Chapter 1

Introduction

1.1 Statement of the problems

Deforestation, water shortage and water pollution are some of the most pressing environmental problems in many developing countries including Thailand (Manopimoke, 1994). The removal of watershed forests and its impacts on ecological balances of the mountainous areas is a burning issue mainly in northern Thailand. Water shortages and water pollution in this region have been attributed to deforestation and pioneer type of shifting agricultural systems practiced by tribal minorities, often called Hmong hilltribes, along with forest clearing by agro-businessmen.

During 1976-1979, the highland development project implemented by United Nations Crop Replacement and Community Development Project started with the introduction of vegetables such as cabbages, carrots, and perennial crops like coffee and longan as substitute crops in an effort to prevent the production of opium in the highlands of northern Thailand (Thai-Australian Highland Agriculture Report, 1981). These sort of programmes are likely to be profitable, considering that the crops can be exported. However, these crops required twice as much land as opium to be profitable. This also resulted in corresponding increase in agricultural land area with increase in use of pesticides and fertilizers. These factors have been reported to cause negative impacts on water quality of the streams in the watershed areas and drying up of streams in the dry season due to lowering of the water table (DikKorn, 1992). Moreover, following the "cash crop" promotion projects, these international development agencies, have been reported as exacerbating many environmental problems in northern Thailand (DikKorn, 1992).

1.2 Rationale

Key among the issues concerning environmentalists and regulators are public health and ecological effects of toxic chemicals being released into the environment (McCarthy, 1990). Therefore, in order to have an idea about ecological disturbances, knowledge of the ecological tolerance of the species found in surrounding the area, the mechanisms by which they resist acute and chronic pollutants, and how they recover and adjust is considered as very important (Kelly et al., 1992). As one of the goals of ecological assessment is to ascertain whether there is an effect of contaminants, Harris et al. (1990), contended that toxicity at ecosystem levels must be studied by investigation of particular ecosystem properties, such as trophic structure, sedimentation etc. Benthic community analysis have been recommended by the United Nations Environment Programme for biological assessment of marine pollution (Gray et al., 1992), US EPA's Rapid Bioassessment Protocol to detect the presence and areal extent of sediment contamination. The EC-directive 67/ 548 / EEC (1979) also dictates the use of macroinvertebrates and fish species to sole complex problems concerning hazard assessment for existing and new chemicals (Slooff et al., 1982).

Different water quality indices have been developed based on differential effects of pollutant type and concentration on benthic macroinvertebrates (Hart and Fuller, 1974; Wilhm, 1975; Bruce et al., 1978; in Dudgeon, 1984). Biotic indices have been used historically for assessment of organic pollution but at present EPA and others have evaluated species tolerance of benthic communities to some common contaminants (Hart and Fuller, 1990; in Maughan, 1993) to develop biotic indices for individual hazardous waste sites. The major advantages of this technique using benthic communities is its direct measure of effects which are closely related with ecological endpoints over a long period of time.

1.3 Aims and objectives

Among the vast body of literature on impact studies, a very small portion concerns the long term changes in natural ecosystem brought about by chronic exposure of modern agricultural chemicals along with typical pioneer type of agriculture on the benthic community. As conservation of water resources are gaining more priorities on the global scale, the rehabilitation capacity of these water bodies should provide idea about their sustainability in future. The main aims and objectives of the study were to see the long term impact of agricultural land use with reference to the benthic community on the highlands of northern Thailand.

The aim of the study was based on the fact that the aquatic ecosystem that has been exposed to broad spectrum of toxic chemicals is expected to change in bio-physical and chemical parameters. Therefore, the benthic macro invertebrates, comparatively immobile group of organisms, which are exposed to toxic environment and various related environmental stress over a period of time is expected to reflect the integrated stess in terms of change in community structure. Various supporting factors correlated with the community structure was expected to provide idea about the present agricultural impact in the stream ecosystem of the study area under existing environmental condition .