

Development of Geographic Information System and Database Program for Supporting the Application of Payment for Ecosystem Services Mechanisms Occurs in the Local Area of Thailand

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Abstract—This study aims to study the needs of geographic information system and database program for supporting local ecosystem services management and policy planning in the representative areas under the Integrated Community-based Forest and Catchment Management through an Ecosystem Services Approach project (CBFCM) by using Payment for Ecosystem Services concept (PES). The research was operated by gathering information on demand from the Bureau of Policy and Strategy of Ministry of Natural Resources and Environment of Thailand (MNRE), and brainstorming of leaders from four representative areas which are; Mae Sa watershed area; Northern, Lam Sae Bai River Basin; North-eastern, Tha Chin watershed area; Middle and Phangan River Basin; Southern. Then, all information needs to combine with all related documents and summarize to be the guidelines for designing the GIS and database program to meet for demand of representative areas. The study found that the representative areas need GIS and database program which can be supporting the application of payment for ecosystem services mechanisms occurs in the local area of Thailand. This program can inform and publicize the PES details. Furthermore, this system can be an example model for future works and other projects.

Index Terms—payment for ecosystem services, local management, PES, natural resources management, environmental management

I. INTRODUCTION

Integrated Community-based Forest and Catchment Management through an Ecosystem Services Approach (CBFCM) is an important project which was cooperated by Ministry of Natural Resources and Environment of Thailand (MNRE) and United Nations Development Program (UNDP), supported by Global Environment Facility (GEF) [1]. The project intended to support policy and present successfulness of integrated-ecosystem management including forest, catchment and biodiversity

management by using Payment for Ecosystem Services concept (PES). Principle of PES is a mechanism for integrated-resource management in local areas. The main concept of PES is that local individual named “Seller or Provider” who manage and protect any local resources and ecology must get the rewards from parties who get any advantage from Ecosystem Services named “Buyer” [1], [2]. In 2005, Millennium Ecosystem Assessment [3] has been categorized the Ecosystem Services into 4 types which are; Provisioning Services (food sources, water sources, herb, forest product, etc.), Regulating Services (climate control, coastal erosion control, flash flood control, etc.), Supporting Services (photosynthesis, biodiversity source, etc.) and Cultural Services (local culture, local wisdom for forest management, etc.). Moreover, PES mechanism have to run under 4 important rules [4] which are; 1) there is a voluntary agreement between seller, provider and buyer, 2) determination of ecosystem service types must be clear, 3) there is at least 1 buyer and seller in each project and 4) the project need to run under the condition that buyer will pay the rewards when the seller provides any ecological service under the time-agreement. PES have been developed and implemented in many countries. This concept was initiated in Costa Rica for forest protection [5]. The US and EU adopted this system for agricultural purpose [6]. China also utilized PES for the Natural Forest Conversion program and the Sloping-Land Conversion program [7]. However, PES in Thailand focus on two dimensions which are; 1) there is a furtherance of PES to work with policy, plan and strategy of environmental and natural resources management of local, region and country. Moreover, there is a development of centre of information for supporting efficient natural resources management and there is a responsiveness of integrated-solving of natural resource problems under PES concept. And 2) there is an encouragement of representative areas to start to develop and adopt PES mechanism to run on their areas clearly for local natural resource and environmental management [8].

Manuscript received March 20, 2019; revised August 6, 2019.

From the details above bring to the aim of this work. It is important to explore the needs of locals to develop Geographic Information System (GIS) and Database Program for supporting the environmental and natural resources management in each local. The system can link and present any information of each parties to be successful guideline models in using PES concept to manage any environmental and natural resources in locals.

II. METHODOLOGY AND EQUIPMENT

A. Study Areas

This work was cooperated by Bureau of Policy and Strategy of MNRE and regional environmental office staffs from four sample areas around Thailand, which are; Mae Sa watershed area (Chiang Mai Province, located in Northern of Thailand), Lam Sae Bai River Basin (Ubon Ratchathani Province, located in Northeastern of Thailand), Tha Chin watershed area (Samut Sakhon Province, located in Central of Thailand) and Phangan River Basin (Surat Thani, located in Southern of Thailand). The representative areas map is presented in Fig. 1.

B. Data and Procedure

The process of this research can be categorized into four steps. Firstly, the work was cooperated with office staffs of Bureau of Policy and Strategy of MNRE to review and summarize all related-documents (called secondary data) to determine conceptual framework and details to be an information for creating a questionnaire about the GIS and database program for supporting any local environmental and natural resources management needs. Secondly, brainstorming of all concerned office

staffs and all stakeholders from four representative areas is necessary. Thirdly, all comments and suggestions (called primary data) from leaders were collected and prepare for sending to department of policy and strategy of MNRE for careful validation. For the next step, determination of GIS and database components were carefully discussed to be the information guidelines to design GIS and database program for supporting environmental management under the PES Concept. For the last step, all information brings to design GIS and database system for meet the demand of representative areas for local environmental management effectively.

III. RESULTS

The project gathered all primary and secondary data such as; reviewing of related documents and brainstorming of comments and suggestions from all stakeholders whose were concerned about local natural and environmental management in their areas. Then, the information can be summarized to be the guidelines to design GIS and database.

A. Comments from Representative Areas

The comments indicated that all stakeholders need the GIS and database program which can work for two important missions; 1) the program can be collected all concerned-documents which plays on environmental management of Thailand such as environmental management plans, environmental policy and environmental regulatory documents. And 2) the program can underline database publicity which can be encourage inter-agency coordination for determination of PES policy and application.

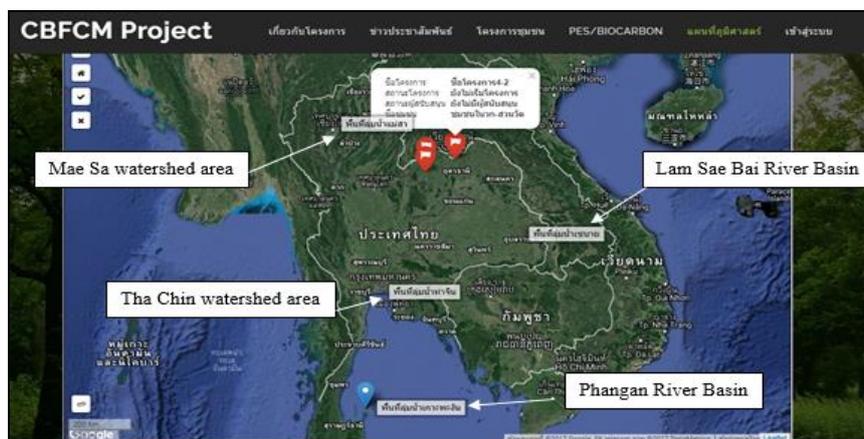


Figure 1. Study areas of this work: Four representative areas (Mae Sa watershed area, Tha Chin watershed area, Lam Sae Bai River Basin and Phangan River Basin)

B. GIS and Database Program Design

The GIS and database program for supporting environmental management under PES concept have to continue for other development projects thus, GIS and database attributes must be carefully determined to design useful environmental management program. The attributes can be explained into 5 points; (1) The system have to be independent from any commercial copyright

for handling with environmental projects and the program must continue to develop for other objectives in future. (2) The system has to access by multi-user in each time easily and run on multi-communication devices efficiently such as personal computer, smart phone, laptop, etc. (3) Each data types in the system must be free from others to modify, search and record easily. (4) The system needs to support a variety of data formats especially, big data which can be used to manipulate data

The components of this system of GIS and database program for supporting the application of payment for ecosystem services mechanisms occurs in the local Area, which presented on the website as shown in Fig. 2. The interested people and stakeholders can point out at each point on geographic maps to get more information easily about each local environmental management project.

IV. CONCLUSIONS AND SUGGESTIONS

Payment for Ecosystem Services or PES is one of important concept to manage natural resources and environment in each local. However, The GIS and database program for Supporting the Application of Payment for Ecosystem Services Mechanisms Occurs in the Local Area is one of the demands which representative area needs. This system become to be necessary to support these four representative areas around Thailand to run each local project and it can be easily to access and get more details about successfulness projects for public, interested parties and all stakeholders. Nevertheless, these systems still have some drawback. There is no domain name for current system thus, all user and interested people must access to the system by <http://43.228.82.24/cbfcfm>, which is not convenient and it hard to remember. Therefore, it is important to develop the domain name and system performance in the future.

ACKNOWLEDGEMENT

Author would like to say thank you to Ministry of Natural Resources and Environment of Thailand (MNRE) for financial support and four representative areas which are; Mae Sa watershed area, Lam Sae Bai River Basin, Tha Chin watershed area and Phangan River Basin for supporting all data which are necessary in this study.

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