Dong Thap Flood Insurance

An Application of Risk Assessment and Product Development

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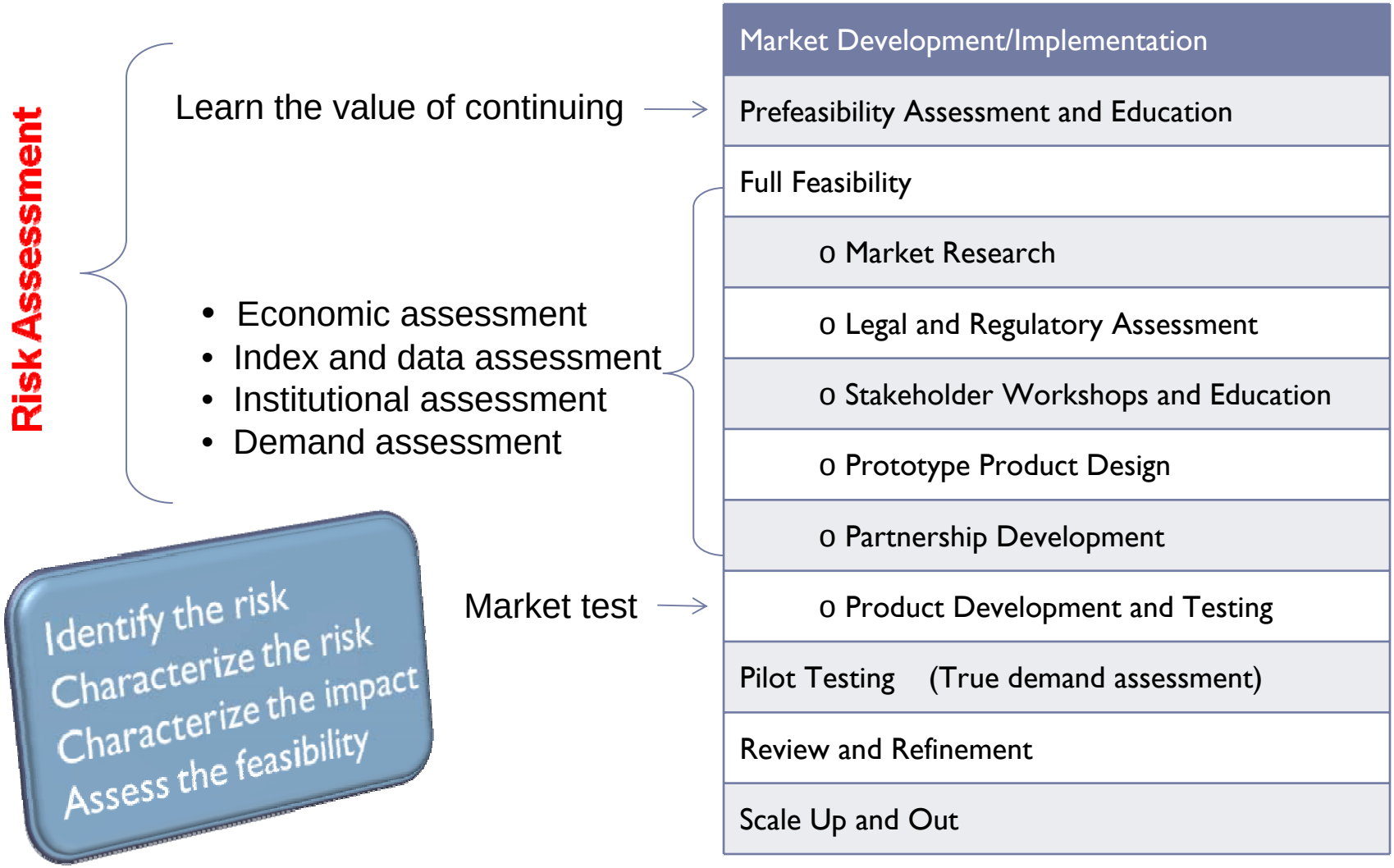
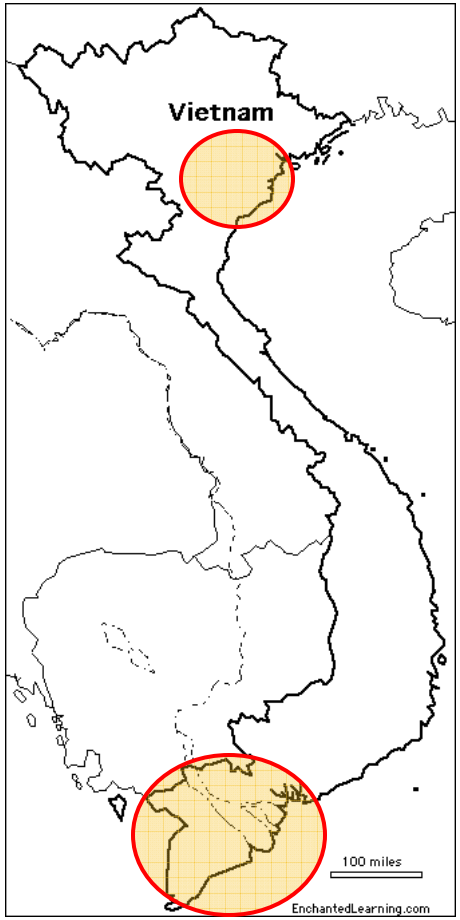
Market Development Model Overview



Case 1: Flood
Prefeasibility and Rapid Risk Assessment



There are many weather risks in Vietnam: Ask……

"What risks are most important?"

- Flood (what kind of flood?)
  - River flood
  - Flash flood
  - Sea surge / typhoon

"Which risk is likely most insurable?"

Flood is always difficult

"What is the most significant vulnerable agricultural activity?"

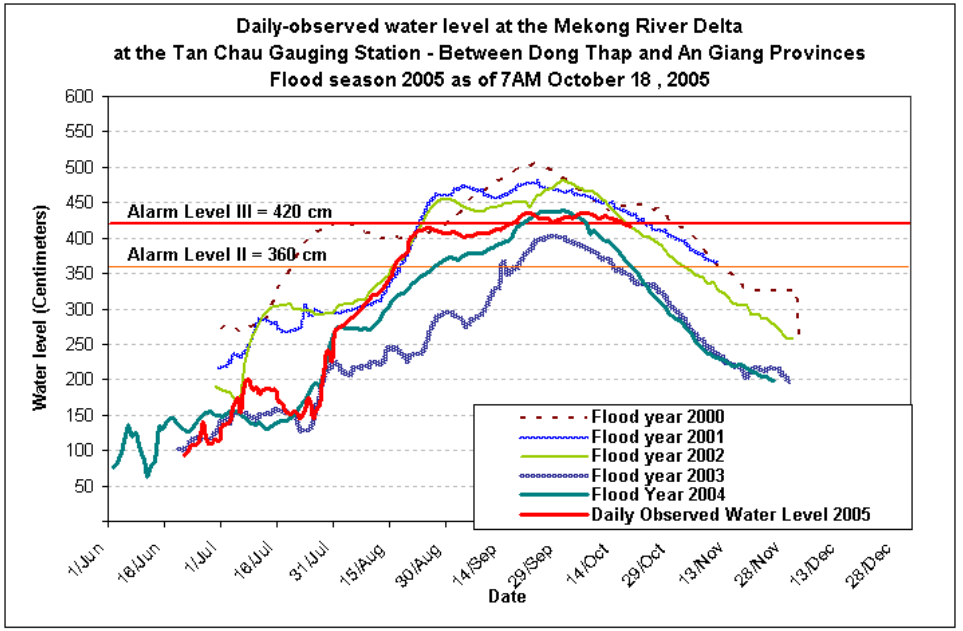
Rice Production

"Where do these occur together?"

Mekong Delta and Red River Delta

What Is the Flood Risk?

- It floods every year in the Mekong and Red River Deltas
  - Part of a natural process that restores fertility and removes waste
  - But, not insurable
- What characteristics of river flooding impact rice production?
  - Timing of flood onset

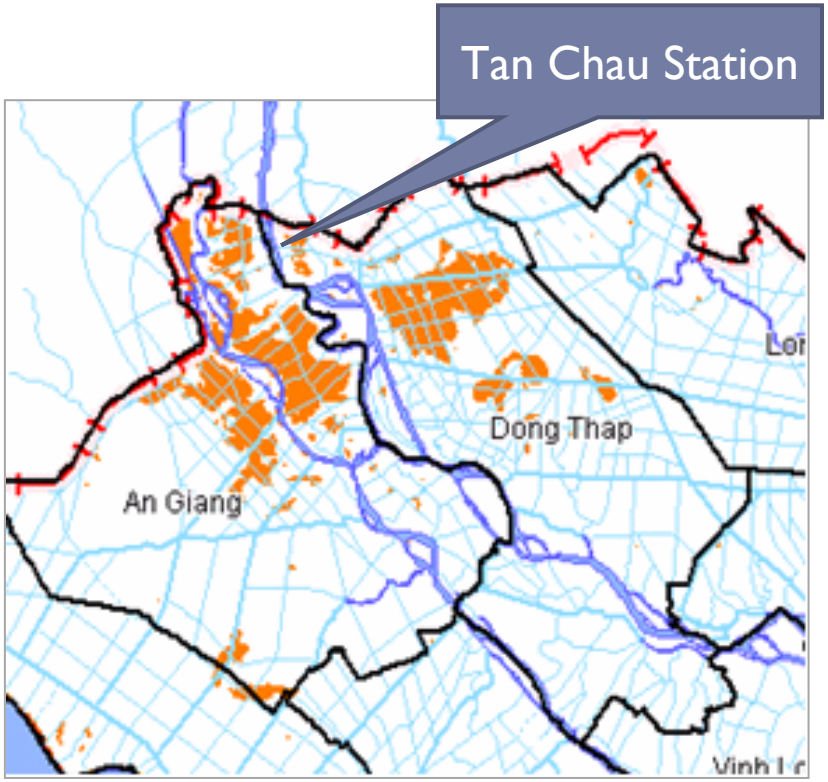


Early food onset is disruptive — Farmers base their production decisions on typical flood pulse timing

Focus the Index on the Local Risk

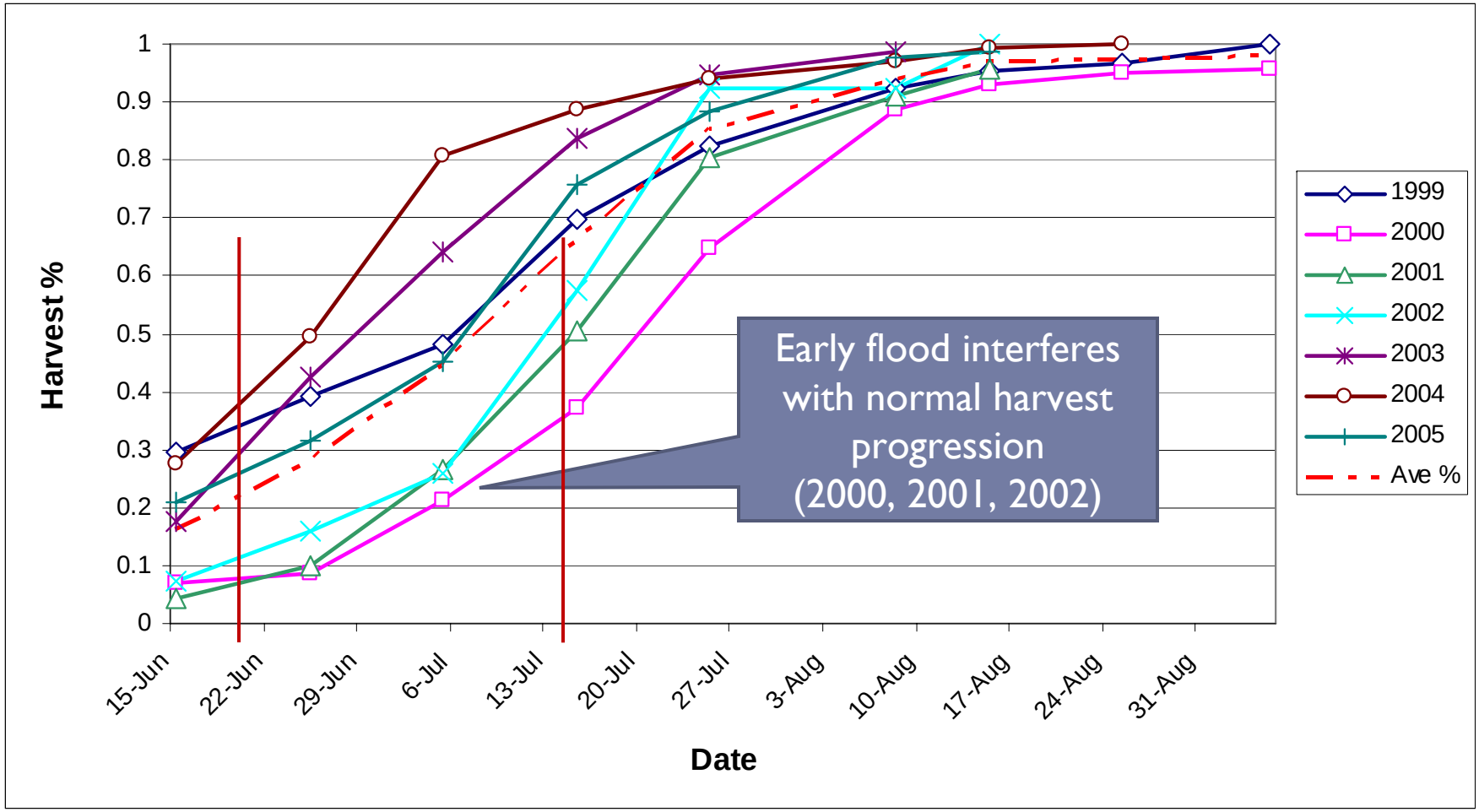
- Mekong Delta
  - Tan Chau Water Level Gauging Station has a long data history
  - Water level not influence by flood control management

- Dong Thap Province
  - Among first areas impacted by early flood
  - Important rice producing area
  - Initial flood mapping shows where early flooding can be a problem



Evidence of Early Flood Impact

Rice Harvest Progression, Dong Thap, 1999–2005

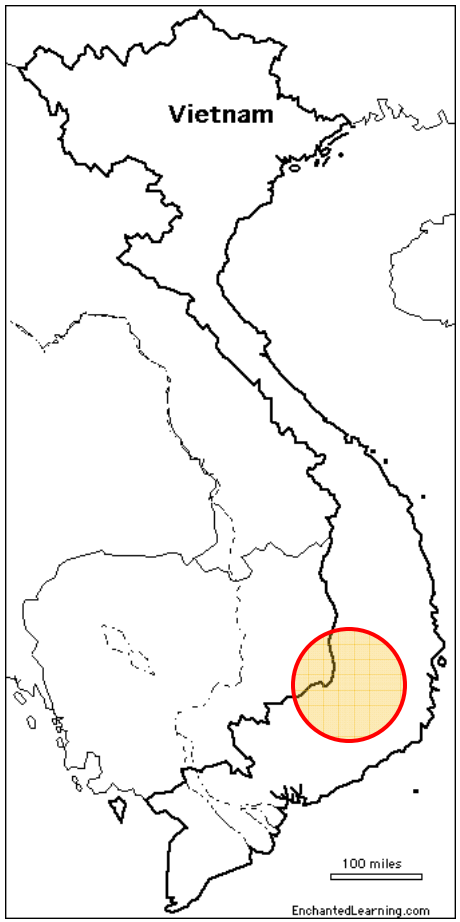


What Is the Impact of Early Flooding?

Early flooding can result in lost income, additional costs, and challenges to livelihoods: Resulting from interviews that the TA team conducted

- Direct crop loss
- Extra cost at harvest, grain drying
- Quality impact resulting in a reduced price
- Extra cost of fighting the floods
- Problems to pay back loans
- Farmers remember selling land in 2000

Case 2: Drought
Prefeasibility and Rapid Risk Assessment



Other concerns focus on drought risk in agriculture

"For what activities is drought very important?"

Coffee production in Dak Lak province

"Can drought be index and insured?"

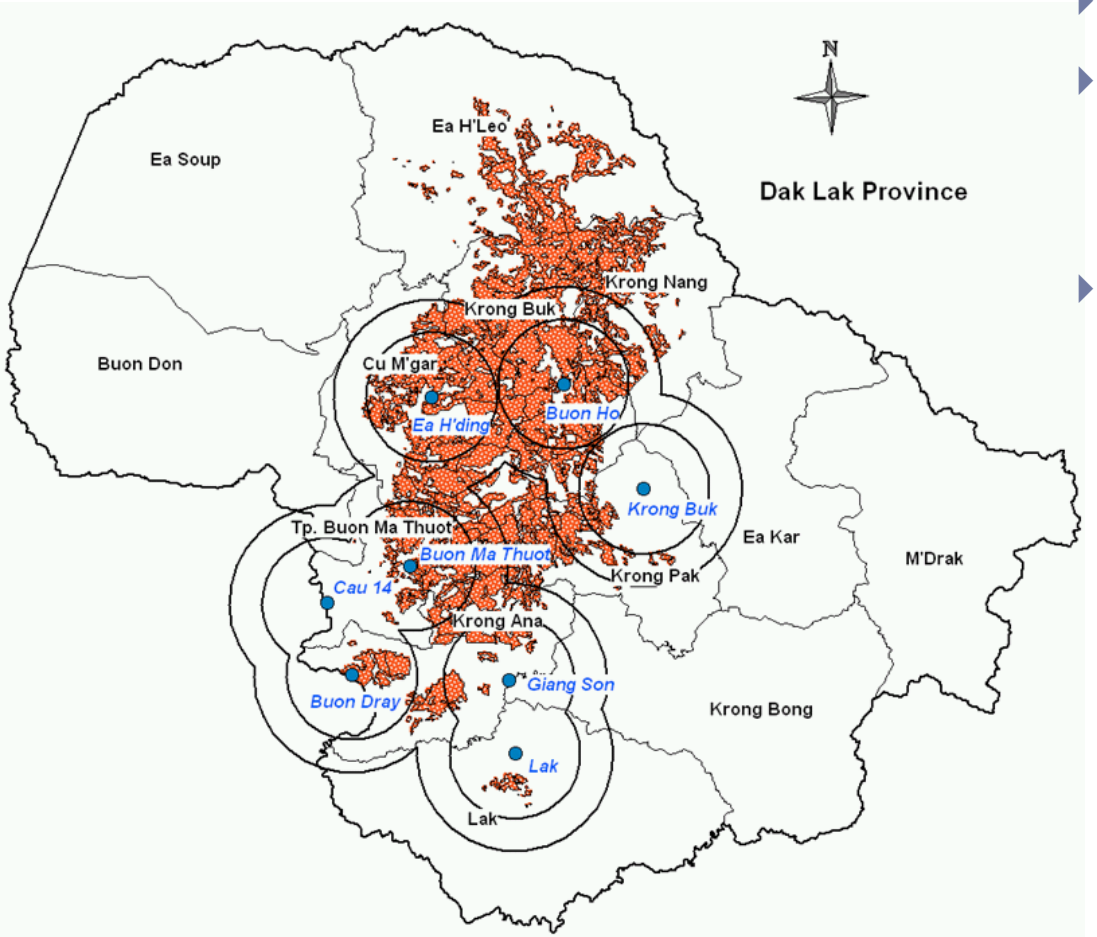
Rainfall can be indexed and insured

But, there are many preconditions:

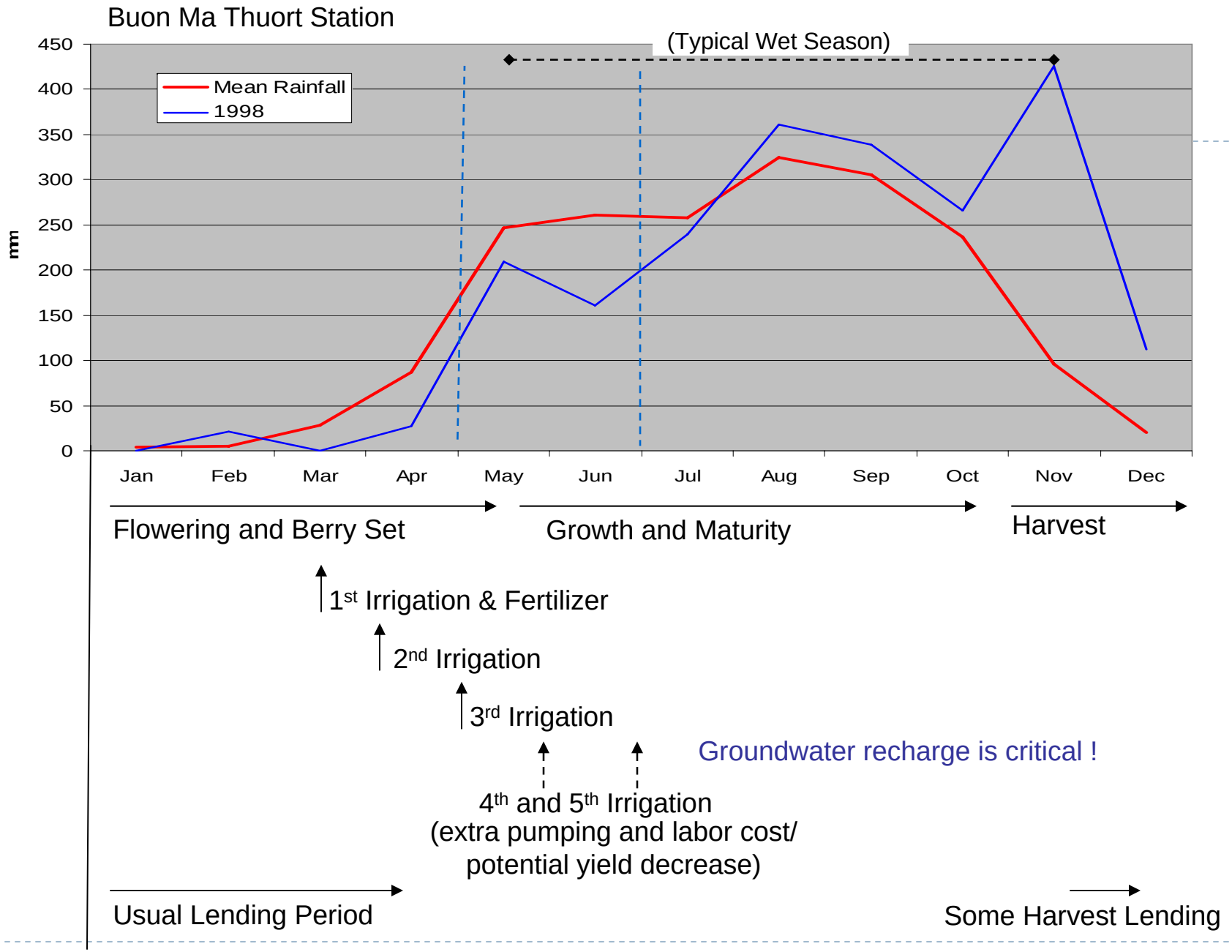
- availability of rainfall data
- rainfall station infrastructure
- rainfall correlated with losses
- frequency of the event
- spatial correlation

Initial work suggests that rainfall index insurance for drought to protect individual coffee producers may be possible

Dak Lak Coffee Production Vulnerability



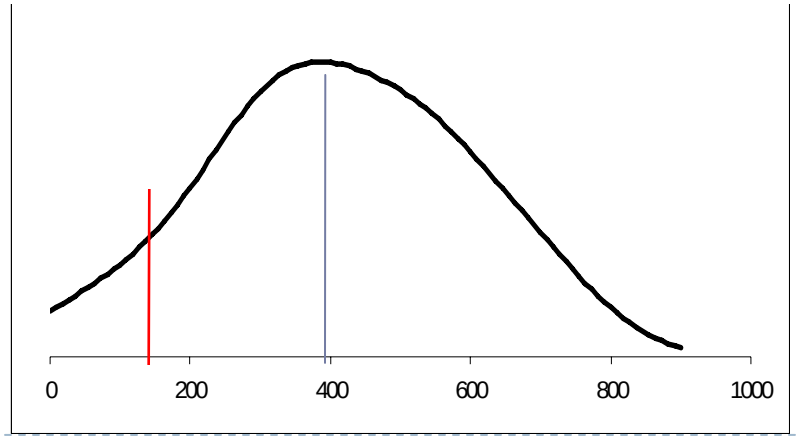
- ~50% of coffee in Vietnam
- ~85% produced on farms < 1 ha
- Requires irrigation in the early spring, mostly from groundwater sources
- Drought risk
  - Drought relates to both groundwater use and availability which relates to rainfall
    - Total annual rainfall
    - Delay in rainy season
    - Both
  - With drought, farmers have higher irrigation costs / yield stress


Buon Ma Thuort Station
(Typical Wet Season)
Mean Rainfall
1998
mm
450
400
350
300
250
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Flowering and Berry Set
Growth and Maturity
Harvest
1st Irrigation & Fertilizer
2nd Irrigation
3rd Irrigation
Groundwater recharge is critical !
4th and 5th Irrigation
(extra pumping and labor cost/
potential yield decrease)
Usual Lending Period
Some Harvest Lending

Prototype Rainfall Index

- Potential business interruption insurance for coffee producers for drought
  - Intended to cover increased irrigation costs and/or yield losses
  - Contract might involve a payment any time the cumulative rainfall index is less than 200 mm

PDF approximation of cumulative rainfall: 15 April – 15 June



Development in Progress

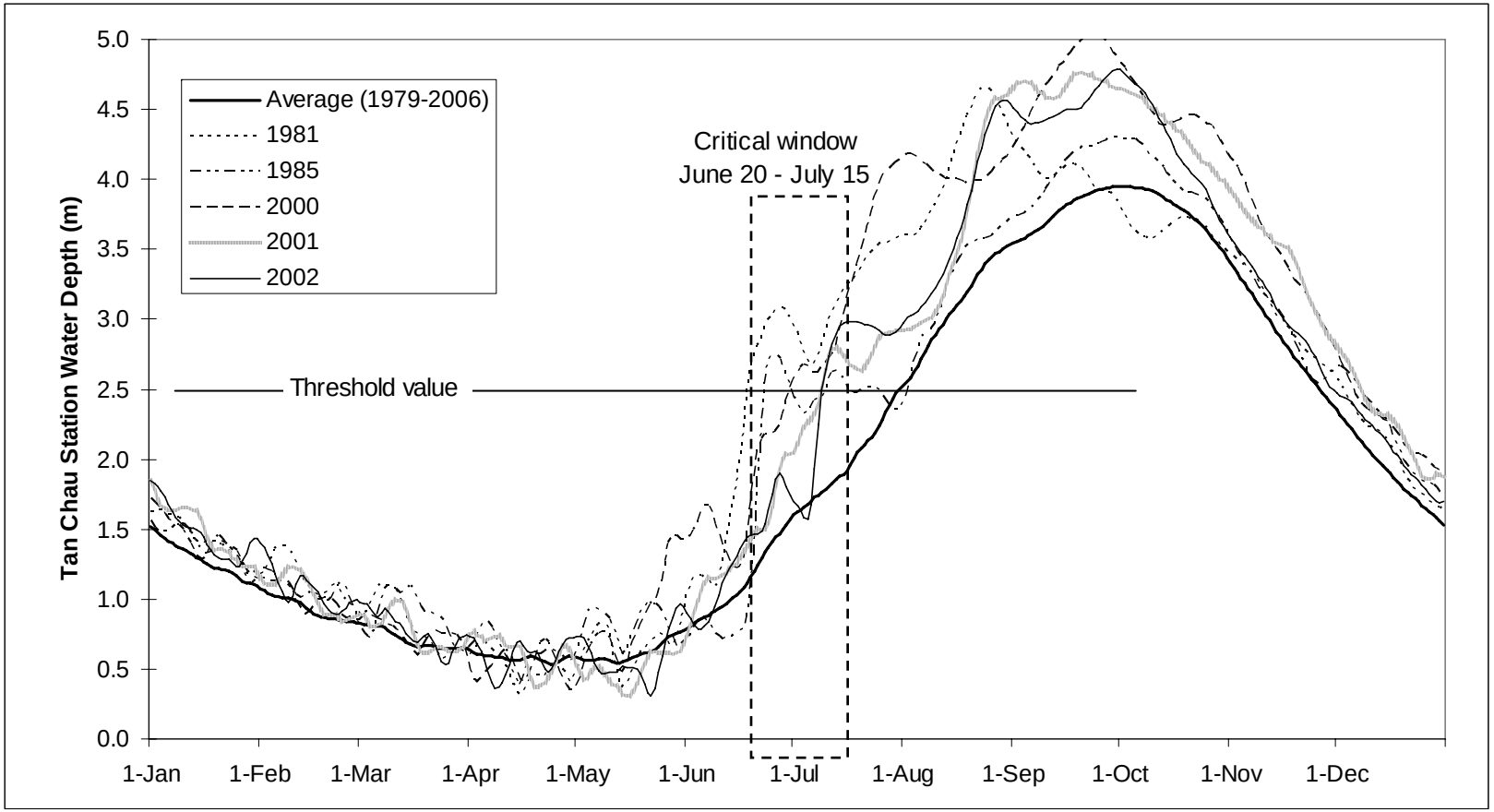
- Overall product design
  - Groundwater dynamics
  - Prototype testing
  - Basis risk considerations
- Development of delivery channel
- Farm level education
- Underwriting
- Legal and regulatory approval

Case 1: Flood

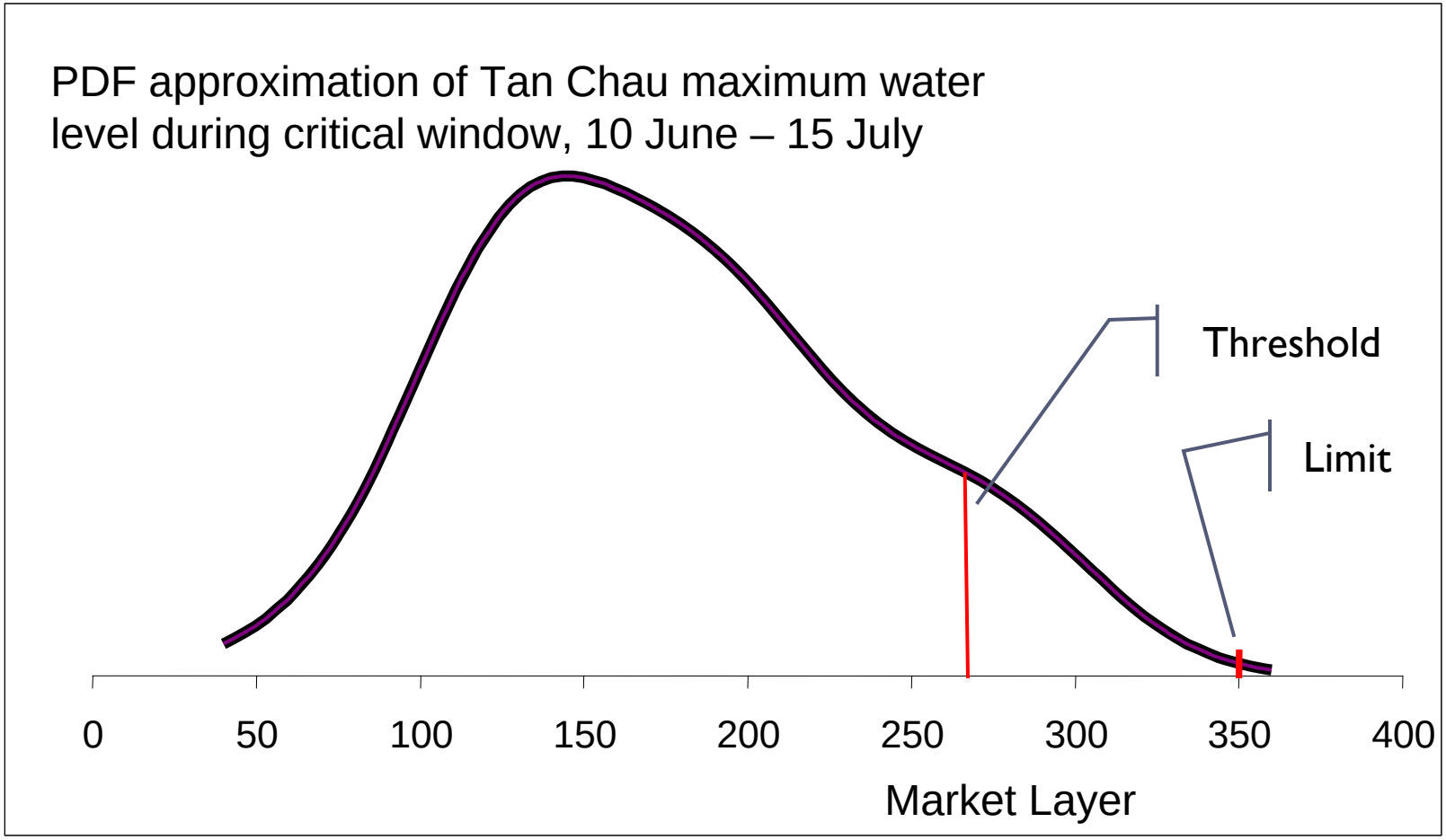
Identify and Characterize the Risk

Early flood onset, measured at Tan Chau Water Level Gauging Station

Is it a reliable index? What is the impact?



Identify and Characterize the Risk



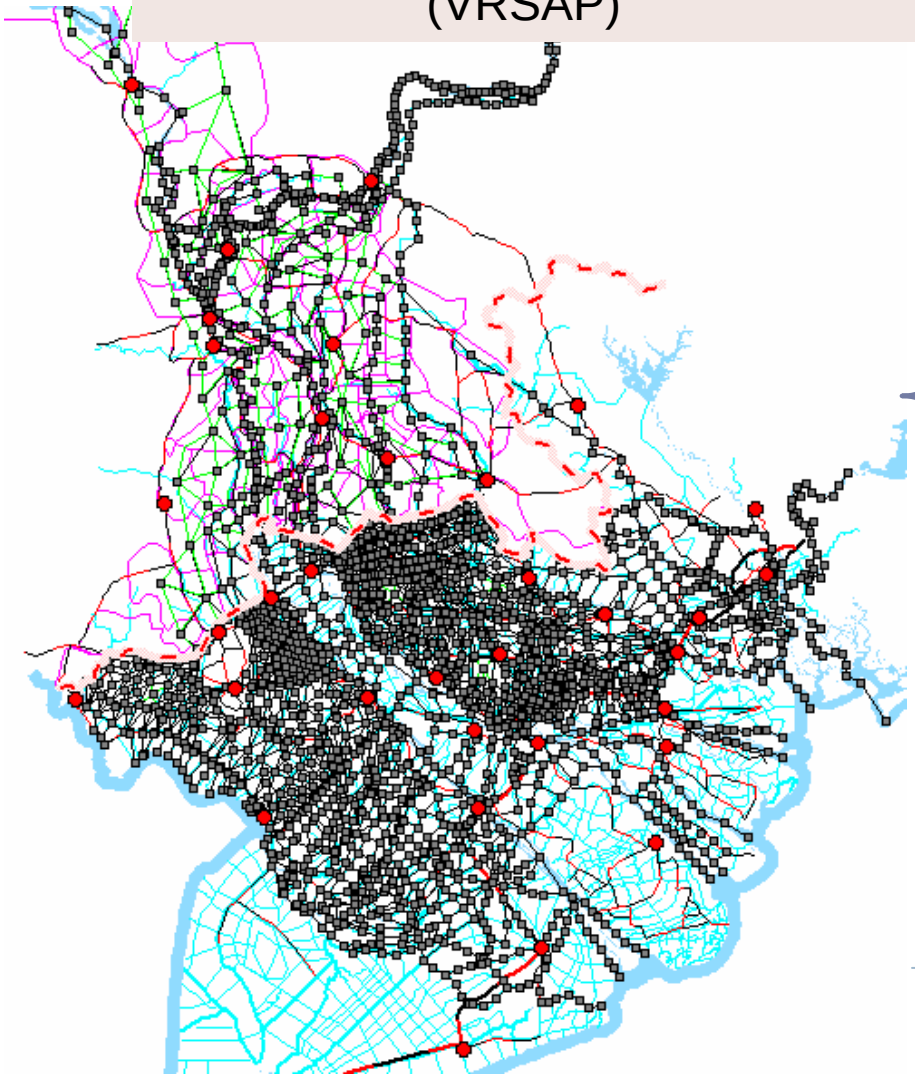
The seller uses this information to price the pure risk

Index Reliability
What Causes Early Flooding?

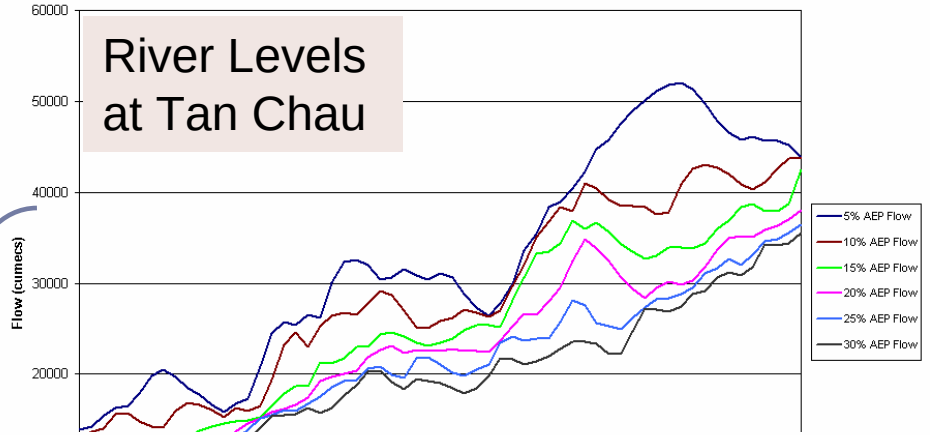
- Flooding in the Mekong Delta influenced by:
  - Rainfall
  - Sea surge from East Sea and West Sea
  - River flow above Tan Chau
- What are the influences on river flow above Tan Chau?
  - Can the index be influenced by external events?
- What are the impacts at different water levels?
  - Within Dong Thap, where is early flooding most severe?
  - Where is the relative risk?
- Significant flood mapping to understand the risk event
- Southern Institute of Water Resources Planning (SIWRP)

Flood Modeling for the Window of Vulnerability

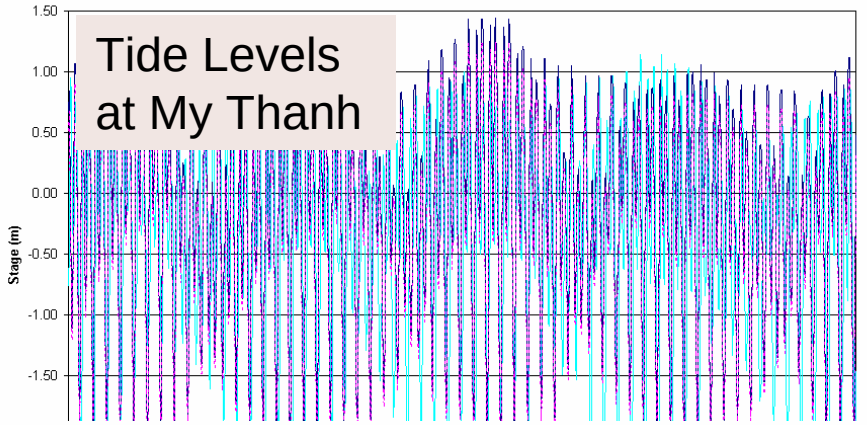
Vietnam River Systems and Plains (VRSAP)



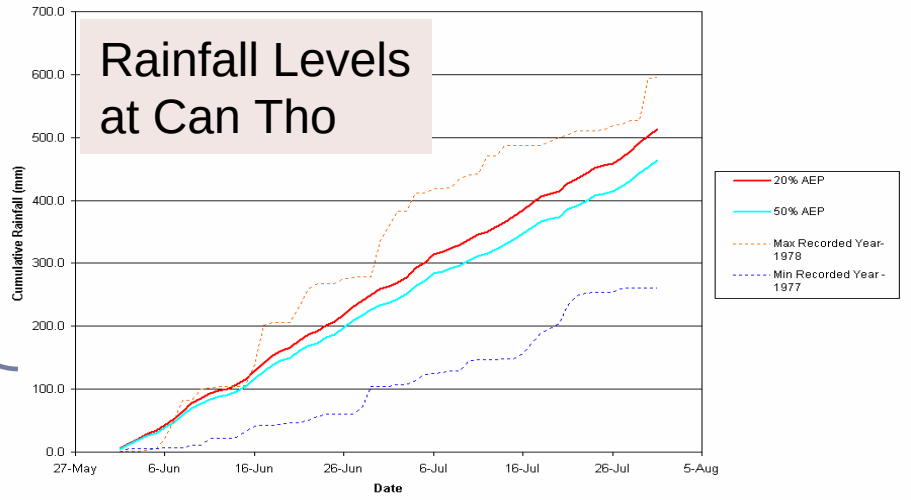
River Levels at Tan Chau



Tide Levels at My Thanh

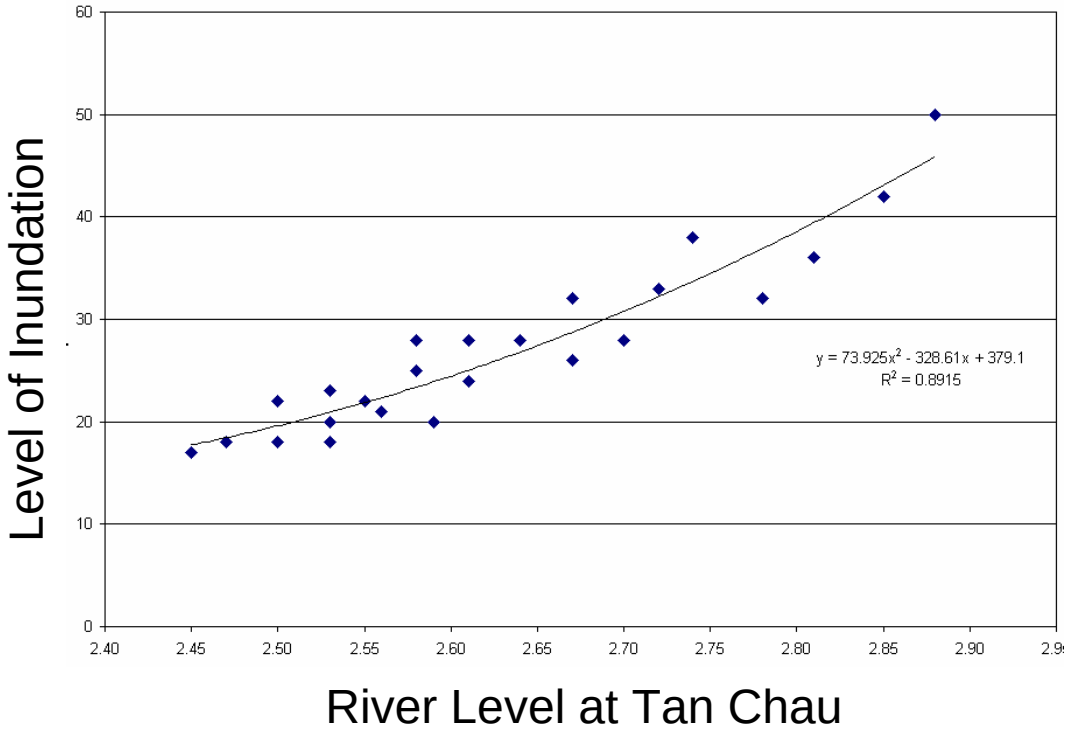


Rainfall Levels at Can Tho



Flood Modeling
Testing Index Reliability

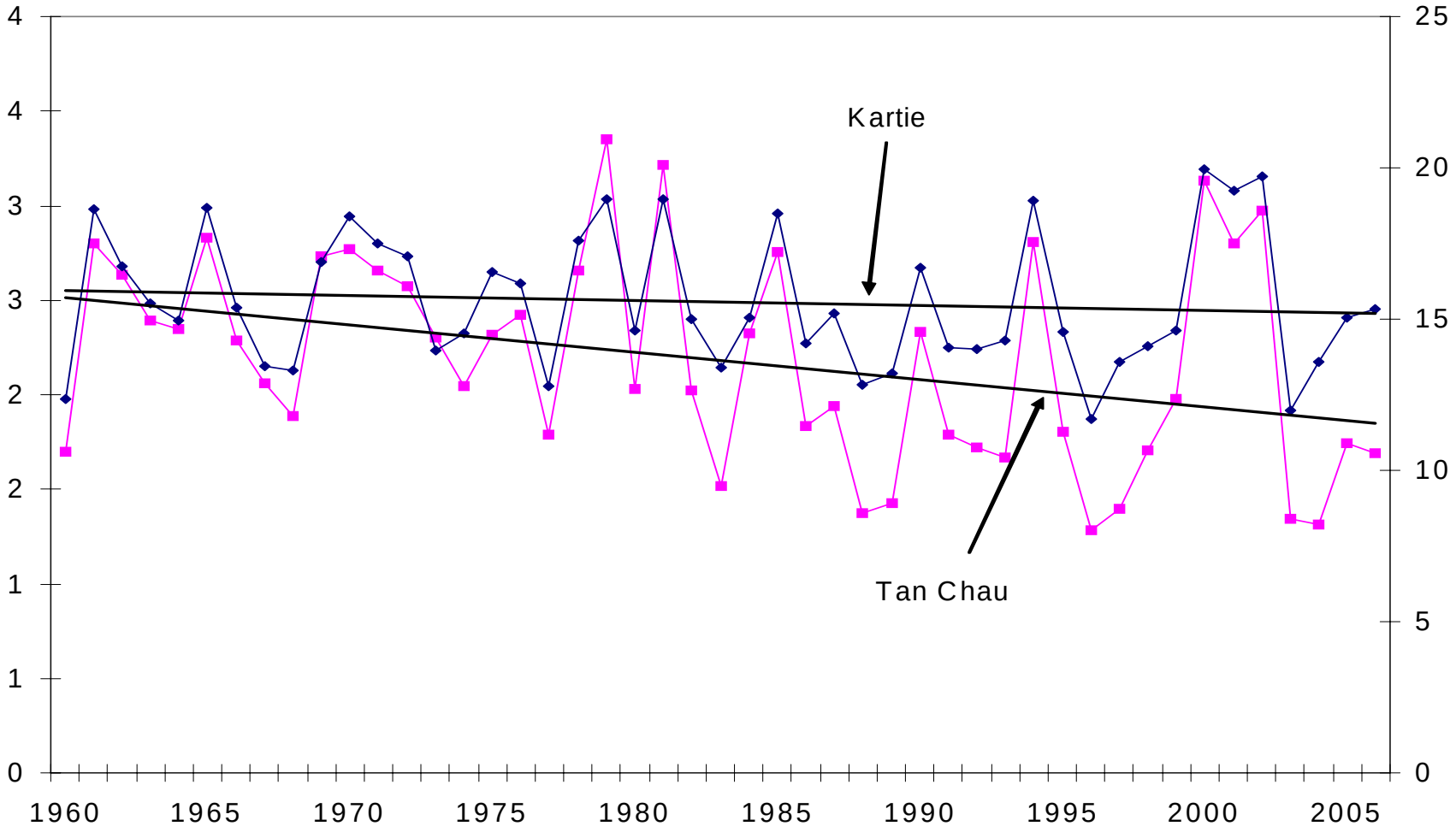
- Dong Thap flooding possibly influenced by rainfall and sea surge, in addition to river level
- Model scenario with rainfall and sea surge set at 80% AEP (extreme) level, and tested against 50% AEP to test if flooding is sensitive to these factors
- Results showed that river levels is the primary influence on flooding in Dong Thap
- Flood risk can be indexed by river level in Dong Thap



Red River Delta showed more complex causes of flooding — very difficult to index

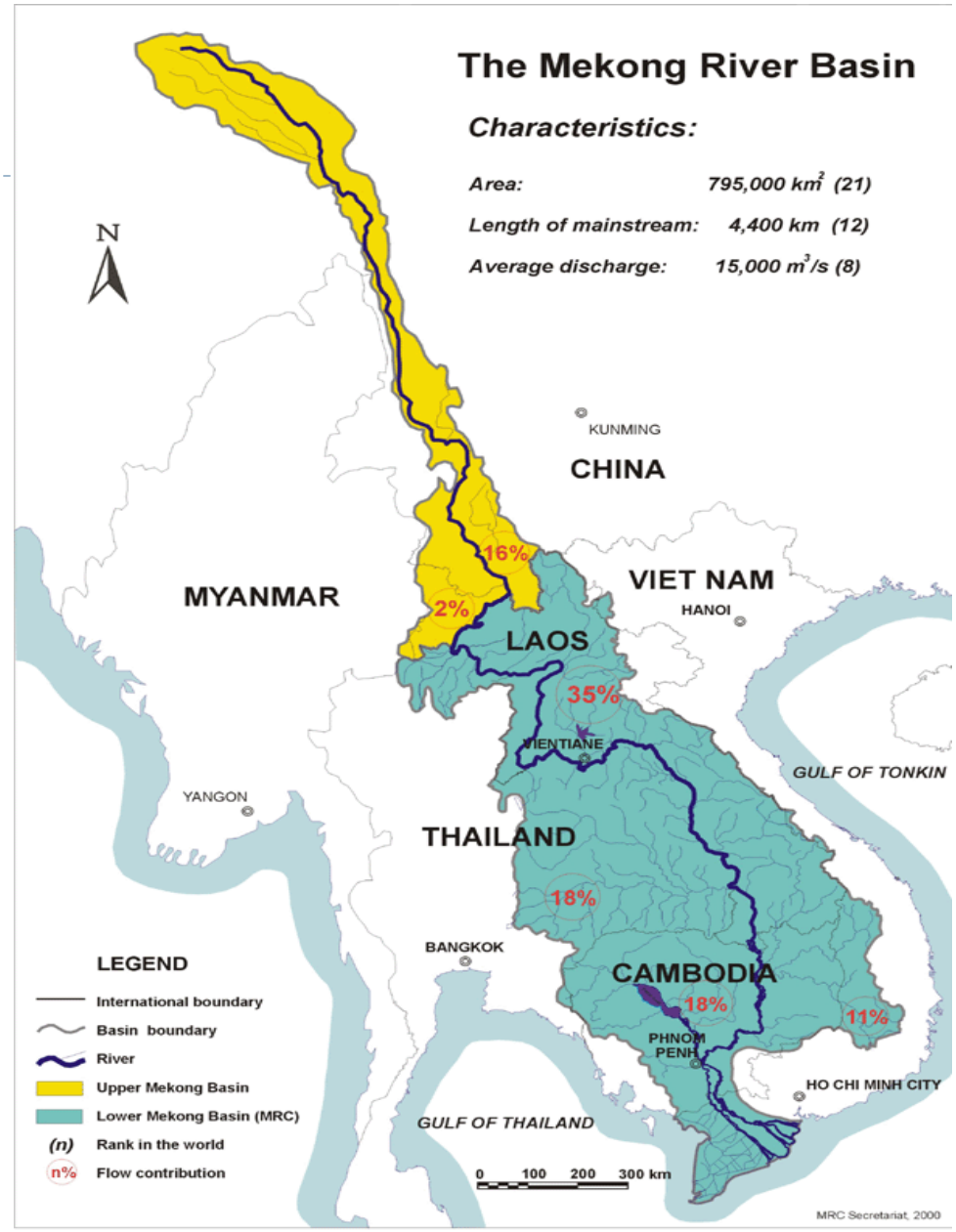
Upstream Influences — Less Water Is Now Flowing from Kratie to Tan Chau

Important to consider possible causes of disparity

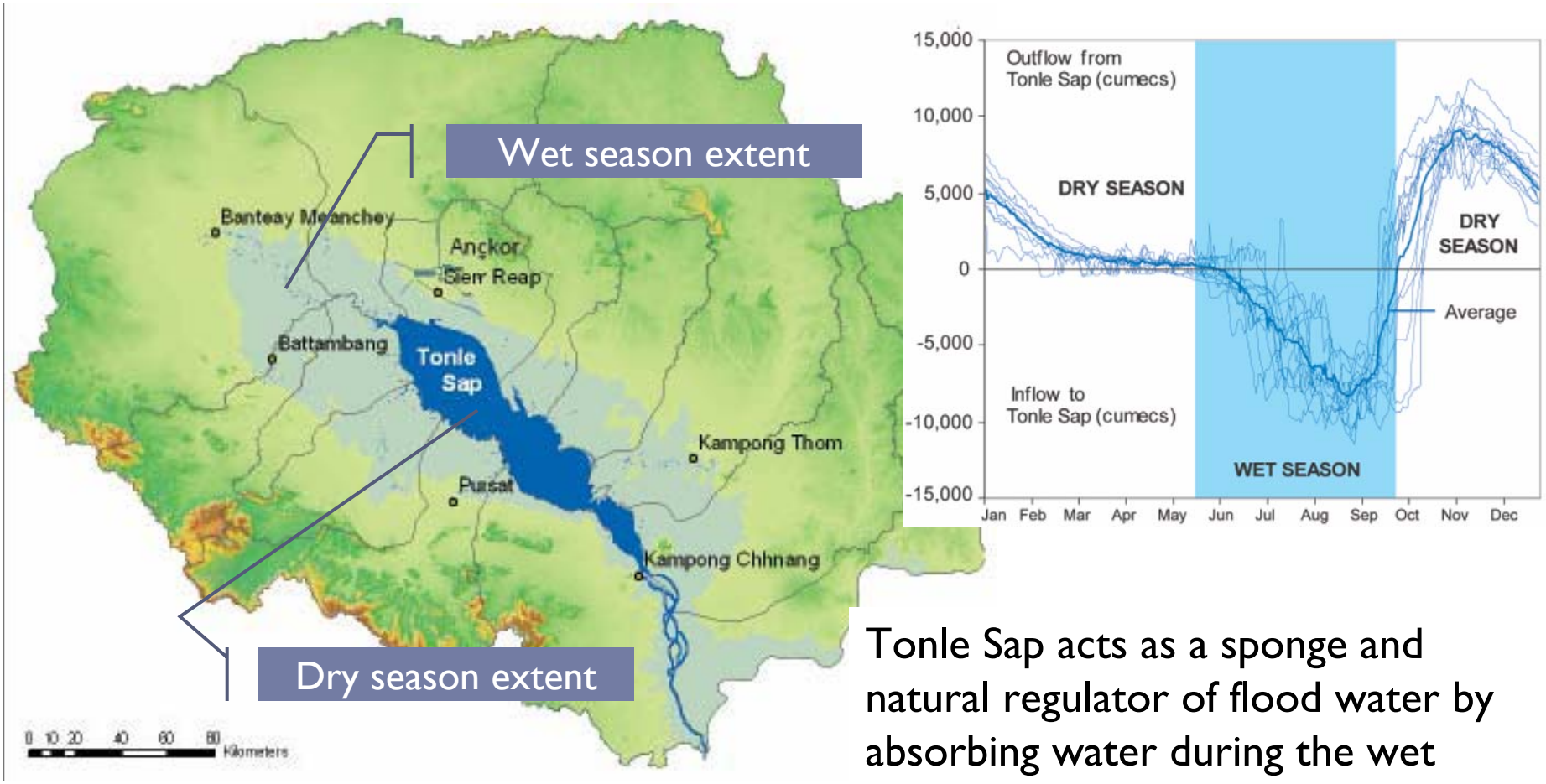


Mekong System

- The Mekong — A complex river system
- There cannot be significant upstream management influences that might impact river levels at Tan Chau during the window of vulnerability
- Knowledge of the Mekong as it moves through the Lower Basin
  - Tonle Sap
  - Kratie
  - Tan Chau



The Changing Size of Tonle Sap

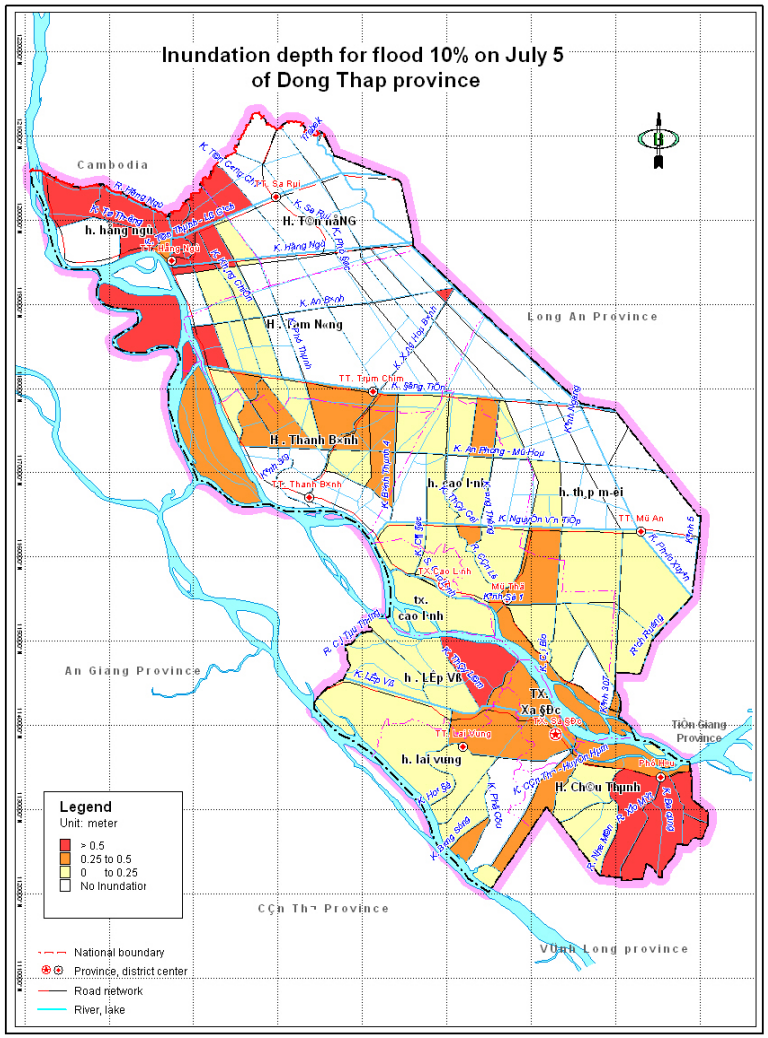


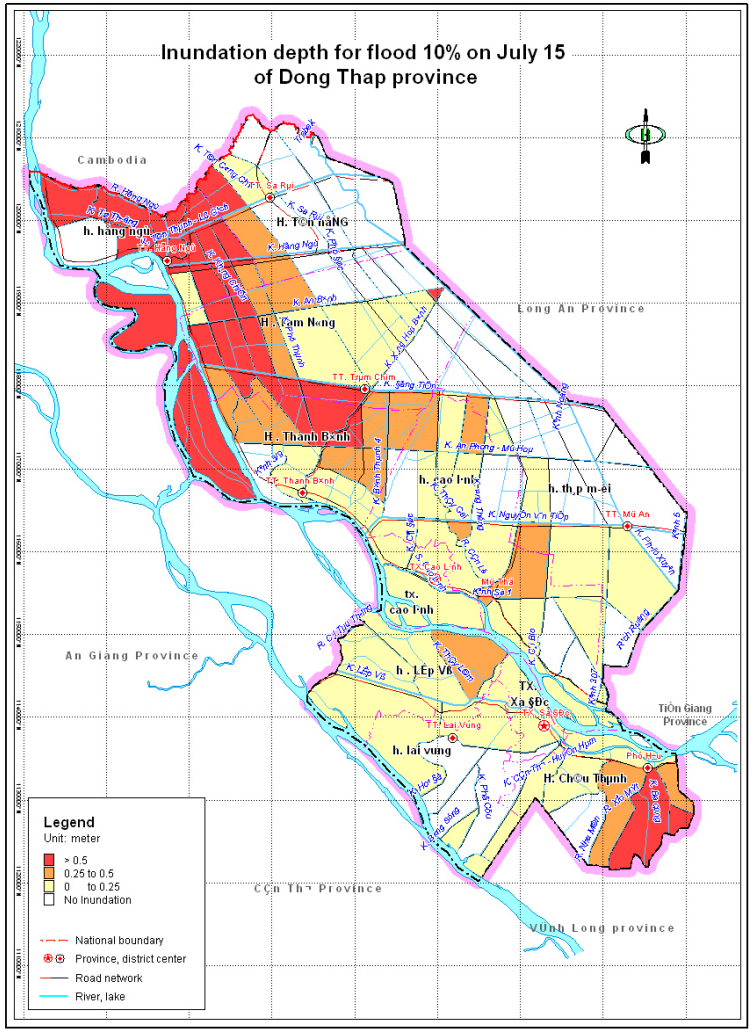
Tonle Sap acts as a sponge and natural regulator of flood water by absorbing water during the wet season and releasing water during the dry season

Possible Causes for Disparity between Kratie and Tan Chau

- Changes in farming practices- increase in rice production
  - Land use has changed — More land in farming or fisheries, increased irrigation intensity
  - Deforestation leading to more seepage
- Changes in the human-made hydrology — Leading to more seepage so less water reaches Tan Chau
- Changes in the Tonle Sap system due to erosion or sediment deposits
- Upstream damns and other impoundments
  - Evidence from literature suggests this is not an influencing factor at this time for Tan Chau during window of vulnerability

Risk Mapping
Characterizing the Risk and Impact



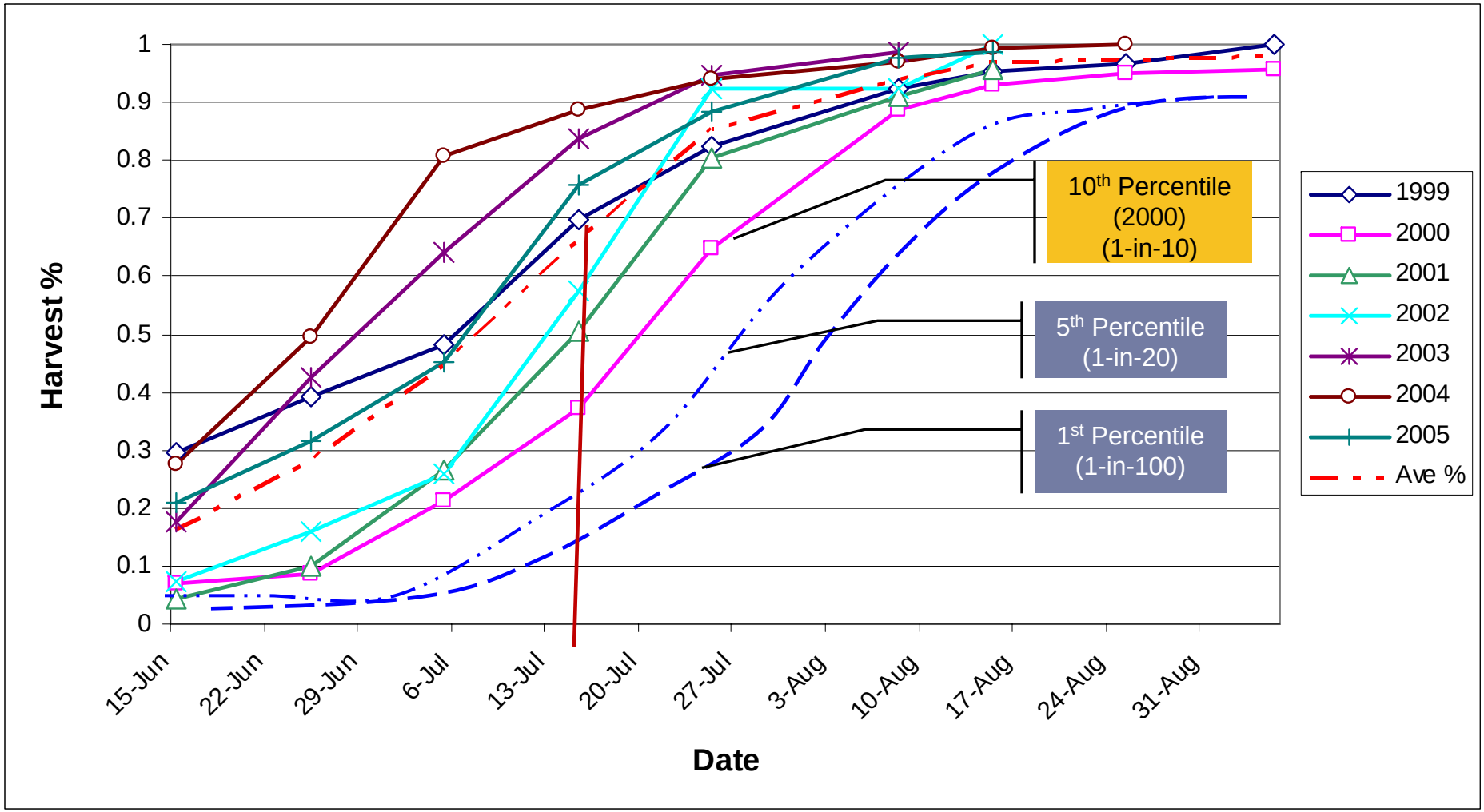


Risk Mapping Indicators

- Risk mapping demonstrates that producers are vulnerable to severe early flood even with the improvements made to infrastructure
- Risk mapping indicates which areas are vulnerable to early flood risk
- Implications for product design — Flood index to proxy losses caused to crop
  - Rice is the strategic crop exposed to flood
  - Flood impact is dependent on variety, time of occurrence, depth and duration of flood water

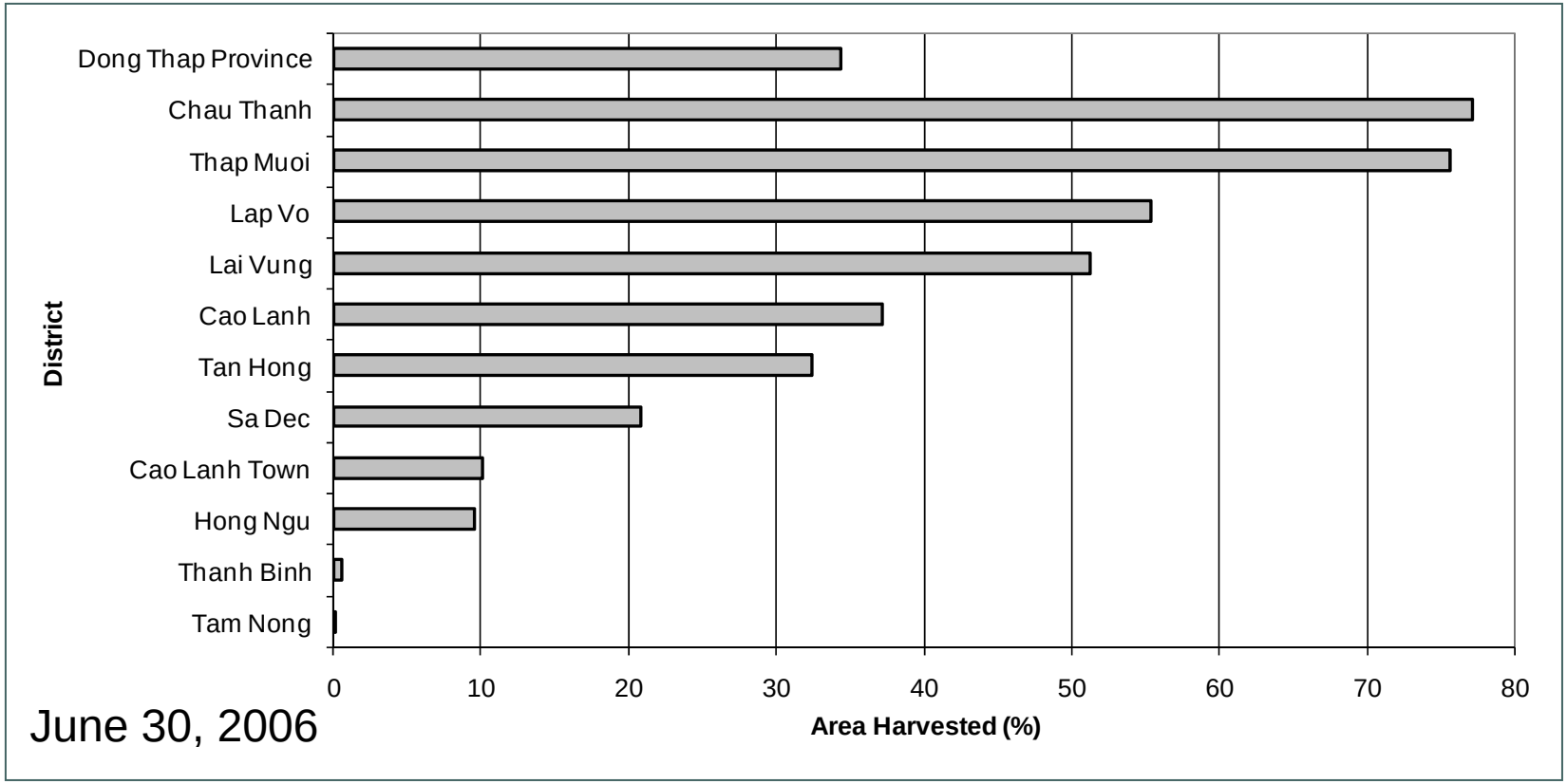
Rice Harvest Progression

Impact of Catastrophic Events



Caution Using Aggregate Data

- Substantial variation in the rice crop calendar across districts
- Impact of early flood will differ with the advancement of harvest



Characterize the Impact at District Level

Two vulnerable districts — Value of Rice VND 600 Billion

- Hong Ngu
  - 20,000 hectares of Summer-Autumn rice
  - 64% of plantings had significant flood damage in 2000
  - ~20% of plantings are harvested by June 25
- Tam Nong
  - 29,000 hectares of Summer-Autumn rice
  - 48% of plantings had significant flood damage in 2000
  - <5% of the plantings are harvested by June 25

Characterize the Impact

Who Is Paying for Losses of Early Flood?

- Farmers — Lose revenues, incur additional costs, etc.
- VBARD — Lending practices aggregate the cost
  - Loan rates do not reflect relative risk
  - Forgive loan defaults / Reschedule loans
- Government of Vietnam (GoV) — Must rescue VBARD with capital injection
- VBARD and GoV practices pay for farmer losses
- VBARD has been acting as a type of agricultural insurer
- Future equitization will require that these risks be addressed by VBARD at the local level

Role of VBARD and Addressing the Big Risk

- VBARD an important component in VN agriculture
  - Access in every location in Vietnam
  - 1/3 of the total credit market
  - 67% of portfolio is tied to farming (90% in Dong Thap!)
  - Extensive experience in financial services to small farmers (Average loan — VND 10 million)
  - Detailed customer records
  - Farmer trust
- Weather risk exposure
  - Disaster-induced repayment risk
  - Strategic priority in addressing farmer chronic debts
  - Commitment to innovative approach to crop insurance

Why VBARD?

- Form of business interruption insurance
- VBARD internalizes business interruption risk
  - Revenue losses and increased costs associated with an extreme flood due to:
    - Lending practices / defaults among clients
    - Loan forgiveness / debt rescheduling / additional costs
    - Opportunity costs of capital
- Flood insurance is difficult at individual level, will take time
- VBARD can act quickly on a macro product that address its risk exposure
  - Helps build the infrastructure, learning, and expertise required to undertake individual level flood insurance

Value of Insurance/Pre-Estimate of Loss

- Need the best possible estimate of *value* of a flood insurance product to VBARD in Dong Thap
  - Cannot understand price without understanding value
- Best estimate of maximum probable loss
  - Cost of business interruption

				2008 Estimates	
River level at Tan Chau	Year	Event type	Frequency	Hectares not harvested	Percent of loans with problems
3.50	NOT YET	1 in 100 years	1.0%	60%	45%
3.35	1979	1 in 33 Years	3.4%	35%	30%
3.13	1981	1 in 15 Years	6.9%	25%	20%
2.98	2000	1 in 10 Years	10.3%	20%	10%
2.85	2002	1 in 7 Years	13.8%	10%	8%
2.76	2001	1 in 6 Years	17.2%	(Too frequent to be insured)	

Basic Steps to Estimate Value

1. Estimate the impact on harvest today of early flood and estimate the proportion of loans that would experience problems with repayment
   - Estimate for different river flood levels
   - Delphi experts from VBARD management adjust estimates
2. Calculate annual value of unpaid rescheduled loans
   - Assume 5-year non-linear repayment rate
   - Some loans are never repaid
3. Calculate annual opportunity cost of outstanding loan balances and net present value of business interruption
   1. Opportunity cost, 10%; Discount rate, 5%
   2. Maximum probable loss estimate

Basic Steps to Estimate Value (cont.)

4. Insure a fraction of maximum probable loss
   - 20% position, but lender can chose level
   - Insurance used as one part of overall risk management
5. Minimum value of insurance to VBARD
   - Sum product of
     - Frequency of loss event
     - Severity (loss) of business interruption
     - Relate to maximum insurable loss
   - Expressed as a percentage of sum insured

Our estimates of the value of this insurance to VBARD and the price of the insurance suggest that VBARD should be willing to purchase the product

Valuing/Pricing Consideration

Buyer values insurance

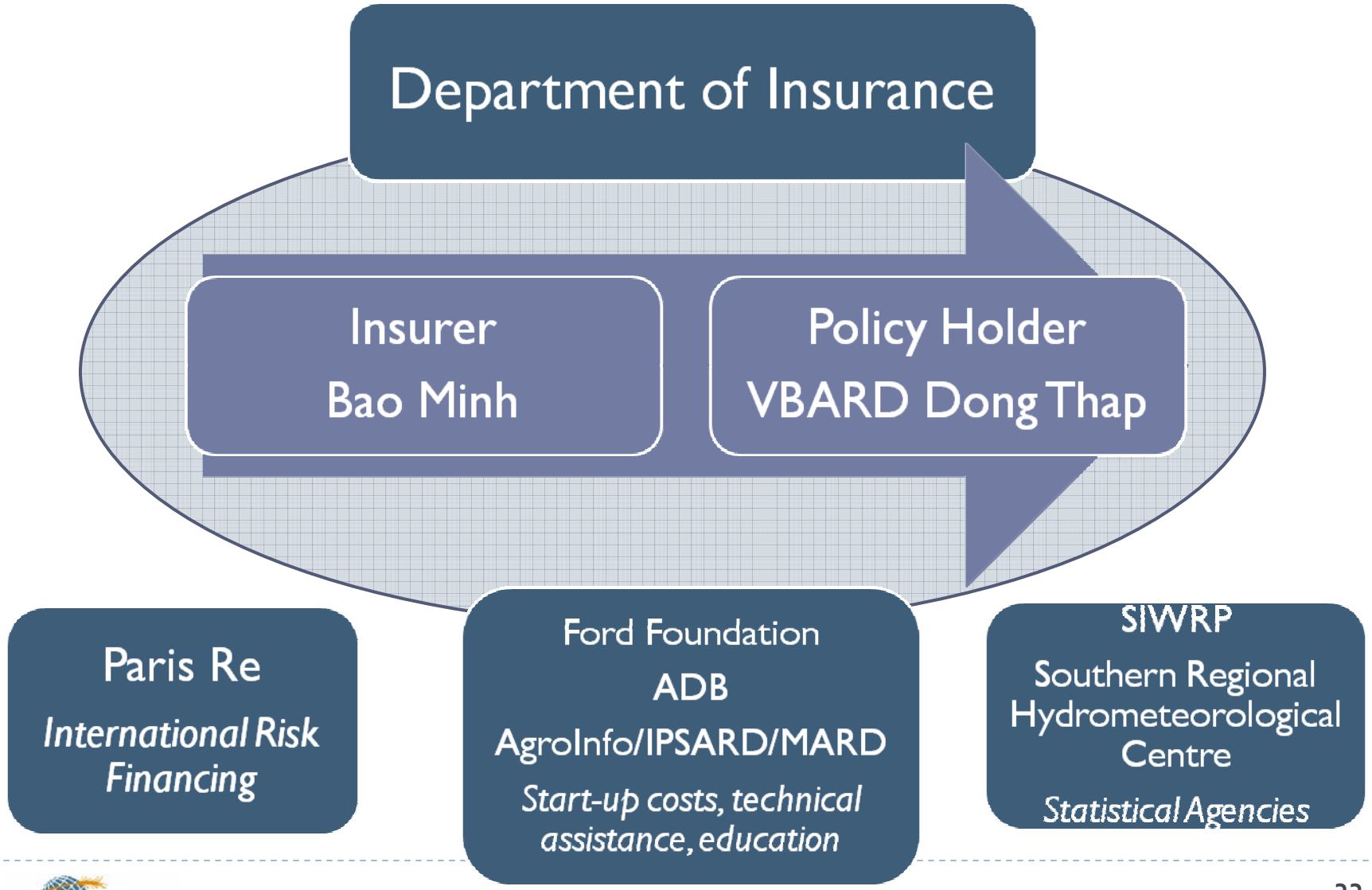
- Frequency and severity of business interruption
- Risk aversion to business loss
- Value due to portfolio flexibility
- Ambiguity of own estimates

Seller prices insurance

- Frequency and severity of weather event
- Ambiguity
- Normal profit/return on risk capital

- Price/value wedge
  - Often the insured mistakenly underestimates the risk
  - The insurer is concerned about uncertainty of frequency
- Coordination in new markets/products is difficult
  - Requires resources and commitment to develop
  - Requires that stakeholders make credible signals

Components Are Ready for a Market Test of Business Interruption Insurance



Business Interruption Flood Insurance

Business interruption insurance for the VBARD when early flood disrupts rice harvest prompting the rescheduling of production loans

Period: 20 June – 15 July

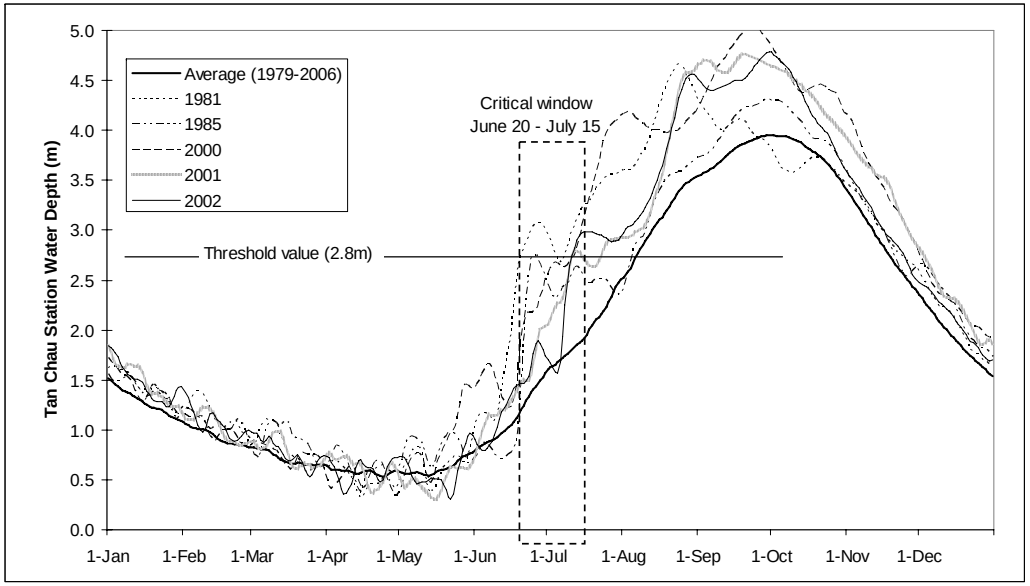
Location: Tan Chau water level gauging station

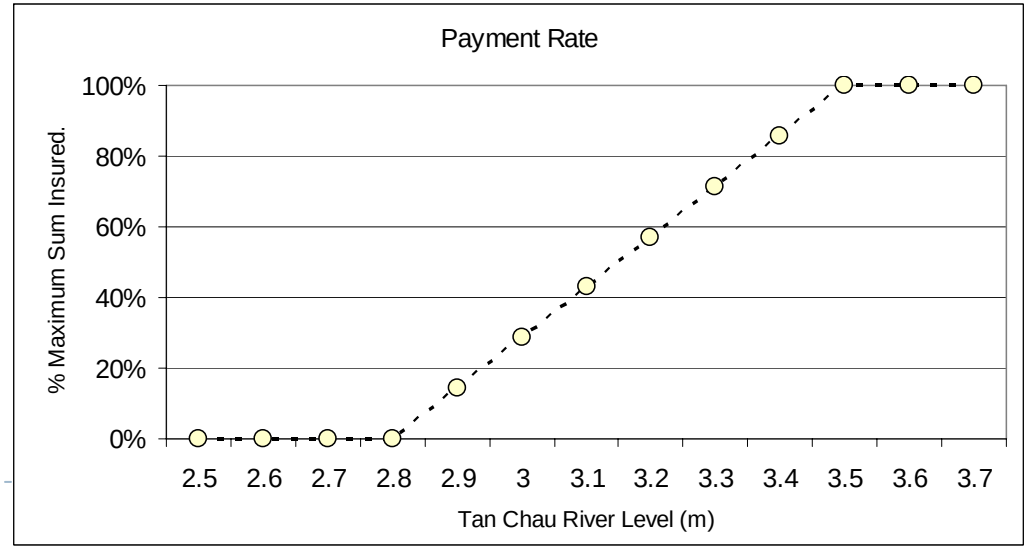
Index: The maximum three day moving average of water levels during the period

Threshold: 280 cm

Limit: 350cm

Cover: Up to 1 million USD





Index-based Flood Insurance Is Ready Now!

The Risk: Excess early flooding in Dong Thap as captured by the level of water at Tan Chau

Target User: Agricultural lender — Vietnam Bank for Agriculture and Rural Development who is exposed to business interruption risk

Contract Structure: Linear payment rate based on levels of water exceeding 280 cm at Tan Chau gauging stations, with back up measures at Kratie station

Insurer: Bao Minh Insurance — Has used recourses and expertise and made a commitment to understand the risk and develop the policy

Reinsurer: Paris Re — Globally well-known reinsurance company that recognizes the value of index insurance and who finds the product structure and index to be credible

Regulatory Approval: Department of Insurance has previously reviewed and approved the contract structure as presented by Bao Minh and Paris Re

This represents a first step in a market test and in understanding index insurance, starting with a very real risk — This is only a beginning, but leadership is required for to start the market development process