



# SPADA - Strategic Pathogen Assessment for Domesticated Animals

## Economic Analysis

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1. Introduction
2. SPADA Economic Assessment
3. Risk Assessment
4. Capacity Development
5. Applications
6. Discussion

# 1. Introduction



- Pathogens associated with domesticated and captive animals now pose a major challenge to public health and economic security at the national and global level.
- In the three most prominent recent cases (HPAI, SARS, BSE), timely gathering, assessment, and dissemination of empirical evidence was critical to response effectiveness.
- To support more effective policies for control and mitigation of disease outbreaks occurring in managed animal populations, we have developed an integrated methodology of economic assessment and risk management.



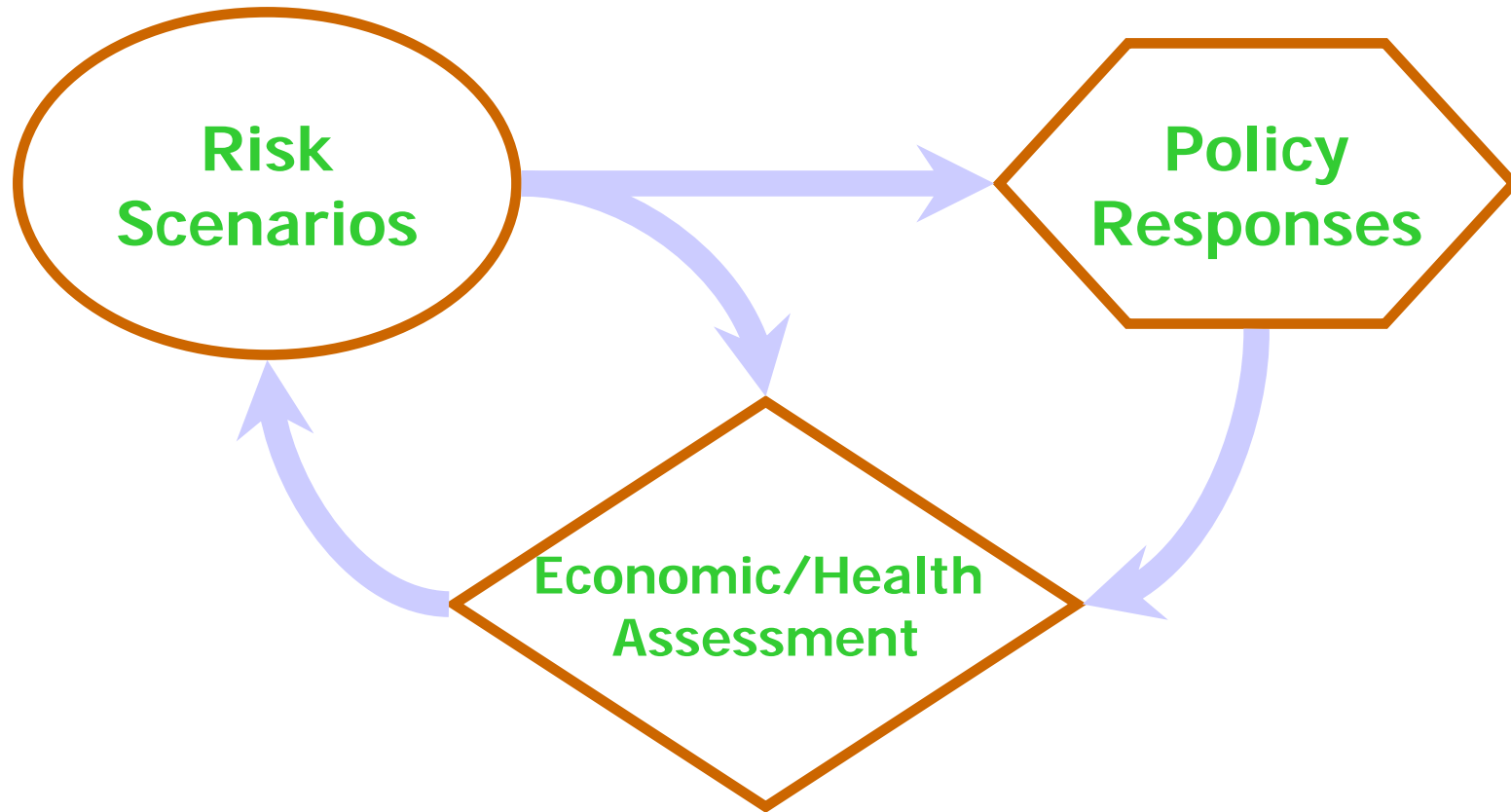
Highly Pathogenic Avian Influenza (HPAI) has potentially momentous consequences for human society.

Even without a pandemic, economic costs of raising HPAI biosecurity are already substantial, and their ultimate incidence is still not well understood.

The SPADA method uses rigorous epidemiological and economic analysis to assess the effects of alternative scenarios for disease occurrence and policy response.

Combining detailed data, computer simulation models, and GIS mapping, SPADA provides new capacity for ex ante, concurrent, and ex post policy analysis.

# SPADA Schematic



# Livestock Development Goals(LDG)



***Goal 1: Eradicate extreme poverty***

***Goal 2: Increase smallholder food security and protein sufficiency***

***Goal 3: Increase smallholder value-added***

***Goal 4: National registry of indigenous livestock varieties***

***Goal 5: Improve animal health***

***Goal 6: Combat HPAI, TADS, and other diseases***

***Goal 7: Ensure sustainability***

***Goal 8: Develop a global partnership for livestock technology sharing and marketing standards***

**In poor countries, HPAI prevention should advance every one of the LDGs.  
In their present form, most control policies do not.**

## 2. SPADA Economic Assessment



- In this section, we outline an approach to assessing economic effects of pathogenic events.
- Assessment can be carried out before, during, and after such events, and applied at the macro, meso, and micro economic levels of policy analysis.



# FAO Rationale for Economic Analysis



- **Determine whether a proposed strategy is viable in economic terms.**
  - Do the expected benefits exceed the expected costs?
- **Identify from what sources it might be financed.**
  - Those who benefit most might reasonably be expected to contribute most. However, the method of contribution (e.g. payment at point of service, direct or indirect taxation) needs to be designed to make financing efficient.
- **Identify potential risks of non compliance.**
  - Those who do not expect to benefit or find it hard to pay for new biosecurity measures may be less inclined to comply with regulations.



# Economic Benefits of Control Strategies



- **Increased income and food security**
- **Reduced costs of dealing with disease outbreaks**
- **Reduced costs of dealing with human disease cases**

# Economic Costs of Control Strategies



Estimates must take into account:

- The total cost of a policy.
  - This is the cost of the extra resources used to implement it plus the output losses.
- The costs incurred by each major stakeholder.
  - Some of these will be actual costs (new resources used) and some will be transfer costs. For example, compensation does not represent a real cost – no resources are used up – but finances are transferred from the government to farmers to improve reporting incentives and reduce the impact of their loss.



- Investment needed to achieve and maintain a heightened state of biosecurity.
  - strengthening of veterinary services infrastructure and capacity
  - improved or new farm buildings and infrastructure, equipment, staff and training
  - improved facilities at markets
  - in extreme cases, complete relocation of farms or markets
- Recurrent costs of preventing outbreaks.
  - surveillance and diagnosis costs
  - movement control
  - administrative costs of enforcing regulations
  - on-farm biosecurity measures
  - on-farm traceability measures
  - in some cases vaccination



- **Indirect costs**

- These are the costs resulting from reduced levels or values of production because of temporary or permanent changes to management systems or markets. In practice, when calculations are made with simulation models, the indirect costs are usually captured for in the estimation of benefits.

- **Transfer costs**

- costs transferred from one stakeholder to another

- **Compensation**

- To encourage reporting and control compliance.
- To avert a livelihoods crisis.



1. Rural Producers
  - Subsistence, direct and indirect livestock benefits
2. Enterprise Producers
  - Income, employment
3. Food Processing Industry
  - Costs, income, employment
4. Consumers
  - Biosecurity, purchasing power
5. Government
  - Biosecurity, economic and social stability, fiscal
6. Rest of World
  - Biosecurity, Poverty/Development, R&D

# HPAI Economic Cost Components



|    |                  |          |   |
|----|------------------|----------|---|
| 1. | Producers        | Direct   | Stock morality/morbidity  |
|    |                  | Indirect | Control Measures<br>Demand Shifts<br>Health risk  |
| 2. | Consumers        | Direct   | Higher prices   |
|    |                  | Indirect | Substitution, health risk   |
| 3. | Government       | Direct   | Response/deployment<br>Recurrent – monitoring, upgrading,<br>research, extension, education |
|    |                  | Indirect | Public relations<br>Transition/adjustment assistance  |
| 4. | Collateral Costs | Demand   | Product/locale aversion<br>Substitution<br>Income/employment risk                           |
|    |                  | Supply   | Demand shock<br>Source substitution<br>Other structural adjustments                         |



- Animal Health
  - Direct contact
  - Spread through movement of livestock, vectors or products
- Human Health
  - Contact, aerosol, vectors and water transmission
  - Direct food consumption
- Demand Shock
  - Market losses arising from demand diversion to other products or locations
- Diversion of public and private resources
  - Reduction in supply and availability/affordability of public and private goods





- surveillance
- stamping out
- quarantine
- movement control
- screening
- zoning
- vaccination
- compensation/penalties



Built on the IPALP data and modeling architecture, the economic component of SPADA is designed to deliver strategic support at three levels:

- Macro – effects on aggregate output, employment, and public finance
- Meso – direct and induced sectoral adjustments, structural shifts, and regional migratory/mobility effects
- Micro – detailed household impacts, with particular attention to lower income groups



A variety of recent critical events offer relevant data that can be used to calibrate response and adjustment costs:

1. Prior HPAI cases
2. SARS
3. Tsunami
4. September 11
5. HIV/AIDS

### 3. Risk Management from a Development Perspective



- HPAI presents an unusual opportunity for international cooperation because millions of poor rural households can contribute significantly the global commons of pandemic disease prevention.
- Their participation in this effort must be better understood and indeed rewarded if success is to be achieved.
- Recruiting smallholders into risk management systems facilitates extension services that can improve their economic opportunities.
- To make such policies effective, microeconomic analysis and localized design and implementation are essential.

# Reducing HPAI Risks while Safeguarding Livelihoods

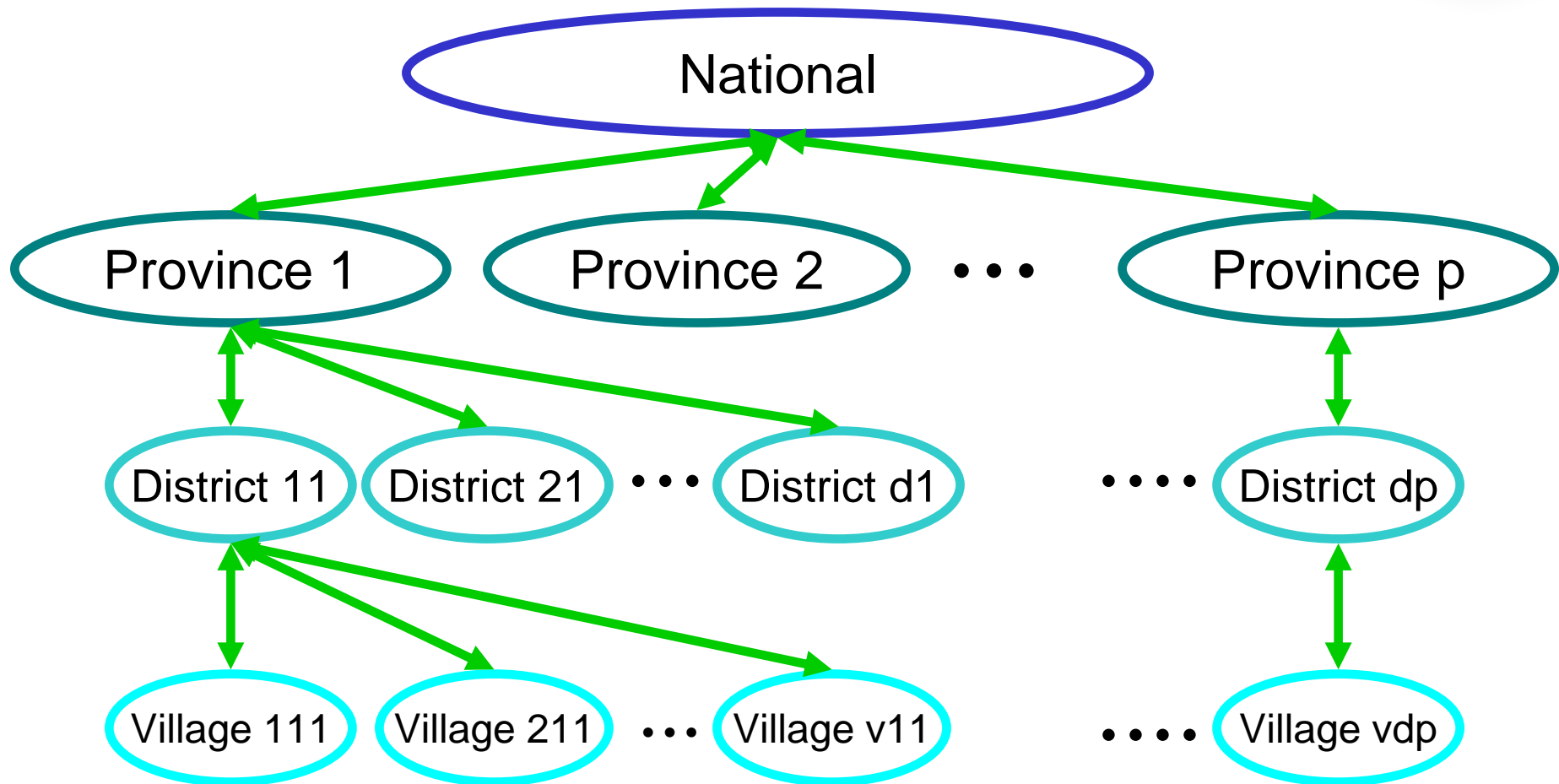


- If policy makers want to reduce HPAI risks to larger animal and human populations, without undue adverse effects on the poor, they need more effective means to identify local outbreaks and contain them.
- The information needed to accomplish this exists, but it has until now been very difficult to obtain and implement.
- Much evidence suggests that local communities are well aware of local outbreaks and infection patterns, but reporting processes are plagued by inefficiency and incentive problems.

# Information Strata



Policy relevant information is fragmented within society and flows are distorted by incentive problems.

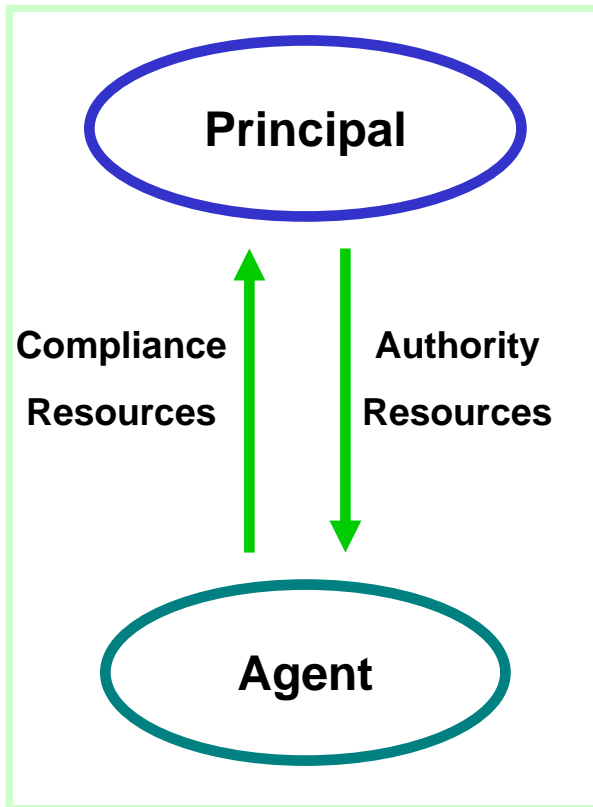


# Principal-Agent Theory

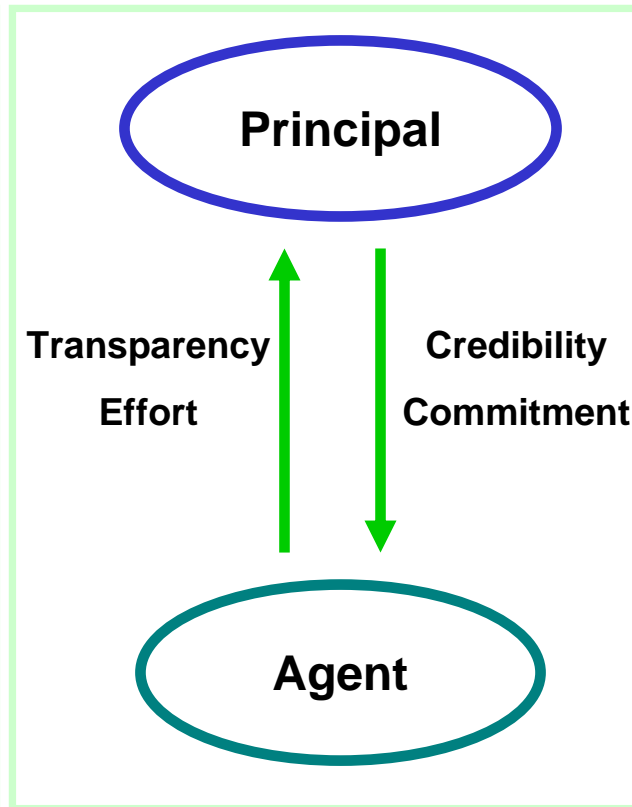


Imperfect information creates incentive problems and monitoring costs.

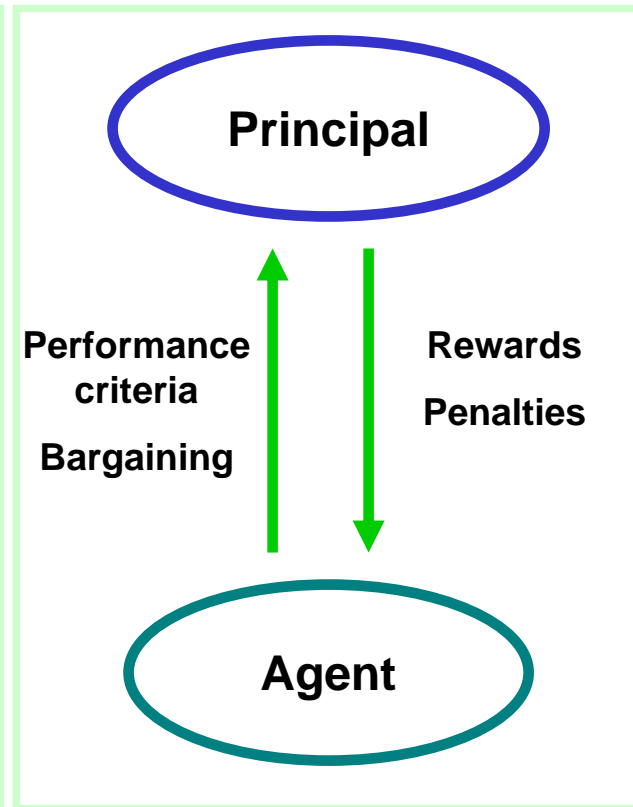
## Structure



## Communication



## Mechanisms





# Socially Effective Monitoring and Control



- The approach recognizes the microeconomic realities of poultry production and livelihoods, including the diversity of household production systems and the complexity of incentives they face. It is divided into three components: Surveillance, Control, and Traceability.
- Effective risk management involves localized design and testing of monitoring, incentive, and penalty mechanisms for disease reporting combined with traceability schemes, the aim of which is to limit downstream disease risks and improve upstream product quality.



- This research examines alternative policy designs that facilitate early detection of outbreaks.
- Effective surveillance combines incentives for collective responsibility and self-reporting, taking into account the resource constraints of different communities, for the development of mechanisms that reduce health risk and protect economic survival of the producers.



- Effective decentralization of control capacity is essential to the long-term success of disease management.
- In the HPAI epicentre countries, this will require new command and incentive relationships between district and provincial authorities, the central government, and outside stakeholders (NGOs, aid agencies, etc.).
- Regional participation and coordination are essential for sustained risk reduction.

# Traceability, Defined



- An important class of strategies are mechanisms to trace the movement of agricultural products through the food supply chain.
- At the same time, consumer concerns with food quality and safety, and the introduction of modern supply chain management systems are increasing the value of product identification across production and marketing networks.
- Thus traceability has dual value to consumers and producers, increasing the effectiveness of demand targeting and raising value-added by origin.

# Traceability in Practice



- With appropriate policies, private and public investments in systems of traceability that address food safety concerns can also benefit smallholders by linking them into more integrated food chains.
- These chains can increase distribution efficiency, reduce marketing margins and risks, and stimulate upstream technology transfer and product quality improvements, all of which improve the likelihood of smallholder survival until alternative income sources emerge.
- This pro-poor benefit stands in sharp contrast to the displacement effects many current control strategies threaten to cause.

# Pro-poor Risk Management



- Well designed surveillance and traceability systems can also improve the terms of market access for the rural poor, making them better off as a result of HPAI policies.
- Risk reduction strategies must incorporate extension and marketing services that transfer standards and technology upstream, product quality and diversity downstream, increasing value added for small holders.



- At the present time, the majority of HPAI resources are concentrated on contingent pandemic planning in OECD countries.
- A more cost-effective approach would be to reduce the risk of pandemic directly by funding infection risk management in epicentre economies.
- Not only might these measures make pandemic damage control unnecessary, they can contribute in the meantime to improving livelihoods among the poorest rural communities.



# How to Frame the Problem



- Despite the global momentum for rapid and intensive measures to control poultry stocks and restructure management practices, in the HPAI epicentre countries these policies must address the economic and institutional realities poor rural majority populations.
- To reconcile such macro and micro perspectives effectively is a much greater challenge than simply allocating international resources to national governments. To promote a more comprehensive analysis of this situation, we offer two salient insights.

# Deal with Risk at Its Source



- Policies toward HPAI in epicentre countries necessarily implicate the rural poor majority.
- These people need to be recognized as part of the solution to reducing disease risk, not the problem.
- We can neither ignore nor exempt such a large group from risk reduction strategies, but the strategies must be designed with them in mind.

# Get the Incentives Right



- Because of diverse initial conditions and weak institutional linkage, national policies cannot be implemented effectively without close attention to local incentives.
- Indeed, to do so may be more likely to increase HPAI risk at the local, national, and global level.
- Despite international pressure to act quickly on control measures, one size will not fit all or even a significant percentage of local conditions.
- We have seen again and again that prescriptive eradication measures fail to achieve their direct objective and can cause many adverse indirect effects.
- By driving the problem underground, contagion risk actually increases and rural markets/livelihoods are more seriously disrupted.

## 4. Capacity Development



Both epidemiological and economic components of SPADA should be developed as scalable assessment tools for adoption in counterpart national government agencies.

Implemented with localized data and self-contained software, these tools should be transferred with a standardized training program for junior technical specialists.

# Four Phases



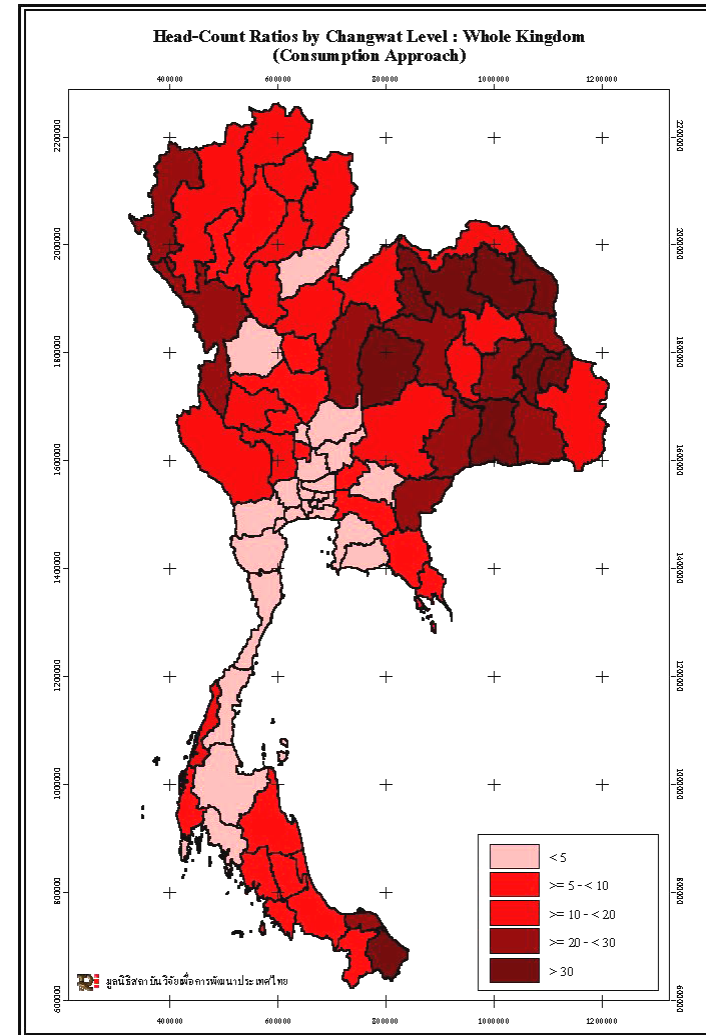
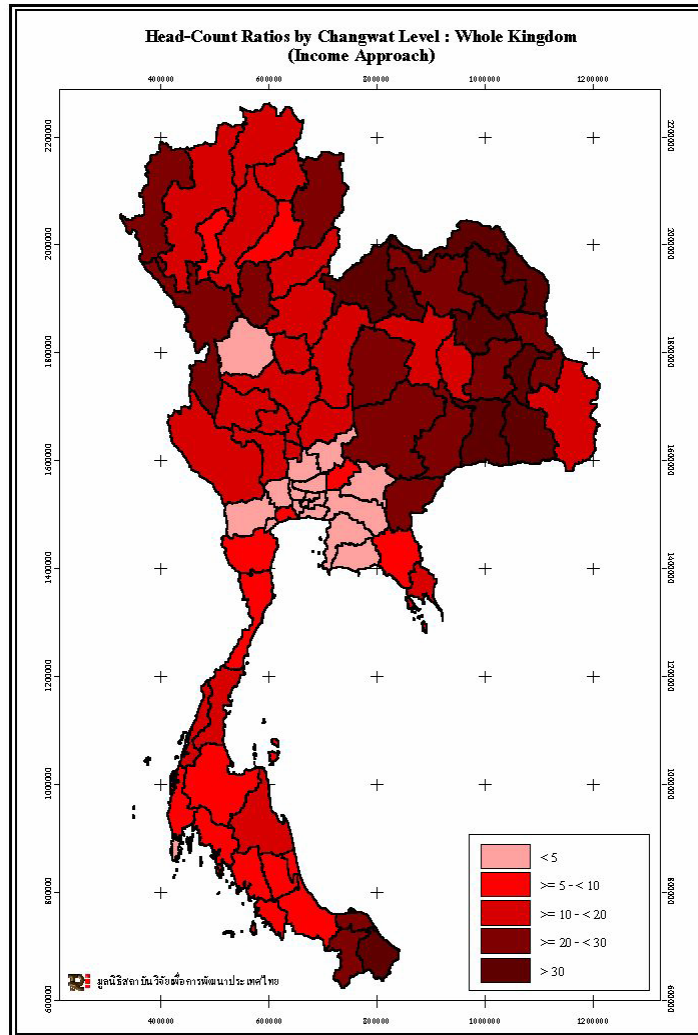
1. Development and testing of SPADA modules in prototype form – 3/6 months
2. Training of counterpart teams (2 junior researchers for each country) – 2 weeks each in host (UK-epi, US-eco) and home countries.  
Training in SE Asia should be consolidated, both teams in Thailand or Vietnam, one week each.
3. Bench testing and documentation of scenario assessments for both countries.
4. Dissemination to other countries



## 5. Applications

1. Initial Conditions: Poverty and Poultry Husbandry
2. Infection Patterns
3. Stratified Economic Assessment

# Poverty Incidence: Thailand



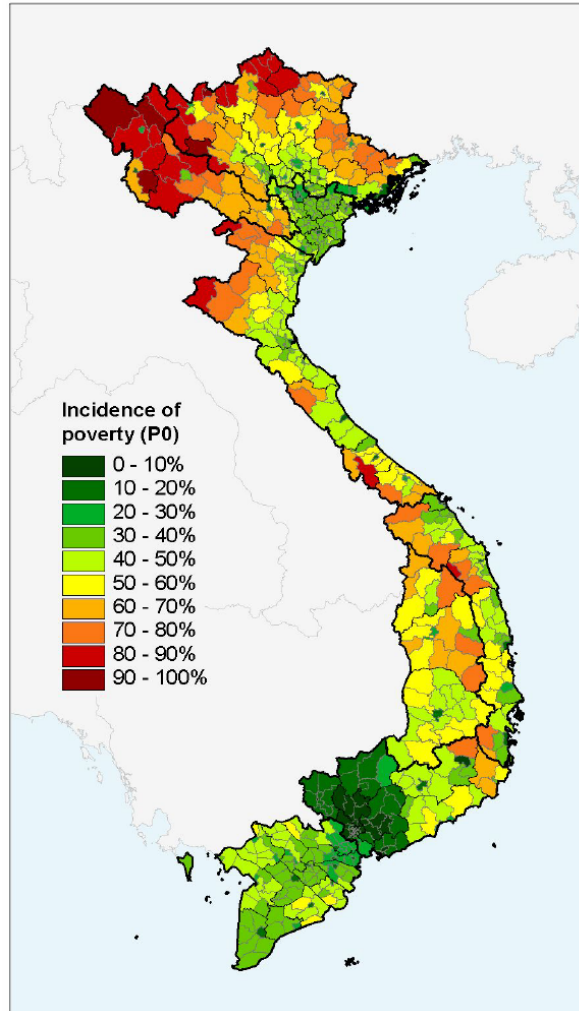


# Poverty Incidence and Density by District



## Poverty Incidence

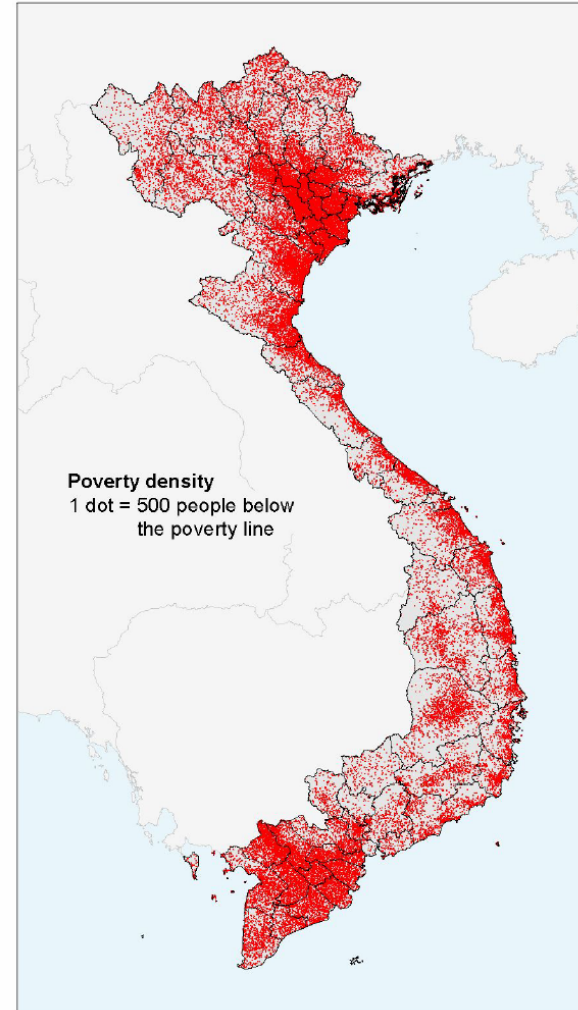
Figure 3. Map of the incidence of poverty ( $P_0$ ) of each district



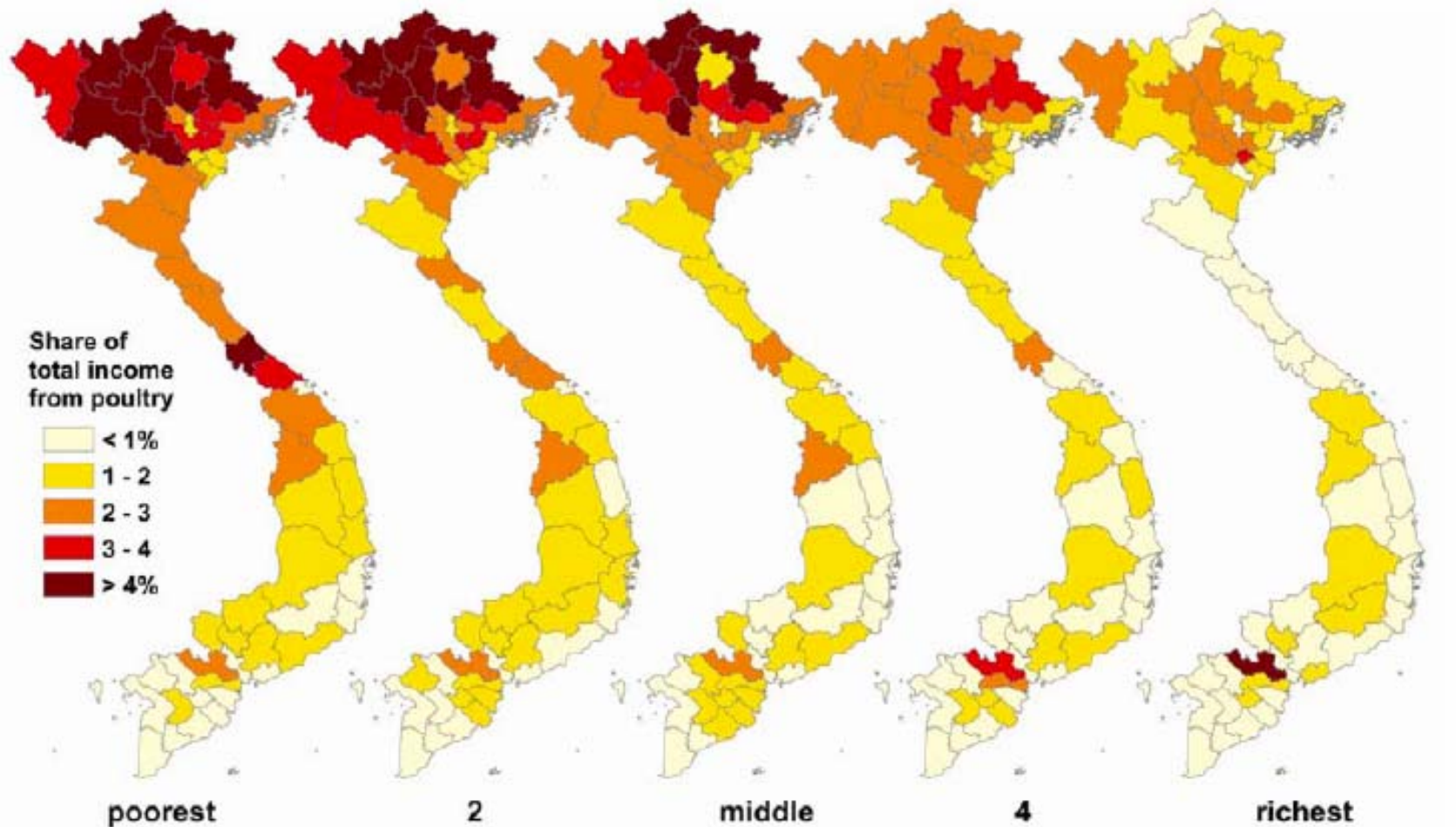
Source: IFPRI

## Poverty Density

Figure 9. Map of the density of poverty



# In Vietnam, the poor are more reliant on poultry for income

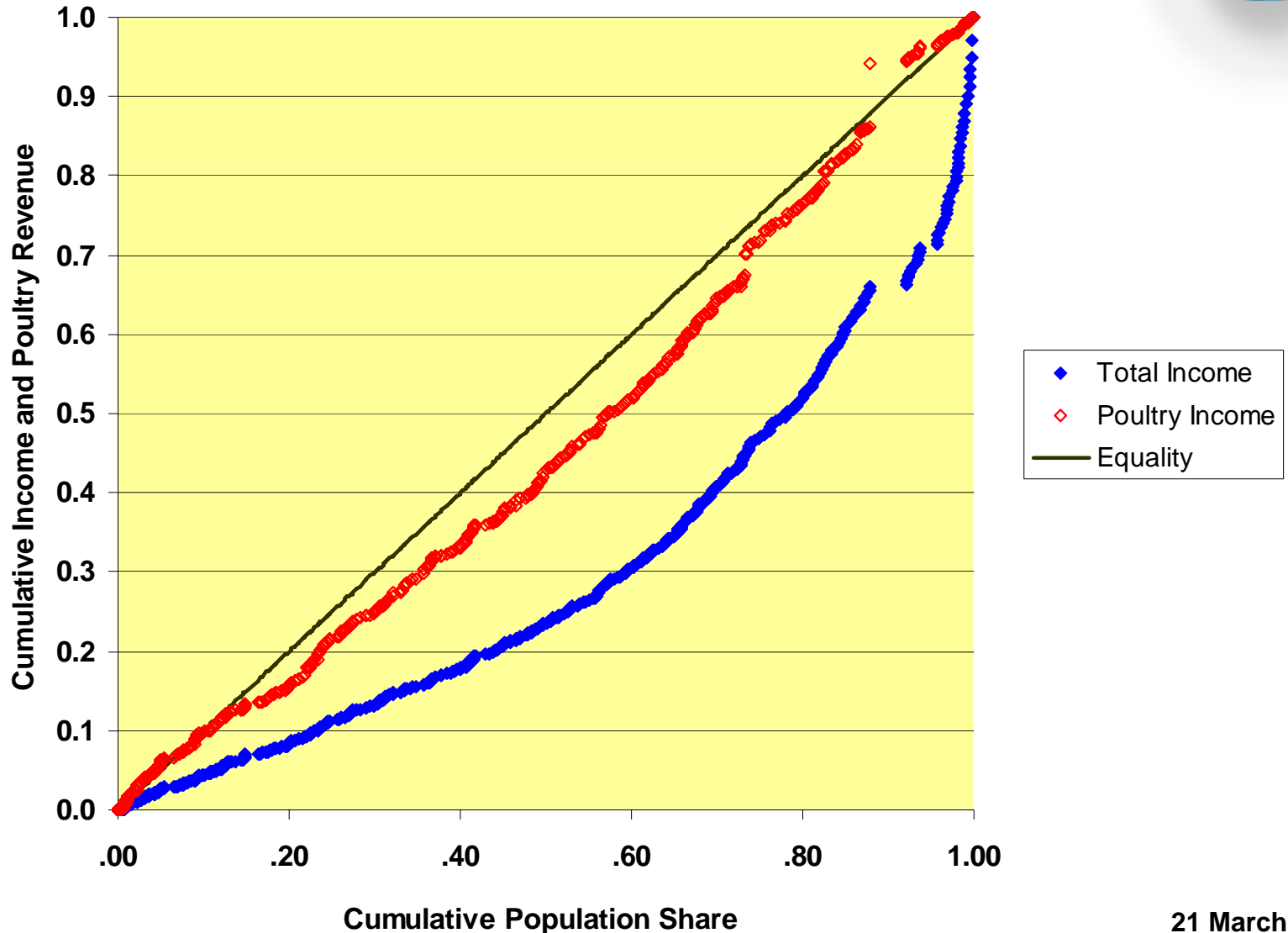


Source: VHLSS 2002

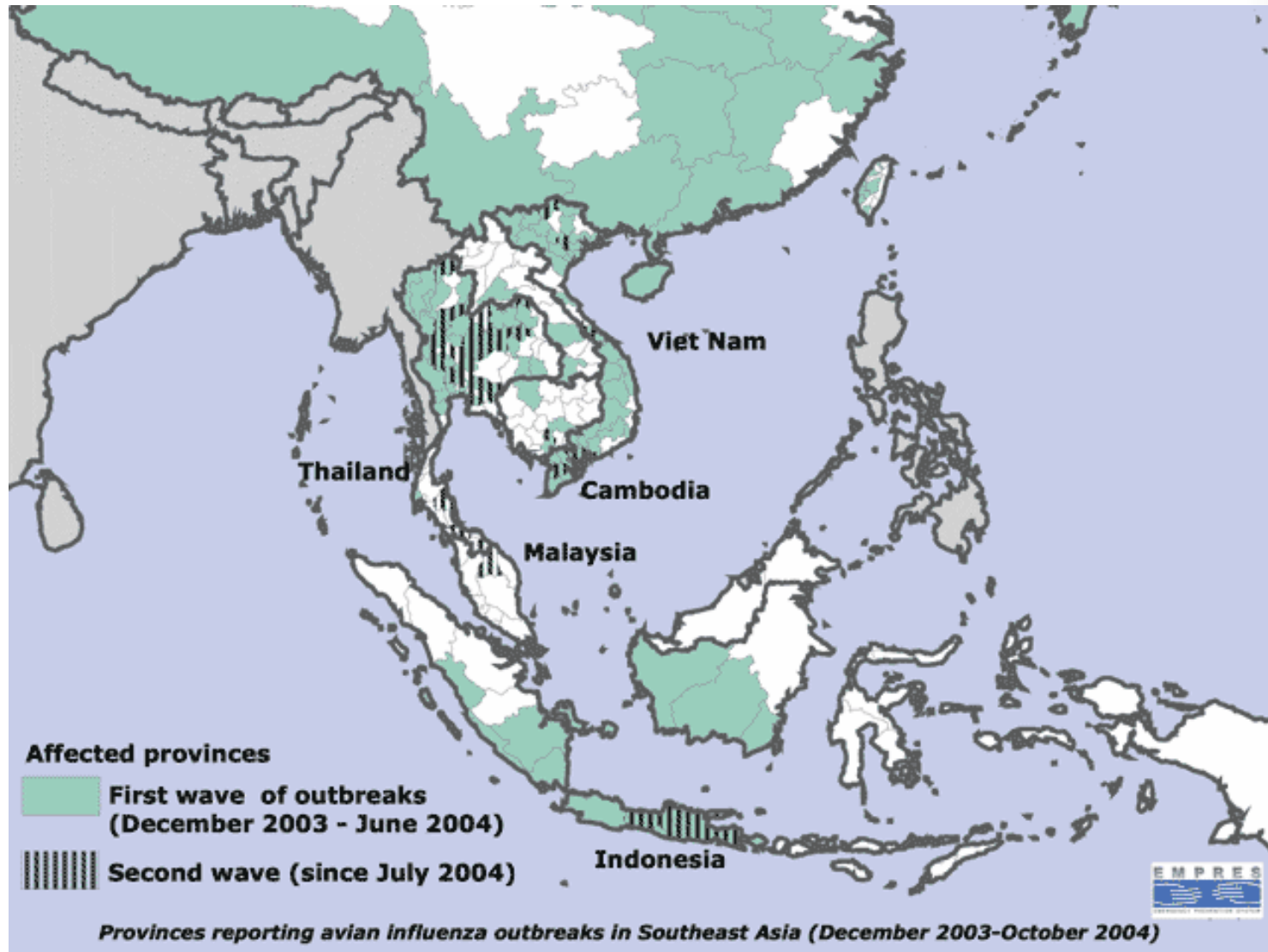
# Income Distribution in Vietnam



Poultry production is strongly pro-poor.



# Infection Patterns - Regional



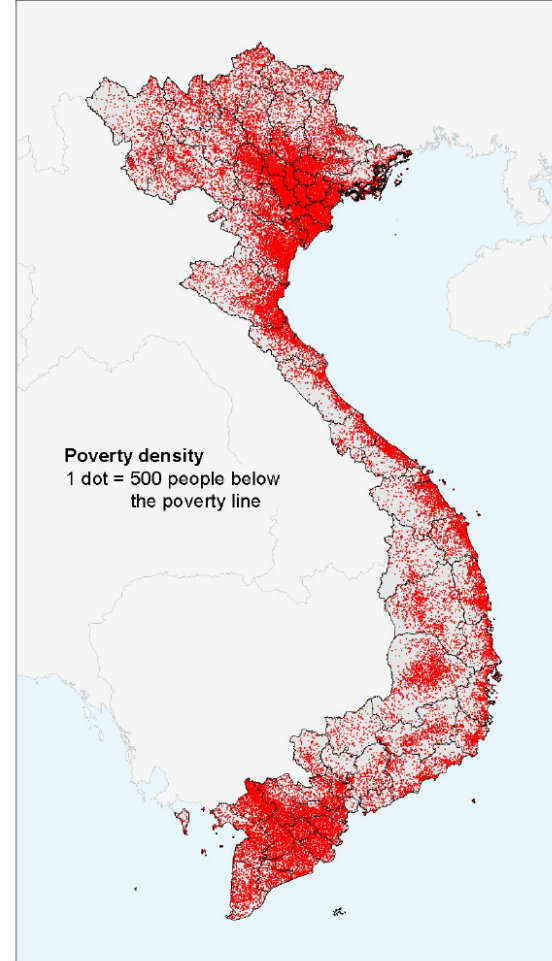


# Infection Patterns - Vietnam



*Provinces reporting avian influenza outbreaks  
in poultry and humans in Viet Nam  
since December 2004 (as of 27 January 2005)*

Figure 9. Map of the density of poverty



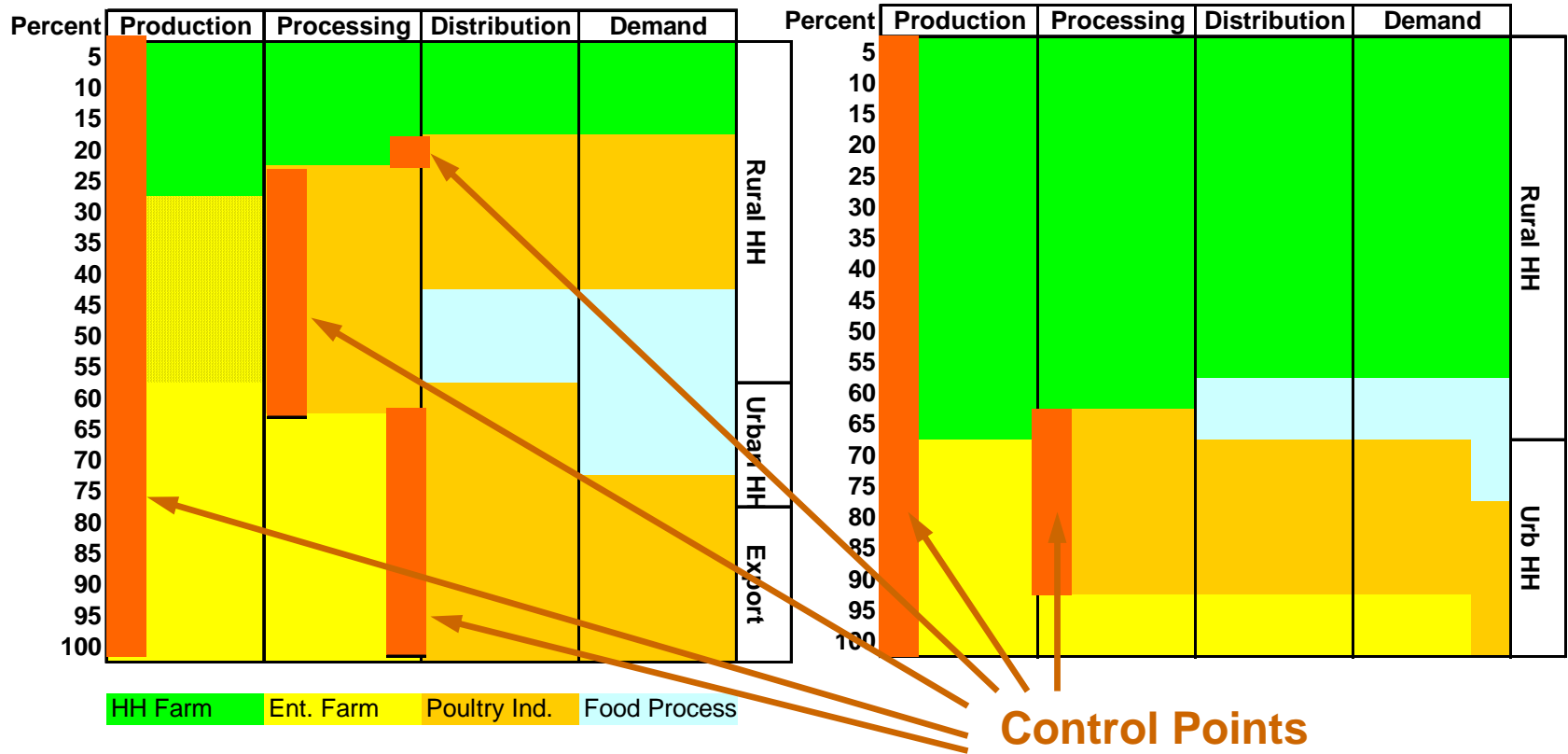


- Estimates of the impact of HPAI in affected countries vary greatly, depending on the structure of the poultry sector, the speed of outbreak control and the method used to estimate the impact.
- World Bank estimates earlier this year suggested that the costs of the current outbreaks in Vietnam might have approached 1.8% of GDP.
  - Estimates for Thailand suggest that the rate of growth of agricultural GDP may have halved during the outbreak year.
  - The total cost of the 1997 outbreak in Hong Kong is said to have been hundreds of millions of dollars when the costs to international trade and tourism are included.

# Meso Incidence



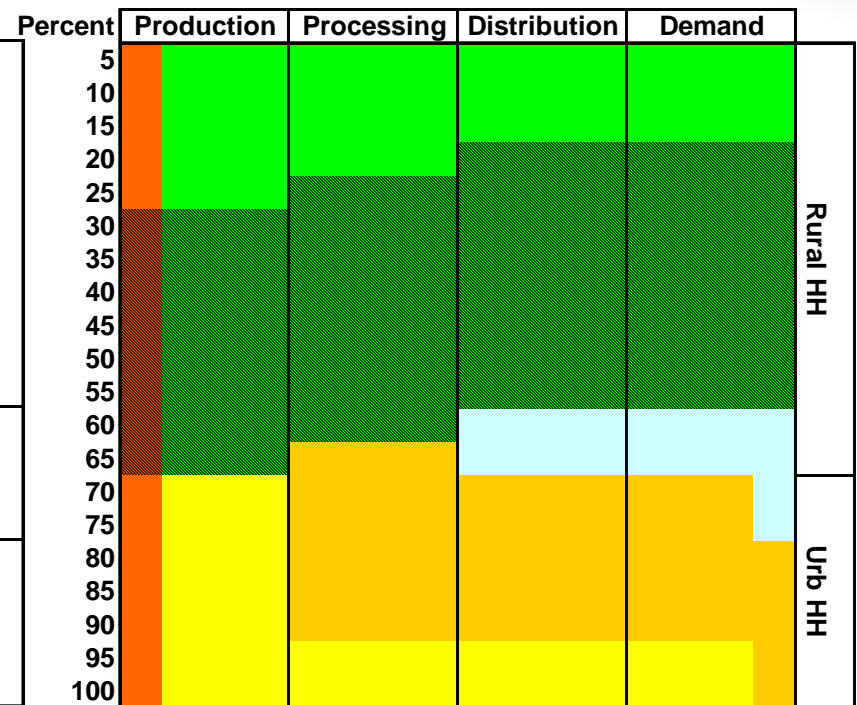
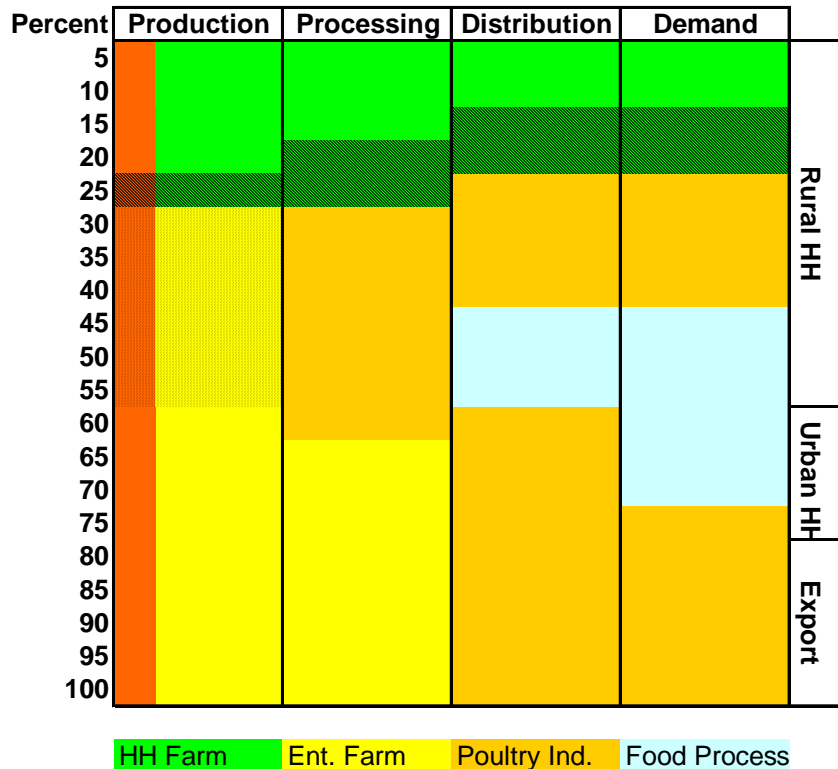
## Poultry Sector Resource Flow Thailand Vietnam



# Displacement



## Stamping Out and Displacement Thailand



There are significant risks that control strategies could permanently displace small producers. This could adversely impact local food security, poverty, and inequality.





Producers – micro-simulation analysis of production systems, at both the enterprise and household level.

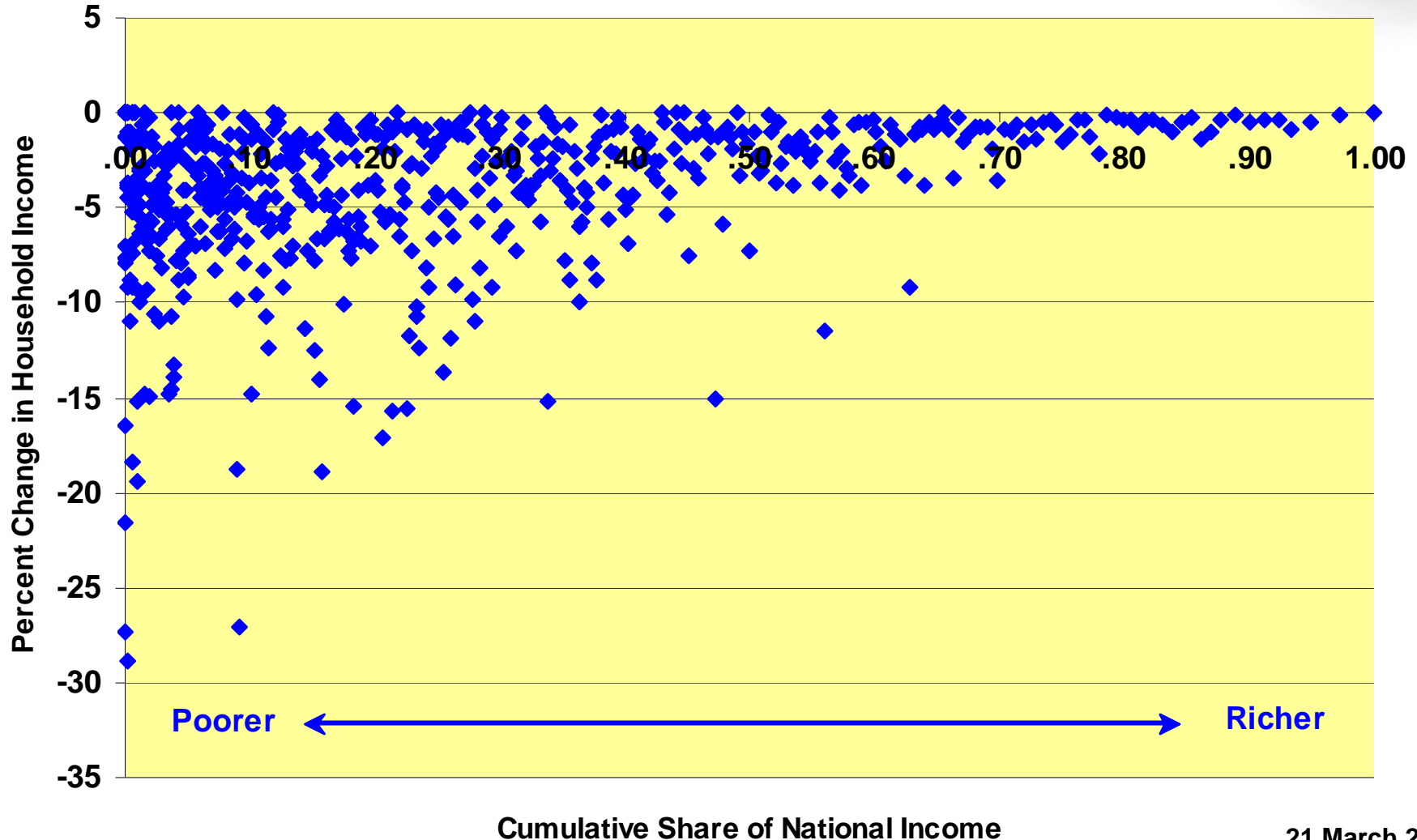
- Impact and Adjustment – affected producers face two alternatives with different policy implications:
  1. Cull and restock - Direct compensation/credit
  2. Exit and diversify - Adjustment assistance
- Incentives, compliance, and other behavioral issues – we plan to conduct detailed analysis of incentive properties

Consumers – about health and prices

# Household Income Effects of a Backyard Poultry Sale Ban



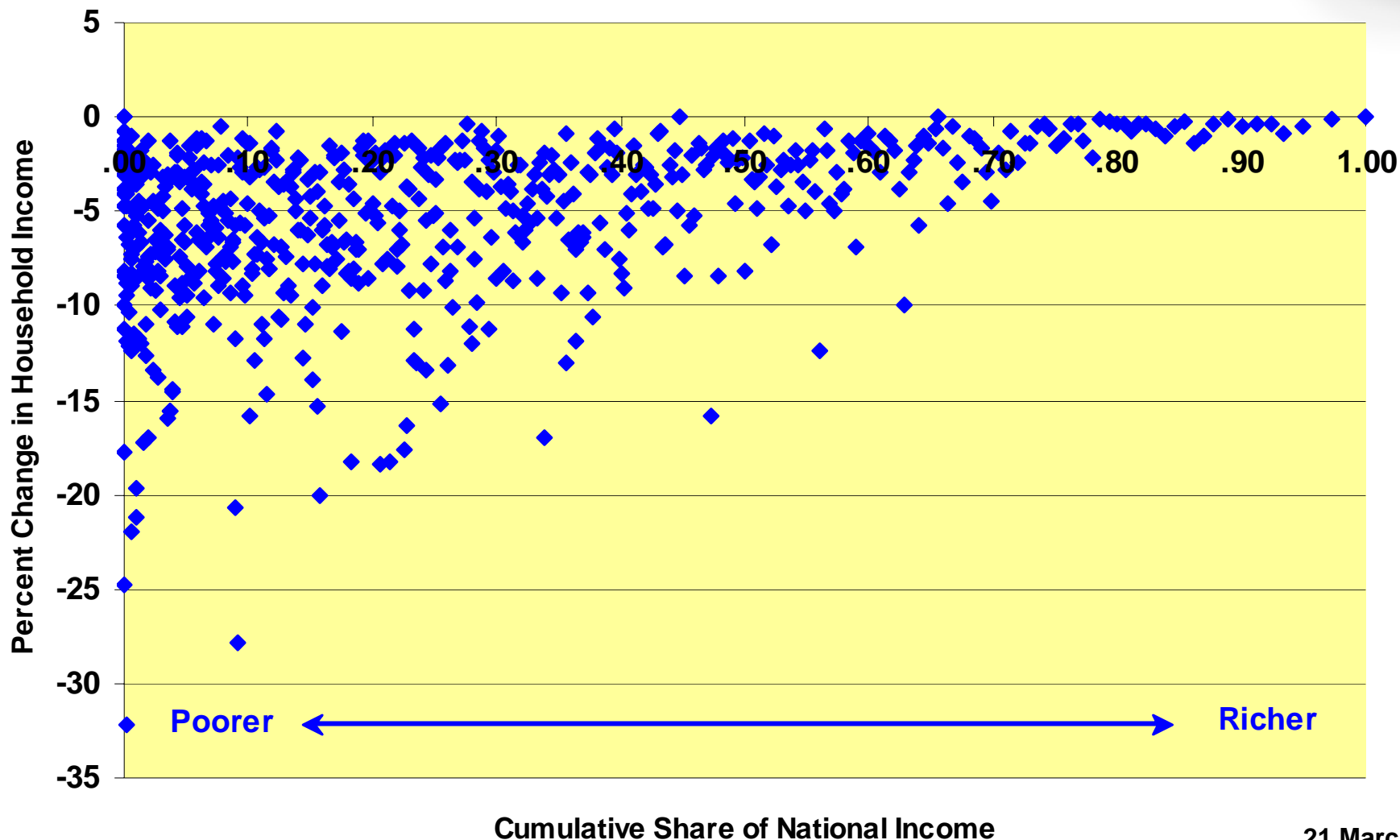
No BY



# Household Income and Expenditure Effects of a Backyard Poultry Ban



No BY w/Exp





# Discussion