

Ag Technologies for Climate Change: Innovation & Tech Transfer to Developing Countries

Travis J. Lybbert & Dan Sumner
Agricultural & Resource Economics, UC Davis

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Our Primary Focus

What policy and institutional changes are needed to encourage the innovation and diffusion of appropriate agricultural technologies?

Points of Departure

- Development and effective diffusion of technology will largely shape how and how well farmers mitigate and adapt to climate change
- Innovation needed in technologies, but also in institutions and policies
 - Multiple (nested) scales: Macro, meso, micro
 - Combination of global and local responses is required
- Distributional concerns hinge on heterogeneity at different scales
 - Agro-ecological zones and climate
 - Country-level development, institutions and policies
 - Infrastructure
 - Farm and farmer types

Outline & Focus of Presentation

1. Climate change & agriculture
2. A catalog of agricultural technologies
3. Innovation, transfer and access/use considerations
 - Intellectual property issues
 - Farmers' perspective on access / use
 - Distributional impacts derive from heterogeneity
4. Policy principles and priorities

A Look at the End...from the Beginning

Policy Principles

- Promote rural economic development
- Improve information flows, incentives, & flexibility
- Provide technology options & complements
- Appreciate local perspective & global inter-linkages
- Nurture trade linkages & integrated markets

Policy Priorities

Climate Change & Agriculture: A few points

- We will likely produce more food in 2080, but it may also be more expensive in real terms
 - Most of the poor, including farmers, are net food buyers
- Agriculture may collapse in some marginal areas, which may spark migration and regional tensions
- Local responses may fit changes in mean temperature and rainfall, but regional and global responses are required for volatility changes
- Despite these serious impacts, most poor countries will likely see dramatic improvements in living standards in the coming decades

A Quick Catalog of (Current) Technologies

- **New traits, varieties & crops**
 - Direct and indirect impacts on mitigation and adaptation
 - Ag biotech: 14.2M tons of CO₂ less in 2007 due to GM crops
- **Water management & irrigation**
- **Other production inputs**
 - E.g., biochar
- **Production management & practices**
 - Conservation agriculture
- **Post-harvest marketing & supply chains**
 - Efficient transportation
 - Reducing post-harvest losses as an effective productivity boost
- **Information & forecasts**
- **Insurance**
 - Innovations in index insurance

Index Insurance Innovations

- Index-based insurance can reduce administrative and moral hazard problems
- NDVI-based index insurance for livestock in Kenya
- Extreme rainfall / heat event index in West Bengal
- “Index Insurance Innovation Initiative” at UC Davis
USAID, OXFAM, FAO



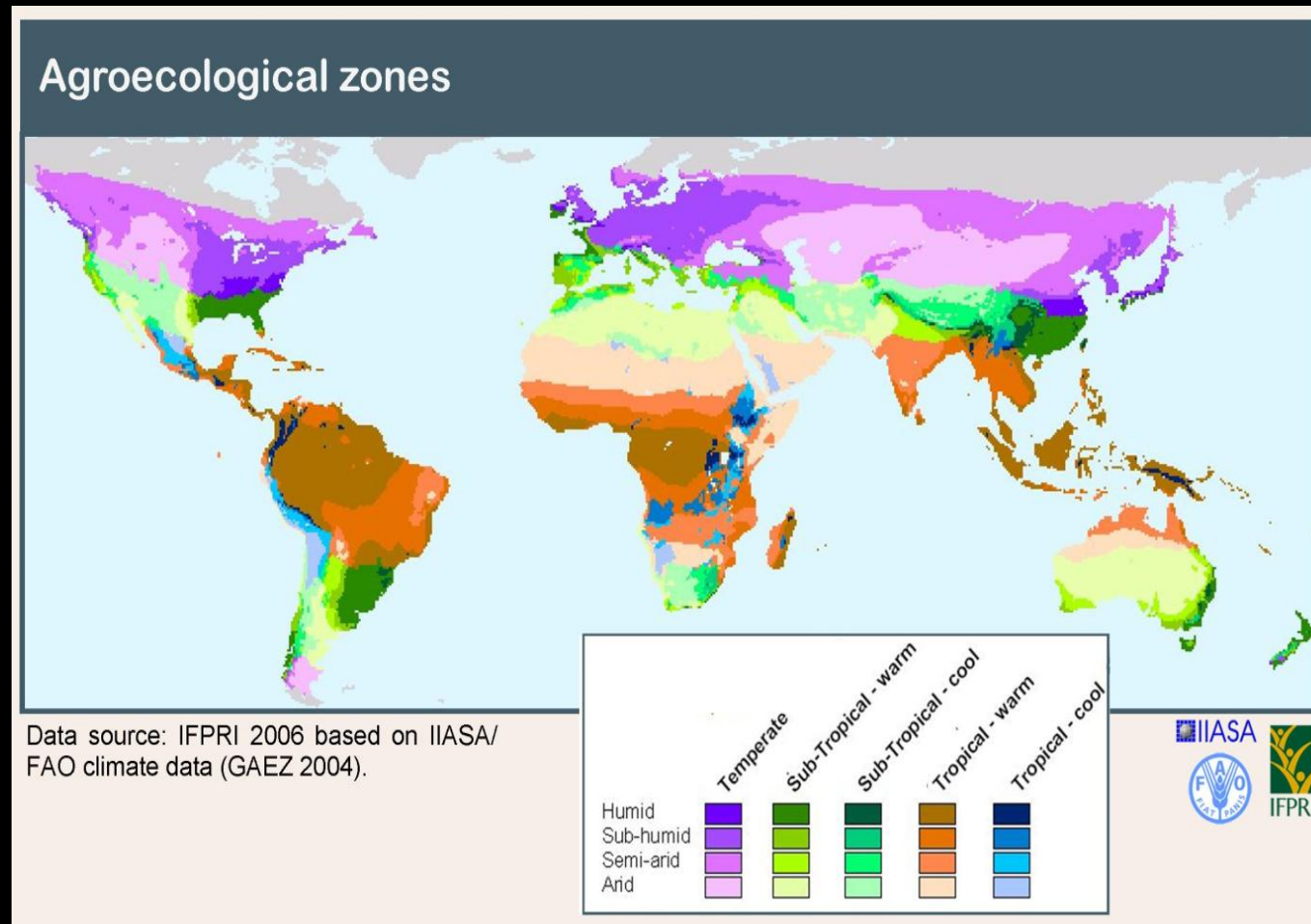
Innovation Considerations

- 95% of private ag R&D takes place in developed countries
- ~50% of public ag R&D is in developing countries
 - Strong in China, Brazil & India, but very weak in most of Africa
- CGIAR system is critical to developing country agriculture, but funds have fallen and NARS capacity often limited
 - Need healthy professional incentives and dynamic workplace to attract and retain cutting-edge scientists
- Competitive and dynamic private sector often needed to convey price signals and to provide incentives
- Water Efficient Maize for Africa (WEMA) Project
 - Monsanto, African Agricultural Technology Foundation, CIMMYT & NARS in Kenya, South Africa, Tanzania, Mozambique, Uganda



Technology Transfer Considerations

- Agro-ecological zones 'cut both ways'



IPRs & The Golden Rice Catalyst

- In 2000, Golden Rice was propelled into the ag biotech and globalization debates
- Later that year, a Freedom-to-Operate analysis identified 70+ patents and patent applications implicated in Golden Rice
- This sparked a wave of negotiations for Humanitarian Use licenses
 - Distance between profitable and humanitarian markets
 - Royalty free access for farmers earning <\$10,000
 - IP stewardship matters more than royalties
- The African Agricultural Technology Foundation (AATF) and Public Intellectual Property Resource for Agriculture (PIPRA) emerged in the wake of these negotiations
 - Public-private partnerships
 - Public IP in agriculture & public domain tools
 - “IP Handbook” online



IP Constraints Going Forward

- How will next wave of agricultural technologies differ?
- Space for HU negotiation may shrink
 - ‘Plug-and-play’ traits with complementary capacity and other less agronomic technologies may relax agro-ecological constraints to transfer, but raise IP constraints
 - Continued economic development will turn some of today’s poor farmers into promising markets for patented, royalty-bearing technologies
- IPRs (patents, PVP and copyright) will continue to play a role, but they are one of many other constraints
 - New traits, varieties & crops
 - Water management & irrigation
 - Other production inputs
 - Production management & practices
 - Post-harvest marketing & supply chains
 - Information & forecasts
 - Insurance

Access & Use Considerations

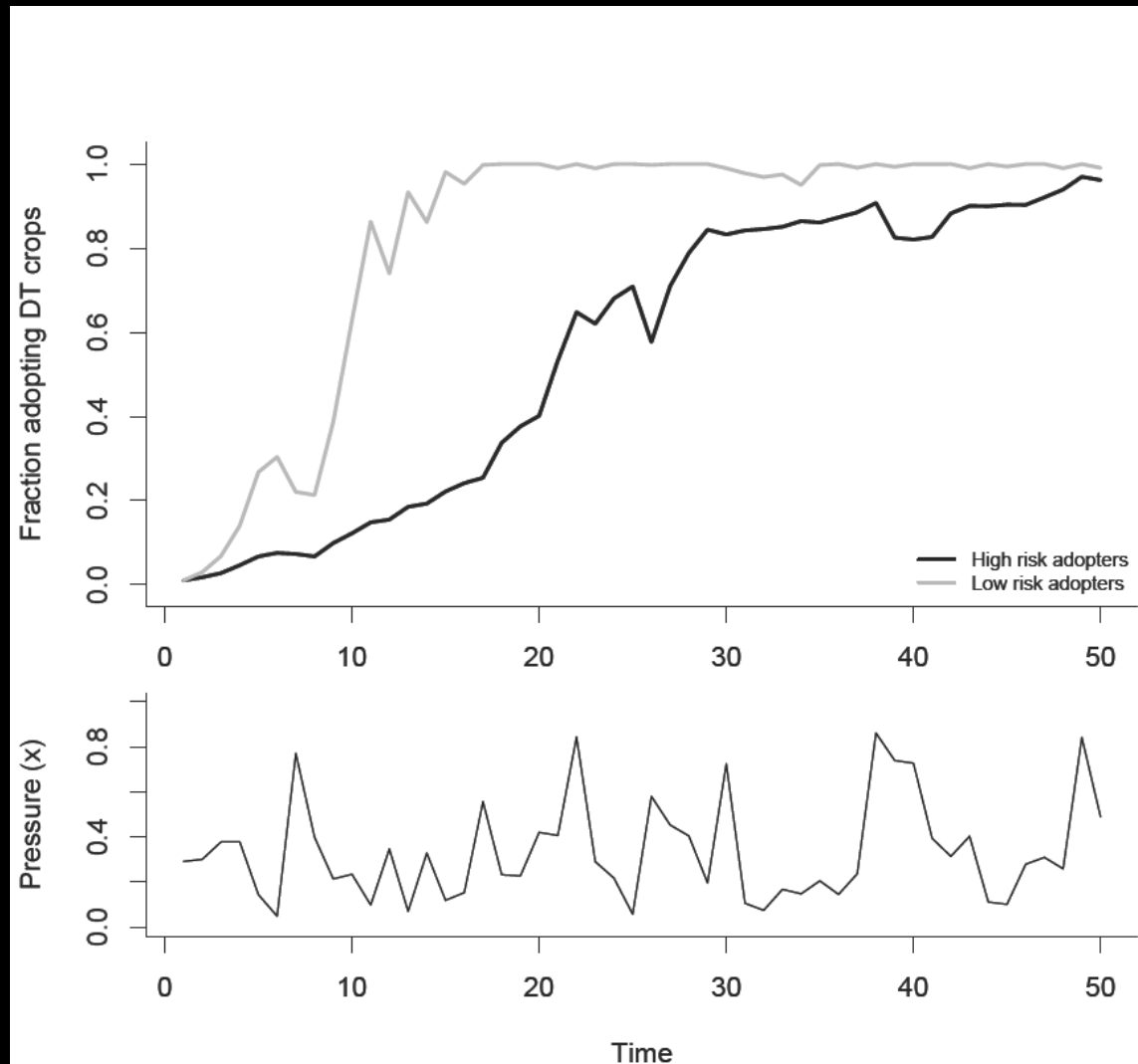
- What does mitigation and adaptation look like from the perspective of African farmers? Landless laborers?
- Input & output markets
- Information and price signals
- Physical and financial infrastructure
- Mixed crop–livestock systems
Implications for conservation agriculture?



Access & Use: Learning Stochastic Benefits

Is drought tolerance a pro-poor trait?
If we build it, will they come?

Drought tolerance can be difficult to appreciate...especially for poor, marginal farmers



Our Full Set of Principles & Priorities

Policy Principles

- Improve information flows, incentives, & flexibility
- Promote rural economic development
- Provide technology options & complements
- Appreciate local perspective & global inter-linkages
- Nurture trade linkages & integrated markets

Policy Priorities

- Ag R&D in developed countries
- Research capacity in developing countries
- Ag biotechnology
- 'Flexible' IPRs & partnerships
- Market integration & infrastructure
- Competitive, dynamic ag markets

Concluding Thoughts

- Twin imperatives of climate change for agricultural development: greater complexity and greater urgency
- Policies and institutions will critically shape how and how well poor farmers mitigate and adapt to climate change
 - Especially in developing countries
 - Not all hard hit poor countries will look the same
- “Build it and they will come” approach is not good enough
 - Need to empower farmers to search for solutions
 - This requires incentives, information and price signals