Using Index-based Risk Transfer Products to Facilitate Rural Lending in Mongolia, Peru, Vietnam

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Financial Services for Small Rural Households

Financial Services Should Involve

1. Savings
2. Lending
3. Risk Transfer — Insurance

Benefits of Improved Financial Services

- ✓ Individuals can better manage risk, smooth consumption
- ✓ Households on the margin may not be thrust into poverty
- ✓ Investment in advanced technologies is encouraged
- ✓ Economic growth occurs faster in countries with insurance

Context — 3 Different Rural Lenders at Different Points in Their Development Process

- Peru — Most integrated into the market

  They price the risk in interest rates or simply don't loan / other constraints

- Mongolia — Transition economy since 1991

  Herders loans have grown exponentially since the last major disaster

- Vietnam — Just starting to equitize (privatize)

  The state bank is the insurer charging same interest rate

Mongolia: Index-based Livestock Insurance

The Risk

Severe livestock losses due to harsh winter weather (dzud)

Target Users

Herders

Contract Structure

Payments based on livestock mortality rates at the soum (county) level

Massive Deaths of Animals

- Mongolia has some 30 million animals
- Sheep, goats, cattle and yak, horses, camel
- Value of animals = US$1 Billion
- Some 11 million animals were lost in 2001–2002 due to severe weather (dzud)
- Animal husbandry in Mongolia is nearly 30% of the GDP and over 85% of all agriculture
- Census is done every year — Mortality data are available by soum from 1970 onwards

Pilot Project 2005–2009
3 Aimags — Soum-Level Mortality
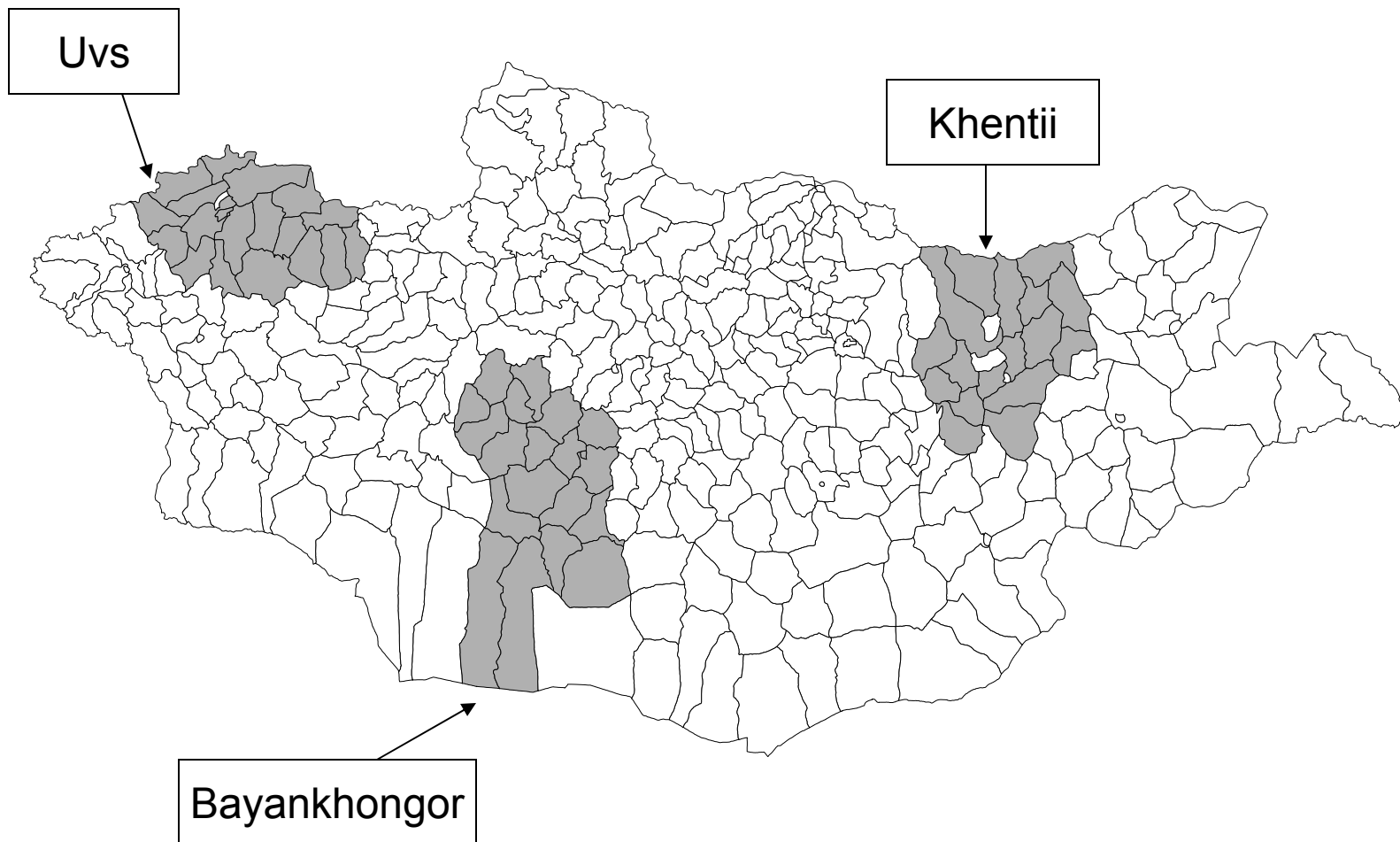
Key Objectives

- Test the product design

- Learn if herders will buy the insurance

- Learn if insurance companies have an interest in selling and the capacity to manage this unique insurance

- Develop a sustainable system that can access global risk markets

Index-based Livestock Insurance
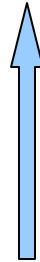
Disaster Response Product — 100% mortality

Base Insurance Product — 30% mortality

Retained by Herders and Banks — 7% mortality

DRP: Social insurance

A layer of very infrequent risk where decision makers may have a cognitive failure problem
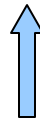
BIP: Commercial Insurance

Offered by private companies with reinsurance from government in the pilot

How the Base Insurance Product (BIP) Works

- Herders pay a premium based on number of animals reported (Can insure between 30% and 100% of the value of their animals)

- Premium rates vary by species and soum, based on relative risk and the threshold mortality level

- Example: Herder has 100 sheep valued at US$50 /sheep

- Value insured = US$5,000

- Mortality rate is 20%

- Payment rate is 20% − 7% or 13%
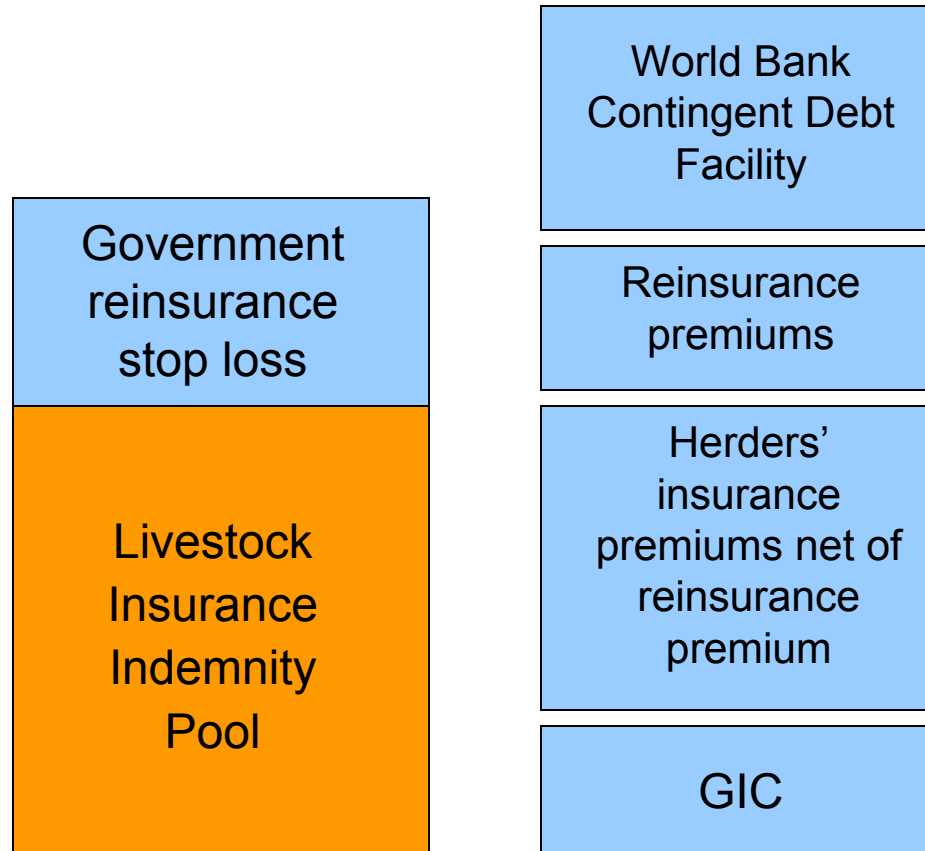
- Indemnity = .2 x US$5000= US$1000

Weather Insurance Products Require Special Financing

- Protect insurance companies from high financial exposure when selling BIP

- Ring-fence BIP from other lines of insurance so that potentially large losses do not impact other lines of insurance or the overall insurance sector

- Allow insurance companies to collectively pool their risk to gain from the aggregate spatial diversification of all sales

- Pre-finance all potential indemnities payments that must be made by the pool
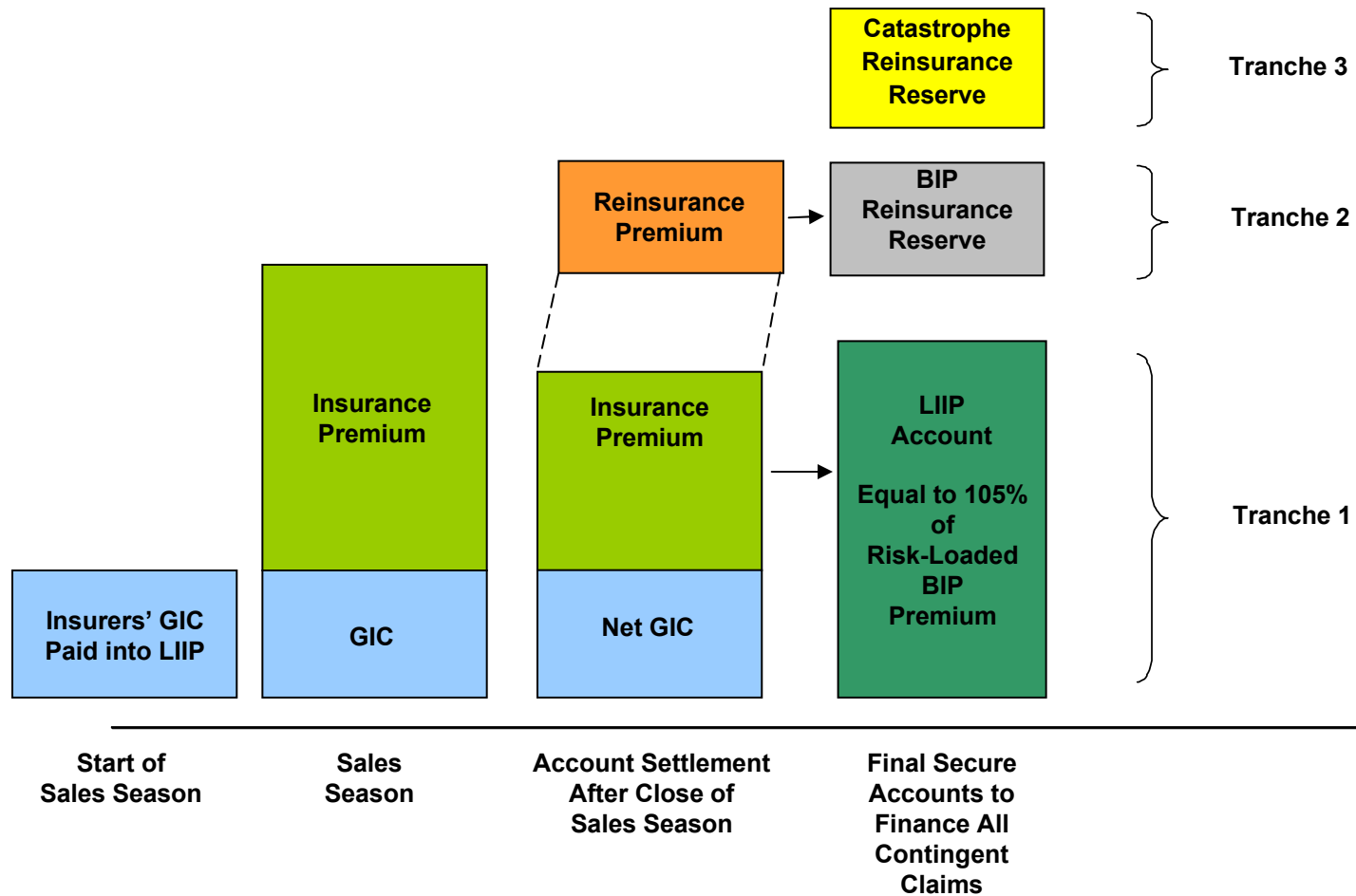
Livestock Insurance Indemnity Pool (LIIP)

- All BIP premiums are placed in the LIIP and fully protected until indemnity payments are made — a pre-paid indemnity pool

- The LIIP is reinsured with a stop loss above 105% of the sum of all herder premium

- Insurance companies pre-pay a Guaranteed Indemnity Contribution (GIC) = 5% layer + pre-estimate of their individual reinsurance costs

Livestock Insurance Indemnity Pool

IBLI Financing Structure

Catastrophe Reinsurance Reserve — Tranche 3

Reinsurance Premium → BIP Reinsurance Reserve — Tranche 2

Insurance Premium

GIC

Insurers' GIC Paid into LIIP

Insurance Premium

Net GIC

LIIP Account — Equal to 105% of Risk-Loaded BIP Premium — Tranche 1

Start of Sales Season

Sales Season

Account Settlement After Close of Sales Season

Final Secure Accounts to Finance All Contingent Claims

Participation Rates in Year 1 and 2

- Roughly 9% of eligible herders in Year 1

- Roughly 14% of eligible herders in Year 2

- Over $100,000 of premium in Year 2

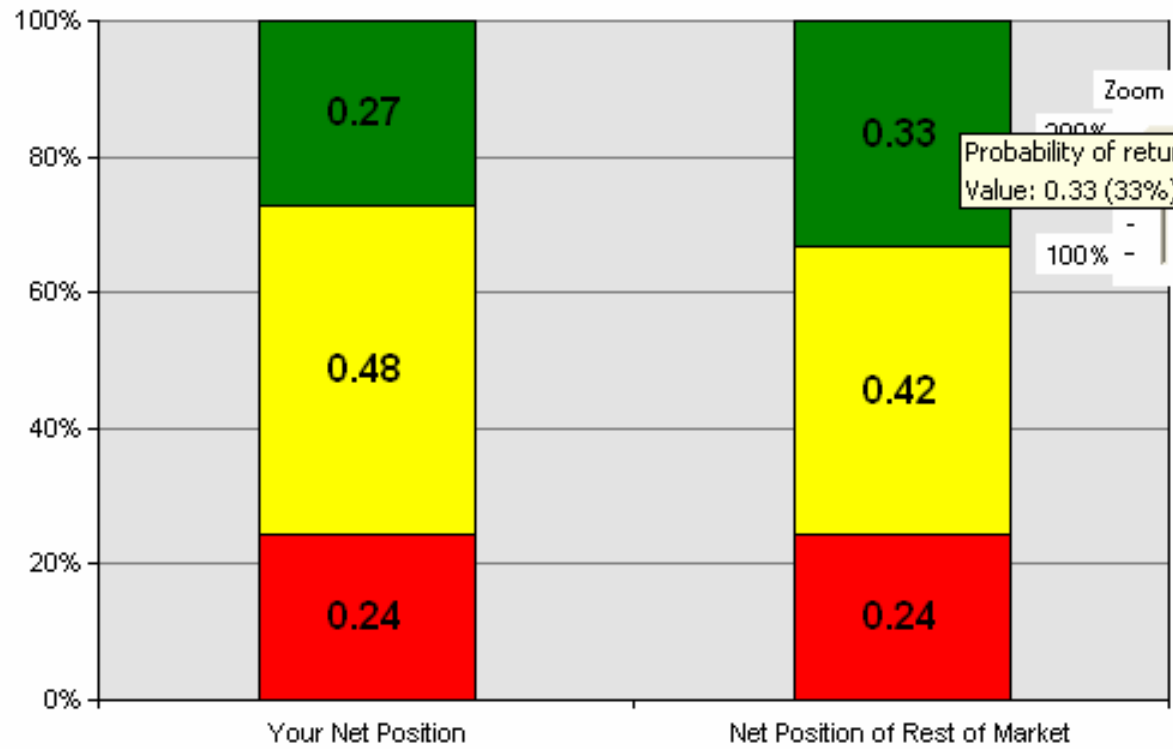## Issue

Herders select lowest level liability

Same story for India

Capital Invested and Returns to Risk for the Insurance Company

- The capital invested from the insurance company is the GIC

- All analysis in the Portfolio Software uses this as the base for considering the risk-return from that capital.

- The GIC is the capital at risk for the insurer

- GIC is only a portion of the total LIIP – Interest is earned on the total value of the LIIP until the indemnity payments are made

IBLI Portfolio Risk Assessment Software (Prototype Version)

Click the tabs on the right to view different graphical analysis. Based on the value entered as your market share, the charts show your company's performance in comparison to the rest of the market. These results will vary depending on your level of market share.

Probabilities for rates of return less than 0% and Greater Than 200%

Your Net Position	Net Position of Rest of Market
0.27 (green)	0.33 (green)
0.48 (yellow)	0.42 (yellow)
0.24 (red)	0.24 (red)

Zoom
200%
100%

Probability of return greater than 200% - Net Position of Rest of Market
Value: 0.33 (33%)

View StopLight Chart

This chart shows the probability that rates of return to the GIC will fall within a certain range of values. The green area represents the probability of having a rate of return that is greater than 200%. The yellow area represents the probability of having a rate of return that is ... The rate of return is calculated as the return on the insurer's GIC.

View CDF Chart

This chart gives the cumulative distribution of the rate of return on the insurer's GIC. The basic information presented here should give you a reasonable expectation regarding how your selected business will perform relative to the rest of the market. Attempting to get your line to sit very near the line for the rest of the market is a reasonable way to organize your distribution of sales.

Next -> Soum Market Share..

Intro	Step 1. Market Share	Step 2. View Results

Market share by Prem:	15.0%	GIC Requirement:	$17,243
Market share of others:	85.0%	Reinsurance:	$14,924
BIP Premium:	$46,368	Reinsurance Rate:	32.2%

All Soums in the following aimags are included in the analysis: Bayankhongor, Khentii, and Uvs

start   IBLI Portfolio Risk Ass...   10:52 PM

Herder Lenders Have Lower Interest Rates

Lenders to herders provided lower interest rates and more credit to those purchasing BIP

Need to link BIP and lending

- Will lower delivery cost
- Premium can be paid with loan
- Opens to way to protect loans

Portfolio Risk

- Less than 5% of herders had loans in 2001
- Today, 70% of herders have loans

Blending Financial Services

- Traditional insurance sales agent model is simply too costly for low income households

- Index insurance sold to small households can be drastically misunderstood and misrepresented — basis risks!

- Can index insurance be used to remove the big risks for microfinance and rural lenders?

- Can the benefits be passed on to small households?

Natural Disasters and Rural Finance

Catastrophic events destroy assets, disrupt cash flow, and impact ability to repay debt
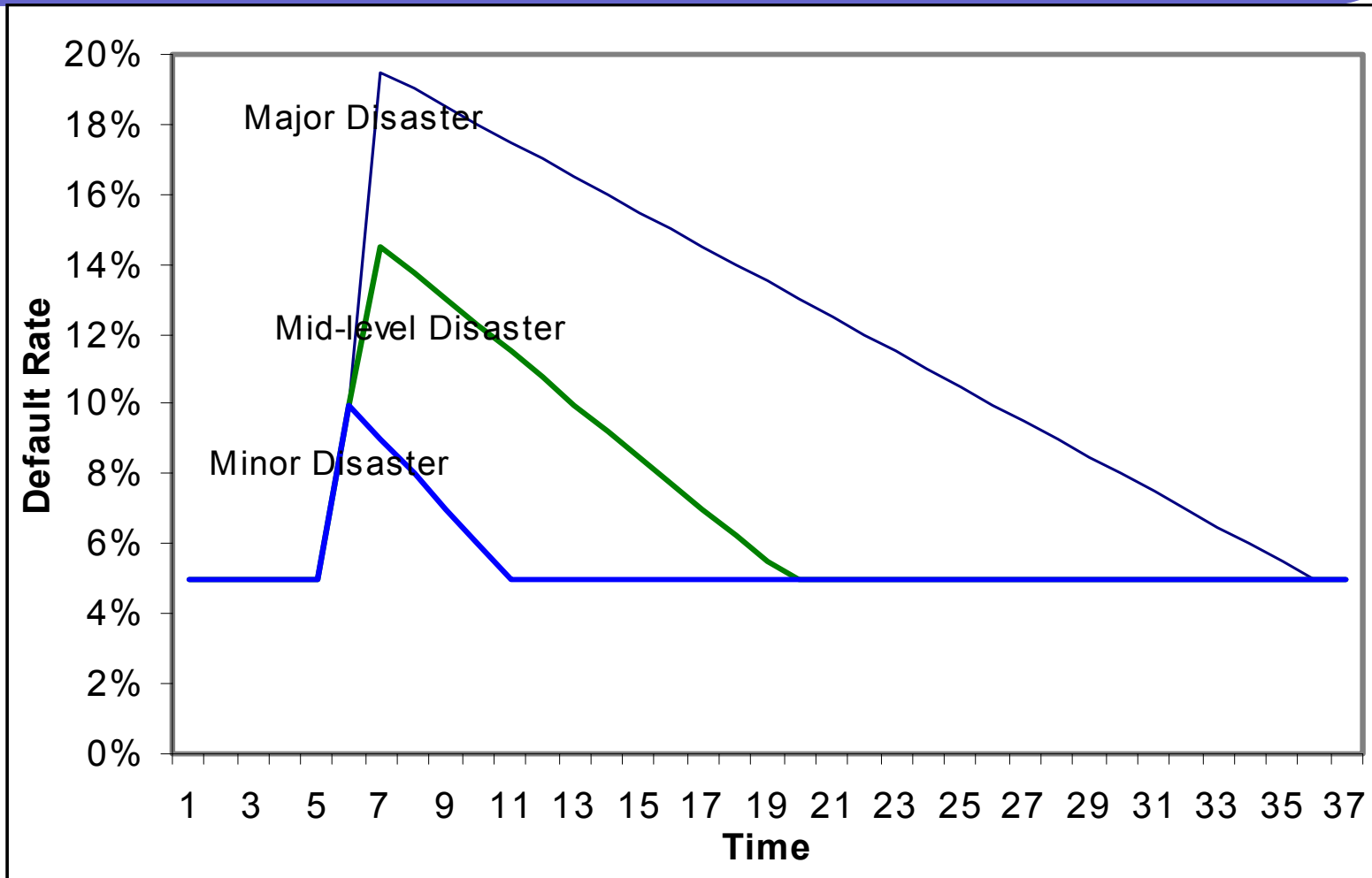
Response from lenders
- Credit rationing
- Risk premiums added to interest rates
- Cut off loans given any sign of disaster
- Simply don't make loans in the area

(Agricultural loans are particularly impacted)

# Rate of Recovery = f (Level of Catastrophe)

Data Challenges

Our ability to empirically understand the dynamic relationships between natural disasters and defaults is greatly hampered by data limitations

- Catastrophic events are infrequent
- Lending practices change over time
- Lenders adapt or change their behavior based on their knowledge of natural disasters and potential cash flow problems
- Is there a default risks because of the natural disaster or are there major credit constraints because of the natural disaster risks?

1997/98 El Niño and MFI Default Rates in Northern Peru
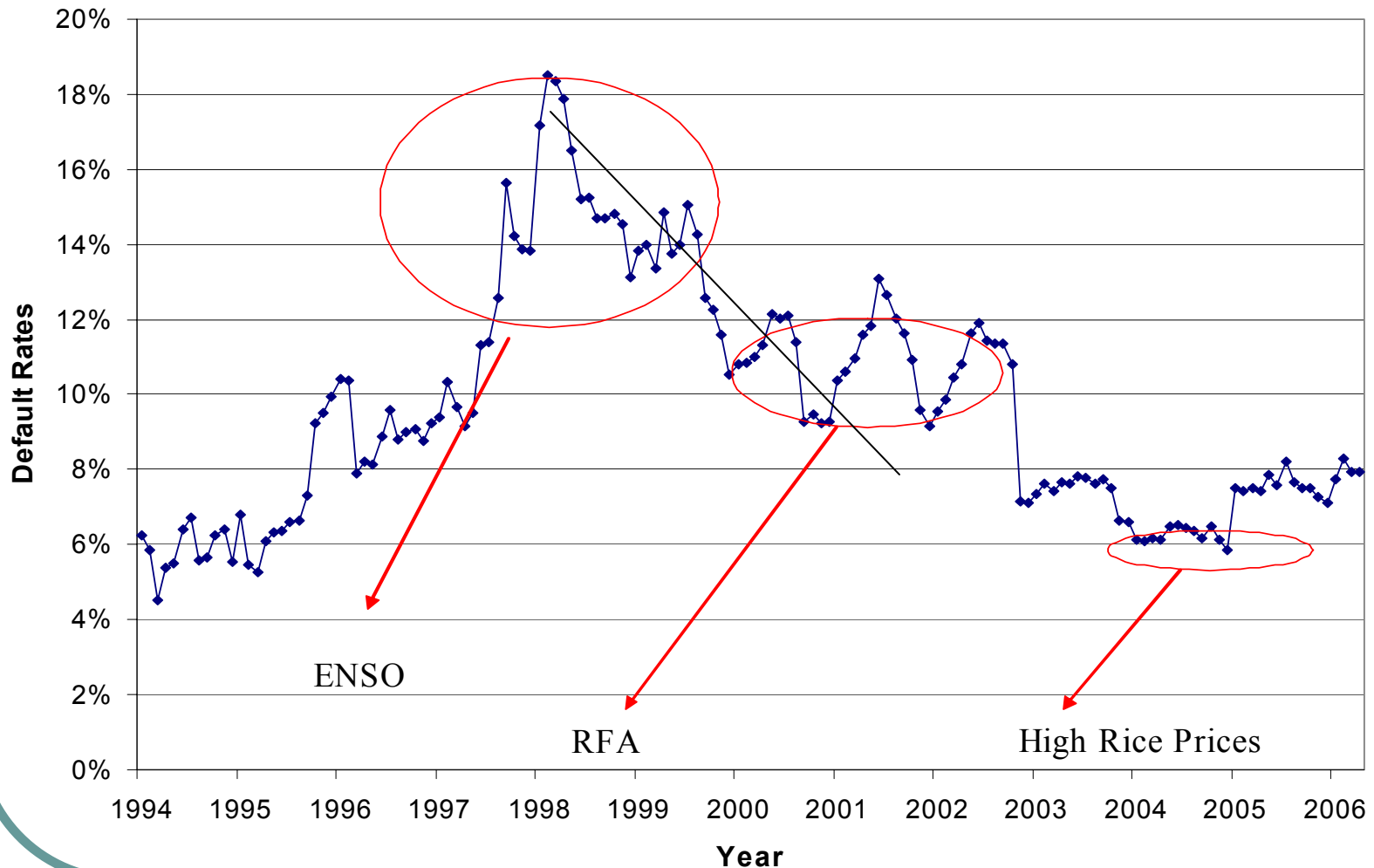
It should have taken about 3.5 years to reduce the rate from 18% to 8%

Liquidity and Real Costs to Lenders

- Those with deposits will withdraw their funds to help cope with cash flow problems of their own brought on by the disaster

- Recovery of loans post disaster is a serious problem: high levels of defaults will never be paid

- Lag time associated with returning to equilibrium level of defaults creates real costs

- Regulatory requirements for reserves or provisioning when repayment of debt in the portfolio is in the arrears

Major Catastrophes for 3 Countries

- Peru — Catastrophic flooding in the northern regions brought on by El Niño
- Mongolia — Extreme death rates of animals brought on by extreme drought and harsh winters.
- Vietnam — Early flooding in the Mekong Delta that is brought on by heavy rains upstream

Each of these events can be used to create an index-based risk transfer product
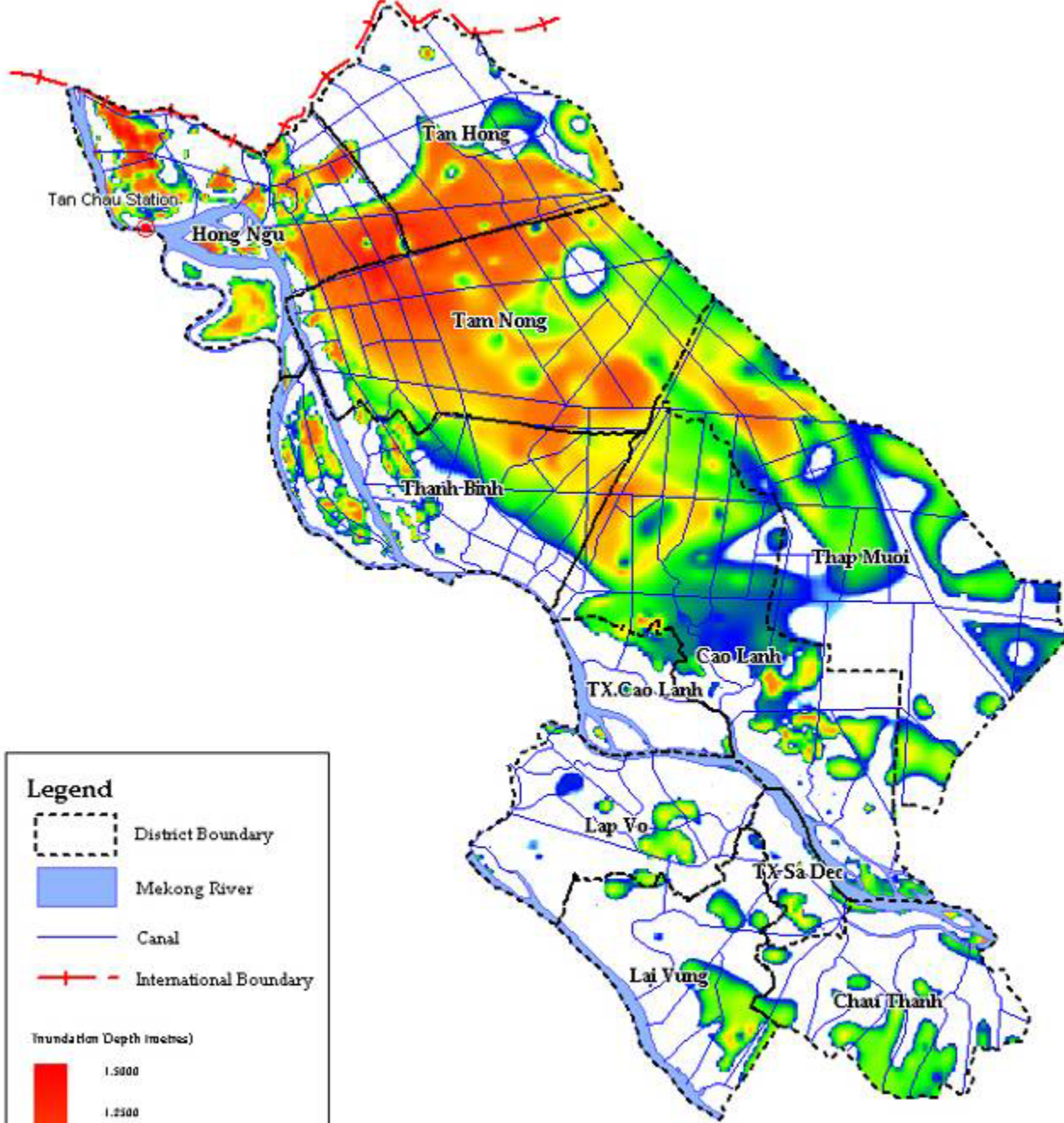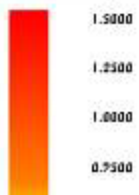
Early Flooding in the Mekong Delta
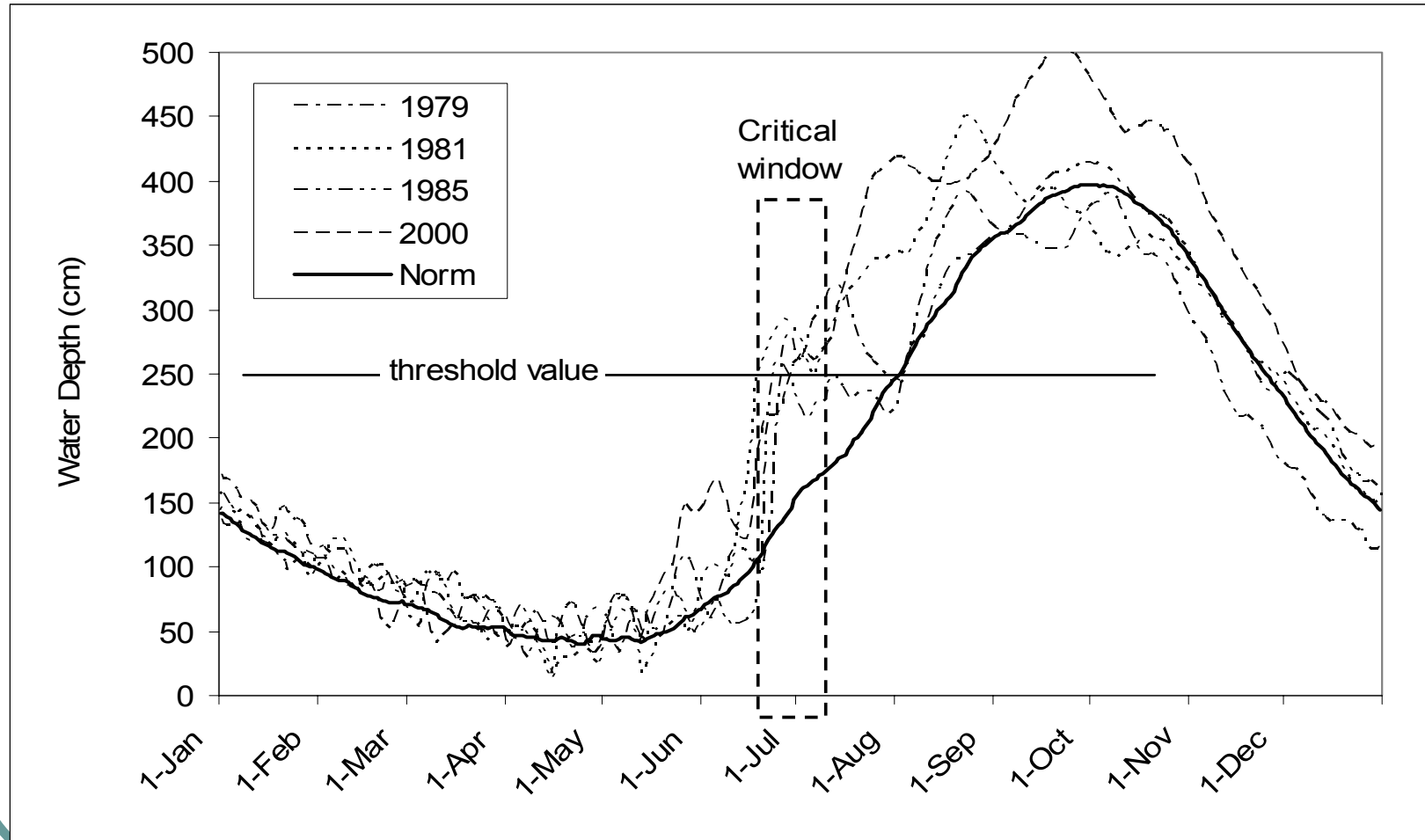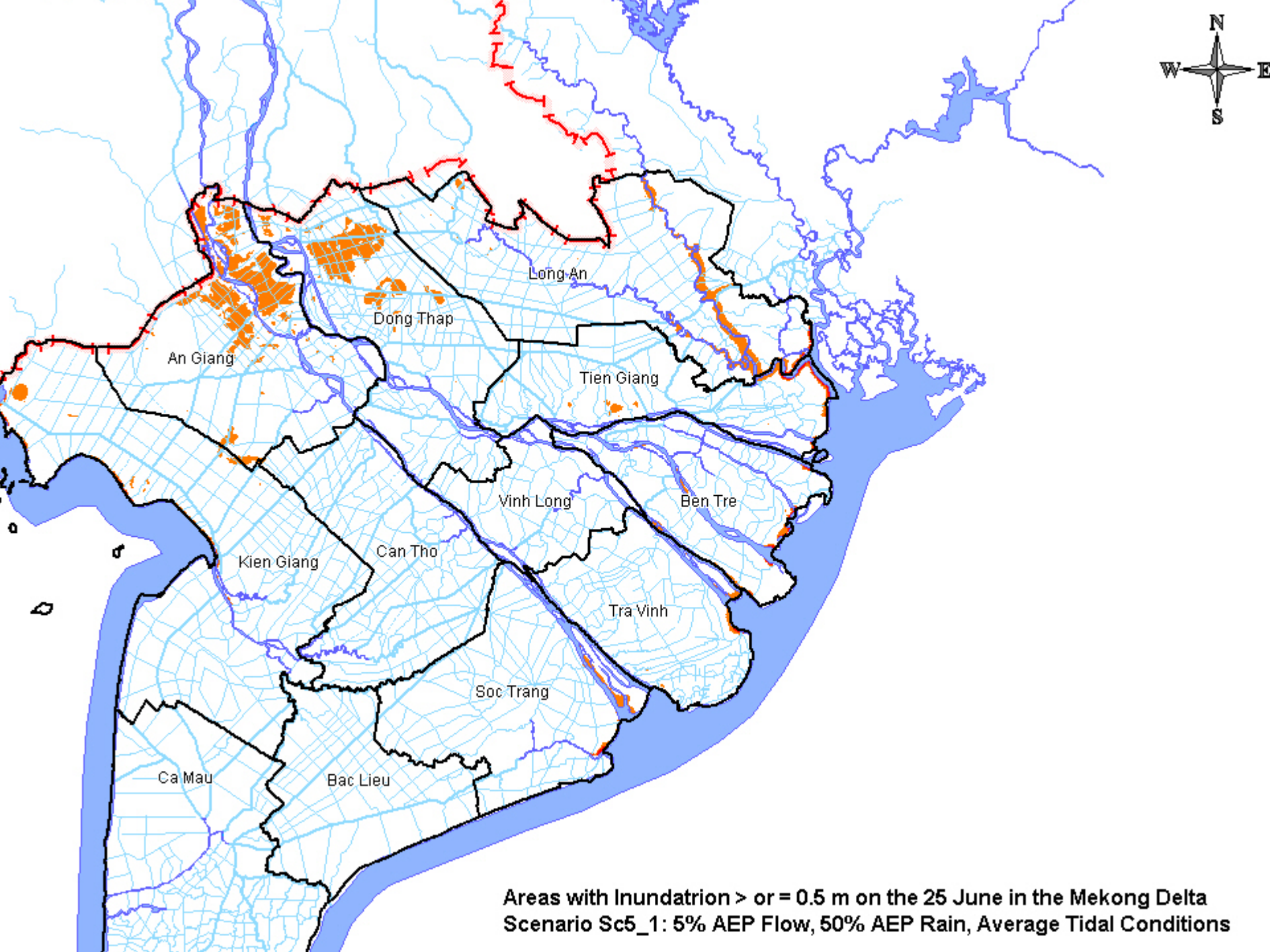
Areas with Inundatrion > or = 0.5 m on the 25 June in the Mekong Delta
Scenario Sc5_1: 5% AEP Flow, 50% AEP Rain, Average Tidal Conditions

Legend

⬚ (dashed box)	District Boundary
🟦 (blue box)	Mekong River
—	Canal
—+—+—	International Boundary

Inundation Depth (metres)

1.5000
1.2500
1.0000
0.7500

Map labels: Tan Hong, Tan Chau Station, Hong Ngu, Tam Nong, Thanh Binh, Thap Muoi, Cao Lanh, TX.Cao Lanh, Lap Vo, TX.Sa Dec, Lai Vung, Chau Thanh

Vietnam: Index-based Flood Insurance

The Risk: Excess early flooding as captured by the level of water coming across the Cambodian border

Target User: Agricultural lenders – Vietnam Bank for Agriculture and Rural Development (VBARD)

Contract Structure: Linear payment rate based on levels of water exceeding 250 cm at the prime river station (Tan Chau) with back up measures from stations upstream

Goal is to increase financial market development by reducing financial risk in agriculture

Kernel Smoothed Probability Distribution for Developing an Index Insurance Contract

Payments occur when river exceeds 250 cm between June 15 and July 10

cm
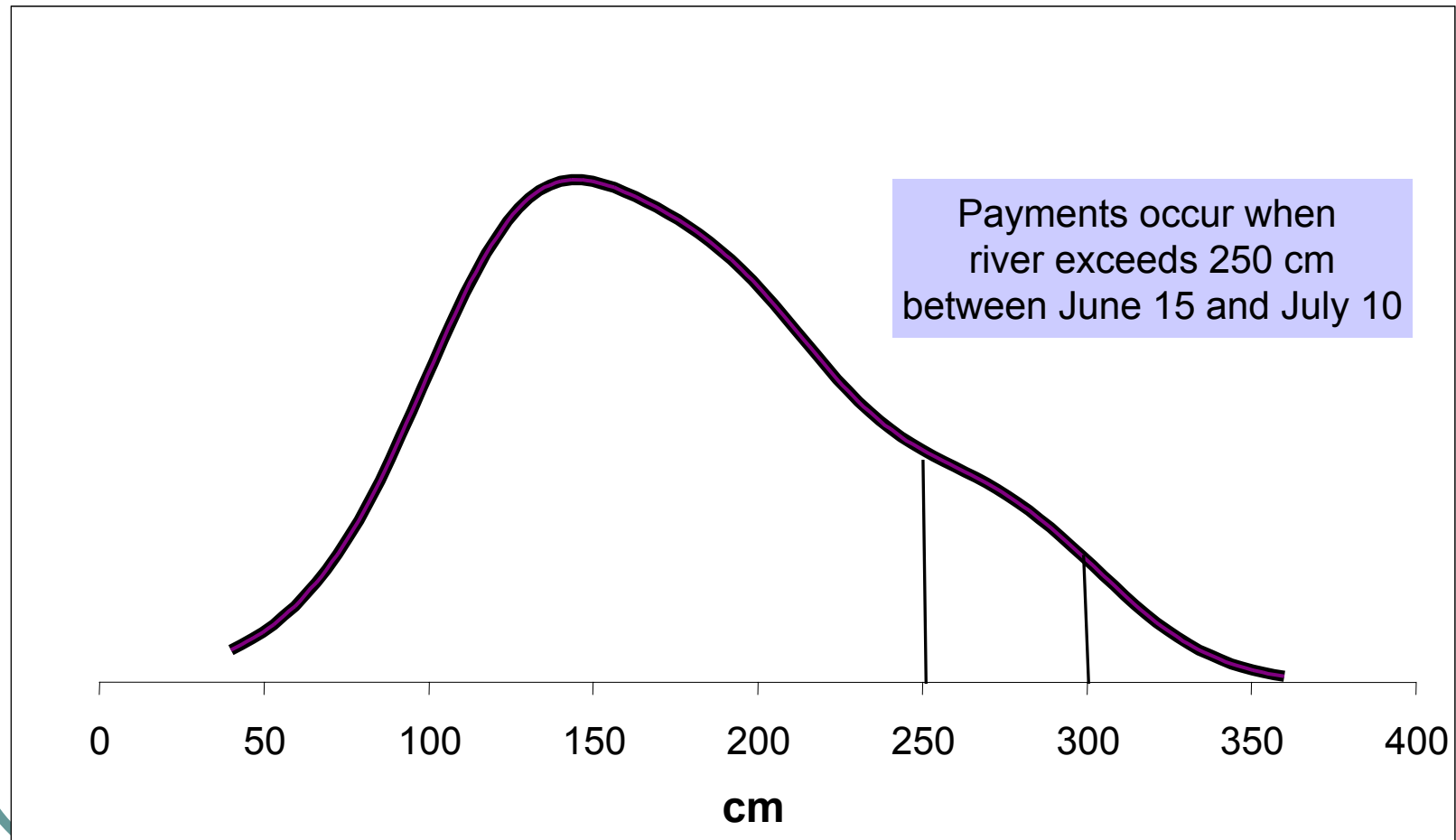
ENSO Insurance in Peru

- Severe rains and floods associated with El Niño are the economically most significant catastrophic risk in Piura

- Index insurance based on rainfall measured at local weather stations is sensible, but has some problems
  - Available rainfall data are limited and incomplete
  - Rainfall stations must be secure and reliable
  - Rainfall stations should comply with World Meteorological Organization standards to attract private sector insurers

Impacts of El Niño in Peru

Excessive rainfall causes flooding that devastates agricultural sector and rural communities

- Kills crops and livestock, destroys drainage and irrigation systems, erodes arable land

- Destroys roads, bridges, railroads, dams, canals, electrical system

- Deposits sediment in major reservoirs that reduces capacity, undermining ability to manage droughts in future

Areas Impacted by 1997/98 El Niño

FEN 97-98: Territorio de afectación por lluvias, inundaciones o huaycos

ENSO 1+2 Index and January–April Rainfall
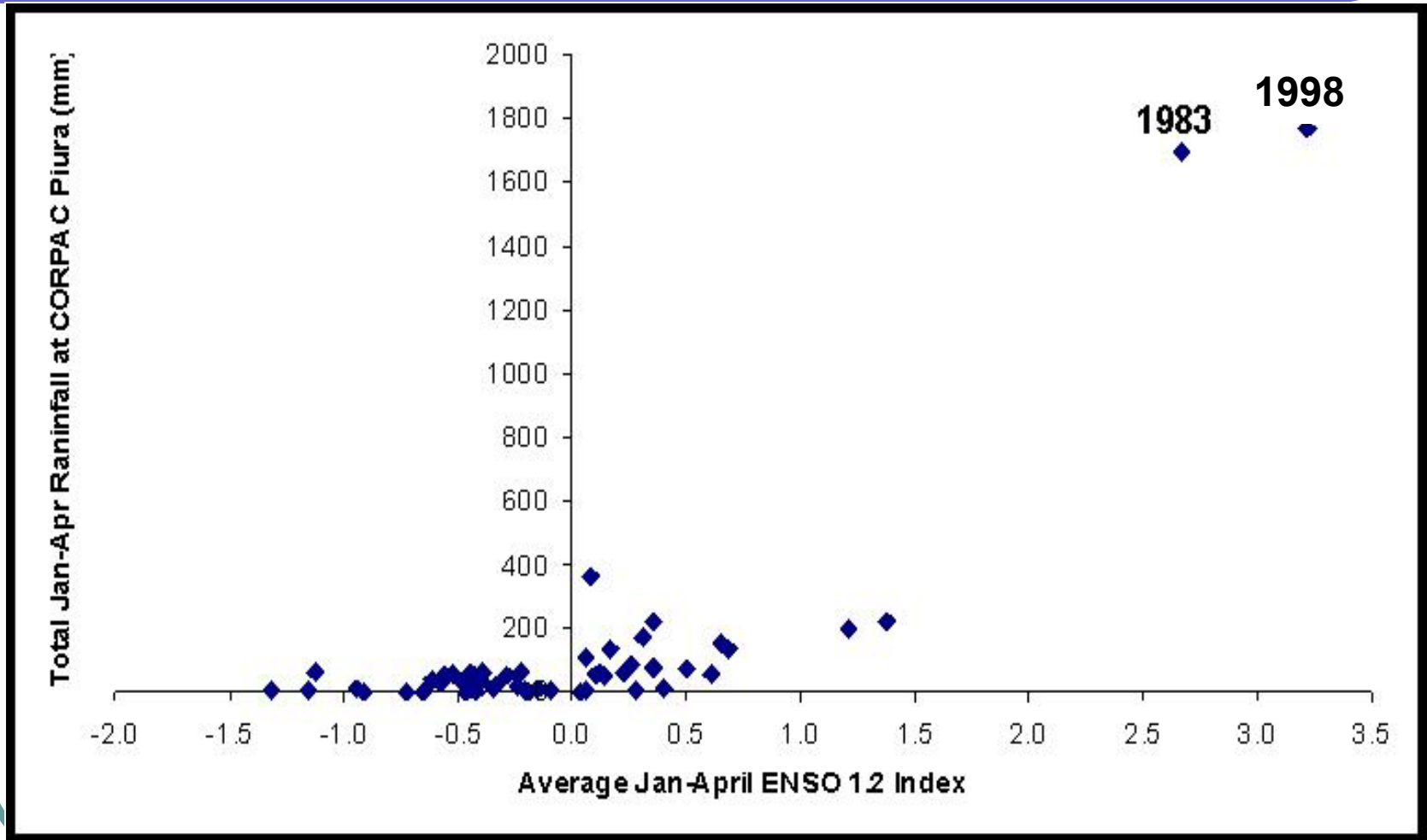
Peru: Why ENSO 1+2 Index Insurance?

- ENSO 1+2 Index is an excellent indicator of catastrophic rainfall in Piura

- The ENSO 1+2 Index is independently measured and published by the U.S. National Oceanographic and Atmospheric Organization (NOAA)

- There is abundant ENSO data — 150 years — to consider the risk profile of ENSO

Peru: ENSO Index Insurance Contract

- Proposed design would use average ENSO 1+2 values from January–April

- Coincides with major growing season in Piura

- Designed to provide indemnities for major El Niño events (1-in-15-year events)

- No payment if index value is less than 2

- Full payment (maximum liability) if index is 3 or greater

Progress on ENSO Insurance

- Support from the regulator (SBS) to classify this as ENSO Insurance.

- There is a willing global reinsurer that is ready to underwrite the ENSO Insurance

- Discussions with MFIs in Piura have advanced a good deal to enhance their understanding of how to use the ENSO Insurance

- Linking reduction of provisions to index insurance as a form of "warranty" BASEL II (This could translate in direct benefits in regulatory needs for reserves)

Risk Is Loaded into Interest Rate Charges

- Cost of Loans to farmers → 40
- Cost of capital → -10
- Administrative cost → -18
- Cost of risk loading? → 12 percentage points

Challenge

Could Risk Transfer of El Niño Risk take even ½ of the 12 percentage points out of this equation?

How Much ENSO Insurance is Needed?

- Assume $100 million portfolio
- Assume El Niño will cause a 10% spike in defaults
- That is $10 million of defaults
- Liability = $10 x 20% rate = $2 million premium
- $2 million premium = 2% of the portfolio or an interest rate load of 2%
- Who can price these risks most efficiently?
  - As long at the MFI load on interest rates exceeds 2 percentage points, ENSO Insurance is more efficient

An Alternative Model for Development of Weather Insurance

Turn the development process on its head

- Insurers typically begin with individual products for smallholders
- Then consider financing the catastrophic risk

Our Recommended Approach for Lower Income Countries

Step 1 — Find the big risk and create an index insurance to provide *ex ante* financing for major catastrophes

Step 2 — Find an appropriate role for government to share in the catastrophic risk as a means of 'crowding in' the market

Step 3 — Link the index insurance to the banking or value-chain activity at various levels

Step 4 — Allow the market to develop more sophisticated insurance products for small farmers over time

Conclusions and Implications

- Lenders have limited ability to pool highly correlated natural disaster risks in their loan portfolios

- Developing effective means to efficiently transfer these risks to global markets is an important area of research and development

- The goal of transferring the benefits of an aggregate index-based risk transfer product to the individual borrower remains critical if the true benefits of reducing the default risks are to be realized

Other Resources

World Bank Institute Web-based Course

Risk Management Challenges in Lower Income Countries
Developed by GlobalAgRisk, CRMG, and WBI
 (Launched in September, 2007)

World Bank Economic Sector Work Document

Managing Agricultural Production Risk: Innovations in Developing Countries
Hess, U., J. R. Skees, A. Stoppa, B. J. Barnett, and J. Nash
Agriculture and Rural Development (ARD) Department Report No. 32727-GLB (June, 2005)

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