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PUBLICATIONS AND PAPER PRESENTATIONS

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THE CONCEPT OF “ISLANDNESS”, AS A FORM OF LIVING AMONG HOUSEHOLDS IN GASPAR ISLAND, TRES REYES ISLANDS, MARINDUQUE, PHILIPPINES

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Abstract

Marinduque is an island with peripheral islands that are inhabited by people. It has about 15 islands and islets, but five of them have existing communities. One of them is the Gaspar Island, the biggest amongst the three islands that composed the Tres Reyes Group of Islands. What puzzled us was why the people live in the island with very limited resources and far from development? The study was focused on the social structure of the 67 households in the island, their concept about “islandness” and their development outlooks in the island. The study involved series of fieldworks between 2007, 2008 and 2009 applying six focused group discussions, six story circle sessions, six participant-observer approaches and four oral history sessions. Results revealed that the households have mean age of 40, the eldest was 72 years old; mean residency of 36.57; household size of seven; majority are considered as tenants, despite their forefathers started living in the island, mean income of Php 160.45 per day, mostly from farming and fishing; majority are elementary school graduate; 20% of the children are malnourished and majority of their homes are made of light materials available in the island. The islanders defined “islandness” in the following descending order: peacefulness or tranquility, poverty and solidarity or belongingness, simple way of life but fight for their rights over the island, hardship and survival, remoteness, limited resources, isolation and indigenous technology. Their preferred development concerns in descending order are as follows: freshwater supply, autonomy in governance, resource management, education, medical services and related knowledge, handicraft livelihood, decent shelter and electricity, ecotourism, comfort room and postharvest facilities.

Keywords: Gaspar Island, islandness, Marinduque, Nissology, social structure.

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Potentials of Fern Species in Sequestering Cu+2 in Natural Water Springs

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Abstract—This study make use of the traditional knowledge of the old folks in protecting rural water supply from natural springs using different species of ferns. It is primarily focused on the species' capacity in sequestering Cu+2, since Marinduque has rich deposits of mineral rocks with copper, thus the presence of two mining companies in the province in the early 70s to the late 90s. The study is of two parts, such as; the identification of the fern species based on the traditional knowledge of the people and the laboratory part to measure the amount of Cu+2 sequestered by each of the species. Seven species of ferns were identified and used in this study, such as, *Acrostichum aureum* L., *Blechnum orientale* L., *Dicranopteris linearis* (Burm. f.) Underw., *Lycopodium cernum* (L.) Pichi-Serm., *Nephrolepis cordifolia* (L.) Presl., *Pityrogramma calomelanos* (L.) Link., and *Sphenomeris chinensis* (L.) Maxon. Clumps of fern samples were gathered and pre-determined for the presence of Cu+2 using AAS. They were acclimatized for a week in a Cu+2-free soil, then separated into smaller clumps and transplanted in plastic pots (8 cm dia., 6 cm height) with equal amounts of Cu+2-free garden soil. Three replicates of these were made for each species. The pots were placed in a plastic pan (10 cm dia., 4 cm height) with 500 ppm copper sulfate stock solution. Fresh leaves and fronds from the fern samples were harvested after three weeks and repeated after six weeks. They were ashed and analyzed using AAS. Results showed that after three weeks, the accumulated Cu+2 in the harvested leaves and fronds was almost threefold and fourfold after six weeks, except the case of *N. cordifolia* and *L. cernum*, which the later died in the 4th and 5th weeks. *S. chinensis*, *P. calomelanos*, *B. orientale*, *D. linearis* and *A. aureum* showed high accumulating properties. These results further support the old folks' traditional knowledge on ferns that help in sequestering the heavy metals, like Cu+2 in the natural springs.

Keywords - Cu+2, ferns, heavy metals, Marinduque, natural water springs, phytoremediation, traditional knowledge.

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TRADITIONAL KNOWLEDGE ON MUSHROOMS AS “NUTRICEUTICALS” AND “COSMECEUTICALS”

IN THE HINTERLANDS OF MARINDUQUE

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Abstract

Mushrooms and fungi are always part of our natural and social environment. In the natural environment, they are seen in the forest, in the backyard and in animals' wastes where rotten materials abound. In the social environment, they are used as source of food and medicine by the people who are familiar with them. Thus, this study is a documentation of the mushrooms and fungi species in Marinduque, which are generally used by the people, especially by the traditional healers as source of food, medicine and cosmetics. The study was conducted in the most interior part of the province, in *barangays* (villages) Bayute, Sabong, Tambunan and Tumagabok, where the practice of using mushrooms and fungi as medicine, food and cosmetics exist. The documentation involved eight *herbolarios* and three elders from the hinterlands of Marinduque, which involved unstructured interview, focused group discussion and participant-observer approach. The study revealed that some mushrooms and fungi are used by the people in preparing dishes, which at the same time they believe that they have curative or medicinal properties, thus the term “nutriceuticals”. Other species have astringent properties good for the skin and promote healthy growth of hair that can prevent baldness, thus the term “cosmeceuticals”.

Keywords: “cosmeceuticals”, fungi, Marinduque, mushrooms, “nutriceuticals”, traditional knowledge.

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Physico-chemical Properties and Heavy Metal Contents of Ino-Capayang Mine-made Lake in Marinduque, Philippines

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Abstract

Ino-Capayang mine-made lake is a monolith remains of mining in Marinduque, opened in 1968 and closed and abandoned in 1980. The lake is surrounded by barren lands and few vegetation scattered with metallic ores forming acid mine drainage continuously draining into the lake. To evaluate the water quality in the lake, water samples were collected from the lake and analyzed for physico-chemical parameters and heavy metal concentrations. Physico-chemical parameters were pH, temperature, electrical conductivity (EC), total dissolved solids (TDS) and oxidation-reduction potential (ORP) were measured on-site using digital measuring devices while heavy metal concentrations were analysed using flame atomic absorption spectrophotometer (FAAS). Results showed that the water in the lake measured with slightly alkaline pH (7.83) and mean temperature of 31.74°C. Measured heavy metal concentrations of Cd (0.006 mg/L), Cu (0.018 mg/L), Fe (0.151 mg/L), Pb (0.0089 mg/L), Mn (0.1404 mg/L) and Zn (0.1507 mg/L) were all within the regulated levels for the freshwater can be intended for propagation of fish and other aquatic resources as well as recreational activities such as boating, fishing, and for agriculture use. Other parameters, such as EC and TDS, were measured with lower levels compared to the characteristics of other mine-made lake in the country, while the measured ORP indicates that the entire water in the lake has high oxidizing agent.

Keywords: Ino-Capayang, heavy metals, Marinduque, mine-made lake, abandoned mines

1. INTRODUCTION

In July 1968, the Consolidated Mines Inc. (CMI) started operating an open-pit bench type mining for copper ore production in Mogpog, Marinduque. Ino-Capayang mine is one of the porphyry copper deposits in Philippines which is associated with the western segment of Luzon Arc [1]. Due to the low price of copper in the market and high production cost, the company was closed in August 1980. After the abandonment, Ino-Capayang, one of the open pits created by CMI was filled with water and became a mine-made lake (Fig. 1). The company left a monolith remains of mine-made lake, considered a threat to the environment and to the lives of the people that can pollute the environment any time. Ino-

Capayang is located between villages of Ino and Capayang, which is located around 3.72 km from the town proper of Mogpog, in the island of Marinduque (Fig. 2).

Currently, the mined-out area excluding the lake is barely covered with vegetation [2] and it has been a site for outdoor activities for people who do biking, walking and shooting. It was reported that the local government of Mogpog, Marinduque is planning to convert the lake and surrounding area into an eco-tourism park, where people can do activities such as walk around the lake, boating or fishing and other outdoor activities. Efforts has been laid out to rehabilitate and bring back the green in the degraded mining area by bioremediation using native plants and their associated microbes of fungi and bacteria [3] as well as ferns, grasses, shrubs and herbs [2]. While trees such as narra, acacia and eucalyptus showed healthy growth in degraded land soil with the help of beneficial fungi and bacteria that strengthen plant tolerance to high acidity and heavy metals present in the soil [4].

Abandoned and inactive mines pose high risks to human health and the environment due to the disturbed and exposed heavy metal-laden soils and sediments and water-filled open pit mines with high heavy metal concentrations. Most of these heavy metals are scattered in the environment through mining that involves removal of large volumes rocks and ore bodies and sometimes the whole mountain [5]. The open-pit mining is used to extract massive deposits of these metals from ores that are at or near the surface and are large in all three dimensions. The method may be used in almost any kind of surface terrain. One of the devastating outcomes of open-pit mining is the pit mine lakes or mine-made lakes that extend below the natural water table [6]. A number of environmental concerns surround pit mine lakes and perhaps the most important concern is the long-term chemical evolution of pit lake water [7] – [9].

The oxidation of rich sulfide mineral ores, such as the scattered pyrite and cuprite ores in the fields lead to the formation of sulfur oxides, which when dissolved in water like rain and runoff create sulfuric acid, an electrolytic-like solution laden with heavy metal ions. The acidic solution formed can dissolve further the harmful heavy metals and metalloids from the surrounding rocks, releasing more metallic ions, like aluminum, cadmium, copper, iron, lead, manganese, mercury, nickel, silver and zinc [10]. These heavy metals present in the soil and



Phytosuccession and Phytosociology of Plants in Ino-Capayang Mined-out Area for Possible Phytoremediation Activities in Marinduque

Roja L. Medianista and Panchito M. Labay

Abstract—Mining is a destructive activity. A lot of earth and rocks are removed in a mining site before the precious metals are extracted. In search for plants that can help in revegetating former minefields this study analyzed the phytosuccession and phytosociology of species in the former Ino-Capayang mined-out area. Twenty-nine, 1x1m quadrats were laid in a belt-like manner in a selected green island of the area. Plants for each quadrat were counted, identified, classified and the biodiversity, richness and evenness indices were computed. Shoot samples of the abundant species were collected and subjected to Cu^{+2} , Pb^{+2} and Zn^{+2} content analysis using AAS. Results revealed 37 plant species belonging to 25 families. The most abundant species were in the peripheries of highly acidic areas, such as ferns (*Pyragranthus* sp., *Nephrolepis* sp., *Sphenomeris* sp.), grasses (*Imperata* sp. and *Saccharum* sp.), and herbs and shrubs of *Chromolaena odorata*, *Lantana camara*, and *Strobilanthus javanicensis*. These were classified as pioneers in the mined-out area. They also showed high levels of heavy metals in the shoots as compared to those plants found in mining-free area of the province. Therefore, these plants have potentials in revegetating former minefields, like that of Ino-Capayang.

Keywords—mined-out area, phytoremediation, phytosociology, phytosuccession.

I. INTRODUCTION

The Philippines is one of the most mineral rich places of the world, due to its tectonic formation [1], [2]. It is 5th in mineral deposits worldwide, 3rd in gold, 4th in copper, 5th in nickel chromite and 12th in nickel deposits [2]. The country has also deposits of silver, platinum, palladium and uranium that are needed in electronics industry [3], [4]. These mineral deposits are located in biodiversity rich areas and geohazard zones for landslides, typhoons and volcanoes [1]. Marinduque Island is one of the heavily mineralized areas for gold, copper and iron [4], thus two mining companies operated in the province since the 60s up to late 90s, using the destructive open-pit mining. One example was that of Marcopper Mining Corporation (MMC), where about 220 million tons of soil and rocks had been removed and dumped to extract one million tons copper from 1969 to 1991 [1], [4]. Once mining happened, the

abandoned minefields or mined-out areas prevailed for years, due to acid mine drainage (AMD) [5]. The acidic nature of AMD, the dissolves heavy metals and the crystallized salts make revegetation of the area difficult to happen [6]. Continuous soil erosion of the contaminated soil affects the agricultural lands nearby [7] and the heavy metals contaminate bodies of water [8]. The mined-out area left by Consolidated Mines Incorporated (CMI) in Ino-Capayang, Mogpog that operated from July 1968 to August 1980, is a concrete evidence of environmental disaster in the province [9], [10].

In 2001, less than 30% of the area is covered with vegetation, excluding the mine-made lake created by the operation [10]. At present, the area is still barely covered with vegetation, with mean pH value of 3.34 ± 0.45 [9].

It is believed that understanding *phytosuccession* and *phytosociology* of species in the *green islands* of the former minefields can help in revegetating the area. Based on ecological parlance, *phytosuccession* is the establishment of a plant community (*green island*) in a disturbed area [11], while *phytosociology* is the distribution, relationship and interaction among plant species and soil microbiota, like fungus in the area under study [12], [13]. Plants adapted to such areas are called *metalophytes* or metal tolerant plants that have capacities to form communities (*green islands*) acidic and heavy metals rich areas [14], [15]. These plants can be tapped for *phytoremediation* of mined-out areas [16], [17], [18].

This study aimed to identify the plants in the CMI *green island*, classify them, measure their biodiversity, richness and evenness indices, and measure the amount of Cu^{+2} , Pb^{+2} , and Zn^{+2} in the shoots of the most abundant species.

II. METHODS

A. Study Area

The CMI mined-out area is located between Ino and Capayang, municipality of Mogpog, approximately 3.72 km road from the town proper (Fig. 1). CMI operated in two ore bodies, such as the Isaw-Pili and Ino-Capayang, which applied an open-pit bench-type of mining. It created an oval, bowl-shaped pit, the Ino-Capayang Mine-made Lake. CMI has copper concentrate tenement area of 1,259.32 ha, but due to low price of copper in the market and high production cost, the company was closed in August 1980 [19]. Its oblong-shaped pit measured 0.724 km east-west and 0.526 km north-south is filled with water almost like a lake [20], [21].

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EN5: Minding Nature's Call! Local Phenology and Rural Folk's Farming Practices

Virginia M. Sotto, Marinduque State College Tanza, The Philippines

The worldwide negative consequences of the Fordist Approach of development in agriculture has forced development planners, policy makers and the academe to look for alternatives; thus, today's emerging trend in agriculture is 'back to basics'. The study looked on socio-culturally and environmentally acceptable approaches of the rural farmers or their knowledge system in relation to their agricultural practices and protection of the environment. This research applied ethnography and actual field observations on selected areas in the island province of Marinduque. The rural folks' knowledge on local floral phenology and its relation to their farming cycles, e.g. preparation of the land, sowing and planting, cultivating and harvesting of agricultural crops and related food products were presented. The study revealed that seasonal development is more recognizable on their farming practices than on conventional farming, and that seasonal development is a scientifically-usable criterion for evaluating the quality of their environment.

EN7: Eerie worms, flying gems! Lessons from the 'Actors' in Harmonising Nature, Culture and Economics for a Sustainable Butterfly Livelihood in Rural Philippines

Panchito M. Labay, Marinduque State College Tanza., The Philippines

The butterfly livelihood in the island province of Marinduque is an 'actor-driven' livelihood that started from a hobby of one person and finally through years become an emerging livelihood. Through this livelihood, the island province of Marinduque becomes 'The Butterfly Capital of the Philippines'. Thus, the study was focused on the role of the butterfly farmers as 'social actors' and their 'agency', who developed the livelihood that harmonizes nature, culture and economics as social arenas for development and sustainability. The study applied ethnography with the concepts of sociology, ethnobotany and ethnoecology. The study revealed the indigenous and endogenous wisdoms, traditional knowledge and developed alternative technological practices that they continuously practice through time. It unveiled their experiences, developed practices and values in studying, identifying, categorizing and farming more than 300 species of butterflies, their respective larval- and nectar-food plants and the socio-cultural 'meanings' they ascribed to them. It also revealed the developed local and global social networks, commodity-chain strategies, cultural beliefs and farming knowledge and practices that all redound to the protection of the environment. Because of the participation of many players in the livelihood nowadays as brought by globalization, the study also presented the emerging contestations and changing socio-cultural, political and economic values of the actors, which are affecting their perceptions and motivations about butterfly farming and its livelihood-related activities.



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**METAMORPHOSIS OF CHANGE FOR RURAL DEVELOPMENT!
LESSONS FROM THE "ACTORS"—THE SUSTAINABLE WAY
OF FARMING BUTTERFLIES IN MARINDUQUE**

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Butterfly farming in the small island of Marinduque started in the early 60s from Romeo Lumawig's hobby of collecting butterflies as dried specimens. This hobby later developed into an export-oriented and environment-friendly livelihood. The study focused on the farmers' (called social actors) experiences, and developed bodies of knowledge, practices, and values in relation to their continuous interactions with nature, culture and economics as social arenas for development. It presented the traditional and endogenous knowledge and alternative technological practices that the 'actors' had developed and continuously practiced through time. It also revealed the emerging social networks, economic strategies (local and global), developed cultural beliefs and indigenous farming knowledge and practices that all redound to the protection of the environment towards the livelihood's sustainability. The paper also discussed the changing and emerging socio-cultural, political and economic values of the people that affect their perceptions about butterfly farming and livelihood-related activities.



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**The Heavy Metal Contents and the Fish Catch Rate in Calancan Bay, Marinduque, Philippines:
Mine Tailings Causeway, Three Decades After**



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Mining and environment are two opposing poles to combine, because the former destroys the later. Thus, this study unveiled the present environmental condition of the former mine tailings causeway called Tambak in Calancan Bay, Marinduque. The heavy metals present in the soil, water and the mollusk, and the fish catch rate in the bay were measured. A survey and actual fieldwork were done from March to December of 2018, covering eight sampling sites and 48 fishing households in the area. Results of the study revealed that after three decades, improvements in the heavy metals' readings in the soil and water were majority below the established standards as compared to previous studies. The fish catch rate increased for some species. Today, no concrete support programs are existing for the people in the area. Thus, the results of this study can be used in framing an environmental management program for the area.

Keywords: Environmental Toxicology, Calancan Mine Tailings Causeway, Fish catch rate, Heavy metals, mine tailings, Marinduque, Philippines

Awareness, Attitude, and Practices on Solid Waste Management in a Philippine Catholic University



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One strategic approach to address the indiscriminate disposal of solid wastes is through solid waste management. Waste management is needed to reduce or mitigate the mounting global crisis on waste which endangers humanity, pollutes the environment, and damages communities. The paper assesses the solid waste management awareness, attitude, and practices of the employees and students of a Catholic higher education institution in the Philippines. Using a descriptive research design, the data were collected using a self-administered survey questionnaire and analyzed using descriptive and inferential statistics. The major findings of the study show that the respondents demonstrated a very high level of awareness and attitude and the great extent of the practice of solid waste management. A significant difference was found in the awareness, attitude, and practices of respondents when they were grouped according to status and religion. Also, the findings established the relationship between awareness and attitude on the one hand and the extent of the practice of solid waste management. Awareness, attitudes, and practices were significantly related to age and educational level, except for sex which showed no correlation with attitude and practices. Generally, the paper validates how knowledge influences attitude that subsequently determines behavior, particularly in solid waste management as intervened by appropriate environmental education.

Keywords: Attitude, Awareness, Catholic University, Descriptive-Correlational, Practices, Solid Waste Management, Philippines

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2.4 Botanicals for healthy pigs and quality meat! Ethnobotanical and phytochemical studies of plants used by traditional small-scale pig raisers in Marinduque

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Small scale household pig raising is a culturally practiced tradition in the uplands of Marinduque, which they usually do in preparation for fiestas, birthday celebrations and other special activities. Thus, this study documented the households' abundant traditional knowledge on animal management using botanicals as ethnoveterinary food and medicine. This study can trigger more studies, especially the effects of phytochemicals to animal health, like pigs for example the effects to their meat and fat contents. The study was carried from 2014 to 2016 using PRA tools with 50 respondents (36 women and 14 men). The utilization values (UV) of the botanicals were determined and the plants were gathered from wild and they were subjected to phytochemical screening for active chemical constituents. Results of the study revealed 63 plant species were used for ethnoveterinary medicine and food for pigs and their active constituents have alkaloids, flavonoids, steroids, saponins, terpenoids, glycosides and phenols. They were used by the households in treating the pigs' skin conditions, diarrhea, parasites and colds. This traditional knowledge has been found disappearing and limited now to the people in the uplands due to changing lifestyle. Further studies on phytochemicals' effects to animal health and quality of their meat are recommended.

Keywords: ethnoveterinary, medicine and food, pig, phytochemicals, utilization value



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the 1st International Conference on Sustainable Agriculture and
Food Management: The Roles of Asian Agriculture Universities

Farmers' Developed Knowledge, Technologies and Practices for Sustainable Butterfly Livelihood in Rural Philippines

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Abstract

The study looked on how the butterfly farmers balanced the nature-culture-market interface as social area for sustainable livelihood. A phenomenological study was made where the experiences, encounters and practices of butterfly farmers as social actors where were observed, codified, counter-checked and cross-validated. Findings revealed their developed knowledge, technologies, traditions and practices made them as para-biologists, local phenologists and farmer-scientists, because they established their own taxonomical classification of butterflies together with their host plants using local names, related the butterflies' occurrences to changes in weather and seasons and developed appropriate technologies in farming them, using available resources. They are cosmovisionaries, giving spiritual meanings to butterflies and their habitats for protection; keepers of social capital and network globalizers in maintaining business with contacts here and abroad. They are market-niche strategizers, social capital investors and product market-value developers, maintaining the livelihood continuous the whole year round, thus a mainstay part of the local economy. The newly emerging socio-cultural, political and economic conditions affect the farmers' perceptions about butterfly farming, but they are not stopping to look on other strategies to sustain the livelihood. They learned that butterflies as natural resource, require healthy environment; as cultural resource, they entail right values and practices and as economic resource, they need proper blending of the natural and cultural aspects of development.

Keywords: Actors, Agency, Butterfly Livelihood, Culture, Economics, Nature



leaf concoctions are used by *herbolarios* against number of diseases, because of their therapeutic properties that range from simple antipyretic to antitumor, kidney tonic, cardiogenic and immunostimulant. The plants are also eaten as vegetables and prepared in different ways, as food. Phytochemical screening of the plant samples revealed that they have triterpenes, alkaloids, triterpenoid glycosides, steroid glycosides, cyanogenic glycosides, saponins and tannins. Chemical analyses revealed that like other vegetables, they have both essential macro- and micronutrients, such as carbohydrates, proteins, fiber, β -carotene, ascorbic acid, calcium, potassium, iron, zinc and copper. The study implies that since the Philippines has diverse flora like these, plant breeders can breed these plants into high valued health crops.

Key words: ethnobotany, ethnomedicine, food nutrients, medicinal plants, phytochemistry, wild vegetables.

THE CULTURAL PRACTICES BEHIND "TAWAK", A TRADITIONAL CURE FOR SNAKEBITE IN MARINDUQUE

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Culture, plants, environment and tourism are related to one another. Our ancestors, the indigenous people have contributed to our culture the knowledge of medicinal plants, which they developed through thousands of years. Today, it has become a part of our knowledge system, a product of two important natural wealth — biodiversity and cultural diversity. The application of this knowledge on medicinal plants is empowering to the indigenous people and allows a more realistic sustainable conservation of natural resources that is appealing to foreign tourists. This looked on the cultural practices attached to the preparation and application of "tawak", as well as its potential for tourism in the province and the identification botanically of the plant species and their phytochemical constituents that possibly make them a cure against diseases, snake venom and animal bites. The study was centred in the island province of Marinduque that involved 26 "magtatawak" (snakebite healers) and through participatory approaches in ethnography; it revealed a total of 150 plant species belonging to 53 families and 127 genera. Majority of the plant parts used are the leaves, roots/tubers, barks and the whole plant. These different concoctions of the "magtatawak" were presented with 35 or more herbal combinations. The phytochemical analyses of the plants revealed the presence of active constituents, such as; alkaloids, saponins, tannins, phenols, sterols, triterpenes and anthocyanins and glycosides.

Key words: biodiversity, cultural practices, indigenous knowledge, phytochemicals, snake venom, 'tawak', tourism.



	<p>Hydro team. The Head Determination Algorithm software was preprogrammed to search for minimum head of 20 meters and maximum predefined penstock lengths of 100 meters to 1000 meters with 100-meter increment. Power calculation and power classification of the determined hydro-power potential was processed in ArcMap using field calculator and python script. Results of the study showed possible locations for development of hydro-energy power facilities in the Ilocos Norte river basin for preferred penstock lengths of 100 to 1000 meters for every 100-meter increment. Mini, micro and pico power plants could be built on the areas identified to have potentials. Mostly of the sites detected was located on mountainous areas or high lands where heads are higher compared to low lands. Sample power classification map was showed in Figure 1. The study was able to assess the hydro-energy resource potential of the Ilocos Norte river basin using SAR dataset and GIS technologies. Moreover, river reaches were delineated, flow was simulated using SWAT and was able to detect suitable heads for power plant development. The study was able to identify potential locations for possible establishment of hydro-energy power plants.</p> <p><i>Keywords: renewable energy, resource assessment, hydro resource, GIS.</i></p> <p>EARTHQUAKE RISKS ESTIMATION: A CASE OF RAPID EARTHQUAKE DISASTER ASSESSMENT SYSTEM (REDAS) APPLICATION IN THE PROVINCE OF ILOCOS SUR</p> <p>Robert S. Ablog^{1*}, G. S. Roa, Jr., and P.R.T. Roa <i>Ilocos Sur Polytechnic State College Santa Maria, Ilocos Sur, Philippines katsarazawa@yahoo.com; rsablog@yahoo.com</i></p> <p>The study aimed to estimate earthquake risk using the Rapid Earthquake Damage Assessment System (REDAS) software in Ilocos Sur. Training on software manipulation and familiarization, pilot site identification, enumeration, database construction and impact estimation at 7.2 magnitude earthquake were employed. The province of Ilocos Sur could possibly suffer huge building and floor area damages with numerous casualties and enormous economic losses. Strengthening the implementation of building code, capability enhancement, disaster awareness programs and creating policies should be done to mitigate the impact of this phenomena.</p> <p><i>Keywords: REDAS, Earthquake, Risk Estimation</i></p> <p>DISHES FROM THE WILD! THE NON-TRADITIONAL VEGETABLES OF MARINDUQUE</p> <p>Roja L. Medianista¹ and Panchito M. Labay² <i>¹Philippine Normal University-Manila ²Wageningen University and Research Centrum, The Netherlands rojamedianista@yahoo.com; panchito.labay@yahoo.com</i></p> <p>The traditional knowledge of the <i>herbolarios</i> on the medicinal, nutritional and poisonous properties of plants is useful in the search for solutions to health and nutritional problems. Thus, this study was conducted to identify the nontraditional vegetables in Marinduque that has been used by the old folks as food and medicine at the same time. Furthermore, there is market for these plants in Europe, Japan and USA, thus the Philippines can explore the possibility of studying further these plants as sources of food and medicines that in the long run can be packaged for commercialization. The study applied the concept of ethnobotany by exploring these plants involving 24 <i>herbolarios</i> and rural folks. These plants were identified botanically and their nutritive and active chemical constituents were determined phytochemically. It revealed 10 species of these plants, which are commonly used as medicine and eaten as vegetables by the rural folks of Marinduque. Majority of these were categorised as annual herbs and found mostly in low to medium altitudes of open fields and secondary forests. Their fresh</p>	le pi in Pl tr ar as TI pi K T IN — La 1P 2A 2S Ca pe th in co pr th co w: ar to th he co gl K
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POTENTIALS OF FERN SPECIES FOR GREEN REMEDICATION OF MINED-OUT AREAS IN MARINDUQUE

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Abstract

This study is part of the program, which I started in 2005 upon my return from the Netherlands. The program is entitled **FERNS** which stands for **Friendly Environmental Rehabilitation of the Natural Systems**. The project did not push through well due to lack of support from the leadership of the College. Preliminary results of the study revealed that fern species have potentials for the phytoremediation of heavy metals laden soil (especially Cu for this report) like the mined-out and contaminated areas. Eight species of drought resistant ferns were used in this study, such as, *Acrostichum aureum* L., *Blechnum orientale* L., *Dicranopteris linearis* (Burm.f.) Underw., *Dryopteris* sp., *Lycopodium cernua* (L.) Pichi-Serm., *Nephrolepis cordifolia* (L.) Presl., *Pityrogramma calomelanos* (L.) Link. and *Pteris vittata* ssp. *vittata* L. They were first acclimatised for a week before transplanting in plastic pots with equal amounts of Cu-free garden soil. The pots were placed in a plastic pan with 5g/L copper sulphate solution. Fresh leaves and fronds from the fern samples were harvested after a week, two, three, up to fifth week. They were ashed and analysed using spectrophotometer. Results showed that after two weeks, the accumulated Cu in each species increased abruptly. After five weeks, *Pteris* accumulated 42.78% of Cu from the solution, followed by *Pityrogramma* (39.1%), *Dicranopteris* (33.1%), *Blechnum* (32.5%), *Acrostichum* (29.0%), *Nephrolepis* (25.95%), *Dryopteris* (23.35%) and *Lycopodium* 15.43%.

Keywords: copper, fern, green remediation or phytoremediation, mined-out areas, Marinduque.

1. INTRODUCTION

The link between plants and minerals has been recognised since medieval times, since minerals are always a component of soil and water. Plants need some of these minerals as macronutrients, such as N, P, K, S, Ca and Mg to grow and complete their life cycles (McBride, 1994). If there are macronutrients, there are micronutrients, such as Fe, Zn, Mn, Ni, Cu, and Mo for the plants' healthy growth development. Thus, plants have evolved

highly specific mechanisms to take up, translocate and store these nutrients. For example is the metal movement across biological membranes, which is mediated by proteins with transport functions (Peterson, 1983; Reeves, Baker & Brooks, 1995).

Though some metals are needed in small amounts, especially the so-called 'heavy metals', but when they exceeded in the soil and water, like in heavily polluted soil and water, they become phytotoxic to plants



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The indigenous knowledge of the herbolarios on the medicinal, nutritional, and poisonous properties of plants is useful in the search for solutions to health problems. Furthermore, there is a market for pharnavegetables in Europe, Japan, and USA. The Philippines can explore the possibility of exporting to these countries. Thus, the author conducted a study, which identified the pharnavegetables commonly used by herbolarios in Marinduque. Extracts of these pharnavegetables were also screened for the active chemicals present. The study revealed 20 species of pharnavegetables, which were commonly used as medicine and eaten as vegetables by the rural folk of Marinduque. Majority of these were categorized as annual herbs and found mostly in low to medium altitudes of open fields and secondary forests. The fresh leaf concoction of these plants was used by herbolarios against 28 diseases because of their therapeutic properties that range from simple antipyretic to antitumor, kidney tonic, cardiostimulant, and immunostimulant. In the hinterlands, the plants were also eaten as vegetables and prepared in different ways such as additive in sinigang, ulang-ulang (a native dish of Marinduque prepared from stewed, grated young coconut, and deshelled shrimps or crabs), soup, stewed vegetable with coconut milk, and fresh vegetable salads. Phytochemical screening of the plant samples revealed that they have triterpenes, alkaloids, triterpenoidal glycosides, steroid glycosides, cyanogenic glycosides, saponins and tannins. Chemical analysis revealed that like other vegetables, pharnavegetables have both essential macro- and micronutrients such as carbohydrates, protein, fiber, beta-carotene, ascorbic acid, calcium, potassium, iron, zinc, and copper. The study implies that since Philippines has diverse pharnavegetables, plant breeders can breed these plants into high value pharnafoods by selecting their health benefits or may develop new crops into new health products.

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