Chapter 1

Introduction

1.1   Rationale/Problem Statement

In the upland areas in Northern Thailand culturally distinct ethnic minority groups reside scattered throughout the mountainous region along Thailand-Burma borders. They consist of mostly Akha, Hmong, Karen, Lahu, Lisu, and Yao ethnicities (Crooker, 2007). Overall, these ethnic minorities in 20 provinces of Thailand make up a population of about 750,000 persons; thereby they represent slightly more than 1 percent of the overall population (ADB, 2001: 5 cited in Krahl, 2011) (For more information about highlander population, see Appendix A). Throughout this paper the term "highlanders" will be used as it is the generally recognized term for this population.

The notion of highlander historically has not only served to improve livelihoods but also aimed to control and incorporate the highland population into the nation, to secure the national boundary, to prevent the production of opium and later on to protect forests and watersheds (Gillogly, 2008: 119 cited in Krahl, 2011). Opium cultivation historically was a major source of income for many of the highlanders. The government worked hard to eradicate their cultivation through crop substitution and livestock farming by the end of 1980s (Crooker, 1988; Dirksen, 1997; Renard, 2001 cited in Crooker, 2007). However, the cash crop-substitution policy led to the highlanders being accused of destroying the country's forests with their "slash-

and-burn" agriculture, as their traditional swidden farming practice was labeled during this period. The government subsequently adopted a policy of relocation forcing highlanders to live on less land and restricting their land use rights. Unintended consequences of these policies have included intensification of land and resource use and permanent settlements. This has in turn contributed to deteriorated soil fertility, diminished crop yields and indigenous crops, increased water contamination from the fertilizer and pesticides use, and significant changes in livestock rearing practices; all of which have raised concerns about food security and health risks (Crooker, 2007).

Recently, increased attention has been paid to addressing various issues concerning highlanders (Fujioka, 2002). Numerous institutions are concerned with highlander development. This includes 31 departments and 168 agencies within 11 government ministries involved in hill area development namely the ministries of Interior, Defense, Public Health, Education, University Affairs, Agriculture, Cooperatives, Science, Technology and Energy, Finance, Communication, Industry, and the Prime Minister's Office (Fujioka, 2002). In spite of this the livelihoods of many villagers are still in question (Hau, 2000).

The highlanders are seen as the most disadvantaged and vulnerable groups among Thailand's rural population. They largely depend on agriculture for income and employment (Fujioka, 2002). Besides crop production, livestock production in highlanders' farming systems is very important and its role varies widely. It provides draught power for crop production used for subsistence needs or market sale (McDermott et al., 1999). Pig rearing continues to be an important source of subsistence food and serves for sacramental purposes (Rattanaronchart, 1994; Tancho,

1997), with almost every family keeping pigs (Cheva-Isarakul, 1998). Thus pig health and production can have a substantial impact on their livelihoods.
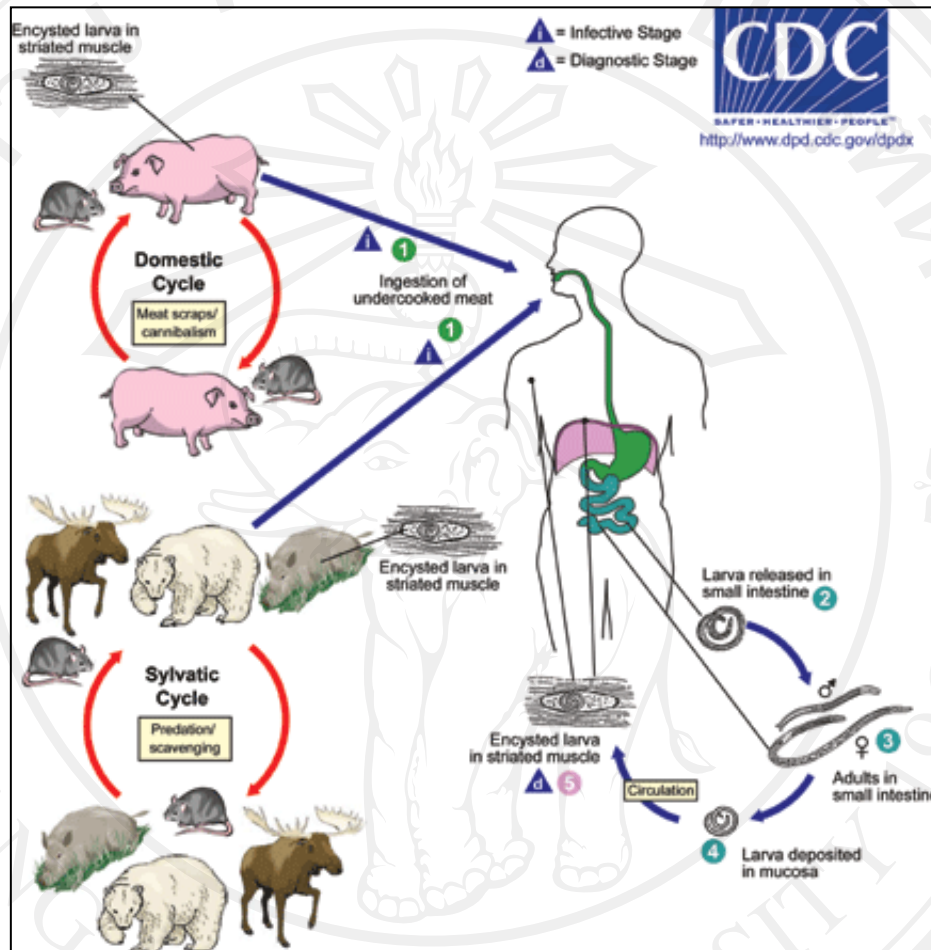
Source: Centers for Disease Control and Prvention (2011)

Figure 1-1:   Life cycle of Trichinellosis

Even though there is no regularly updated data recording incidences of parasitic infections in the highland villages, interview of experts and review of literature confirms that Trichinellosis is endemic in these borderland highlands. The nature of occurrence, transmission, and circulation of Trichinellosis (Ramasoota, 1991) in these areas can be explained by the interaction of highlanders with the pigs they grow and of both with their environment. Epidemiological investigations reveal that outbreaks of this disease have taken place mostly in rural areas where pigs are

most commonly raised on a free range basis and some are kept in low standard pens as a result of limited investment in husbandry beyond minimal needs (Khamboonruang, 1991; Ramasoota, 1991; Rattanaronchart, 1994; Willingham, 2003). Pigs will eat nearly anything, including garbage and wild animal carcasses often accessible to pigs. This fosters the transmission of the parasite to pigs and, in turn, to humans, as pork is popularly eaten raw or undercooked during rituals associated with local and traditional festivals (Ramasoota, 1991).

Besides the distinct settings and practices and weak public health infrastructure placing them at higher risk of zoonosis, these populations are confronted with difficulties resulting from the lack of citizenship, language barriers, market pressure, social exclusion, and globalization. As these external factors continue to evolve, often resulting in increasing economic vulnerability of highland populations, concerns are being raised about the potential of the borderland area as an epicenter of outbreaks of zoonoses.

1.2   Research Objectives

1.2.1 Consistent with the EcoHealth-One Health approach, this study attempts to understand Trichinellosis risk in borderland highlanders as a basis for prevention and control measures by developing a transdisciplinary framework. This framework considers the interaction of highlanders with the pigs they grow and their environment as a single system.

1.2.2 Both quantitative and qualitative methods employed in Bayesian Belief Network (BBN) are applied in this study to explain Trichinellosis risk in borderland highlanders and effects of uncertainty in the management system. Also, the concept

of optimizing expected utility is applied in solving the BBN in order to indicate the options available and choices made as a basis for decision-making to reduce Trichinellosis risk.

1.2.3 This study does not intend to suggest to that interventions aimed at highlander's livelihood systems should be launched in the form of a policy forcing villagers to change their modes of pig production to reduce disease risk. Rather, it encourages policy makers to better understand the underlying mechanism by which the livelihoods system affects disease risk in order to find the appropriate policy to control the emergence and spread of diseases.

1.3 Expected Outcomes

1.3.1 Most importantly this study will reveal a paradigm shift taking place in Economics research toward understanding a complex, real-world problem, such as emerging zoonoses, using the EcoHealth-One Health approach.

1.3.2 This study will address the core concept of economics; that of the idea of utilizing scarce resources to satisfy unlimited wants or needs of humans. In this case, Economics can help policy makers or planners make more effective and efficient decisions in terms of their potential to affect pig-rearing strategies and associated development to improve biosecurity and mitigate zoonoses risk.

1.3.3 This study will be considered innovative research for its novel utilization of mixed methods including quantitative and qualitative methods in decision making.

1.4   Scope and Limitation

The study concentrates on the ethnic minority groups that reside scattered throughout the mountainous region along Thai-Myanmar border of Thailand's Chiang Mai, Chiang Rai, and Mae Hong Son Provinces, including Akha, Hmong, Karen, Lahu, Lisu, and Yao ethnicities, using mixed methods including qualitative and quantitative methods to assess the risk of being infected with Trichinellosis in human associated with pig production modes. Its data gathering and analysis further concentrated on two villages in a single District, Mae Ae, Chiang Mai Province, of mainly Lahu ethnicity. The highlanders of the Northern Thailand borderland are quite heterogeneous group with substantial intra- as well as inter-ethnicity differences in terms of economic and environmental circumstances, cultural practices and so on. The expectation was not that the study could extrapolate findings based on two villages. Rather it was to use the two villages to further develop and test a novel approach and methods, as well as a disease risk model based on a framework constructed using existing information and data. This included theory from multiple disciplines as well as published and informant-provided data on the borderland highlanders in general, including that on their pig husbandry and eating practices, The village-level field study provided a basis for testing and further refining the model, including the BBN method, as well as documenting the people-pig-environment interactions in their economic aspects for at least the two villages.

1.5 Hypotheses

1.5.1 EcoHealth-One Health approach can be applied to develop transdisciplinary Trichinellosis risk frame work in borderland highlanders.

1.5.2 Highlanders make decisions on the allocation of scarce resources in livestock production to optimize their utility

1.5.3 Bayesian Belief Network Analysis can solve the decision-making problems based on the interconnection of human and animal health.

1.5.4 Government institutions or non-governmental organizations can make effective and efficient decisions to reduce zoonoses risk if they understand the concept of EcoHealth-One Health approach

1.6 Definition of Terms

Bayesian Belief Network (BBN): A statistical method invented in the 1940's and 1950's to take into account the effects of uncertainty in management systems in decision making processes (Henrion et al., 1991 cited in Dambacher et al., 2007). It is a graphical description of the conceptual model that captures the analyst beliefs in the causal relationships of significant variables in the system of interest (Dambacher et al., 2007).

EcoHealth-One Health Approach: A systematic and participatory approach to understanding and promoting sustainable health and well-being of humans, animals and the environment thought of as all part of one ecosystem; as well as making decisions, taking action, and evaluating outcomes (Waltner-Toews, 2009).

EcoHealth-One Health approach is an emerging field of study and practice that examines the biological, social and economic dynamics of an ecoystem and relates these changes to human and animal health, holistically. It brings together people from various disciplines such as veterinarians, ecologists, economists, social scientists, policy makers, and others to explore and understand how the above dynamics affect human and animal health (UNBC, n.d.).

Highlander: The term used within Thailand for all of the various tribal peoples who migrated from China and Tibet over the past few centuries (Srisoontorn, n.d.). They reside scattered throughout the mountainous region along Thailand, Laos, and Myanmar borders (Crooker, 2007). Some people also use the term 'Ethnic minority', but this must include Chinese, Laotians, Indians or Malaysians. Some people use the term 'Highlanders' to include Chinese people who live in the mountains as well. There are six major highlander groups within Thailand: Akha, Lahu, Karen, Hmong, Mien and Lisu reside in 20 provinces (Srisoontorn, n.d.).

Influence diagram: A graphical and mathematical representation of a decision problem (Lumina Decision Systems, 2013) which is an extension of BBN (Watthayu and Peng, 2004) that includes decision making, uncertainties, utility maximization, and how they influence each other. It is also known as decision diagram or decision network (Lumina Decision Systems, 2013).

Parasitic Zoonoses: Diseases hosted by animals which are caused by parasites that can be transmitted to humans (Westmount Animal Clinic, 2009). Besides, a number of livestock parasites also cause economic losses from the impact on the quality and quantity of animal products. In addition, the complex life cycles of most

parasites, the distinct conditions of animal husbandry in rural areas, slaughtering facilities, and marketing practices can have a severe influence on the transmission and outbreak of the diseases.

Probabilistic Risk Assessment (PRA): Application of probability distributions to identify variability or uncertainty in estimations of risk. It is a quantitative explanation of the degree of variability and uncertainty in risk estimates for unwanted events such as the outbreak of diseases (Mitchell, Smith, and Murphy, 2004: 1-10).

Risk: Risk is fundamental to any decision making scheme. Risk can be defined as imperfect knowledge for stochastic events where the probabilities of the possible outcomes are known (Hardaker et al., 1997 cited in Kaan, 2000; Siegel and Alwang, 1999 cited in Devereux, 2001). To put it simply, risk is uncertain consequences (Kaan, 2000) resulting in welfare losses (Devereux, 2001).

Trichinellosis: Trichinellosis or Trichinosis is a parasitic disease caused by a roundworm (nematode) called *Trichinella spiralis*. Trichinae can be readily avoided by proper handling and cooking of certain meats, particularly pork products (Medical-dictionary, 2002). The severity of symptoms depends on the quantity of infectious worms consumed. The initial clinical manifestations of the disease are nausea, diarrhea, vomiting, fatigue and fever, following by headaches, fevers, chills, cough, eye swelling, aching joint muscle pains, itchy skin and diarrhea. In case of heavy infection, patients may experience difficulty controlling movements and have cardiovascular and respiratory problems. Severe cases can progress to coma or death (Medterms, 2011).

Zoonoses: Zoonoses, also called zoonotic diseases are diseases caused by infectious agents transmitted between animals whether wild or domesticated and humans through a variety of infection routes, including animal bites, vectors, and animal-to-human contact (Olsen, 2004; Koo, 2009). All zoonoses can create a serious health threat if not controlled (Stregowski, 2012).