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Discussion Paper No. 8

Tracing Cross-Border Cattle and Buffalo Movement from Lao People's Democratic Republic and Myanmar to the People's Republic of China and assessing associated Foot and Mouth Disease risk¹

Based on a project in the People's Republic of China implemented by the Yunnan Animal Science and Veterinary Institute (YASVI) under the Asian Development Bank Regional Technical Assistance 8163-RE

The Discussion Paper Series of the Greater Mekong Subregion's (GMS) Core Agriculture Support Program Phase 2 (CASP2) is a platform for stakeholders of the GMS to examine the current and emerging development concerns affecting the subregion especially on but not limited to, food safety and quality assurance, environmental sustainability, and inclusive agro-based value chains. The papers are posted at the GMS Working Group of Agriculture's (GMS WGA) website (www.gms-wga.org).

The information and views expressed in the papers are those of the author/s and do not necessarily reflect the official opinion of the GMS WGA.

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Abbreviations

ADB	-	Asian Development Bank
DCZ	-	disease control zone
FMDV	-	foot and mouth disease virus
FMD	-	foot and mouth
GMS	-	Greater Mekong Subregion
Lao PDR	-	Lao People's Democratic Republic
PRC	-	People's Republic of China
TAD	-	transboundary animal disease
YASVI	-	Yunnan Animal Science and Veterinary Institute

Executive Summary

Demand for beef and beef products is high and increasing in the PRC. The large cattle and buffalo populations in Cambodia, the Lao PDR, Myanmar, Thailand, Viet Nam, and the South Asian countries present great opportunities to supply this large and growing market. However, unchecked animal movement presents considerable risks in relation to hazards of importance to animal and human health and economic development. The large numbers of cattle and buffalo that currently transit through the Greater Mekong Subregion (GMS), largely informally and to meet the demand from the PRC, present considerable risks for the spread important pathogens for animals and trade, such as FMD virus, and human health, such as pathogenic strains of *Escherichia Coli*. This uncontrolled movement and associated disease risk threatens livestock producers, allied businesses and consumers throughout the GMS.

The Yunnan Animal Science and Veterinary Institute estimates that approximately 1 million live cattle and buffalo from the Greater Mekong Subregion (GMS) entered the People's Republic of China (PRC) through Yunnan Province illegally in 2015. The study determined that a high proportion of these animals had been exposed to the foot and mouth disease virus (FMDV); thus, many of them may be carrying the virus. Foot and mouth disease (FMD) is extremely infectious. It destroys livelihoods and bars GMS trade in many livestock products to potentially lucrative FMD-free markets internationally. FMD spreads rapidly, typically through livestock movement. Illegal and poorly controlled animal movement across GMS borders is a key pathway for the transmission of the FMDV. Moreover, other hazards of importance to human health and GMS trade products affect GMS consumers and businesses and limit market access for livestock and livestock products from the GMS. In this context, illegal and poorly controlled animal trade presents a risk to regional food security, producer livelihoods, and animal trade in the subregion.

To begin to address these issues, the Asian Development Bank (ADB) Regional Technical Assistance (TA 8163-REG) allocated a \$60,000 grant² to a project under a letter of agreement between ADB and the Ministry of Agriculture of the People's Republic of China (PRC). The main objectives of the project were to better understand cattle and buffalo movement patterns and to improve livestock traceability, which are essential for the rapid identification of FMD and the implementation of effective preventative measures. The project also sought to identify animal movement pathways in key counties within Yunnan Province, where control measures might best be targeted to reduce the risk of FMD spread.

Animal movement patterns were analyzed and the risk of FMDV spread was assessed. The project mapped the four main pathways through which cattle and buffalo enter the PRC from the Lao People's Democratic Republic (Lao PDR) and Myanmar and conducted extensive serological sampling to identify exposure to the most common FMD serotypes circulating in Asia. The study findings indicated a number of key areas for policy change, institutional capacity building, and investment to regulate cross-border livestock movement, reduce the risk of FMD spread, and thereby promote trade in animals and animal products. Beyond FMD, the findings and recommendations also have implications for the design of food safety and broader livestock-related hazard surveillance and risk management systems.

The study concluded that appropriate regulation of cross-border livestock trade and the establishment of disease control zones (DCZs) could promote legal livestock trade and contribute to controlling FMD. Such initiatives must include animal identification and traceability systems, transparent livestock movement management systems, risk-based monitoring of animal health status, and vaccination at borders.

² In this paper, the symbol "\$" refers to the United States dollar.

Five primary recommendations emerged:

- (1) Establish bilateral and/or multilateral mechanisms to improve the coordination of national policies, investments, and institutional capacity building for (a) the control of live cattle and buffalo trade between the Lao PDR and the PRC, and between Myanmar and the PRC; and (b) the management of associated disease and broader hazard risks.
- (2) Establish bilateral and/or multilateral coordinating mechanisms for the surveillance of cattle and buffalo movement, FMDV, and other hazards of importance to animal production, food safety, and trade among GMS countries, in coordination with the OIE-led SEACFMD³ program.
- (3) Conduct feasibility assessments to identify investment opportunities that support the establishment and management of the DCZs, under the direction of the GMS Working Group on Agriculture.
- (4) Mobilize funds for the establishment of traceability systems and DCZs, through technical assistance and infrastructural investments as proposed in the Strategy for Promoting Safe and Environment-Friendly Agro-based Value Chains in the Greater Mekong Subregion and Siem Reap Action Plan, 2018–2022 (To be finalized).
- (5) Establish cross-border animal DCZs to assess and control FMD and broader hazard risk and increase legal access to the PRC market. Facilitate the establishment of public–private partnerships for investment in the necessary infrastructure and services.

Encouraging legal animal movement and the development of DCZs along the Lao PDR–Yunnan and Myanmar–Yunnan borders presents a novel strategy that can minimize the risk of FMD spread from the GMS countries to the PRC; promote livestock trade to the PRC to the benefit of communities living in the border areas; and support smallholder farmers in Lao PDR, Myanmar, and the wider GMS whose livelihoods depend on livestock raising and trade. The establishment of FMD-focused DCZs for cattle and buffalo in Yunnan can provide lessons for the control of other production pathogens and foodborne hazards in other areas of the GMS. Moreover, the approach can be built on and/or replicated to address the movement of pigs and poultry and the sustainable management of broader human and animal health risks associated with animal and animal product trade in the GMS while promoting trade and market access for the subregion’s animal suppliers and their products.

³ The Sub-Commission for Foot and Mouth Disease Control in South-East Asia and China (SEACFMD) is led by the World Organization for Animal Health (Oficina Internacional de Epizootias—OIE).

1. Introduction

Foot and mouth disease (FMD) is an important transboundary animal disease (TAD) that causes significant economic losses to livestock producers and has considerable effects on economic development and trade in the Greater Mekong Subregion (GMS). FMD is a highly infectious viral disease of ungulates that is primarily spread through animal movement (Rosenberg, Astudillo, and Goic 1980; Windsor 2011). The disease causes considerable loss of productivity and animal value and is a major barrier to the export of GMS livestock products to FMD-free markets internationally under the terms of the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures. Employing impact survey questionnaires post outbreak in 2010 Young, et al. (2013) estimated that animals lost 54-92% of their value, on average, post disease due to weight loss, treatment costs lost draft capacity and/or death. A related study demonstrated the considerable impact effective control of FMD through vaccination of cattle and buffalo populations in Cambodia on reducing poverty and vulnerability and increasing food security (Young, et al. 2016), this would undoubtedly apply across the GMS. Few would refute Perry, et al. (1999)'s assessment that the control of highly infectious diseases is crucial to improving trade within and outside the region and that FMD is the top priority among disease that affect cattle and buffalo.

The Yunnan Animal Science and Veterinary Institute (YASVI) estimated approximately 1 million cattle and buffalo were illegally traded across Yunnan's international borders in 2015, which may be conservative. The majority of the animals are thought to originate in the GMS, although some may have transited through the subregion from as far away as Bangladesh or India. The high volumes of illegal cross-border movement of live cattle and buffalo into the People's Republic of China (PRC) in recent years has been driven by soaring demand and high market prices for beef in the mainland PRC. As FMD is endemic in much of the region (Gleeson 2002), the risk of animal transmitting the virus enroute to Yunnan, within the province, or on into mainland PRC are likely extremely high. In addition, cattle movement can spread other pathogens of importance to livestock, such as *Pasteurella* (hemorrhagic septicemia) and foodborne pathogens, for example, pathogenic strains of *Escherichia Coli*.

The volume and uncontrolled or poorly controlled nature of cattle and buffalo movement in the GMS—primarily into the PRC via Yunnan—is undoubtedly associated with the frequency and scale of FMD outbreaks in the subregion. Moreover, large-scale, poorly regulated trade presents considerable risks of spreading other diseases, zoonoses, and foodborne hazards. This hampers the development of sustainable animal production and trade and has negative effects on GMS producers, allied businesses, and consumers. Moreover, the uncontrolled or loosely controlled trade in live animals and associated hazards present a major barrier to the GMS becoming recognized as a leading global supplier of safe and environment-friendly agricultural products. Under the World Trade Organization Sanitary and Phytosanitary Agreement, the lack of control over animal movement makes demonstration of disease freedom and/or effective risk management systems to potential trading partners near impossible. Due to the cross-border nature of animal trade in the GMS, it is in the interests of each GMS country to act collectively to improve the monitoring and management of risks associated with animal movement and trade in the GMS.

2. Background and Approach

In 2014, the Asian Development Bank (ADB) and the GMS countries agreed that the ADB Regional Technical Assistance, TA 8163-REG, would support country-initiated activities consistent with its outputs and the overall objectives of the Core Agriculture Support Program Phase 2. The following year, ADB signed letters of agreement with individual GMS countries under TA 8163-REG and allocated a grant of \$300,000 to the PRC for multiple projects. The PRC's Ministry of Agriculture designed five projects to be implemented under the letters of

agreement, including a project for tracing cross-border livestock movement and the risk of spreading FMD across Yunnan Province's borders with the Lao People's Democratic Republic (Lao PDR) and Myanmar.

The cattle and buffalo movement and FMD risk project received a total grant of \$60,000 and was implemented by YASVI during July 2015 to June 2016. The purpose of the project was to identify the major cattle and buffalo movement pathways between the PRC and the two neighboring countries, with particular focus on tracing animals entering Yunnan from the two countries and transiting to other destinations within the PRC. The study was also intended to inform the identification of key counties along major animal movement corridors in Yunnan Province, for targeting control measures to reduce the risk of FMD spread.

The project was designed in alignment with the Transboundary Animal Disease Zoning Trial Program in Yunnan Province, a long-term program approved by the PRC's Ministry of Agriculture; Ministry of Commerce; General Administration of Customs; and General Administration of Quality Supervision, Inspection, and Quarantine. The program aims to regulate cross-border livestock movement, establish DCZs, and promote livestock husbandry and animal product processing within the border area zones. The border DCZ is envisioned as a delimited area where special policies addressing illegal animal movement can be applied so as to allow animals to enter the province via quarantine, health inspection, and completion of official trade management requirements, thereby formalizing previously illegal trade.

The project was based on three key components:

- (1) tracing cross-border cattle and buffalo movement across the Lao PDR–Yunnan and Myanmar-Yunnan borders, and identifying movement patterns;
- (2) predicting the risk of FMD spread; and
- (3) developing policy, institutional, and investment recommendations and interventions to reduce illegal cross-border cattle and buffalo movement and decrease the risk of hazard entry into and subsequent spread of disease in the PRC.

Specific tasks included tracing and describing actual cross-border cattle and buffalo movement in Yunnan; identifying the source and destination of individual animals; understanding the risk profile and identifying risk hotspots for disease spread along movement pathways; and workshops and field trips to build animal health worker, farmer, and trader capacity to rapidly identify FMD and animal characteristics—such as diagnosing FMD and introducing the pilot animal identification system.

The project was the first to pilot the tracking of cross-border cattle and buffalo trade from the Lao PDR and Myanmar into Yunnan. The project provided data on movement patterns and indications of potential policy, regulatory, and investment solutions to formalize trade and support FMD prevention and control. A tag-based animal identification system was designed and piloted. This pilot facilitated traceability of animals and the collection of animal data, including identification of animals with prior exposure to FMD, that could be fed into risk assessment and risk management decision making processes. The results provided evidence for scaling-up of livestock traceability systems based on information and communications technology in the GMS, and supported the establishment of DCZs along Yunnan's borders and, potentially, more widely in the GMS.

3. Methods

Six cities and prefectures in Yunnan share borders with the Lao PDR and Myanmar, consisting of 17 PRC border counties. Extensive interviewing and surveying of cattle and buffalo traders and blood sampling of live animals were conducted in these prefectures.

To collect preliminary data, a project coordination meeting was held in September 2015 in Kunming. Four experts from YASVI and eight animal health workers/veterinary officers, two from each of the prefectures of Xishuangbanna, Puer, Lincang and Dehong, attended the meeting. Information on trans-boundary animal movement and FMD status and approaches to control and prevention was collected. The key informants provided information on the suspected origin of animals entering the PRC through borders in their prefectures, the locations of live animal markets and probable movement pathways were mapped. The participants also estimated the number of animals arriving in Yunnan from Lao PDR and Myanmar and identified their suspected final destinations. In March 2016, the study team hosted a workshop on Tracing Cross-Border Livestock Movement and the Risk of Spread of FMD along the PRC-Lao PDR and PRC-Myanmar Borders in Yunnan Province. In total 62 veterinary officers, animal health workers, traders and farmers from 14 border counties/cities of the four prefectures attended. In addition, officers from provincial Departments of Agriculture, scientists from provincial veterinary diagnostic laboratories. All participants were surveyed and the majority were interviewed.

Sera samples were collected from cattle and buffalo entering Yunnan from the Lao PDR and Myanmar and tested in YASVI's Tropical and Subtropical Animal Disease Laboratory. In total 2398 serological samples were tested using C-ELISA and 3ABC-ELISA for FMD virus antibodies against FMD serotype O, A, Asia-1, and non-structure proteins in January 2016. In addition, 216 samples were tested by qPCR for the presence of FMD virus RNA.

4. Results

Cattle and buffalo trade

Four main pathways through which cattle and buffalo enter Yunnan directly from the Lao PDR and Myanmar were identified, although significant numbers of live animals also enter at other locations not detailed here (Table 1).

Table 1 Live Cattle and Buffalo Trade Pathways into Yunnan from the GMS

Pathway	Estimated Volume head/day (head/year)	Main Mode of Transport
From Luang Namtha Province to Boten, Lao PDR → Mohan, PRC → Mengla County, Xishuangbanna Prefecture, PRC.	300 (100,000)	Truck
From Chiang Rai Province, Thailand → Soley, Myanmar → Jinghong City, PRC	1,200 (300,000)	Boat and truck
From Mandalay, Lashio, and Panghsang in Shan State, Myanmar → Menga Village of Mengma Township, Menglian County of Puer Municipality, PRC.	500 (180,000)	Truck or on foot
From Mandalay, Lashio, Namhkam, and Muse in Shan State, Myanmar → Longdao Township of Ruili City, Dehong Prefecture, PRC	800–1,000 (300,000)	Truck or on foot
Other Cross-Border Pathways	1000 (100,000)	Various

GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: Yunnan Animal Science and Veterinary Institute.

Four cities/prefectures, consisting of 12 counties, were identified as key target areas for monitoring and risk management initiatives—Dehong, Lincang, Puer, and Xishuangbanna—on the basis of high absolute numbers of transiting animals and estimates of illegal movement. These counties were identified as key for the targeting of risk management efforts.

The study found that most cattle and buffalo that enter Yunnan were traded in Myanmar and Thailand. In particular, Mae Sot, Thailand, is a major live animal market hub, where it is believed as many as 100,000 head of cattle and buffalo are traded monthly. In Myanmar, Lashio in Shan State and Kyaukpadaung, Maymyo, and Sagaing in Mandalay are also key cattle and buffalo markets.

Foot and mouth disease exposure

The serological results indicated that 15.0%–34.3% animals were positive for FMDV O antibody, 4.8%–15.8% for FMD A, and 20.1%–35.5% for Asia-1. However, sampled animals positive for 3ABC antibodies were considerably higher at 20.0% to 47.8% of the population. These findings clearly demonstrate the high rates of FMDV exposure among cattle and buffalo entering Yunnan from the GMS and indicates a high risk of FMD transmission during transit. Moreover, the origins and typically lengthy pathways the animals travelled within the GMS indicate high risks of transmitting FMD en route. This is reflected in the high frequency of FMD outbreaks experienced in the GMS.

Importantly, the project resulted in the development of extensive social networks that will form a basis for future data collection and information sharing.

Greater information sharing is essential to promote inclusive, safe, and environment-friendly food production in the GMS and to unlock potential markets for GMS animal products. The project established a network of animal health workers, traders, farmers, and key informants from four PRC prefectures/cities to collect and share information of transboundary animal disease (TAD) control. The network can contribute to improved monitoring of cattle and buffalo movement from the Lao PDR and Myanmar into the PRC, facilitate implementation of traceability systems and the establishment of DCZs, and thereby support GMS FMD surveillance and control. The project also provides a further step toward increased information sharing between GMS countries in relation to FMD, other TADs, important trade and sanitary and phytosanitary hazards, and human health hazards more generally.

5. Policy Directions, Including Needed Investments and Institutional Reforms

The project resulted in five main recommendations for policy directions.

- (1) Establish bilateral and/or multilateral mechanisms for (a) coordinating policies, investments, and institutional capacity building for the control of live cattle and buffalo trade between the Lao PDR–PRC and Myanmar–PRC; and (b) managing associated disease and broader hazard associated risks. Draw the attention of high-level decision makers to the significance of TADs and continue promoting cooperation among GMS countries in this regard.
- (2) Establish collaboration mechanisms among the GMS countries with the objective of establishing electronic track and trace systems for livestock movement to safely increase access to the PRC market for GMS suppliers. This will benefit the PRC, as a large and growing importer, and the GMS countries, as current and potential exporters of live cattle and buffalo. Coordination with organizations such as GS1 on options for

barcode-based traceability systems for animal product leaving the DCZs can also be considered.

- (3) Given the PRC government's efforts in developing the transboundary DCZ in Yunnan, the GMS Working Group on Agriculture could conduct feasibility assessments and identify investment opportunities that support the establishment and management of the proposed DCZs, so as to effectively control TADs, reduce sanitary and phytosanitary barriers to trade, and facilitate cross-border livestock trade in the region.
- (4) Based on the project's findings, the PRC has proposed two key investment needs within the Strategy for Promoting Safe and Environment-Friendly Agro-based Value Chains in the Greater Mekong Subregion and Siem Reap Action Plan, 2018–2022: (a) a technical assistance project of \$1 million to build an e-traceability system for tracking livestock movement along GMS borders to better control TADs; and (b) a \$50 million investment in establishing livestock DCZs along GMS borders. Other GMS countries have proposed similar technical and infrastructural investments to establish traceability systems and DCZs. Resources need to be mobilized to support implementation of these initiatives.
- (5) Establish livestock DCZs at key border areas in the PRC, the Lao PDR, and Myanmar to (a) mitigate and manage the risk of FMD incursion through cattle and buffalo, (b) control other key production and zoonotic diseases, and (c) serve as a buffer zone to regulate livestock trade between the PRC and other GMS countries. A DCZ can encompass systems for risk analysis and facilities such as animal identification (tagging); livestock movement management (e-traceability); quarantine, serological, and pathological surveillance infrastructure and expertise; and vaccination facilities and services. Food safety testing for pathogens and residues could be built into the system once operational. It is also important to encourage the private sector to be involved in the DCZs and set up modern slaughterhouse, meat processing, and bio-digester facilities, and local feedlots, through public–private partnership schemes.

6. Conclusions

That demand for beef and beef products is high and increasing in the PRC is well-established. The large cattle and buffalo populations in Cambodia, the Lao PDR, Myanmar, Thailand, Viet Nam, and the South Asian countries present great opportunities to supply this large and growing market. However, unchecked animal movement presents considerable animal disease, zoonoses and food safety risks. The large numbers of cattle and buffalo traded illegally into the PRC present considerable risks for the spread important economic and human health pathogens, such as FMD virus and pathogenic E. Coli, which threaten livestock producers, allied businesses and consumers throughout the GMS.

Understanding animal movement patterns, monitoring risk and establishing effective traceability systems are essential for the timely identification of key hazards such as FMD, and for the implementation of effective and efficient outbreak responses. This can better protect the livestock industries of the PRC and the GMS countries. Assessing FMD risk in the live cattle and buffalo trade into the PRC via Yunnan can inform wider GMS risk management strategies for FMD and the many other hazards of importance to animal and human health and trade. Addressing the issues can benefit livestock industries throughout the GMS, including the smallholders and small enterprises that dominate the industry numerically.

Encouraging legal animal movement by developing DCZs along the Lao PDR–Yunnan and Myanmar–Yunnan borders presents a novel strategy that can minimize the risk of FMD spread from the GMS countries to the mainland PRC, promote livestock trade to the benefit of communities living in the border areas, and support smallholder farmers in the Lao PDR and

Myanmar whose livelihoods depend on livestock raising and trade. In addition, the establishment of DCZs can enable improved surveillance and management of foodborne hazards within Yunnan and the GMS more widely.

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About the Core Agriculture Support Program

The Core Agriculture Support Program (CASP) supports the GMS in attaining its goal of being a leading producer of safe food using climate-friendly agriculture practices. Now on its second phase, since 2012, CASP2 is committed to increasing the subregion's agricultural competitiveness through enhanced regional and global market integration and subregional connectivity.

The agriculture ministries of the six GMS countries supervise the implementation of CASP2 through the GMS Working Group on Agriculture (GMS WGA). A technical assistance (TA 8163) with financing from the Asian Development Bank, the Government of Sweden, the Nordic Development Fund, and the Water Financing Partnership Facility supports the CASP2 implementation. The GMS WGA oversaw the development of the discussion papers.

About the Asian Development Bank

ADB's vision is an Asian and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to a large share of the world's poor. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

Core Agriculture Support Program Phase II

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