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UTILIZATION MANAGEMENT OF BIOLOGICAL DIVERSITY IN PATTANI WATERSHED, SOUTH THAILAND

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Abstracts

Research on utilization of biodiversity in the Pattani Watershed was conducted to survey and enlist biodiversity resources using all parties' participation from people residing in the Pattani Watershed. Other objectives were to enhance their understanding in biodiversity value and sustainable use as well as to build the awareness on the biodiversity conservation among the public and all stakeholders. Both quantitative and qualitative research techniques were employed in combination with participatory action research and the uses of specific methods in collecting biological samples based on their particular types. With samplings from 18 communities representing 6 different ecosystems, revealed that the total species of living organisms found in the upper, middle and lower watershed regions were 170:119:50 for vascular plants, 53:65:96 for fishes, 85:90:12 for mushrooms, and 38:55:52 for algae, respectively. Wild life were only observed in middle and lower watershed regions for 25 and 3 species, respectively. As for conservation and local wisdom in biological resource applications, as many as 8 approaches were presented, and they were sustainable uses, storing and entrapping, repair, reconstruction, development, protection, reservation, and zoning. In promoting knowledge, the pronounced lessons were established, and they included those related with basic learning, context searching, pollutant reducing, co-planning, reserving, and promoting sustainable development.

Key words: Utilization Management, Biological Diversity, Pattani Watershed.

INTRODUCTION

Biodiversity can generally be divided into three levels, of which the genetic diversity is a creature's variety in genetic component and turns out to be genetically different either within a single species or between different species. These are the difference which appear to be used in determining the geographical proximity of creature in the evolution of life. Secondly, is species diversity, which measured by the number of each species and population of those species. In this context, the age and sex structure of the population is also considered. Thirdly, is ecological diversity, within the each system is a source of ecological habitats of the particular creature type with reference to physical and biological factors that are appropriate to each species living in the system. Biodiversity is the identity of our world. It helps to maintain the world atmosphere, soil, water and climate last longer as possible. So, it can be said that biodiversity is the foundation of life of all livings on the Earth (Narong Seeswad 2005). On the otherhand, biodiversity is important to mankind. As humans are part of the bios, they must live together with other livings. With existence of various living species, humans can use biodiversity in all aspects and their uses are more than other living species. As for biodiversity conservation and application with regard to Pattani watershed, it is very important because the northern basin area in lower part locates the elevated earth with forests lining from the north to the south, and originated from SankalaKhiri Mountain ridges in the district of Betong, Yala Province, and flows into the

Gulf of Thailand, Pattani Province. With its approximate 443,810 population (Department of Environmental Quality, 2004), their uses in various forms of consumption are normally observed, and hence their activities can be sensibly undertaken to conserve and sustain the biological resources forever.

RESEARCH METHOD

As for Scientific Research, the followings were steps in detail. Sampling of vegetation in the survey area was conducted by collecting leaves, flowers and their fruits. Collected samples were then subjected to storage using methods of breeding and preservation. Records of all species were also done during this procedure, and their data included the followings. 1.) Collection sites included province, district, sub-district, locality and so on so forth. 2.) Collection date in referring with the plant budding season. 3.) Local or folk name from the learned individual(s) in the collecting area. 4.) Forest types like of tropical rain forest, dry evergreen forest, or along the stream, the valley as well as the ridge. 5.) General characteristics of stems, flower, and fruits. 6.) Name of Collector(s). Sampling of fixed plankton was conducted by collecting samples at various points throughout the Pattani watershed for 18 sites. This was done by placing and soaking 3 pieces of PVC materials with 50 cm in length and 10 cm width for the period of 14-21 days in water at the depth of 50 cm. Fish sampling was conducted using Active Sampling Method by using of nets, and the samples were then analyzed. Sampling of mushrooms was performed by exploring the various mushrooms during their fruiting period, which occurred in 1-2 days after rain. Observation data included collection date, nature of their sites, and mushroom photographs. Once collected, those samples were subjected to be dried or preserved in 5% formalin with spore printing of their spores then performed for the purpose of classification. Sampling of wild mammals and birds used sampling of APHA (1992) with modification based on local wisdom and folk knowledge. Population of animals was counted by the road side while journey for observation made along the roads in the area. By this approach, counts of different types of pets were made possible and better in particular with those of grouses, pheasants, peacocks, civets, mongooses and reptiles. Traces of these animals were also used, and these included use of live sound, nest counting, and dung counts and so on so forth. Social Science Research used qualitative research techniques in combination with techniques of participatory action research. Participators included folks and locals. They were interviewed (Indept Interview). Meanwhile, the leaders of professional OTOP Officers, communities, chiefs of district executives joined the focus group interview. Such qualitative research techniques were conducted in the main villages in the Pattani watershed. Researcher teams chose the particular and specific districts, sub-districts, and villages based on availability of convenient transportation as well as problems and the effects of biodiversity application. 2.3 In preparing the study area to be explored, ensuring its natural conditions and studied network with 6-ecosystem arrangement was emphasized. By this way, the mountain and forest ecosystems in the upper and middle region represented agricultural ecosystems and inland water sources. Coastal ecosystems located 3-7 kilometers from the coast were represented by the lower region. Study areas with those categories were below. 1. Chulabhorn 7, 9 villages as mountain ecosystems 2. Ban Chantharat, Betong District as mountain ecosystems 3. Santinimit 2 villages as forest ecosystems. 4. Santinimit 1 village as forest ecosystems 5. KokChang market area as inland water ecosystems 6. Old Market community, Bannagsta District as agricultural ecosystems. Sa-ek Sub-District community as agricultural ecosystems. 8. TalingChan Sub-District community as agricultural ecosystems. 9. Krong Pinang District community as agricultural ecosystems. 10. PongKayee village as agricultural ecosystems. 11. Satengnok village community as agricultural ecosystems. 12. MuslimSamphan community as agricultural ecosystems. 13. CharuPattana community as agricultural ecosystems. 14. Old

Market community as agricultural ecosystems. 15. Community of Tasek Sub-District, Pattani as agricultural ecosystems. 16. Pakaharang village, Pattani Province as coastal ecosystems. 17. Tanjung village and mangroves, Yaring District, Pattani Province as coastal ecosystems. 18. Paknaam village, Pattani Province as coastal ecosystems.

Data collecting was conducted on locality and made community network. Community networks consist of 18 they consist of localities were given seminar on the curriculum of physical, and biological data collection. Basic data collection was firstly conducted with discussion, and summarization. It followed by the collection of 2nd, 3rd, and 4th round which conducted by research team who worked on samples along side with Yala Rajabhat University students. Summarizing collected data for 2nd, 3rd and 4th round, and enlisting of biological resources. Manpower preparation. Community network members were selected by the Office of Sub-district Administrative Organization for each locality. They were given invitation letters, and their representatives then attended our meeting. In such meeting, the understanding of community network was efficiently delivered. Curriculum training on the preparation of local database was set for the purpose of data collection and later deliver to the community. Recruiting students and network coordinator was done by selecting 2 students from locality. These students were assigned to coordinate in samplings, and 2 students for each unit worked on the weekend day. Recruiting men for the main coordinator groups who were ready to work with community networks in the next stages of data collection. By these stages, data collecting was worked by researcher team with community network support. The works in this stage included seminar conduction for all localities, followed by enlisting of the routes for observation and study procedures, which were scientific and social related. Preparation of natural classroom. This determined the good localities for setting natural classroom within those particular localities. Natural classroom community condition was determined by considering its safety, transportation facility, and convenience in making an understanding, especially in the context of using Thai and local languages among folk scholars. Constructing the local curriculum included the following works. 1) Seminar on the importance of creating a local curriculum was conducted with participation of 10 teachers in Pattani watershed (2 from each school). These teachers together with local community network synthesized the curriculum. 2) Creating local curriculum was worked out by our research team with groups of local and regional basic education service staffs as well as people from the locality. They drafted the curriculum and determined the natural classroom in the study area. 3) Enhancement of knowledge and understanding on the importance, application values of natural resources and biodiversity in Pattani watershed was initiated by defining the scope of works and using various media during the research practices. Such works were made uses of charts/knowledge documents/radio broadcasting/Community Radio. Activities included the group discussion and interviews folk scholars. After the conducting the enhancement of knowledge and understanding the importance and values of natural resources and biodiversity in Pattani watershed through exhibition of the knowledge in the area, the seminar for exchanging knowledge among communities and researchers as well as discussing the utilization of valuable resources and biodiversity was followed, and finally the action plan for sustainable uses of natural resource and biodiversity for this defined area was resulted.

RESULT AND DISCUSSION

Results of the biodiversity utilization in the Pattani watershed were as follows. 1. General and ecological conditions of the Pattani watershed. The Pattani watershed was the important watersheds in the Deep South with geography of high wooded terrain and flat. It was

a bed of flood water that lined from north to south and some parts lined in the east. Its south border was the watershed of the SankalaKhiri Mountains in Yala with about 300,000 hectares of forest plantations, mainly rainforest. There was a forest reserves, national parks, wildlife Sanctuaries and 957,014.75-hectare forest reserves. It was about 24.66% of the region shared by Pattani Province, and this was characterized by ecological areas along the river plains and the mangrove forest with the coastal area of not less than 37 square kilometers. In coastal ecosystems, it included animal populations that were different from other ecosystems. It was the social ecology of wetland plants that were influenced by the dynamics of mangrove ecosystems, i.e. the coastal landscape, climate, tidal waves and currents as well as salinity water stains, soil and nutrients, etc. The finding is in agreement with Konkoetsu, 2010; Komiyama A, et al (2008). In addition development of Quality Promotion on the Environment (2003) reported that Pattani watershed is in a part of an important ecological system in which there are many ecological system like the Hala – Bala forest, a tropical forest, mangrove forest, rainforest, freshwater ecological system, Pattani river and brackish water ecological system. These ecological system are the large habitat to the diversity life's include plants and animals that may not be found in other locations in other parts of Thailand. The finding is in agreement with Development of Forestry (1999).

2. Results of the Pattani River Basin biodiversity study were as below. Diversity of tree species which were used to treat diseases and for health care were KanKhrao (*Fagraea fragrans* Roxb), KrataeTaiMai (*Drynaria quereifolia* Linn.) Khoi (*Streblus asper* Lour.) Khaa or galangal (*Alpinia galangal* Swartz). KhiLaek or cassia (*Carria siamea* Britt) KhiKhroak (*Urena Lobata* Linn.) KhlongKhlaeng (*Melastoma malabathricum*) ChaPhloo or leaf pepper (*Piper sarmentosum* Roxb) ChumhaedThaed or alata (*Cassia alata* Linn.) TamLeung or gourd (*Cocinia grandis* Voigt), TakKhraiHom or citronella (*Cymbopogon nardus* Rendle) ProngPaa (*Cycas pectinata* Griff.) PakLianPhee (*Cleome viscosa* Linn.) PakWaan (*Sauropus androgynus* (Linn.) Merr. PhinTon (*Jatropha multifida* Linn.) PhaaThalaiJon (*Andrographis paniculata* (Burm) Well.ex Ness., PheKaa (*Oroxylum indicum* Vent.), papaya (*Caricapapaya* Linn.) basil (*Ocimum basilicum* var *citratum* Back.). Papaya (*Carica papaya* Linn.), MaengLak or basil (*Ocimum basilicum* var *citratum* Back.), MaKrood or lime (*Citrus hystrix* Dc.), YoPa (*Morinda elliptica* Ridl.), LamTen-(*Stenochiaena palustris*) WanHangJorakhe or aloe Vera (*Aloe baebadensis* Mill.), HwaiTaMoi (*Pothos scandens* Linn.) Horapha or basil (*Ocimum basilicum* Linn.), YaaPakking (*Murdannia loriformis* (Hassk.) Rolla Rao et Kammathy.), YaaBaiPhai (*Panicum repens*) SaabSear or Siam weed (*Eupatorium odoratum* Linn.), SledPhangPhon or nutans (*Barler lupulina* Lindl.), Waa (*Eugenia cumini* Druce.), Boraphed or wormwood (*Tinospora tuberculata* Beumee.), Manao or lime (*Citrus aurantifolia* (Christm. & Panz.) Swing, SabooKhao (*Jatropha curcas* Linn.), Samui (*Micromelum minutum* (G.Forst.) Wgiht & Arm.), KhaaNun or jackfruit (*Artocarpus heterophyllum* Lam.), Phikun (*Mimusops elengi*.Linn.), Khamin or turmeric (*Curcuma longa* Linn.), PaanSamo (*Gynochthodes sublancolata* Mig.), Maiyarap or mimosa (*Mimosa pudica* Linn.), LiPhao (*Lygodium* sp.) Kluipa or wild banana (*Musa* sp.), KluiHin or wild banana (*Musa* sp.2), rose Malaya (*Rhododendron Malayanom*), PlaaLaiPheak (*Eurycoma longifilio* Jack), MoKhaoMoKaengLing or Nepenthes. (*Nepenthes* sp.), YaaTaiBai (*Phullanthus urinaria* Linn.), BuaBok or asiatica (*Centela asiatica* Urban.), KledNaKhaad (*Drymoglossam piloselloides* (Cinn.) Presl), Boraphed (*Tinospora tuberculata* Beumee.), Bon (*Caladium* sp.), ChomPhooNaam or Jasmine (*Jasminun. sambac* Ait.) ChomPhooNaam (*Syzygium* sp.), and TaoRaang or Caryota urens (*Cayota urens* Linn.) The finding is in agreement with Li Chen et al (2013); Komiyama A, et al (2008); Development of Forestry (1999) Garden ornamental plantings that were found in the Pattani watershed included Hmaksong (*Areca catechu*), HmakHom (*Areca trinadra*), Rang kai (*Arenga westerhoutii*), HmakPhon (*Orania sylrcola*), HmakHwing (*Pinga* sp), Chok (*Arenga pinnata*), ChangHai (*Borassdodendron machadonis*), TangLangKhao (*Krriodoxa elegas* Daranster), KaPhoSiSib (*Licuala distans*), JangThai (*Rhapis*

Subtitis), Fern GoodDoi with coarse leaves (*Blechnum moorei*), Fern HluangDoiTung (*Woodwardia cochinchinensis*), Fern NaKhaRaach with coarse leaves (*Davallia solida*), Fern Holly (*Cyrtomium falcatum*), Fern RaYaaYoDom (*Locopodium hlegmaria*), Fern WanKibRaed (*Angiopteris evecta*), Fern BaiMakhamBaiSiao (*Nephrolepis acutifonia*), Fern BaiMakhamSoiRaYaa (*Nephrolepis cordifolia* cv. *Crestata*), Fern Rachini (*Nephrolepis exaltata*), Fern BaiMakhamBoriphat (*Nephrolepis. falcata*), FernWanNokYung (*Hlminhostachys zeylanice*), Fern KledNacharach (*Drymoglossum piloselloide*), Fern KledKrataeTaiMai (*Drynaria quercifolia*), Fern HoKhaoSiida (*Platyserium walichi*), Fern KhaKai (*Pyrrosia adnascens*), Fern SiLoTum (*Plilotum mudum*), Fern IndiaDang (*Pteris argyrea*), Fern NgeonKhrek (*Pteris cretica*), Fern YanLiPhao (*Lygodium circinnat*), Fern PhakKudHin (*Selaginella delicatula*), and Fern RangKai (*Selaginella siamensis*) The finding is in agreement with Kasem Jankeaw (2000) ; Somyot thungwa *et al* (2000) ; Suzuki , K., Laougpol. C., Sridith, K. (2005) : Santisuk, T. Chayamarit, K., Pooma, R., Suddee, S. (2006) : Chain, W .Y. (1983). Mushrooms that were found by a field survey in the Pattani watershed, and classified in groups of decomposers ecosystem included *Podostroma cornudamae* (Pat.)Boedijn, *Xylaria* sp.1, *Xylaria* sp.2, *Xylaria* sp.3, *Cookeina sulcipes* (Berk.) Kuntze, *Cookeina tricholoma* (Mont.) Kuntze, *Agaricus* sp.1, *Agaricus* sp.2, *Agaricus* sp.3, *Agaricus* sp.4, *Agaricus* sp.5, *Agaricus* sp.6, *Agaricus* sp.7, *Agaricus* sp.8, *Lepiota humei* Merr., *Lepiota* sp.1, *Lepiota* sp.2, *Entoloma nitidm* Quel., *Marasmius* sp.1, *Mycena* sp.2, *Mycena* sp.3, *Oudemansiella radicata* (Relh:Fr.) Sing, *Tricholoma crassum* (Berk.) Sacc., *Heinemannomyces splendidissima*, *Boletus bicolor* Pk., *Tylopilus* sp. (near *B.nigropurpureus* Corner), *Boletellus* sp., *Heimiella* sp., *Bondazewia* sp., *Cantharellus cibarius* Fr., *Clavaria vermicularis* Swartz : Fr., *Clavaria zollingeri* Le'v, *Clavulinopsis aurantio-cinnabarina* (Schw.) corner., *Craterellus cornucopioides* var. *midiosporus*, *Gymnopilus* sp., *Inocybe* sp.1, *Inocybe* sp.2, *Inocybe* sp.3, *Crepidotus mollis* (Schaeff.ex Fr.) Kummer, *Dacryopinax spathularia*(Schw.)Mart, *Fistulina hepatica* Schaeff. Ex Fr., *Amauroderma dubiopansum*, *Amauroderma macer* (B.) Pat., *Amauroderma rude* (B.) Pat., *Ganoderma applanatum* (Pers.ex Wallr.) Pat, *Ganoderma lucidum* (Leys.ex Fr.) Karst., *Ganoderma subresinosum* Fr., *Ganoderma* sp.1, *Ganoderma* sp.2, *Gomphus* sp., *Lentaria* sp., *Ramaria murrillii* (Cok.) Cor., *Ramaria* sp., *Coltriciella dependens* (Berk. & Curt.) Murr., *Cyclomyces tabacinus*, *Phellinus portoricensis* Overth, *Phellinus pullus* (Berk.et Mont.), *Phellinus bicolor* (Jungh.) Cunningham, *Geastrum mirabile* (Mont.) Fisch., *Calvatia cyathiformis* (Bosc) Morgan, *Lycogalopsis* sp., *Cyathus striatus* Willd., *Dictyophora indusiata* (Pers.) Risch, *Dictyophora multicolor* Fisch., *Dictyophora multicolor* Fisch. ,*Microporus xanthopus* (Fr.) Ktz., *Russula* sp., *Merulius corium* (*Meruliopsis corium*), *Stereum* sp. (*Xylobous* sp.), and *Tylostoma berkeleyi* Lloyd. Edible mushrooms included *Termitomyces microcarps* (Berk & Breome) R.Heim, *Plerotus cystidiosus* ok. Miller and *Pleurotus os treatus* (Jaequin ex Fries Kummer) as well as *Pleurotus Cornucipiae* var. *citrinopileatus* (singer) The finding is in agreement with Ohira Kittiporn Arpha *et al* (2010) ; Osman, K. *et al* (2000) ; The Forest Herbarium. (2002). Alga with application for animal feed were *Chroococcus minutus* (Kutzing) Naegeli, *Lyngbya* sp., *Merismupedia elegans*, *Oscillatoria tenuis* C.A.Agardh, *Phormidium fragile* (Meneghini) Gomont, *Chroococcus minutus* (Kutzing) Naegeli, *Ankistrodesmus convergens* Ehrenberg, *Closterium ehrenbergii* Meneghini, *Cosmarium nudum* (Turner) Gutwinski, *Oedogonium microgonium*, *Pediastrum duplex* Meyen, *Scenedesmus quadricauda* (Turpin Bre'bisson), *Euglena acus* Ehrenbry, *Phacus tortus* (Lemmermann) Skvortzow, *Achnanthes biporoma* (Hohn & Hellermann) Lange – Bertalot, A. *infrata* (Kutzing) Grunow, A. *brevipes* Ag., A. *lanceolata*, A. *oblongella*, *Achnantheidium lanceolatum* Bre'bisson, *Amphora* sp., *Bacillario phyceae* (diatom), *Diploneis subovalis* Cleve, *Eunotia monodon* Ehrenbry, E. *pectinalis* (O.F.Muller) Rabenhorst, E.

lineolata Hustedt, *E. praeurupta* Ehrenberg, *E. soleirolii* (Kutz) Rabenhorst, *E. razickac* Baily & Mawan, *Fragilaria capucina* Desmaz, *Gomphonema auritum* A.Braun, *G. parvulum* (Kutzing) Grunow, *G. intricatum* Kutzing var *vibrio* (Ehrenberg) Cleve, *G. lanecolatum* (Ehrenberg), *Gyrosigma scalproides* (Rabenhorst) Cleve, *G. distortum* (W.Smith) Cleve, *Melosira varians* Agardh, *M. hustedtii* Krasske, *Navicula* sp., *N. viridula* Kutzing, *N. radiosa* Kutz var *tenella* (Breb) Grun, *N. terminata* Hustedt, *N. exigua* (Greg) Grum var *Signata* Hust, *Nitzschia amphibia* Grunow, *N. obtusa* W.Smith, *N. fonticola* Grunow, *Pinnularia gibba* Ehrenberg, *P. braunii* var. *amphicephala* (Mayer)Cleve, *P. legumen* Ehrenberg, *P. acrosphaeria* Breb., *Stauroneisanceps*, *Synedra ulna* (Nitzsch) Ehrenberg, *Surirella robusta* Ehrenberg var *splendida* Van Heurck The finding is in agreement with Vichit Rangpan (2008) who stated the effects of water Quality on the periphyton populations in the Pattani River. Periphyton parameters that were used for the study include species richness, total density, biomass accumulation, chlorophyll a and shannon – Wiener diversity index (H'). Periphytic algae were collected on standard artificial substrates (glass slider) at the six-sampling stations. Periphytic algae attached on the glass slider consisted of 43 species of Bacillariophyta (Diatom), 5 species of Cyanophyta, 6 species of Chlorophyta and 2 species of Euglenophyta. Fish species found in the survey area of Pattani watershed were Gray Feather Back (*Notopterus notopterus*), Thai River Sprat (*Clupeichthys perakensis*), BaebRangDoak fish (*Parachela maculicauda*), 2 BaebBang species (*Parachela siamensis* and *P. oxygastroides*), BaebYao (*Oxygaster. anomalura*), SiuBaiPhaiTaebKhao (*Danio tweedei*), SiuPhom (*Rasbora agilis*), SiuTaebHleang (*Rasbora pauciperforata*), SiuKhuwai (*Rasbora sumatrana*), snakehead (*Channa striata*), snake (*Pangio oblongus*), PlongOiHnuadYao (*Pangio cuneovirgata*), PlongOi (*Pangio kuhlii*), PlongOiTaWanOak (*Pangio myersi*), KhayengKhiKai (*Pseudomystus leia canthus*), KhayengHangJud (*Mystus micracanthus*), KhayengBaiKhao (*Mystus singaringan*), KodKhang (*Hemibagrus johorensis*), Kasong, ChonSai (*Channa lucius*), KangPhraRuang (*Kryptopterus bicirrhis*), LamPhan (*Clarias nieuhoffi*), DukDang (*Clarias batrachus*), catfish, catfish, soft (*Clarias macrocephalus*), catfish fillet Lane (*Clarias meladerma*), catfish dwarf (*Enchelocharias keliloides*), Chado, mussels (*Channa micropeltes*), KhaemNguang (*Hemirhamphodon pogonognathus*), KaTungHeaw (*Xenentodon cancila*), SiuKhaoSan (*Oryzias minutilis*), HlaiNaa (*Monopterus albus*), HlodThongLai (*Macrognathus aculeatus*), HlodDang (*Macrognathus circumcinctus*), Kating, Ting (*Macrognathus maculates*), PaenKeaw (*Parambassis siamensis*), HmoChangHjiab (*Pristolepis fasciatus*), HmoChangHjiabPhru (*Pristolepis grootei*), BuSai (*Oxyeleotris marmoratus*), Hmo (*Anabas testudineus*), HmoJamPa (*Belontia hasselti*), LadPhakTai (*Betta imbellis*), KadNaamDaeng (*Bettapi*), KradeeMuk (*Trichogaster leeri*), and Salid, BaiMai (*Trichogaster. pectoralis*) The finding is in agreement with Pattani Dam (2000); Carpenter (2001); Hickman *et al* (2004); Kajanavanit (2002). Tree species found in the mangroves in the Pattani watershed included small leave KongKang (*Rhizophora apiculate* Bl.), large leave KongKang (*Rhizophora mucronata* Poir.), Kloe (*Pluchea indica* Less), JamudPlaHlod (*Oxystelma secamone* (L) Karst.), ChaaLe-ad (*Premma obtusifolia* R. Br.), white Tabun (*Xylocarpus granatum* Koen.), black Tabun (*Xylocarpus moluccensis* Roem.), sea TaTum (*Excoecaria agallocha* L.), ficus (*Ficus bengalensis* L.), TobTaeb (*Derris tirfoliata* Lour.), white beans (*Bruguiera cylindrical* Bl), ThaoKhan or True virginia creeper (*Cissus carmosa* Roxb), ProngHnoo (*Acrostichum speciosum* Willd.), , red flower PangkaHuaSum (*Bruguiera gymnorhiza* (L) Savigny), PanNgoo (*Achyranthes aspera* Linn), PhoThalae (*Thespesia Populnea* (L) Engl), LamPhoo (*Sonneratia caseolaris* (L) Engl), Lamphaen (*Sonneratia ovata* Back), Sakkhee (*Dalbergia candenatensis* Prain), SamMaNga (*Clerodendrum inerme* (L) Gaertner), SiNgam (*Scyphosiphora hydrophyllaeae* Geartn.f.), Siam weed (*Chromolaena odorata* (L)), shatavari (*Asparagus racemosus* Willd.), white SaMae or Avicennia alba (*Avicennia alba* Bl), black Samae (*Avicennia officinalis* L), HngonKaiTalae (*Heritiera littoralis* Ait), HnamPungDo (*Azima sarmentosa* Benth. & Hook.),

sea HlumPho (*Intsia bijuga* (Colebr.) O. Ktze.), HwaiLing (*Flagellaria indica* L.), white flower Nge-aakPlaHmo (*Acanthus ebracteatus* Vahl.), Acanthus (*Acanthus volubilis* Wall.), KhoanSawan (*Lpomoea quamoclit* Linn), and Chingchie (*Capparis micracantha* DC.) *Convolvulaceae*. The finding is in agreement with Kon koetsu, (2010); Vichit Rangpan (2008); Santisuk (2006); Whitmore (1985). Wildlife species, one component of forest ecosystems found in the Pattani watershed included loris (*Nycticebus coucang* Boddaet), sambar (*Cervus unicolor* Kerr), deer (*Muntiacus muntjak*), White-Handed Gibbon (*Hulobateslor Linneus*), deer mice (*Traqlus javanricus* Osbeck), Gibbons Crown (*Hylobates pileatusn* Gray.), gaur (*Bos gaurus* Smith), monkey (*Macaca namestrina* Linnacus), owl Cork (*Athene brama* Temmmminck), dove lights (*Streptopelia tranque barica* Harmann), Java Dove (*Geopelia striata* Linnaeus), the empty string Church's gray (*Gallirallus Striatus* (Linnaeus)), the Black Hawks (*Milvus migrans* (Boddaert)), red Hawks (*Haliastur Indus* (Boddaert)), bittern ordinary light (*Ixobrychus cinnamomeus* (Gmelin)), birds, insects brown (*Muscicapo dauuricapallas*), blue rock thrush (*Montico Solitarius* (Linnaeus)), birds, insect Yellow-rumped (*Ficedia Zanthopygia* (Hay)), birds, insects, red (*Ficedula parva* (Bechstein)), birds, insects neck hazel (*Byornis banyumas* (Harsfield)), birds with Ruby (*Luscinia calliope* (Pallas)), birds for Vibha (*Acridothers tristis* (Linnaeus)), , KohTao Caecilian (*Lchthyophis kohtagensis*), red tortoise or leave turtle (*Cyclemys dentata* (Gray)), East Forest gecko. (*Cyrtodactylus intermedius*), BaoTanSai lizard (*Geckogekko lepetricolus*), small are lizards (*Aconthosaura lepetricolus* (Cuvier)), southern lizard (*Leiolepis belliana* (Gray)), giant Kingkarn (*Chysignathus cocineinus*), JingHlaenHlakLai (*Mabuya macalaria* (Blyth)), BongHlaa snake (*Naja sumatrana* (Muller)), green snake DokHmak (*Chrysopelea ornata* (. Shaw)), and Cobra, Cobra HaoChang (*Ophiophagus hannah* I (Cantor)) The finding is in agreement with Department of forestry (1999), Kasem Jankeow (2000); Duellman, *et al* (1987); Porter (1972). Diversity of butterfly species found were light dark color DaraPhrai (*Thaumantis klugius lucipor* (Westwood)), red spot Duk (*Euthalia evelina compta*) (Fruhstorfer), petite Tan (*Paduca fasciata fasciata* (C. & R.Relder)), red band NilGai (*Ancistroides armatus armatus* H. .Druce), Yellowish brick color butterfly (*Cirrochroa orissa orissa* C. & . Felder), Vespers (*Melanitis leda leda* L.), tiger brown plain coconut larvae (*Elymnias nesaea lioneli* Fruhstorfer), ordinary plain Wren (*Orthotomus sutorius* (Pennant)), ordinary plain coconut larvae (*Elymnias hypermnestra tinctoria*. Moore), worm coconut shag (*Amathusia phidippus phidippus* L.) wing-pointed coconut larvae (*Elymnias penanga chelensis de Niceville*), dark brown butterfly (*Faunis canens arcesilas* (Stichel)), tail sword butterfly of mountain (*Graphium agetes agetes* Westwood), ordinary BaiRak leaf larvae (*Danaus chrysippus chrysippus* (L.)), yellow BaiRak leaf larvae (*Parantica asparia aspasia* (Fabricius)), brown BaiRak leaf larvae (*Parantica melaneus plataniston* (Fruhstorfer), and patterned JorKaMia (*Euploea mulciber mulciber* (Gramer)). Among found bird and the poultry species included Wreathed Hornbill bird or Cu buckets (*Accros undulates*), Hornbill (*Buceros vigil*), Rhinoceros Hornbill (*Buceros rhinoceros*), Wrinkled hornbill (*Aceros corrugates*), smooth-mouth Wreathed Hornbill (*Aceros subruficollis*), White-crowned hornbill (*Aceros comatus*), Black Hornbill (*Anthracoseros malayanus*), Kagawa Hornbill bird or birds (*Buceros bicomis*), Bushy-crested hornbill (*Anorrhinus galeritus*), hill Pheasant (*Polyplectron inopinatum*), brown rice Crest Falcon (*Spizactus nanus*), giant Pitta (*Pitta caerulea*), and shorter bulging bird (*Centropus rectumguis*) The finding is in agreement with Department of forestry (1999); Amnuay Pinratana (1985; 1988). 3. Local wisdom for the biological resources application in the Pattani watershed. Local wisdom of folk on the application in routine activities was observed in aquatic animal practices of Fresh Water Genatica Resource. It was observed that there was fish catching during September to December by majority of people using fishing hooks like flag dipping in the still water from water sources of pond during limited water. However, they used

nets in flood season. Others that were used included harpoon bow, stabber and shooter as well as trap and special net for special fishes. Pongpang was used in the fish trap at low tide the water flow. Wildlife utilization was of 4 major types, and those were bird catching using bird cage with a particular cage specialized for Red-whiskered bulbul, which was adapted into breeding and competitive culture. The finding is in agreement with Kasem Jankeow (2000). Wild pig capturing was very frequent causing its short supply in the markets. The catch of bees was observed operating in the night to prepared for herbal medicine. Bee catchers used to nail the tree making them ease in climbing. They also recited verses from the Quran as they believed the action brought them safety in handling bees. Pickled fish processing used Nile Tilapia, and this became popular export product. Plants were usually used as herbs, foods, and for making home such as Tembusu (*Fagraea fragrans* Roxb.), Chenga (*Hopea ferrea* Laness, Share), and Miraboo (*Intsia palembanica* Miq.) Vegetables were used as food for both humans and pets. They were, for instances, dipping sauce, and popular vegetables like star gooseberry (*Sauropus androgynus*), LamTen (*Stenochlaena palustris* (Burm.)), Elephant ear (*Colocasia esculenta* (L.)), vegetable fern (*Diplazium esculentum*), Siamese rough bush (*Streptulbs asper* Lour.) for goat feed, Sago (*Metroxylon rumphii* Mart.) for poultry cow and buffalo feed. Those were used for medicine included Cassia (*Senna siamea* (Lam.)), Physic (*Jatropha curcas* L.), and Ringworm bush (*Cassia alata* (L.)).

4. Threats of biodiversity and their causes. In general, biological resources that were threatened included fish species using electric fishing and hand catching in rice field, etc. The first threat in the Pattani watershed encompassed wildlife and forest commercialization. As seen in in the upper area, the commercial trade of wild pigs and forest products that occurred along the Thailand-Malaysia Border. Second threat was change of the land use, in particular, the rubber field to the housing, and dam construction resulting in population evacuation. The third was of projects and developments including the settlement and housing, the tourism development as in Piyamitra village.

Ganoderma lucidum was fermented to wine or dry. The tourist trade of wild species of lemurs, monkeys and birds was observed in KokChang market. The final issue was the development of the rubber industry and establishment of industries in the area. The finding is in agreement with Kasem Jankeow (2000). Study results showed that species threatened in the Pattani watershed included common swamp eel (*Monopterus albus*), Striped tiger leaf fish (*Pristolepis fasciatus*), Puntius rhombeus fish (*Systomus binotatus*), Asian redbellied catfish (*Hemibagrus johorensis*), Bocourt river catfish (*Mystus singaringan*), Lipped barb (*Osteochilus hasselti*), and Asian Arowana (*Socleropagas ferrmosus*). However, rare species of fish in the Pattani watershed were Dwarf snakehead (*Cahnnna* (cf.) *gachua*), Siamese glassfish (*Parambassis siamensis*), Needlefish (*Xenentodon conlila*), slender walking catfish (*Clarias nieuhoffi*), Twospot catfish (*Mystus micracanthus*), Long-fatty finned *Mystus* (*Preaolomystus Leiacautilus*), and Kuhlii loach (*Pangio kuhlii*). Endangered fish species included Marble Goby (*Oxyeleotris Marmoratus*), KrimKrai (*Trichopsis Vihatus*), and Hampala barb (*Hampala Macrolepidota*). Rare plants in the Pattani River Basin included wild banana (*Musa* sp.), rattan (*Calamus* sp.), white *Jatropha* (*Jatruppha curcas* Linn), and *Morinda coreia* (*Morinda coreia* Ham.). Rare plants in the Pattani watershed included Anan (*Fagraea Fragrans* Roxb.). Endangered species of plants. Included Areca nut (*Areca catechu* L.), Areca trinada (*Areca trinada*), YanLiPhao Fern (*Lygodium circinnat*), and Black HoKhao fern (*Platyserium walichi*). Rared palm and fern species in the Pattani watershed include Hai rice palm (*Borass dodemdron*), Chaoon palm (*Oncosperma tigillarium*), and fishtail palm (*Cayata mitis*). Endangered species of palms and ferns species in the Pattani watershed included giant snakefern (*Davallisa solida*) and orange-color Fanfern (*Licuala Listans*). Threatened species of mushroom in the Pattani watershed was Squarrosulus mushrooms (*Lentinus squarrosulus* Mont.). Rared mushrooms were ganoderma mushroom (*Ganoderma lucidum*), Lingzhi mushroom (*Ganoderma lucidum* Fr.), Applaratum mushroom (*Ganoderma applaratum* Leys Fr.). Karst)) and Abalone mushrooms (*Pleurotus autreatus* FR.). Endangered

species of mushrooms are termitous mushrooms (*Termitomyces clypeatus* Heim.), (*Termitomyces cylindricus* SC.H), and mushroom rice (*Termitomyces microcarpus*) (Bark & Broome) R. Iteim)). In addition, there were typically localized plants observed, and they were wild banana (*Musa* sp.) and Malaya rose. (*Rhododendron Malayanum*). 5. Results of the biodiversity conservation and local wisdom. As for conversation of the upper area where the origins of water sources were located, enforcement of the untouched conversation should be considered practising. The so-called sustainable conservation could be controlled and well operated in the upper area of the villages of Chulabhorn 7 and 9, Jantararat, and KokChang market. For the lower area like villages of Pakaharang, Paknaam, and Yaring sub-District of Pattani, the restoration and repair should be practised, and possibly by the aid of modern technology so that prevention of its bad consequence. In the central area of the Pattani watershed where the utilization of bioresources was very intensive, especially for the purpose of housing, approaches of improvement and development should be emphasized. Those said area encompassed sub-Districts of Tasek, Pakaharang, Paknaam, and Yaring of Pattani Province. Whereas local wisdom conservation was seen applicable by using database technology, creating lesson instruction for local wisdom, disseminating knowledge in schools such as those that were affiliated with regional or zoning offices, or segmenting/grouping. As such, there should be 3 zones; the upper for agriculture and forestry, the middle and lower zones for housing and developing as well as considering the impact of such utilization to come. The finding is in agreement with Kasem Jankeow (2000). 6. Promoting knowledge, understanding of local instruction on biodiversity conservation and utilization in the Pattani watershed. Cognitive study on conservation the Pattani watershed from local wisdom was collected for contruction of curriculum content that suited the particular school levels and with title on the biodiversity conservation and sustainable utilization in the Pattani watershed. There were 2 levels of basic education, and higher education as well as public education currently operated. For each of these, 5 units were taught, and score of efficiency was 80/80. 7. Biodiversity database. Database of biodiversity in the Pattani watershed was contructed. It contained species lists of plants, mushrooms, algae, fishes, and wild animals that were found in the field survey of the Pattani watershed. Utilization by local people from the database was also mentioned so that the public could bring the database to deploy in planning at the local level, such as the administration at the district level and the publics also could manage. Biodiversity as well as to raise awareness of sustainable conservation. The finding is in agreement with Suthi Thungwa & Benchawan Buakhuan (2004) who stated the study on collection and analyze of information related to local wisdom in Pattani Province to uphold the tradition of local wisdoms in building house and things related to house, and in working both are very important to maintain as long as possible and they impact a lot on the conservation of biodiversity if both wisdoms can be preserved.

CONCLUSION AND SUGGESTION

Research on biodiversity utilization in the Pattani watershed with its aims of exploring the biological resources and being participated by all sectors of the public, of enhancing the understanding of the biodiversity value and sustainable utilization, of raising the public all and stakeholders' awareness on the biodiversity conservation, was conducted. Using both quantitative and qualitative research techniques combined with participatory action research and the use of specific methods in collecting biological samples and specific types of biological resources, the samples in 18 communities, and of upto 6 ecological types, were successfully studied. Results showed that the upper area of the Pattani watershed found 170 species of

vascular plants and 53 species of fishes, 85 species of mushrooms, 38 species of algae, and 25 species of wild animals. In the middle area of the Pattani watershed, it was found 119 species of vascular plants, 65 species of fishes, 90 species of mushrooms, 55 species of algae, 25 species of wildlife animals. Whereas, in the watershed area, 50 species of vascular plants, 96 species of fishes, 12 species of mushrooms, and 52 species of algae, and 3 species were observed. Results of bioresource conservation and local wisdom for its utilization in this study presented 8 methods of actions, i.e. the sustainably utilizing, encapsulating, repairing, reconstructing, developing, protecting, conserving and zoning. With aspect of promoting knowledge and lesson using pronounced learning instruction, it was found basic learning, context searching, and reducing pollutant, as well as joined planning, treating, and enhancing sustainable development were among the choices.

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