing a sustainable fair trade business in collaboration with communities in the Napo and Pastaza provinces of Ecuador.

**Note on the Author**

This Trust was written by Chris Jarrett, a student at Elon University and summer intern with Runa in 2010, based on his experiences living in a Kichwa community (Rukullakta) in Napo and conversations with Kichwa farmers in Napo involved in Runa's guayusa project. A list of interviewees is included at the end of this document, and sections based on a specific interview are cited as such.

It is important to note that traditional knowledge of guayusa is by no means limited to the Kichwa people of Napo. Many indigenous groups throughout the Amazon have utilized this plant for centuries. In Ecuador, the Huaorani, Shuar, Achuar, and other indigenous nationalities have extensive knowledge of guayusa. This document, however, focuses on traditional knowledge of the Kichwa people of Napo, since this is the group with which Runa and Chris Jarrett have the most extensive personal experience. Ideally, the Trust will be expanded in the future to include the knowledge of other groups in the area.

**The Runa Foundation**

The Runa Foundation was originally developed by three undergraduate students from the United States as a university class project in coordination with indigenous farmers in Ecuador. Today, the Runa Foundation provides a consistent income for 600

families in the Ecuadorian Amazon by purchasing their organically-produced, shade-grown guayusa leaves at a guaranteed minimum price and providing them with technical support through a team of experienced agronomists.

After the farmers harvest and bag the leaves, field technicians employed by Runa weigh the bags on site and pay the farmers fair trade prices ($0.35/lb) in direct cash payments. The bags of leaves are loaded onto the bed of a truck and driven to the Foundation's office in Archidona, where the first guayusa factory in the world is located. The dryer technicians take scrupulous notes on which technician collected the harvest, which farmer the leaves came from, the condition and date of the harvest, and how many pounds were unloaded. Up to 1000 pounds of guayusa leaves can enter the factory daily! Once this has taken place, Runa then dries, crushes, and packages the leaves, preparing them for export to the United States where it is sold as tea.

The Runa Foundation has become the first organization to design a fair trade, organic production chain to purchase guayusa leaves from small-scale farmers, process it into a tea, and export it to the United States. Runa's agricultural technicians assist farmers in preparations to grow guayusa, applying organic pesticides, caring for the trees during the cultivation process, and harvesting the leaves. This is an innovative system that Runa has developed as a commitment to improve the abilities of local farmers while providing them with an added income and an incentive to reforest their lands with a plant that is central to their cultural heritage. Through its guayusa project, the Foundation works hard to preserve and value indigenous Kichwa culture and traditional knowledge, while helping to reforest the Amazon and promote community development.

**Context**

*Environmental*

Ecuador is considered one of the few "megadiverse" countries in the world as it has 35% of the world's hummingbirds, 17% of the world's birds, and the third largest number of amphibians in the world.[3] The Amazonian region contains a significant amount of this biodiversity, with many species of trees, birds, amphibians, fish, mammals, and other living creatures. There has been a common misconception of the Ecuadorian Amazon as a largely unpopulated area with unlimited natural resources, which has led to unsuccessful development strategies in the past.

A variety of indigenous tribes have inhabited the Ecuadorian Amazon for thousands of years, most of which practice small-scale agriculture, hunting, fishing, and collection of trees and plants for food, construction materials, and medicine. Since the Spanish first arrived in the mid-16th century, various waves of settlement and large-scale exploitation of natural resources have occurred. Two of the most environmentally damaging periods in the history of the Ecuadorian Amazon were the rubber boom from the 1820s until the early decades of the 20th century and the expansion of petroleum exploration and extraction, starting in the late 1800s and growing significantly in 1937 with a large government concession to Shell, and in 1964 with the arrival of Texaco. During the land reform period in Ecuador, the national government granted *colonos* (mostly non-indigenous landless farmers from throughout the Ecuadorian Sierra) small tracts of land in the Amazonian provinces and created incentives for them to develop extensive cattle-raising operations.

Cattle-raising is the single largest contributor to deforestation in the Ecuadorian Amazon, but petroleum extraction also leads to significant loss of tree cover. Petroleum exploration and drilling also disrupt wildlife through the operation of loud machinery (helicopters, seismic testing machines, drills, etc.), contaminate rivers and streams, and require significant road construction, which in turn facilitates further colonization and resource exploitation. Additionally, a variety of cash-crops, such as coffee, African palm, cocoa and bananas, have been grown in the Ecuadorian Amazon with little attention paid to reforestation and soil nutrient retention.

*Social*

The Ecuadorian Amazon is home to considerable cultural diversity as well. There are eight main indigenous nationalities in the *Oriente* (Amazonian) region of Ecuador and three main nationalities in the province of Napo- Kichwa, Shuar, and Huaorani, each of which has its own distinct history, myths, traditions, and cultural identity. The Kichwa people have a long history as hunters, fishermen, horticulturalists, and traders as a people living in an area of the Amazonian jungle closest to the frontier with the Andean highlands.

In the traditional Kichwa lifestyle, women wake up around two or three in the morning to boil a large pot of guayusa tea, and the rest of the family joins to drink together until around five or six. During this time, elders interpret family members' dreams, play music, and plan the workday. Family members also spend this time making instruments needed for hunting, fishing, and other activities in the jungle (ex. *shigras*, or netted purses used to carry food or other items; *serbatanas*, or long blow-guns used to hunt birds, monkeys, and other animals; etc.). After drinking guayusa, they bathe in the river and then return to prepare for the workday and drink *chicha*, a traditional drink made out of fermented cassava (yucca), plantains, or *chonta* (an orange-colored fruit that comes from a large tree with spikes) and drunk from *pilches* (small, gourde-like wooden bowls).

[3] "Biodiversidad," Bienvenidos al Ministerio de Ambiente, http://www.ambiente.gov.ec/paginas_espanol/4ecuador/biodiversidad.htm (accessed June 23, 2010).

The men generally spend the morning working the fields- clearing, planting, tending, and harvesting a variety of crops to sell in local markets, including corn, cassava (yucca), plantains, and cocoa. Some will also go hunting *watusas*, *wantas*, armadillos, monkeys, birds, and other animals, or fishing with nets and a paralyzing tree chemical called *barbasco* in nearby rivers. Meanwhile, the women tend the *chagra*, or small family subsistence horticulture plots, watch over the children, and prepare food for the family's mid-day meal. In the afternoons, community members relax, play sports, bathe in the river, and work on other small side projects. Around nine-thirty or ten at night, the family heads to bed to wake up early for another day.

This lifestyle, although still partially relevant to the Kichwa people's daily lives, is rapidly changing with increased urbanization, capitalist development, and greater exposure to Western media and ways of life. Due to these reasons, as well as a history of racial and ethnic discrimination against indigenous peoples, many Kichwas in Napo feel embarrassed by their cultural heritage and reluctant to maintain traditional cultural practices such as speaking Kichwa, wearing traditional clothing, and participating in rituals like drinking guayusa.

Young Kichwa have greater access to education, better-paying jobs in cities, and a variety of luxuries associated with a Western lifestyle that their parents and grandparents never had, but many have also lost the sense of identity and values that have kept their families healthy and relatively self-sufficient for generations. Elders often complain that young people don't obey their parents, focus all their energy on city life and not on learning about the jungle, don't respect traditional dating rules (minimal contact between the sexes until a formal marriage proposal), and generally lack interest in the traditional Kichwa way of life. This trend is furthered by the rapidly increasing exposure of young people to Western culture through television, music, magazines, and other media. As a result, much of the Kichwa people's traditional knowledge of the jungle (ex. medicinal plants, non-intensive hunting and fishing methods, healthy diets based on natural, non-processed food etc.) is in danger of being forgotten as young people find it to be less applicable to their everyday lives.

Despite the challenges presented for Kichwa culture by the homogenizing forces of globalization, many Kichwa elders remain strong stewards of the traditional knowledge passed down to them through generations of sophisticated oral tradition. They remember the meanings of dreams, how to tend the *chakra* (small family horticulture plots used for subsistence farming), how to make tools and find resources necessary for life in the jungle, and value the continual existence of a way of life that has allowed their people to co-exist with their natural environment, resist exploitation, and create spaces of autonomous community organization. Without a significant revaluation of Kichwa culture, however, the extensive cultural knowledge of the Kichwa people will slowly disappear as new generations move to the cities, forget how to live in the jungle, assimilate to dominant Western (also called "white-mestizo") culture, and find themselves obligated to accept new waves of capitalist expansion and natural resource exploitation.

*Political*

Politics in the Amazon have historically been controlled by power holders in the Andean highlands, beginning with the imperial government of the Incas, through the Spanish invasion and colonial enterprise, to the more recent period of nation-state formation (since Gran Colombia, composed of what is now Colombia, Ecuador, and Venezuela, gained its independence from the Spaniards in 1822 and Ecuador gained its own independence in 1830). The Amazonian region of Ecuador has often been treated as an endless source of natural resources, from gold to cinnamon to rubber to a host of other highly profitable items. Throughout every period of Ecuador's history since the arrival of the Incas, there have been efforts to extract these resources with little or no respect for the rights of the region's inhabitants. In addition to the resource extraction strategies of traditional elites in Quito and other powerful cities, political instability and lack of significant investment in the region have been the norm in the area. As a general rule, the Ecuadorian Amazon has received only the minimal amount of investment needed to sustain rapid resource extraction and keep local people from significantly challenging the dominant order.

However, neither the Incas, nor the Spanish, nor the modern Ecuadorian nation-state have been able to prevent uprisings, rebellions, and widespread resistance to these external forces. A notable example of such resistance was the rebellion of the legendary Jumandy in 1578.[4] The chief, together with his fellow rebels, burnt a series of Spanish settlements on the Amazonian frontier, hid his people in a cave, and was later martyred. Jumandy is indeed a central figure in the consciousness of today's Amazonian indigenous movement, often incorporated into official rhetoric and viewed as an ideal of anti-imperialist struggle.

As a part of this process, since the early 1980s, a nation-wide indigenous movement has risen to national prominence, due in part to a unique historical and political moment characterized by a global resurgence of indigenous peoples and international recognition of their rights. Ecuador's indigenous movement led a nation-wide uprising in 1990 that paralyzed the country for nine days, contributed to the overthrow of three presidents (Abdalá Bucaram in 1997, Jamil Mahuad in 2000, and Lucio Gutiérrez in 2005), and continues to be a formidable political force in Ecuadorian politics.

In the Amazon, this movement has been vibrant as well, with the most visible actors of resistance being the Shuar Federation,

[4] Marc Becker, "Indians and Leftists in the Making of Ecuador's Modern Indigenous Movements," Marc's House of Knowledge, http://www.yachana.org/indmovs/chronology.php (accessed June 23, 2010).

formed in the 1960s, and the Organization of Indigenous Peoples of Pastaza, which led a prominent march from Puyo to Quito in 1992 demanding land titles and recognition of Ecuador as a plurinational state. Unfortunately, though, much of local politics remain unstable and, at times, corrupt. The national government supports petroleum extraction and mining operations in the Amazon because of their importance for financial stability, and despite legal gains that have established systems of "prior consultation" ("*consulta previa"*) requiring enterprises, both public and private, to obtain prior consent before operating, many communities remain divided over whether or not to allow large enterprises access to their land for mineral extraction. Petroleum politics are perhaps the most controversial in the Ecuadorian Amazon, as large oil companies and the state oil company, PetroEcuador, often offer significant gifts to communities in exchange for rights to their lands.

Nonetheless, local, provincial, and national governments have all begun to make efforts to invest in more sustainable development strategies in the Amazon. A variety of innovative social enterprises have arisen in the area to chart a new course for development. The most well-known example of this is the Kallari organization, which has established a viable fair trade production and sales chain for cocoa (*cacao* in Spanish) in Napo. The Runa Foundation is also following this trend by creating a sustainable, fair trade, organic production and sales chain for guayusa, a culturally important plant with high caffeine content and exceptional potential.

# Appendix C
# 2010 Mongolia Heritable Innovation Trust

The 2010 Mongolia Heritable Innovation Trust document is the first trust document to be written by someone who did not go through the same H.I.T. training as a traditional H.I.T. intern team. It serves as the foundation for the development of the 2011 Mongolian trust document. The executive summary is displayed here in its original wording so as to preserve the integrity of its contents. The items documented in this trust have been included in the Trust Items section of the main document.

**Heritable Innovation Trust**


**Mongolia 2010**

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**2010 Heritable Innovation Trust: Mongolia**

**Executive Summary**

In 2010, the Heritable Innovation Trust (H.I.T.) expanded to Mongolia. Three communities, including the South Gobi Desert, the Arkhangai aimag, and the capital city of Ulaanbaatar were introduced to the Trust upon invitation from Tsend Enkhtuya and the Mongolia National Business Incubator Federation (MNBIF). The communities above have all opted to become participants in a network into which they have entrusted their values and experience. By trusting counterparties, market visibility and creativity are being brought to bear on the values disclosed herein.

The goal of the Heritable Innovation Trust is to constitute reciprocal knowledge networks that perpetually benefit whole communities. The Trust team, in partnership with our Mongolian hosts, made our best attempt to present the information herein with integrity, accountability, and transparency.

**Environment and Ecosystem**

Mongolia is a landlocked country which borders Russia to the north and west and China to the south and east. Covering over 1.5 million square kilometers, Mongolia ranks as the 19$^{th}$ largest country in the world.

Temperature range varies seasonally and daily. In recent years, winter temperatures have been significantly colder than usual, a condition called a dzud. These freezing temperatures have obscured ground cover such as grass and shrubs, leading to the starvation of millions of livestock. Livestock loss is one of the reasons for significant migration and relocation in recent years as herders settle in ger districts on the outskirts of Ulaanbaatar and other urban centers as they hope to find other work.

Mongolia is internationally known for its desert landscape and while this climate composes a majority of the total land area, highland and mountain regions have markedly different environments.

**Urban Centers**

In Mongolia, there are three primary words used to describe different types of urban development; aimag, soum, and khot. An aimag is a province and there are a total of 21 aimags in the country, for example the Arkhangai aimag. A soum is a smaller district within a province, usually containing an urban center. There are 329 soums in Mongolia. Lastly, a khot is a city/municipality. For example, the capital city of Ulaanbaatar is an independent khot and is not part of any province, similar to Washington D.C. in the United States.

The largest urban center in Mongolia is Ulaanbaatar. In comparison, most aimag centers are much smaller in population and physical size. Aimag centers contain government offices where federal parliament representatives work.

Urban centers have a mix of modern buildings and ger districts. In general, modern buildings comprised the central business and ger districts are arranged around the outskirts. Each ger is segmented from other gers using a large wooden fence. The fences enclosed an area large enough to set up a ger, store goods in their yard and set up another shelter if desired.

**Gobi Desert**

The Gobi Desert is located in the southeast of Mongolia and is the fifth largest desert in the world. Aimags located in the Gobi include the Bayankhongor, Dornogovi, Dundgovi, Govi-Altai, Govisumber, and Omnogovi. The Trust team spent the majority of our time in the Omnogovi aimag and was based close to the capital, Dalanzadgad.

Temperature ranges significantly in the Gobi Desert. Over the course of 24-48 hours, temperatures fluctuated more than 60˚C. Our hosts reported that temperatures range from below - 40˚C in the winter months to over 50˚C in the summer months. During the Trust visit in early summer/June, temperatures ranged from near 0˚C at night to approximately 40˚C during the daytime.

Rainfall is minimal in the Gobi. Precipitation usually falls in the summertime, and only a few centimeters per year on average. During the visit we experienced two bursts of rainfall which significantly altered the visual landscape. Small tufts of grass and other vegetation quickly absorbed the rainfall and expanded in size and darkened in green color.

The Gobi Desert area is composed of many flat open spaces but also contains a large mountain chain known as the Govi-Altai Mountain range. At the end of this range is the Govi Gurvan Saikhan National Park which is home to the Three Beauty Mountains. This park hosts many varieties of wildlife including sheep, golden eagles, and bearded vultures and highlights landscape of steep rock formations, a large glacier, and a frozen waterfall which continues to stay frozen in the summertime.

Just north and west of the Three Beauty Mountains there is a broad stretch of desert which previously was the floor of an ancient sea bed. The sea has since evaporated and in the process, left behind the fossilized remains of many creatures including coral, eggs, and dinosaur bones.

Desertification is increasing the size of the Gobi desert. Global climate variation combined with livestock consumption of ground vegetation and human extraction all contribute to the increasing size. As the desert expands, wind storms blow the topsoil away. Generally the topsoil lands in China, Korea and the Pacific Ocean. In order to mitigate the effects of desertification, locals and foreigners aim to increase vegetation. Saksaul trees, also known as ZAG in Mongolian or *Haloxylon ammodendron* in Latin, are native to the area and are being planted to reduce desertification.

Animal husbandry is the predominant lifestyle in rural areas of the Gobi Desert. Camels, goats, sheep and horses are the most popular livestock.

**Highlands**

West of Ulaanbaatar, the ecosystem changes from rolling hills to highland foothills. The road from Ulaanbaatar to Tsetserleg, the Arkhangai Aimag Center, passes through the aimags of Tov, Ovorkkhangai and Bulgan. Karakorum (also spelled Kharkhorin), the 13th century capital of Mongolia, is located in the Ovorkhangai aimag. The Trust team spent the majority of time in the Arkhangai aimag within a few hundred kilometers of the center Tsetserleg.

Arkhangai has an area of approximately 55,000 sq km and is home to 90,000 citizens. Most citizens work in agriculture or animal husbandry. The area is nationally known and branded as having the highest quality dairy products in Mongolia. Urban markets offer many products but mainly focus on fresh and processed food.

Climate varies in the province due to changes in elevation. In the lower elevations (1,300 meters), the team experienced temperatures between 10˚C and 30˚C. In the higher areas, mountain peaks (at elevations up to 3,500 meters) were capped in snow during the month of June. Winter temperatures were reported to be above- 40˚C.

Arkhangai contains arable land which is mostly used to grow root vegetables such as carrots, potatoes and onions. Grasses in this region are very common and provide feed for livestock. Herds of animals including horses, sheep, goats, and yaks were seen in roadside pastures during the entire journey.

Trees and forests are regularly located on hillsides. A single variety of pine seemed to be exclusive to the area. This pine varietal had very soft needles and is suffering from beetle infestation. We estimated that as much as one third of each forest had been affected by the infestation. According to members of the local community, the beetle has entered Mongolia from Siberia, reportedly displaced by large forest fires and other environmental crises to the north.

The Arkhangai aimag has significant fresh water resources. Rains and melting snow from the mountains formed large rivers. Some river crossings were approximately 100 meters wide and required a bridge to cross on foot or with a vehicle. Other smaller streams were approximately one meter deep and fordable by jeep or four-wheel-drive vehicle.

**Meet the Trust Communities**

In the United States public school system, children are taught two things about Mongolia. First, ‘that it is the land of Chinggis (Ghengis) Khan, history’s greatest conqueror.’ Second, that Mongolia ‘contains the Gobi desert, a very cold place.’ Outside of those teachings, Mongolia remains a mystery to most of the rest of the world.

In the 13th century, Mongolia was the world’s largest empire with lands stretching from modern day Korea to Poland. Technology, innovation, warfare and genetics transferred during this period have significantly influenced global development.

Today, Mongolia is re-entering global interactions in a new context. Herders and nomads that have existed on the land for centuries face changing climate conditions and market based economic impacts which affect their daily life. Western modernity has become popularized in the urban areas and is becoming prevalent in architecture, technology, communications, infrastructure and fashion throughout the country. New construction is commonplace. Infrastructure left behind by the Russian occupation is being re-engineered and put to use for a global marketplace heavily influenced by China, Taiwan, Korea, and Russia. Talk and evidence of a rapidly changing climate and a 'resource based economy’ create a sense of opportunity and fear in the general population. Mineral development is promoted as a local economic savior, but benefits and costs of mineral development are not well communicated to or understood by the population at large.

Mongolia is a new democracy and is led by a clarifying and evolving vision. Its renowned history has created significant expectations for the future. Leadership is governed by a mix of extraordinary thinkers and central planned industrialists who carry

legacies of the past into present discussions. The populace is a melting pot of different cultures, each adept with different qualities, value systems and aptitudes. At present, there is a large information gap between the leadership and the populace. This gap, over time has created an environment in which distrust can impact interactions between the public and private sector. However, in the interest of moving forward, all counterparties are ready to work together to close the gap.

## Urban Centers

### *Ulaanbaatar*

Ulaanbaatar (locally known as UB), the capital of Mongolia, is the largest khot in Mongolia hosting approximately one million people, 33% of the country's population. Ulaanbaatar is located near the country's geographic center and slightly north. It has the second lowest average temperature of any national capital.

Spread out over several kilometers of flatlands and rolling hills, the modern buildings in the city center are surrounded by ger (yurt/tent) districts. Past the boundaries of the ger districts, herders have settled and keep livestock.

Coal is used as the primary heating source in Ulaanbaatar. This fuel source causes heavy air pollution in the colder months.

Throughout the year, sporadic dust storms envelop the city and can turn the entire sky dark even during a bright day. These storms deliver heavy winds and sand from the western steppe.

Ulaanbaatar contains a diversity of building styles, ranging from Russian influenced designs to modern industrial and neo-classical. Sukhbaatar Square is the central feature of the government district. The buildings that line the Square include the Estate Palace, the opera house, and modern office buildings.

There is a refined fashion sense throughout Mongolia but specifically in Ulaanbaatar. Men and women were dressed in the latest designs including business and social attire. In many cases, the quality of dress was similar to styles one might see in New York or Paris. Assumed income level and living context had seemingly no effect on clothing quality. Citizens leaving office buildings and citizens walking out of ger districts all wore styles of comparable quality.

#### People

Tsend Enkhtuya, (also addressed as Ts. Enkhtuya or by short name, Enkhee) was our trip co-sponsor and host from the Mongolian National Business Incubator Federation (MNBIF). Ts. Enkhtuya and the Mongolian National Business Incubator Federation yayplanned the majority of arrangements for the Heritable Innovation Trust team and accompanied us throughout the trip.

While in the capital, the Trust team was invited to participate in full day business incubator training sessions which included workshops by InfoDev (a joint venture program of the World Bank and the International Finance Corporation). Meetings with the Chairman & CEO of the Mongolian National Chamber of Commerce & Industry and with the Oyu Tolgoi Communications office broadened our awareness of the local and international business environment. In these meetings, the Trust team introduced the concept of the Trust and developed partnerships with entities that could enhance participation nationwide.

On the third day, the MNBIF held a full day conference on business incubation and this conference was attended by over 300 people. Dr. David Martin's keynote address was well received and received two rounds of applause during the presentation.

Following the conference, the Trust was introduced to local and federal government officials and was well received. On the last day of the visit, the team was invited to attended "A Meeting on Fair Mineral Development," co-sponsored by the President of Mongolia and the World Economic Forum.

## Gobi Desert

### *Dalanzadgad*

Dalanzadgad (also known as DZ) is the center of the Omnogovi aimag and is a gateway to the South Gobi Desert region. The urban center has a population of around 14,000 and has been growing steadily since the identification of vast copper and gold mineral reserves at the Oyu Tolgoi mine only a few hours drive away. A flight from Ulaanbaatar to Dalanzadgad takes approximately one hour and the drive takes approximately twelve hours.

Driving through the downtown area, our escorts pointed out many industrial buildings that lie vacant and unused. Due to material intensive construction, these buildings are very strong and show very few signs of deterioration. As we experienced, the

thick walls and ceilings kept cool air well insulated from the hot breeze outside. Temperature inside the buildings was approximately 20˚C cooler than exterior prevailing temperature.

A coal fired electric power plant is located in downtown Dalanzadgad and it provides power to the immediate municipality and also to a surrounding ger districts, approximately 75 kilometers away.

Large wooden fences surrounded all of the ger plots in Dalanzadgad, however, for miles we had not seen any trees except for Saksaul trees. Saksaul trees are similar to the shape of driftwood and therefore not used for fence lumber. We did not ask, but held the intention of the question, "Where did the lumber come from?" How there came to be so much wood this far from a forest remains a mystery. While wooden fences were present in all urban centers, the other locations were much closer in physical proximity to lumber resources.

On the outskirts of town there are several locations which serve as collecting areas for municipal solid waste. These locations have accumulated various discarded resources over time.

The Trust team was accompanied to the Gobi region by Ts. Enkhtuya and D. Purevsuren from MNBIF and Nemekhbayar Rentsen and N. Narannyam from Mongolian TV Channel 9. Channel 9 prepared a documentary of the trip which aired on national television.

Upon arrival at the Gurvan Saikhan Airport, teams were greeted by local government and business leaders who would accompany us on the visit to the Gobi Region. These leaders included Sumiya from Bayan-Uul Company and Byambadorj from the South Gobi aimag Business Council. Proprietor Oyundelger hosted us at a nearby ger camp named "Tuvshin Shankhat."

Batbayar & Jazei, operators of the company Gobyn Undur, Mongolian for 'Gobi Highest' were our escorts in the region. In addition to tourism services, Gobyn Undur has started development of a large Saksaul tree farm approximately 15 kilometers from Dalanzadgad.

***Camel Herding Camp***

On our second day in the Gobi, the team scheduled a visit to a camel herding camp a few hours drive from Dalanzadgad at location (43º 16'N; 105º 47' E). We left the aimag center at approximately 4:30 am in a two-vehicle caravan driven by Sumiya and Batbayar. After leaving town, the two cars began traveling at different speeds. Over time, the cars separated. Realizing that we were no longer in contact with the other vehicle, our vehicle stopped to scan the horizon for cars. Seeing none, we continued forward on our heading. We began to get a sense that we did not know where we were going. Every so often, a ger camp would appear in the distance. Batbayar navigated the vehicle to each ger, pulled the car within 25 meters from the ger door and began to honk the car horn. At an early hour, the ger inhabitant awoke from sleep and offered us assistance and directions. Eventually we used the directions to navigate to a crossroad with Sumiya's vehicle and continued together to the camel camp.

Along the road the team stopped at prayer circles. These circles consisted of a rock pile; small (usually blue) rags with prayers printed on them; and vodka bottles all assembled in an upward pointing cone shape. Practices for good luck required a person to pick up stones from the ground surrounding the circle and, while walking around the circle clockwise three times, toss the collected stones into the pile.

During the road stops we had an opportunity to observe the landscape and environment. In abundance we saw small stones, sand and grass. The stones were consistently small, mostly smooth and were colored in earth tones such as blue, green, grey, brown and red. Thousands of these stones composed each square meter. Rarely, a larger stone would be found, but most commonly stone size was smaller than 10 centimeters.

Another landscape component was grass. Approximately three grass tufts were located in each square meter of land. This spacing was reasonably consistent across the landscape. Grass density was low and stone density was high. At a close distance, the human eye could observe an abundance of stones and minimal grass. As we shifted gaze to the horizon, the slightly raised grass obscured the rock colors and created a blurred green optical effect on the extended horizon. Yet, the proportion of grass to stones never changed approaching the horizon.

After approximately four hours of navigation and driving, we arrived at the camel herding camp. Upon arrival, a noise filled our ears which can be described as a combination between camel singing and groaning. In western culture, the sound is similar to the sound of an orchestra warming up for a performance. The hundreds of camels in the camp constantly produced the oscillating drone.

Exiting the car, Batbayar walked into the camp to meet Bud, the head of the camel herding household. They greeted each other in the traditional Mongolian way with Bud's outstretched forearms resting over the top of Batbayar's elbows, Batbayar's outstretched arms under Bud's forearms, touching the underside of Bud's elbows. Bud then invited us to observe all of the operations

in the camp. Three generations of Bud's family worked closely with each other and demonstrated many processes during our visit including camel wool sheering, de-ticking, domestication techniques, milking, riding, saddling and food and drink preparations.

Between demonstrations, all guests were invited into Bud's ger. The team introduced the Trust concept to Bud and showed him the Papua New Guinea document on a laptop computer. Ts. Enkhtuya translated the conversation and explained the value system underpinning the work. Finally, the team invited Bud to participate in the process to which he happily agreed.

***Gobyn Undur/Incubator/Dairy/Goya Distillery/Government Meeting***

Back in Dalanzadgad, the team spent time meeting with local business operators. Businesses visited included a Saksaul tree nursery, a felt production incubator, an urban dairy, souvenir producers and a Goya vodka distillery. Before leaving Dalanzadgad, the team was able to meet with Chairman Batchuluun Lkhachin of the Citizens Representative Khural of Umnugobi aimag and discuss implementation of the Trust in the region.

The trip to the South Gobi was sponsored by Khan Bank, the Mongolian National Business Incubator Federation, and the Oyu Tolgoi Mining Company. Each sponsoring entity was linked to one or more business opportunities arising from the Trust program prior to departure.

**Highlands**

***Tsetserleg/Erdenebulgan Sum***

The provincial capital Tsetserleg, of Arkhangai is a small urban center with about 16,500 inhabitants. It is built around an artesian spring that provides cool, potable water to the city.

The team was invited to meet with D. Aruinjargal, Director of the Division of Labour & Social Welfare in the aimag who was introduced to the Trust and then invited the team to meet local business leaders and social welfare providers. The team visited a regional health clinic, a hospital in the midst of rehabilitation, produce vendors at the city market and Sh. Lkhagvasuren; proprietor of the COST Company which specializes in baked goods and bottling water.

***Highlands***

In order to reach our first camp, the team traveled 12 hours by jeep from Ulaanbaatar, covering approximately 450 kilometers. Due to melting snow and rain in the mountains, the Trust Team encountered flooding which slowed travel. The jeeps were able to ford all of the streams we encountered and we arrived safely to our ger camp.

In the morning, flood waters continued to rise and the host team met to discuss plans for the day. Originally, travel plans included a visit to a yak herding camp in the highlands but the flooding made travel there impossible. Instead, the host team chose to avoid flooded areas and travel to a different yak herding community located slightly further to the west.

To reach the first yak herding camp, we drove approximately two hours from the ger camp through the Ikhtamir soum. Along the way we saw snow covered mountains, rolling hills covered in patches of orange flowers, large pine forests, prayer circles and flocks of sheep, yaks and goats.

***Yak Herding Camps***

Tuvshinjargal, the head matron at the first yak herder camp (location 47º 23'N; 100º 23'E) invited us into her family's ger to observe production and preparation of various dairy products. Tsend Enkhtuya explained the process and products to us in English. Tuvshinjargal demonstrated production of Shar tos (Yak Milk Yellow Oil) and Khailmag (Roo) as well as the stirring process for Tarag (yogurt) and the distillation of Arhii (Yak milk vodka). Urom (bubble butter), Zhuukii (butter), and Byaslag (cheese) had been previously made and were offered to all guests for tasting.

After these demonstrations, the MNBIF and Trust teams traveled to a Sainbileg's yak herder camp. Here, Ts. Enkhtuya and Sainbileg signed an agreement to constitute a yak dairy cooperative. MNBIF and M·CAM sponsored this operation in order to engage with the cooperative members present, but also with the herders the team was unable to visit due to flooding.

***Horse Herding Camp***

Horse herder Enkhbayar and family of the Tsenkher soum in the Arkhangai aimag (location 47º 30' N; 101º 54' E) invited the Trust and MNBIF teams into their camp and informed us about the many facets of horse herding. This visit was only a few hours in length but extremely informative.

Enkhbayar's family members seemed to be in constant action. The younger son brought the horse herd into camp from the pasture. His wife demonstrated horse milking. Various members showed us how they hitched horses to wooden posts to keep them from wandering away. When it came time to prepare the large group meal, every one of the family members pitched in to work on part of the process. Other guests, including MNBIF members also pitched in and helped butcher the goat, prepare and clean the carcass, separate and slice internal organs, and begin the cooking and preservation processes. Some goat components such as blood and intestine were combined and cooked directly on hot coals. Other muscle, cuts similar to chops or tenderloin, were combined with potatoes, onions, carrots and river stones into a pressure cooker to create a stew.

Components of a disassembled ger were scattered north of the main living area. Enkhbayar illuminated the assembly process for the team.

***Hasu Shivert Resort & Hot Spring/Hasu Company***

The Hasu Shivert Resort is located in the Arkhangai aimag. Located at least 60 km from Erdenebulgan soum center, this all-inclusive resort grows all the food, grain, animal meat, and milk on property for its guests. The facility can host 200 guests and has many health amenities all of which center around the 68˚C natural hot springs. The springs fill a large outdoor swimming pool to provide relaxation to visitors. Throughout the year and particularly in the cold seasons, the facility uses geothermally heated water to heat the buildings.

We met with Munkhbat Hasu, the proprietor of the facility, who guided us through their operations. First we visited his A-Frame greenhouse. The greenhouse measured approximately 5 meters x 25 meters and had a large south facing wall. Inside drip irrigation provides water to pepper and tomato plants. Currently, the greenhouse can be used for approximately 4 months of the year; however Hasu hopes to add upgrades to the structure to extend his growing period. Next to the A-Frame greenhouse are two traditional domed greenhouses where many different types of seedlings were growing.

Outside of the greenhouses a hot water spring flows by and creates an ecosystem conducive to algae growth. This algae is harvested and used for healing skin and facial wraps inside the facility health spa.

**Integral Accounting**

The six aspects of Integral Accounting, as described in the 2010 Heritable Innovation Trust Foreword by Dr. David E. Martin, outline a system which value is ascribed to every part of a society. Each part -- commodity, custom and culture, knowledge, money, technology, and well-being -- adds its own unique aspect of value, benefiting the group as a whole.

**Commodity**

*"Commodity is those elements present in communities which, through cultivation, production or value-add, can be used to generate means of social or commercial engagement."*

In traditional terms, Mongolia contains large reserves of mineral resources, livestock, agriculture, textiles and energy production materials. In addition, Mongolia contains large quantities of sunlight, wind, water, recycled materials, agriculture, livestock, buildings and ingenuity. As camel herder Bud described to us, the production of wool is so high and the market price is so low that herders are dumping it into the environment rather than bring it to market. However, value-add production and new uses for the wool could raise the market price and create local business opportunities. Some value-add uses include natural fiber rope used for animal husbandry or shelter construction, felt production for organic air filters, insulation, clothing, and blankets. Certain types of wool can also be put through a catabolic process and formed into carbon nanotubes, which are used in electronics for energy storage.

Due to the popularity of drinking vodka for cultural celebrations, empty glass bottles can be found throughout the countryside. This excess amount of glass could easily be recycled into building materials.

Milk and milk related products are highly nutritious and highly valued in the cities; however, distribution logistics from the herding camps to the city markets remains a barrier. Herders of sheep, camel, goat, yak, and cow will bring products such as Shar tos (Yak Milk Yellow Oil), Khailmag (Roo), Urom (bubble butter), Zhuukii (butter), Byaslag (cheese), and Tarag (yogurt) to the markets. The quality of the milk/milk products, particularly from the Arkhangai Aimag, is highly rated and the brand is valuable within Mongolia.

Animals (sheep, goats, dogs, yaks, cows, and horses) have significant commodity and money value. Livestock can be traded at markets and between herders and can be used to produce food or work. An intersection between commodity and money value manifests as a commonly understood social agreement in which; if an automobile driver hits and kills or injures a herder's animal, there is a set price that driver will pay to the herder.

Trees appear frequently in some highland regions and less frequently in others. In the Arkhangai aimag, pine trees are plentiful; however, due to a beetle infestation, many of the trees are dying and presenting a fire risk. Logging the dead trees for firewood, building materials, or fencing could improve forest health and provide a cheap feedstock for many processes. Forestation efforts in the Gobi Desert hope to expand the presence of Saksaul trees in the environment.

Large vacant buildings are also a commodity in Mongolia. During the historical Russian occupation, many large over-engineered buildings were built. These sturdy buildings provide the location for various types of production facilities, especially facilities requiring temperature control.

**Custom & Culture**

*"Custom and culture are practices and expressions of individual or community held values and traditions which create a context for social interaction."*

The performing arts are prevalent in Mongolian culture. By using their own body as a medium, the Mongolian people create art in the form of music and acrobatics. Mongolian music is unique in that the sounds are mostly vibrational tones made by using vocal cords. While the sound is unlike traditional western singing it can be compared to vocal play. Mongolian throat singing or overtone singing is in most cases combined with varying versions of base guitar and a morin khurr or horse-headed fiddle with two strings. Acrobatics, the performance of balance, agility, and motor coordination, is also a very popular performance art in Mongolia. Each individual performance illustrates both the flexibility and strength of the performers.

To celebrate or welcome a guest in Mongolia it is a cultural practice to offer a one-ounce glass of vodka to the guest upon arrival. Throughout the years this tradition has become commonplace and not participating in the gesture is considered disrespectful. However, over time a social conundrum has emerged. It is expected of the host to first serve the guest of honor and then themselves. At a point in history, the hosts began using this expectation to serve their guest poison. When the populous discovered this tactic they created the vodka salutation. The "blessing", as described in the 2010 Heritable Innovation Trust Item section, is a solution for Mongolian people to both honor the earth and divinity while testing the vodka for nefarious substances. The salutation combines two competing energies. One energy is an energy of thanksgiving, welcome and friendship. The other is self preservation. The technique involved bonds two counterparties and builds trust through proving integrity by giving.

One of the cultural icons in Mongolia is the ger which is a conical tent-like living structure. This structure is known as a yurt in some parts of the world. While it provides shelter, it also allows for a cultural protocol to be developed allowing families to organize a small space into living cooking and sleeping quarters. All activities inside of a ger follow a protocol. Once inside the ger there are specific locations for dwellers to walk based on gender. Women are to walk around to the left near the kitchen equipment while men are required to walk around to the right to help keep order in the food preparation process. Most of the kitchen utensils, food storage and fuel access are on the door side of the ger. There are also special procedures for guests. If a guest enters the ger, the guest is invited to sit on the chairs or bench opposite the door.

The driving patterns in Mongolia are unique and focus on maintaining social and environmental structure rather than allowing for speed. Most driving done in Mongolia is done on country roads. Most roads are not paved; rather they are worn down tracks made by tires of cars, jeeps, and trucks. Over time, travel has pre-cut lanes into the natural landscape and the paths can range from extremely bumpy to smooth. Rarely do more than 8 pre-cut tire tracks constitute a path. While drivers realize that the bumpy tracks cause the vehicles to move more slowly and that driving on the flat grass would allow a vehicle to drive faster, most drivers for the sake of preserving the environment adhere to the cultural norm which sticks to travel only using the pre-made tracks. The best track amongst the viable tracks is picked, but rarely do drivers deviate from the tracks. If there is a deviation, it is not for very long.

**Knowledge**

*"Knowledge is information and experiential awareness which can be transmitted through language, art, or other expressions.*"

Mongolian nomads have a strong connection to the land and have passed their knowledge and traditions down through generations. One such manifestation of knowledge is a mobile shelter called a ger. While many places around the world face homelessness and refugee type situations due to changing climate and shelter immovability, the Mongolian people have perfected a style of shelter which requires two people to set up, minimal supplies and only thirty minutes to construct. The ger is a versatile structure for hot, cold, wet or dry climates and combined with its simple design, low cost, ease to set up, and ability to sleep up to 40 or more people per shelter make the ger a viable shelter solution worldwide.

Heritable knowledge is also passed down through generations in the different communities, especially in regards to their natural remedies. One of these remedies is Sohor Khar. Generations of people have used this small beetle to cure cancer and rectal pain.

One vital component of knowledge is context. While building a fire with two of our hosts, we assembled three large rocks on top of which we put a cooking pot. As the fire got started, our hosts gathered small discarded waste plastic bottles from around the park area. Next, our hosts took the bottles and placed one after another into the fire, each time smiling from ear to ear and happily saying, "Ecology!" as the bottles melted and vaporized. The perspective challenged our perception of what it means to be ecological. When a piece of plastic waste is located at least 500 miles away from the nearest recycling center, it seems very ecological to get rid of it by burning it rather than to leave it in place. In fact, this process rids the local environment of waste. On the other hand, the waste is turned into toxic smoke and fumes, harmful to humans and the environment. This perspective exchange allowed our team members to reflect on the context and reconcile what, for us, was action we would not have considered. Yet, both achieve ecological outcomes.

**Money**

*"Money is modes of transmitting and recognizing value exchange using physical and virtual surrogates including currency, systems of credit and barter."*

Denominating wealth exclusively as currency is clearly inadequate in the abundant land of Mongolia. In fact, for the majority of people in the rural communities, money as currency is infrequently used and wealth and transaction potential is measured in animals or agricultural products. According to a 2008 UNDP report, 22% of Mongolians live on less than $1.25 per day. Such statistics suggest that Mongolia is a land of poverty and hopelessness. Yet upon inspection, there is abundant wealth. Herding families with 'nothing' in terms of cash manage to keep hundreds of livestock, procure magnificent ornamental decorations and keep entire communities well fed.

While markets exist in all urban centers in Mongolia to buy, sell and trade almost anything (agriculture, clothing, meat, dairy, and consumer goods), the Mongolian communities subscribe to a different set of value metrics. Wealth, particularly in rural areas, derives not from money, but from a strong connection to land, to livestock and to community.
Munkhbat Hasu, proprietor of the Hasu Shivert Resort, is a living example of someone with a strong understanding of how to steward wealth in community. At the Shivert Hot Spring Resort, Hasu realized the problems short term debt was causing in the surrounding agriculture community. His analysis found that many short term loans required a payback period to be transacted before harvest time. This forced farmers to pick food before it is ripe. Unripe fruit and vegetables fetch a lower price at the market. Since all area farmers had a similar debt timing structure and harvest period, all farmers had to sell their unripe food at the same time and the same market; causing a glut and further deflating the market price of the vegetables. Hasu realized that issuing longer term credit, rather than debt, allowed for greater economic benefit to all the participants in the economy. First, he realized that waiting for the highest quality fruits and vegetables to become ripe, increased price at the market. Also, he realized that cold storage would allow goods to be released and sold over time, increasing market price. Lastly, Hasu's offers credit and payment, not just in cash but, additionally, sometimes in seed and/or fully grown vegetables. This function eliminates the need for two exchanges, food/seed for money and later, money for food/seed. Eliminating two middle steps reduces friction and provides a higher yield to both counterparties.

A cultural norm involving money and community has arisen in Mongolia since automobiles have become more widely used in the countryside. In the event that an automobile driver hits and kills or injures a herder's animal, a socially agreed upon, pre-set price is in place that the driver will pay to the herder. The type and quality of animal determines price. For example, sheep and goats cost roughly $100. Cows and yaks cost roughly $400. Normal horses cost roughly $500 and prized racing horses can cost $1000 or more. This compensation to the herder equals the equivalent market price if the meat, milk, etc., were sold.

While abundant wealth exists throughout Mongolia, the lure of monetary wealth is becoming attractive. Western influence, a market economy and the increase of the mining industry all clash with local culture and value systems but also offer new global options and opportunities. The Oyu Tologoi mine in the south is rumored to be the largest gold and copper deposit it in the world. Many interests, governments, corporations, and individuals all have a stake in the outcome. Currently, money and commodity are driving the process.

**Technology**

*"Technology is the artifacts or schemes by which value-added experiences and production can be effectuated."*

The Mongolian desert and steppe terrain are vast. Increasing desertification, decreasing water supply and drastic winter temperature shifts are causing natural systems to adapt.

Rarely are trees associated with deserts nor are they associated with technology, however in the Gobi, they are becoming a strategic technology asset. Saksaul Trees, native to the Gobi Desert, have deep and horizontal root systems that prevent erosion. The bark and needles contain water, which can be consumed by humans and animals.

As stated above, the ger, the main form of shelter in Mongolia, is simple, inexpensive and adaptable for all climates. Each dwelling ger, includes a simple wood burning stove that is used for heating and cooking. On the roof of the ger, a flat vent is opened to allow for ventilation.

On top of each ger stove, a specialized curved pan can be placed for cooking. This pan fit directly into a top opening in the stove and the seal it creates conserves a significant amount of heat and fuel. The curved pan is very versatile for cooking.

Yak herders are known for distilling yak milk into vodka. A milk vodka still is a highly specialized piece of equipment which can capture alcohol fermented from milk. It can also be used to distill saline or impure water into fresh water.

In areas where volcanic river stones are available, for example in the horse herding camps, it is tradition to cook using the stone. By combining rocks and food in a pressure cooker they evenly heat the food. The scalding rocks are extracted before the meal and passed around between diners to sterilize their hands before eating.

The Hasu Shivert Resort, located in the Arkhangi aimag operates three greenhouses. The A-frame greenhouse is approximately 5 meters x 25 meters and contains drip irrigation to pepper and tomato plants. The two traditional greenhouses house seedlings. In the future Hasu hopes to add an improved insulated second glass panel so that year-round growing will be possible. He has partnered with the Heritable Innovation Trust and Global Innovation Commons to research and develop recycling technologies, building materials, and geothermal additions for the greenhouse.

**Well-Being**

*"Well-being is the capacity for any person or ecosystem to function at their optimal level."*

The people of Mongolia have created a marketplace full of natural products. The majority of edible and wearable goods are made organically. Very few agriculture facilities are certified organic which provides a large value add opportunity for the Mongolian agriculture sector. Organic certification would greatly increase the market price of almost all Made-In-Mongolia goods. There are noticeable differences in the increase of taste, quality, digestibility, food edibility lifespan and health which are all benefits derived from having a lifestyle based on natural organic products.

Expansion of the Gobi Desert has increased dust in China and Korea due to wind patterns. To ameliorate this problem, Korea and Mongolia are working together to create a green corridor through the desert. In addition to stopping desertification, tree planting provides food for humans and animals, shade for travelers, wood for heating, roots to prevent erosion and fine dust, and income and employment for workers. Trees are truly an integral manifestation as they provide value to every part of their lives.

Family life is strong in Mongolia. In most situations, we visited camps which housed three generations and sometimes multiple branches of a family. Herding and agriculture production allows for generational connections and learning opportunities not present in other cultures. Time spent raising children within a solid family values ecosystem creates bonds and systems of trust.

The invention and proliferation of the satellite dish has had a profound effect on family values, behaviors and interactions. This technology has granted access to communications channels throughout the countryside in many cases increasing awareness of outside cultures and value systems. However, many 'adult' channels have not been encrypted in Mongolian airspace which has lead to the intrusion of an external value set. This technological case study demonstrates how the connection between technology and well being can serve to increase or decrease societal well being.