

CHAPTER 1

INTRODUCTION

Concentrations of green house gases (GHGs) in the atmosphere, which influence global climate change phenomenon, are increasing due partly to anthropogenic activities. Methane (CH₄) is the second GHGs after CO₂ that contributes to the increased global mean temperature. CH₄ is naturally produced and consumed by methanogenic and methanotrophic bacteria in anaerobic and aerobic conditions, respectively. Its concentration in the atmosphere is increasing by one percent annually, due to higher methane production than consumption rate. Methane emission has been studied in Thailand for less than ten years (Jermasawatdipong *et al.*, 1999). Sources of methane are agricultural sector, industrial sector and waste. The major source is the agricultural sector, contributing 87 percent of the total emitted methane. However, no research on methane consumption has been conducted in Thailand. Many research reported that forests and other non-flooded arable soils are methane consumers (Bender and Conrad, 1995; Bowden *et al.*, 1998; Goldman *et al.*, 1995; Jensen and Olsen, 1998; Prieme and Christensen, 1997; Prieme *et al.*, 1997; Singh *et al.*, 1998; Sitaula *et al.*, 1995; Whalen and Reeburgh, 1996). Methanotrophic bacteria thrive in well aeration soils and use methane as substrate for their energy. It implies that methane, which is an output (source) of a sub-system can be an input (sink) of another sub-system within a system. Therefore, methane source and sink were studied to generate database of net methane emission of a system and gain a better understanding of the pattern of methane production and consumption in different land uses.

Area of Mae Chaem district is an ecosystem, which is a watershed of Mae Ping River, located in Chiang Mai province. The area consists of agricultural and forest land uses, which can be sources and sinks of methane. Land uses in Mae Chaem watershed comprise of rice fields, orchard fields, fallow cultivation fields, field crops, pine forests, deciduous forests and evergreen forests. Final product of microorganism activities under flooded condition is methane, therefore, it is the

output of flooded rice field during rice growing season. On the other hand, non-flooded land area like orchard fields, fallow lands, field crops and forest areas or even rice fields in dry season, soils are under aerobic condition, which is suitable for methane consumption activities of methanotrophic bacteria. Hence, methane becomes input of these land uses and CO_2 is the final product, which benefits for photosynthesis processes of plant systems.

In recent years, computer-modeling approach offers scientist to gain a better understanding of the governing processes and their interactions by allowing systematic data collection and interpretation. Therefore a simulation model was developed and used in the study to gain better understanding in seasonal variation of methane emission and the relation between sources and sinks.

The general objective of the study is to develop a database for seasonal methane emission from various land uses in Mae Chaem watershed. Specific objectives of the study are as follows;

1. To monitor and quantify the seasonal variation of methane emission from various land use types in Mae Chaem watershed.
2. To describe and predict methane emission, which is affected by source and sink capacity of various land use types.