Integrated Pest Management (IPM)

challenges and priorities in developing countries

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Objectives

- Explain how IPM works
- Use a case history to show how IPM has benefited millions of developing country farmers
- Point to the main problem constraining long-term sustainability
- Suggest priority needs

“Farmers' 'best mix' of control tactics based on crop yield, profit, and safety”

Kenmore PE, Heong KL, Putter CAJ. 1985. Political, social, and perceptual factors in integrated management programmes. In: Lee BS, Loke WH, Heong KL, eds., *Integrated Pest Management in Malaysia*. Malaysian Plant Protection Society, Kuala Lumpur, pp. 47-66

Farmers' best mix of IPM control tactics

Preventive

- Disease and insect resistant plants
- Crop rotation
- Intercropping
- Soil fertility management
- Other good farming practices suitable for the area

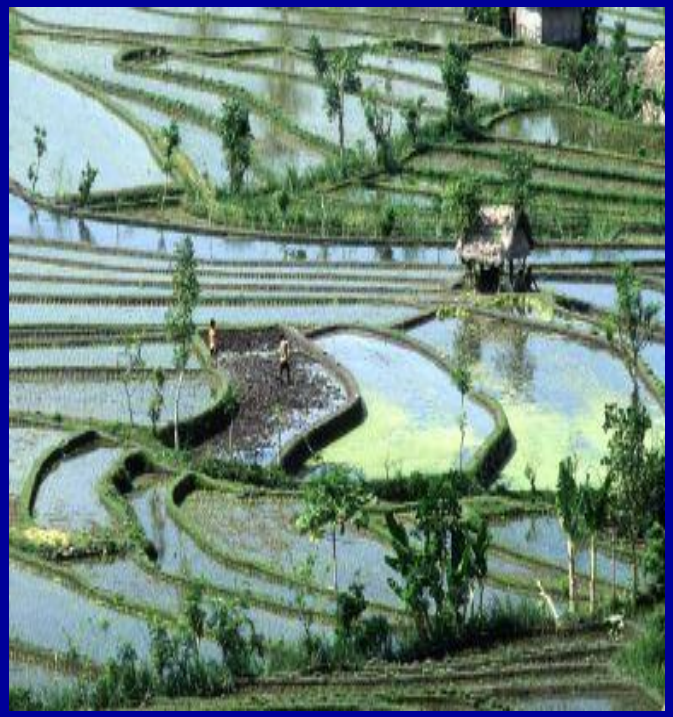
Corrective

- Pesticides
- Other interventions to arrest pests that have exceeded acceptable levels

Integrated pest management

Inputs

- Renewable natural resources
- Ecological understanding
- Sound conservation management
- Judicious use of artificial inputs



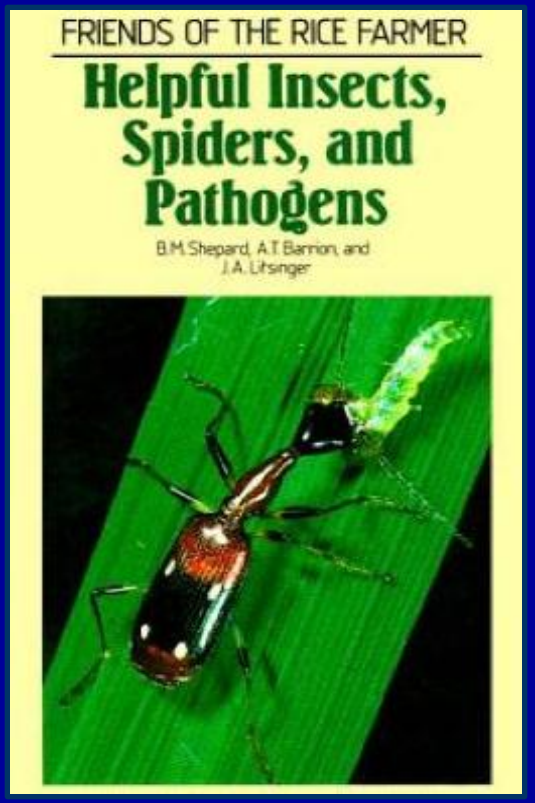
Outputs

- Stable, acceptable yields and profits
- Environmental protection
- Ecological security
- Less depletion of non-renewable natural resources
- Social acceptability

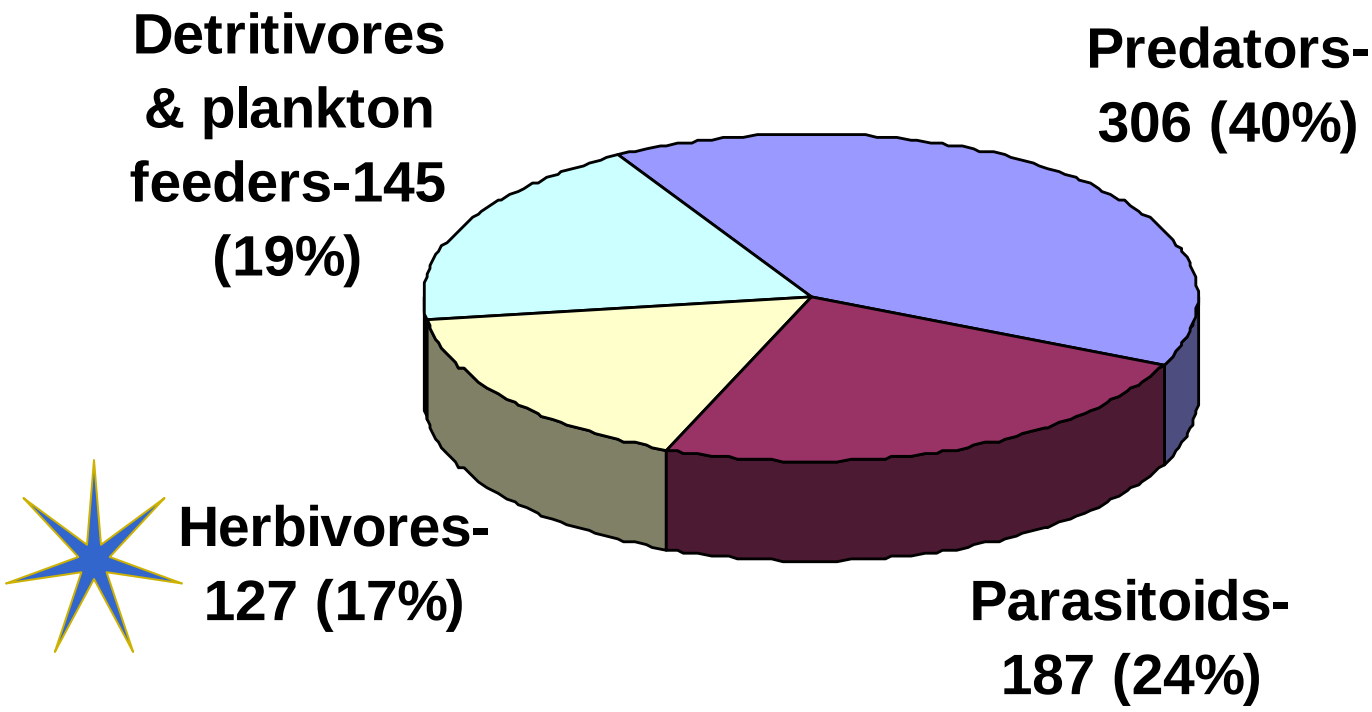
Understanding and exploiting biodiversity: essential in IPM

The plant's natural defenses

Naturally occurring biological control agents



765 arthropod species in one Indonesian rice field (Settle et al. 1996)

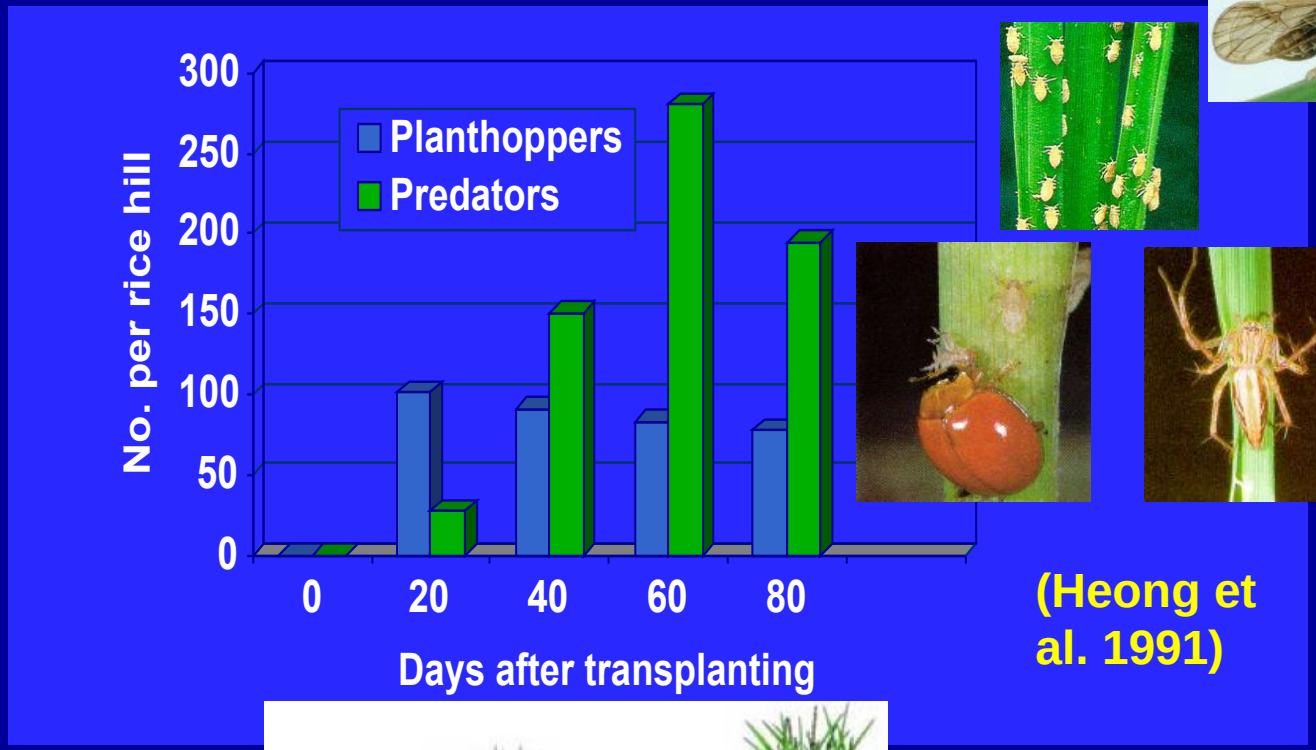


Case history in IPM in rice, tropical Asia

Large-scale outbreaks of the brown planthopper *Nilaparvata lugens* (BPH) occurred frequently in the new high-yielding rice in the 1970s

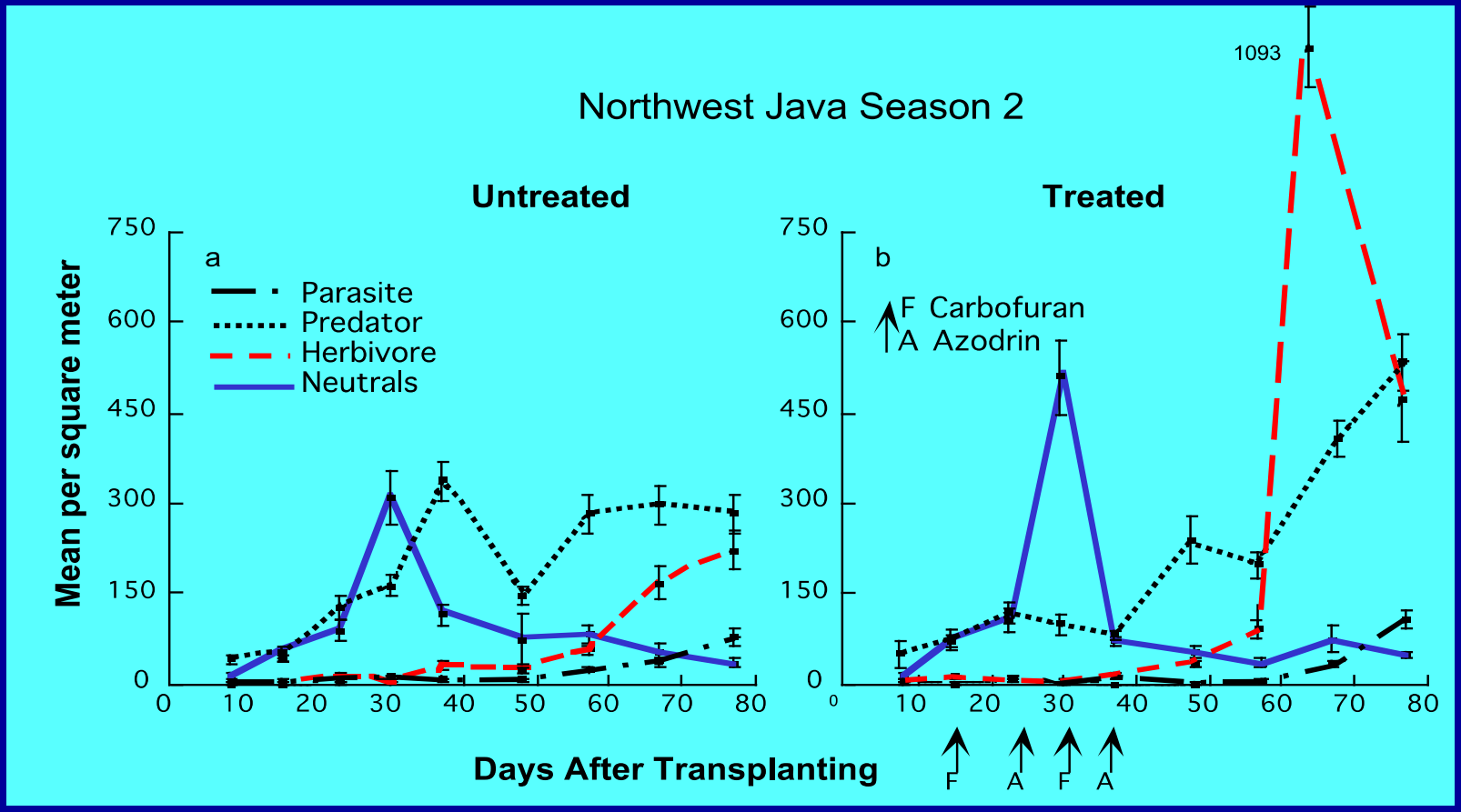
Throughout Asia, farmers were applying insecticides prophylactically to rice

Relationship in brown planthopper and predator populations in untreated rice



(Heong et al. 1991)

Pest flare-up following insecticide use in Indonesian rice (Pontius et al. 2001)



BPH international migration

IPM heralded as the solution

- In 1980, FAO and cooperating countries in South-Southeast Asia started setting up farmer-field schools to train rice farmers in IPM
- In1991, IRRI and cooperating countries started a Farmer Participatory Research (FPR) program to reduce early-season spraying

IPM

FPR

IRRI
INTERNATIONAL RICE RESEARCH INSTITUTE

Millions of farmers benefited from the IPM and FPR programs

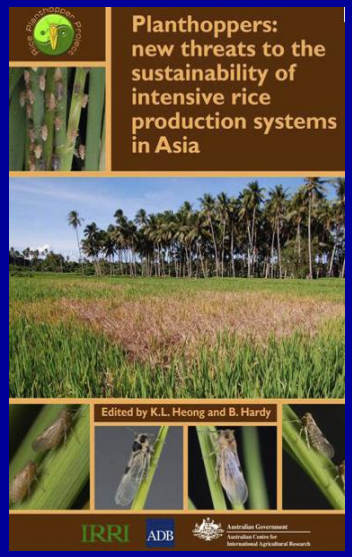
Greatest impact in Indonesia

- Banned 57 insecticides known to cause BPH outbreaks and also stopped insecticide subsidies
- Some 1.5 million rice farmers received IPM training (Oka 2003)

What were the results?

- Insecticide use dropped 50 – 80%
- BPH populations generally declined to non-threatening levels
- Rice farmers' crop yield, profit, and safety benefited

Despite their success, the efforts were not sustainable



- Since 2005, insecticide use has resurfaced as the primary tactic for controlling rice insects in tropical Asia
- BPH and other rice planthoppers have reached historical outbreak levels

What went wrong?

Harris LM. 2011. *Modeling a cost-effective IPM dissemination strategy for vegetables and rice: An example in South Asia*. MS Thesis, VA Polytech. Instit. & State Univ. Blacksburg, VA

"Although, the amount of funding has been sufficient to develop IPM technologies and disseminate them to farmers during the duration of a project cycle, the programs have lacked continuity and connectivity."

	No. farmers	No. extension workers	Farmer : extension worker ratio
Philippines	5,000,000	2,000	2,500 : 1
Vietnam	10,000,000	2,000	5,000 : 1

From KL Heong, IRRI

Overarching priority: innovative dissemination networks to enable continuity and connectivity

The audience:

- farmers
- extension workers
- researchers
- policy makers
- NGOs
- other groups

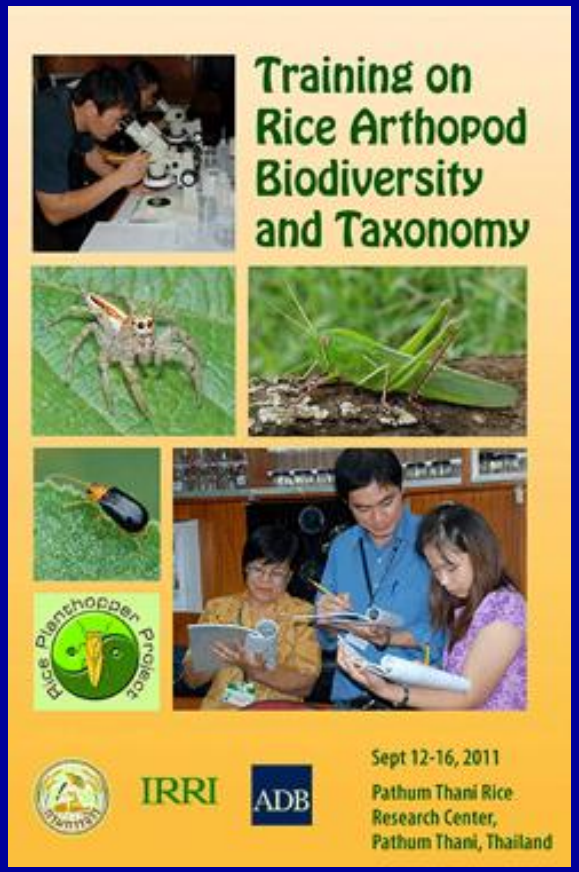
What about developing Coursera IPM courses online?

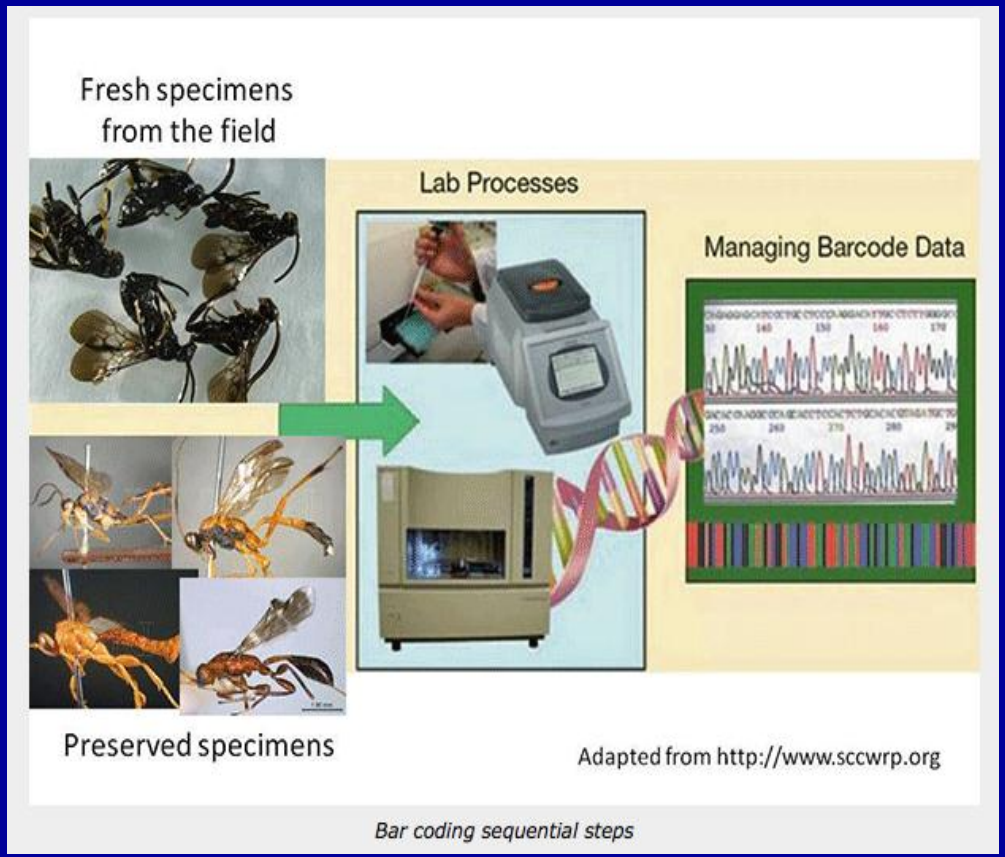
High priority research

1. Taxonomic research and services to increase understanding of ecosystem function of agricultural biodiversity
2. Understanding the effects of local and regional landscape patterns on pests and their natural enemies
3. Understanding the genetic connectivity and migration of subpopulations in pest species that function as metapopulations

To manage a living agroecosystem requires recognizing its inhabitants and their functions

Taxonomists and ecologists at U.S. universities and the Smithsonian could lead the way



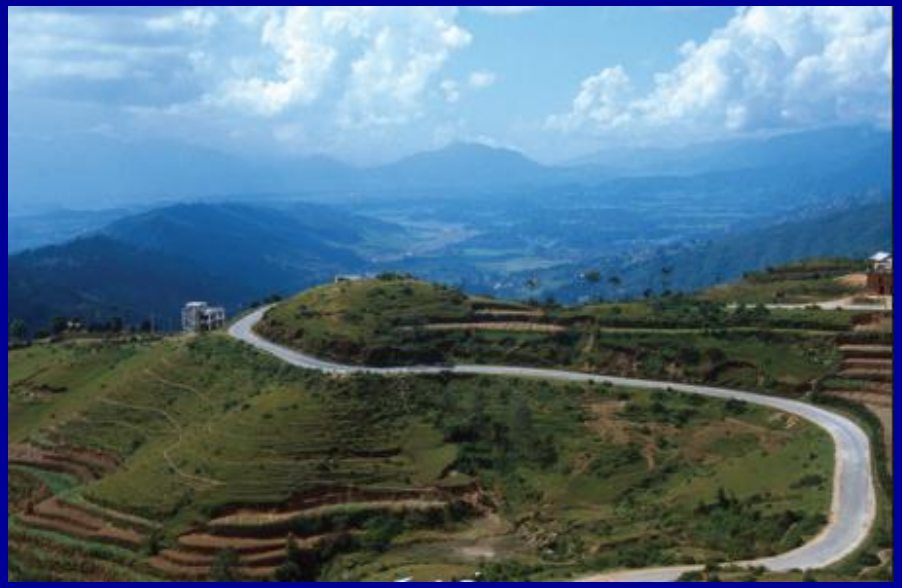


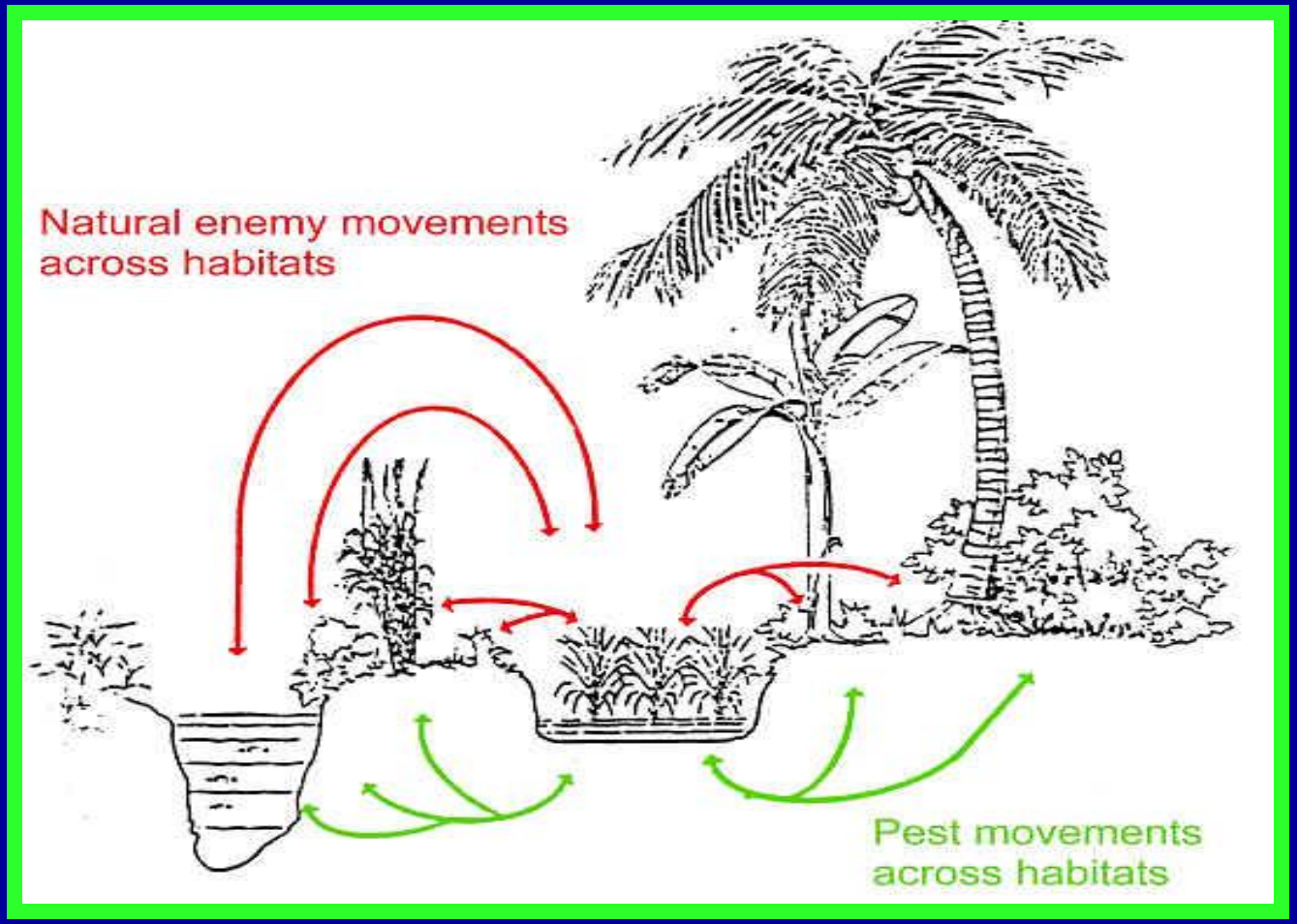
Bar coding sequential steps

Understanding the effects of local and regional landscape patterns

How do surrounding crops other than those being managed and wild habitats affect pests and biological control agents?

How do heterogeneous habitats affect pest dynamics at the local spatial scale and across the broader geographical landscape?

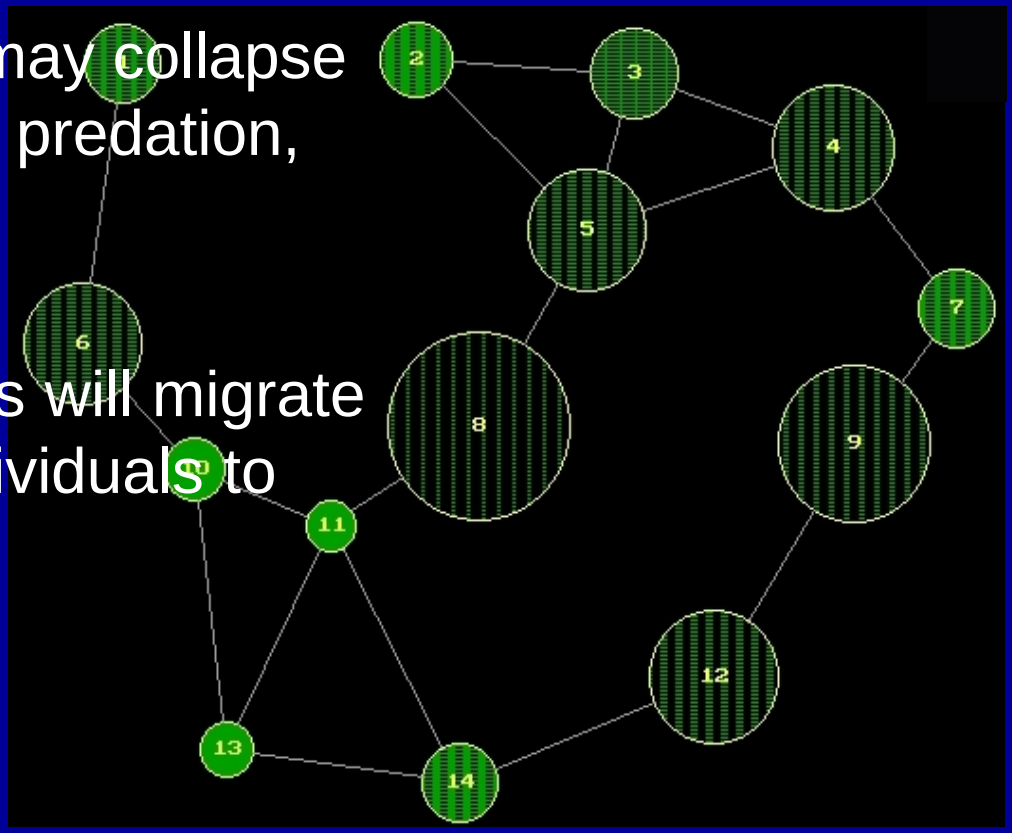




From KL Heong, IRRI

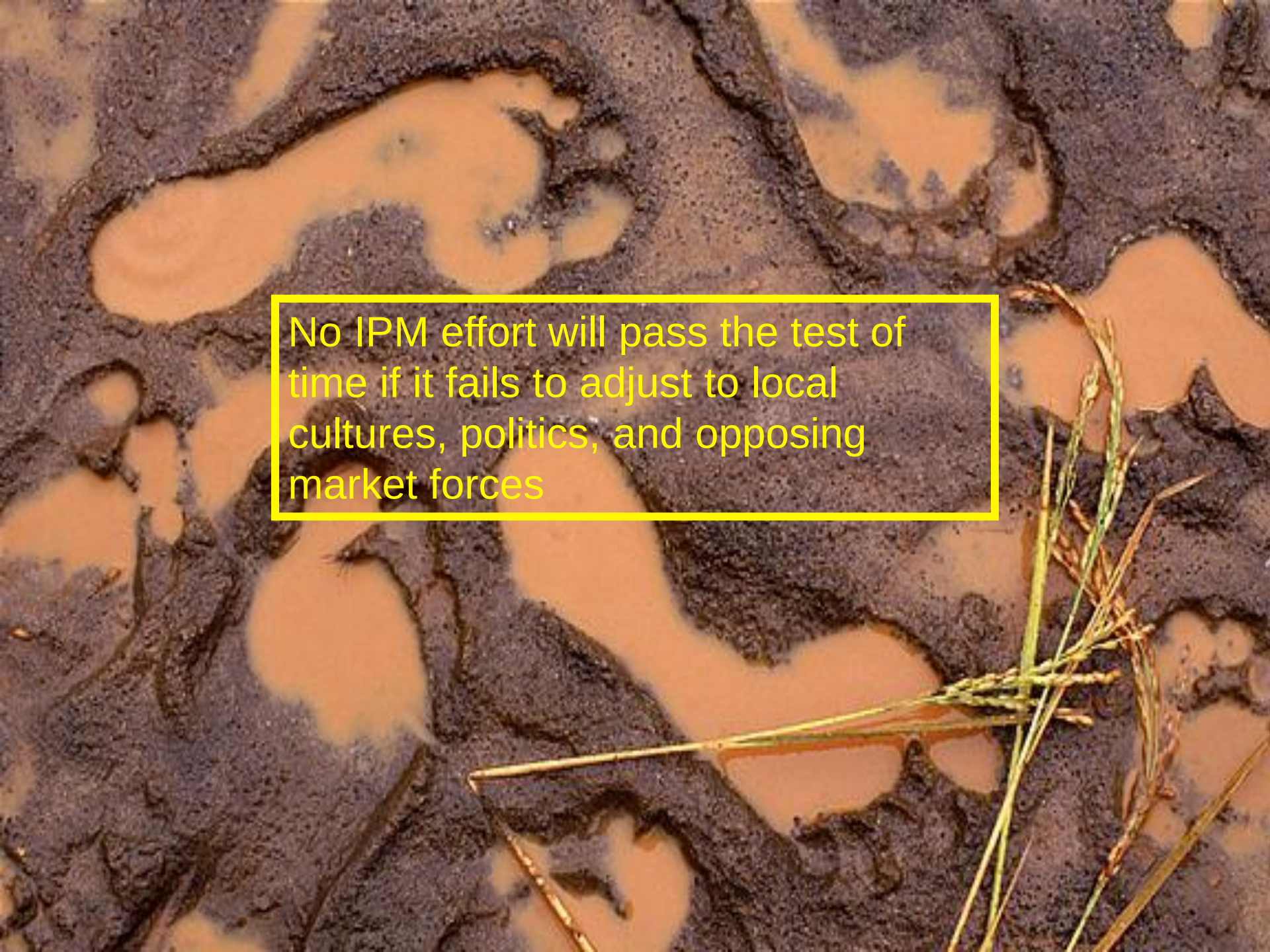
Metapopulation: genetically connected subpopulations that occupy spatially discrete areas

- One subpopulation may collapse from an area (due to predation, etc.)
- Other subpopulations will migrate remain to supply individuals to those areas



Academic gobbledygook?

Research on metapopulations needed to pinpoint specific triggers leading up to pest migration


No IPM effort will pass the test of time if it fails to adjust to local cultures, politics, and opposing market forces

Thank you!