

# Modeling Socio-Ecological Systems: Connecting the Physical Environment and People in KBS LTER

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KBS LTER ASM—September 16, 2016

# Connecting People and Place

- Objective environmental conditions and subjective human values
- Society-environment reciprocity
- How does the physical environment shape people's connection with the environment?
  - Life chances, thoughts, views, actions
- To fully explore these questions, we need to make these complex connections more explicit via conceptual frameworks and empirical models.

# Connecting People and Place

- Data integration
- Understanding spatial and temporal variability
  - Comparatively across nations and over time
  - Importance of scale
- The way forward:
  - Developing multi-item latent constructs using SEM to improve our understanding of human decision-making.
  - Linking people's views (latent constructs) with the physical environment to better understand its contextual embeddedness using MSEM.

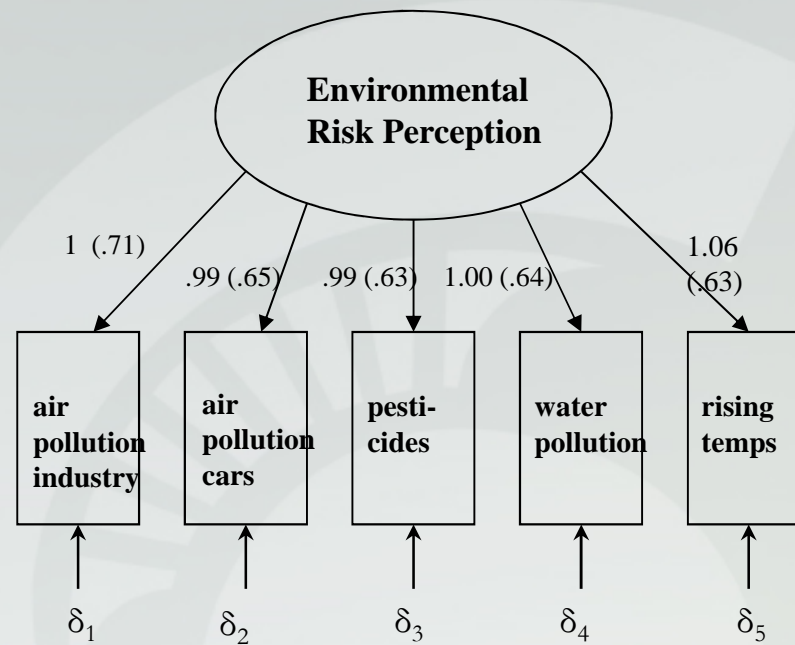
# Climate conditions and climate change views

- How do climate conditions shape views of climate change's perceived seriousness and timing?
- Direct effects, indirect/interactive effects?
- Data: Gallup 2001-2012 & NOAA Climate Extremes Index
- Annual & seasonal measures
- Main Findings:
  - political orientation has most important effect on both seriousness and timing
  - climatic conditions do not affect perceptions of CC timing
  - climatic conditions have negligible effects on perceived seriousness

Marquart-Pyatt et al. 2014. "Politics Eclipses Climate Extremes for Climate Change Perceptions." *Global Environmental Change* 29:246-257.

# Emissions and Risk Perception

- How do GHG emissions shape environmental risk perceptions?
- Direct effects, indirect/interactive effects?
- International Social Survey Program (ISSP) Environment Data from 2010 (n=29)
- Country-level data from the World Bank, etc.
- Multilevel SEM
- 21% of the variability in risk perception is between countries



Chi-Square: 509.9,  $p < .001$  CFI & IFI: 0.99 AGFI: 0.98 RMSEA: .06  
(N=40448)

Note: Factor loadings are presented as unstandardized values for the model pooled (standardized in parenthesis).

**Figure XX: Measurement Model of Environmental Risk Perception**

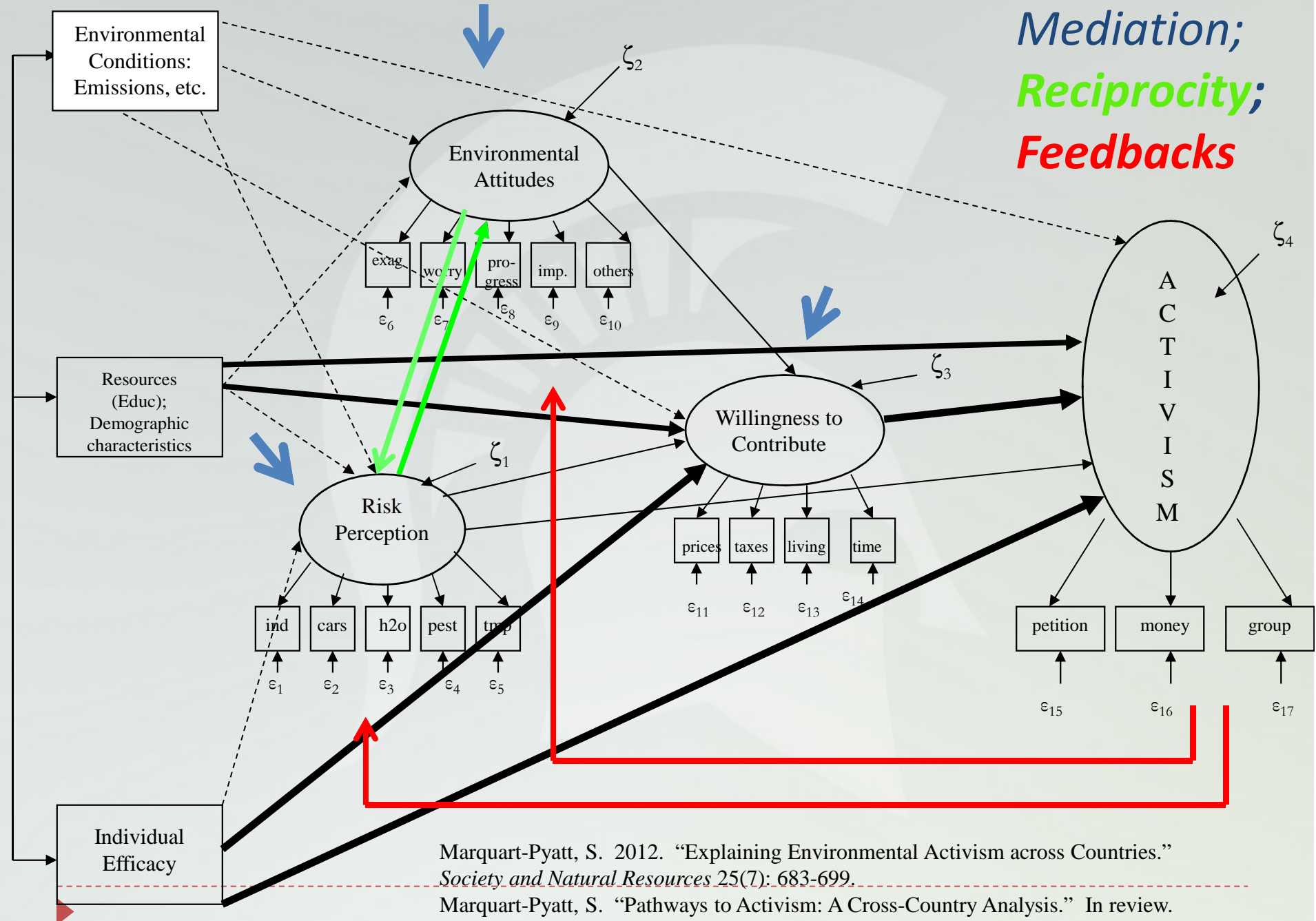
# Emissions and Risk Perception

- Used 4 measures of GHG
- Nitrogen emissions & sulfur emissions affect risk perceptions
- No effects for measures of environment policy and institutional structures
- Findings contribute to an improved understanding of country (i.e. place/spatial variability)
- Importance of nesting/contextual embeddedness

Marquart-Pyatt . 2016. "Emissions and Environmental Risk Perception: A Multilevel Study" *working ms*

# REVISED Path Model of Environmental Activism

*Mediation;*  
*Reciprocity;*  
*Feedbacks*



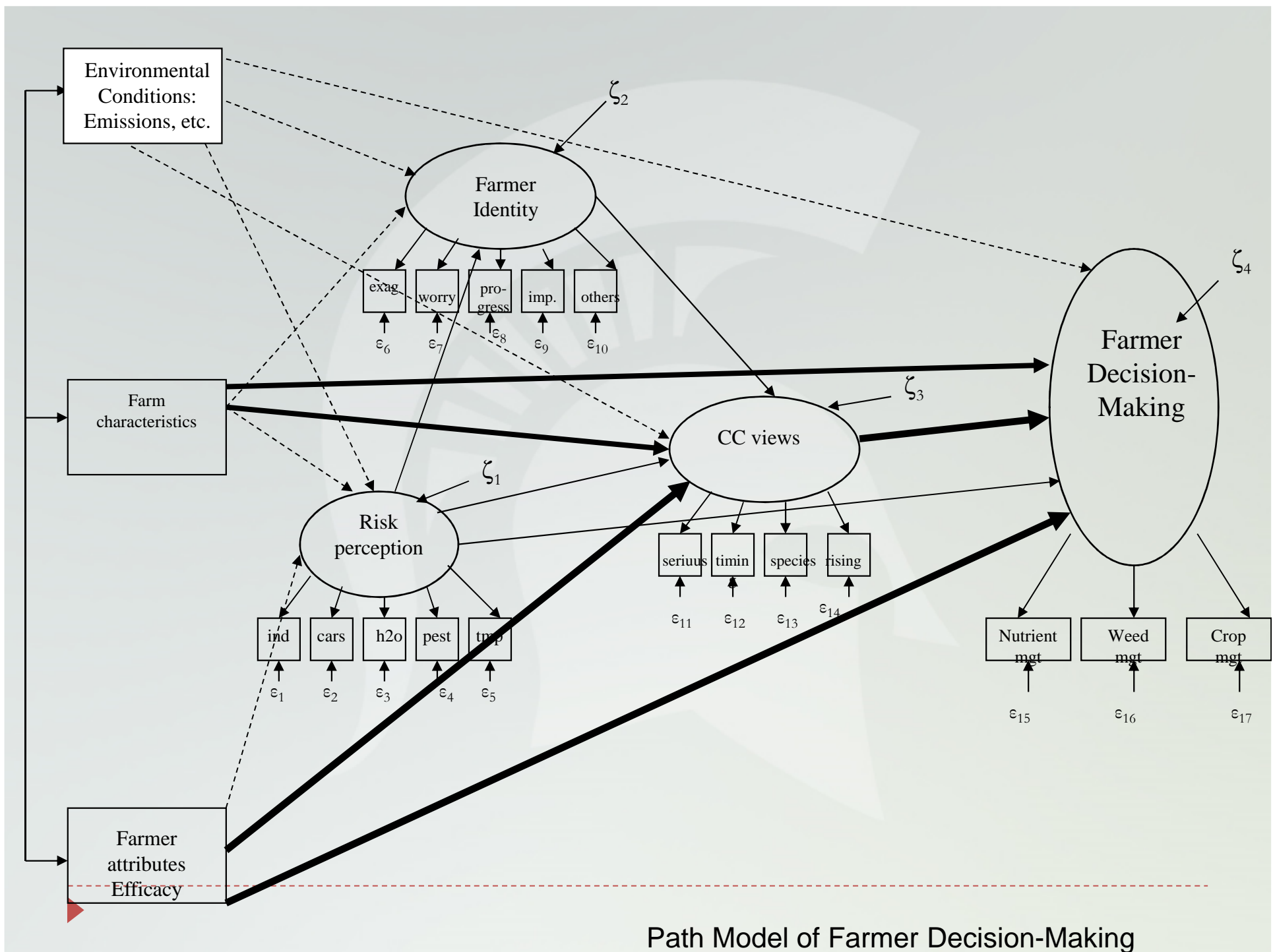
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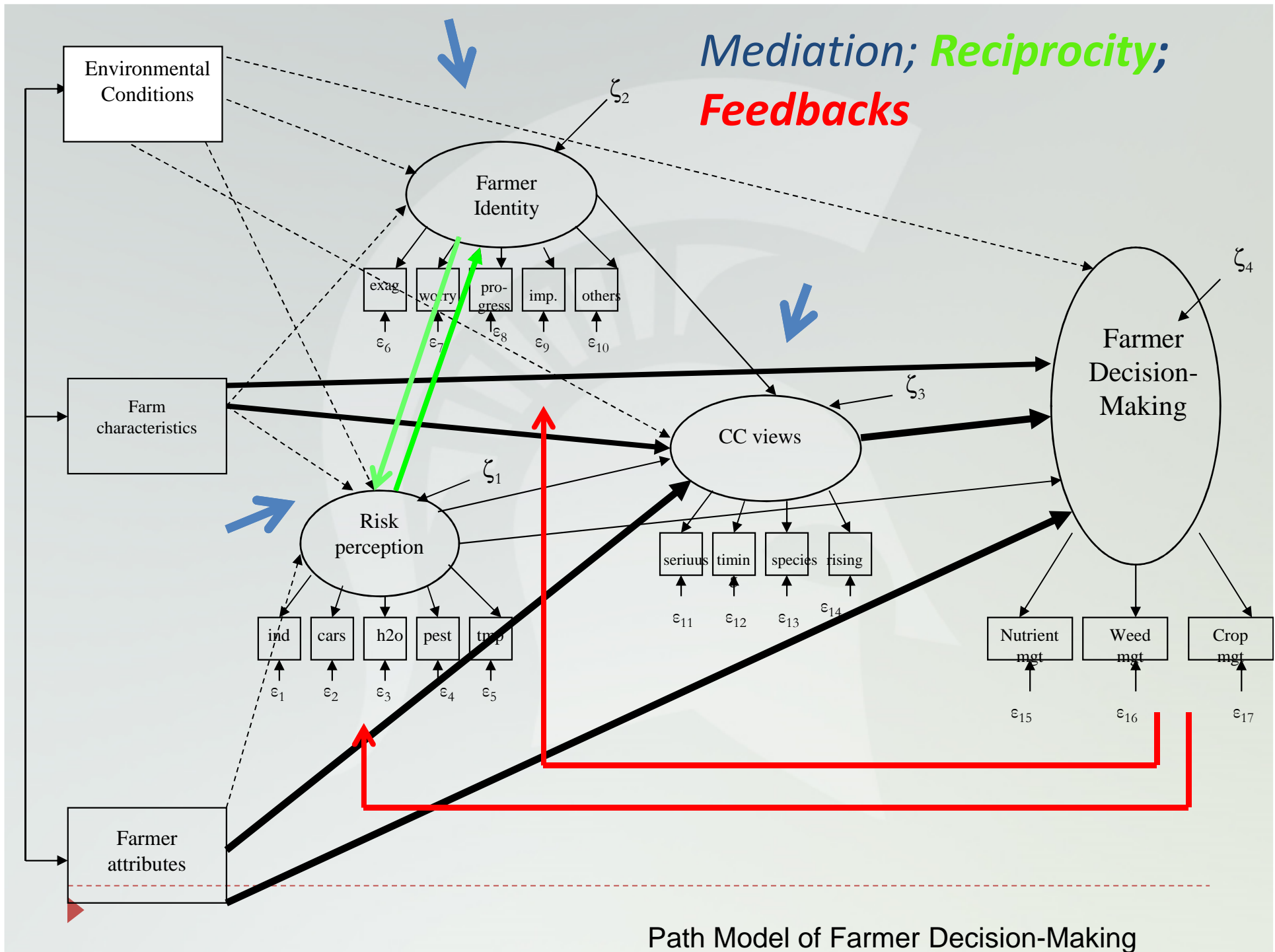


# Relevance for KBS LTER

- Spatial and temporal variability
- Contextual embeddedness
- Granularity
  - from regions to fields
  - from macro to micro
  - connecting ecological and social
- SEM is a framework for path models, includes direct and indirect effects, reciprocal relations and feedback loops



*Mediation; Reciprocity;*  
*Feedbacks*



Path Model of Farmer Decision-Making

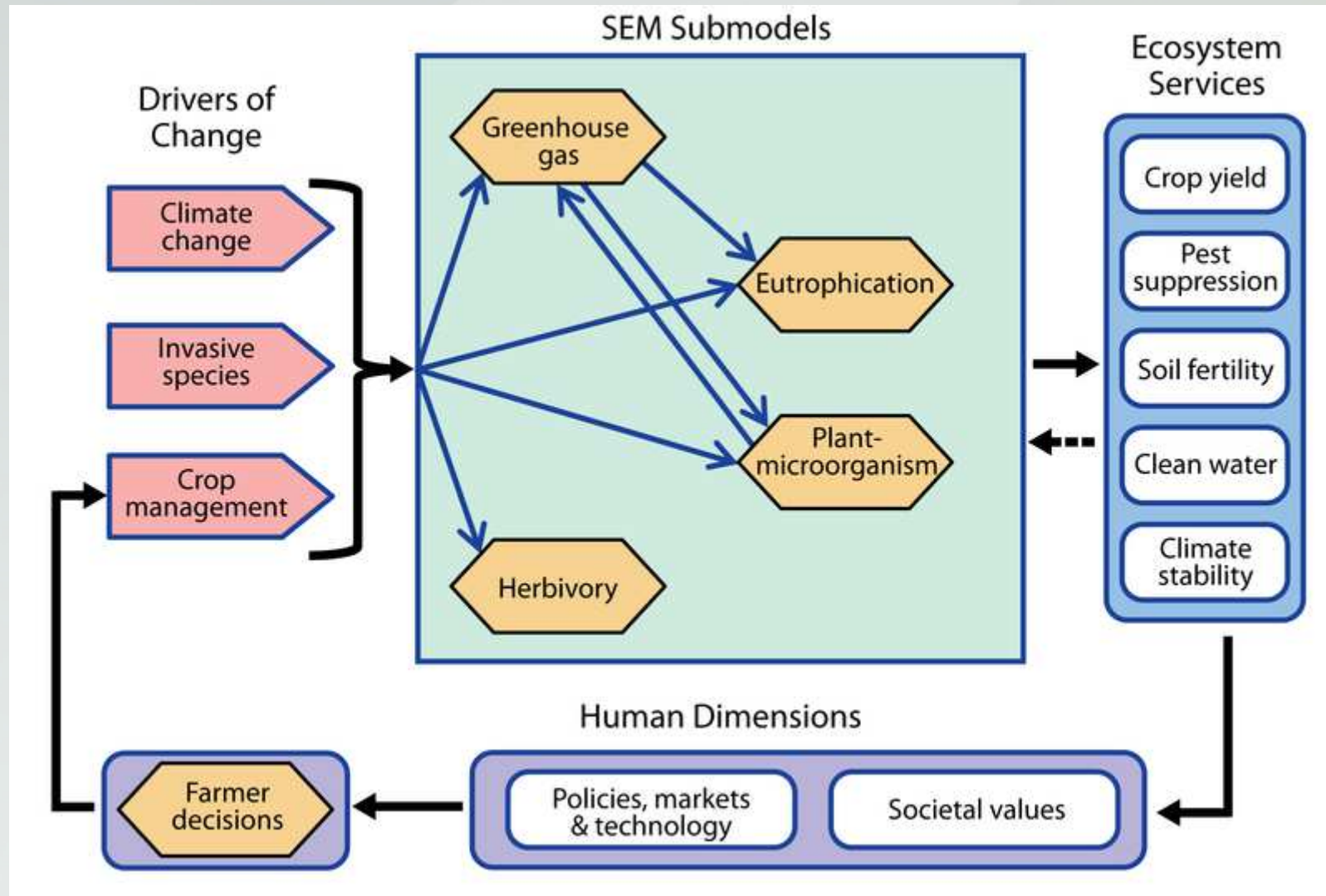
# Main Take-Aways

- Data integration
- Benefits and pitfalls of modeling approaches
- SEM is a statistical modeling approach.
- Visual depictions of complex hypotheses and indirect effects, reciprocal relations, & feedback loops
- Long-term, iterative hypothesis testing, with shorter term insights revealing data gaps & research needs.
- Attention to model (and modeling) assumptions that address complexity in ecological systems and in connecting them with human decision-making.

# The Road Ahead: What We Need to Know

- Move from preliminary models to identifying patterns
  - across space and over time
- Seasonal variability
  - extreme weather events: heavy rainfall
- More connections between ecological & social data; embeddedness
- How do we understand the connections between ecological processes?
- How do they affect farmer decision-making?
- How do human actions affect the physical environment?

# Modeling in the KBS LTER



Thank you!  
Comments, questions?

*Sandy Marquart-Pyatt*

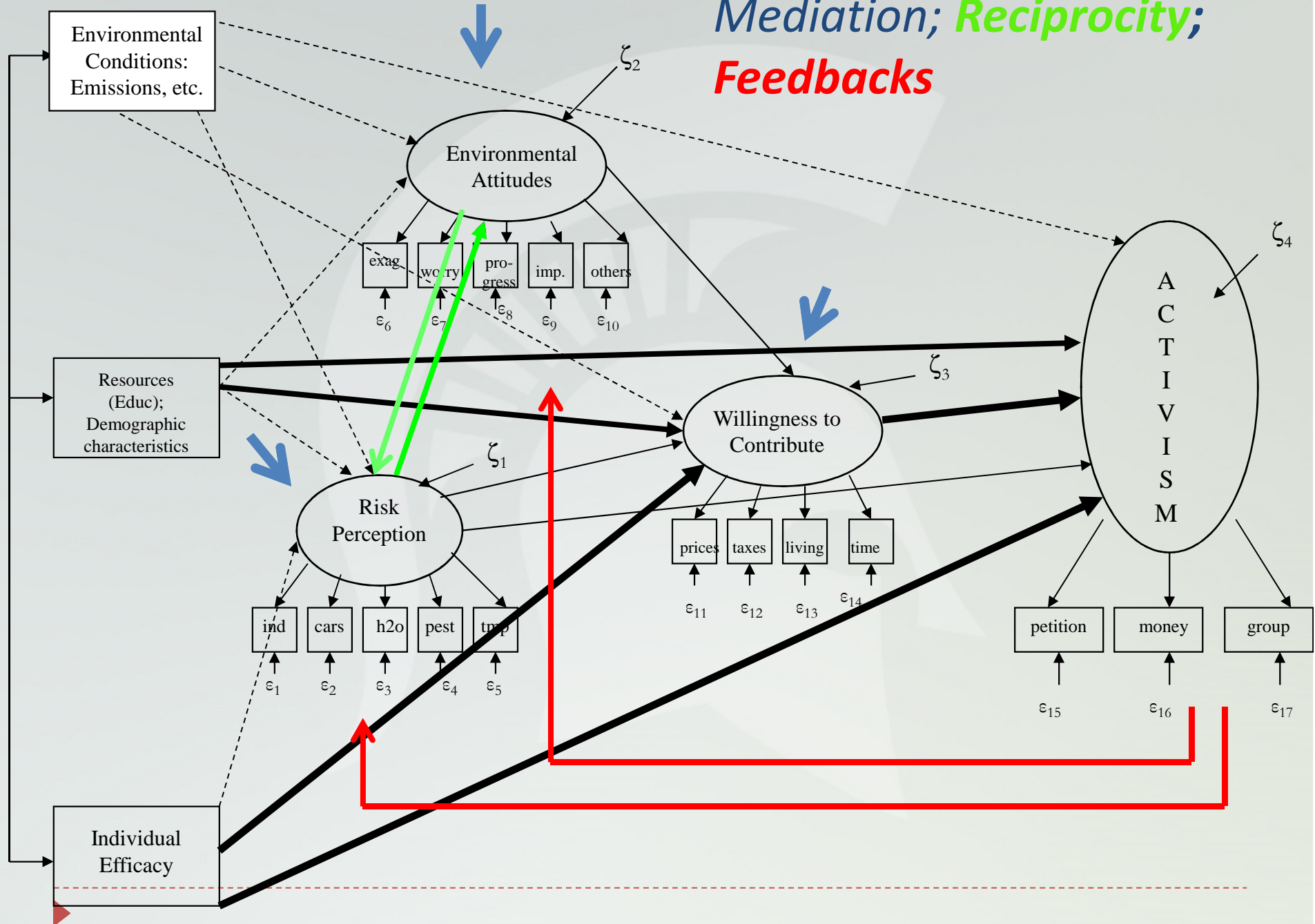
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*Mediation; Reciprocity;*  
*Feedbacks*



*REVISED* Path Model of Environmental Activism

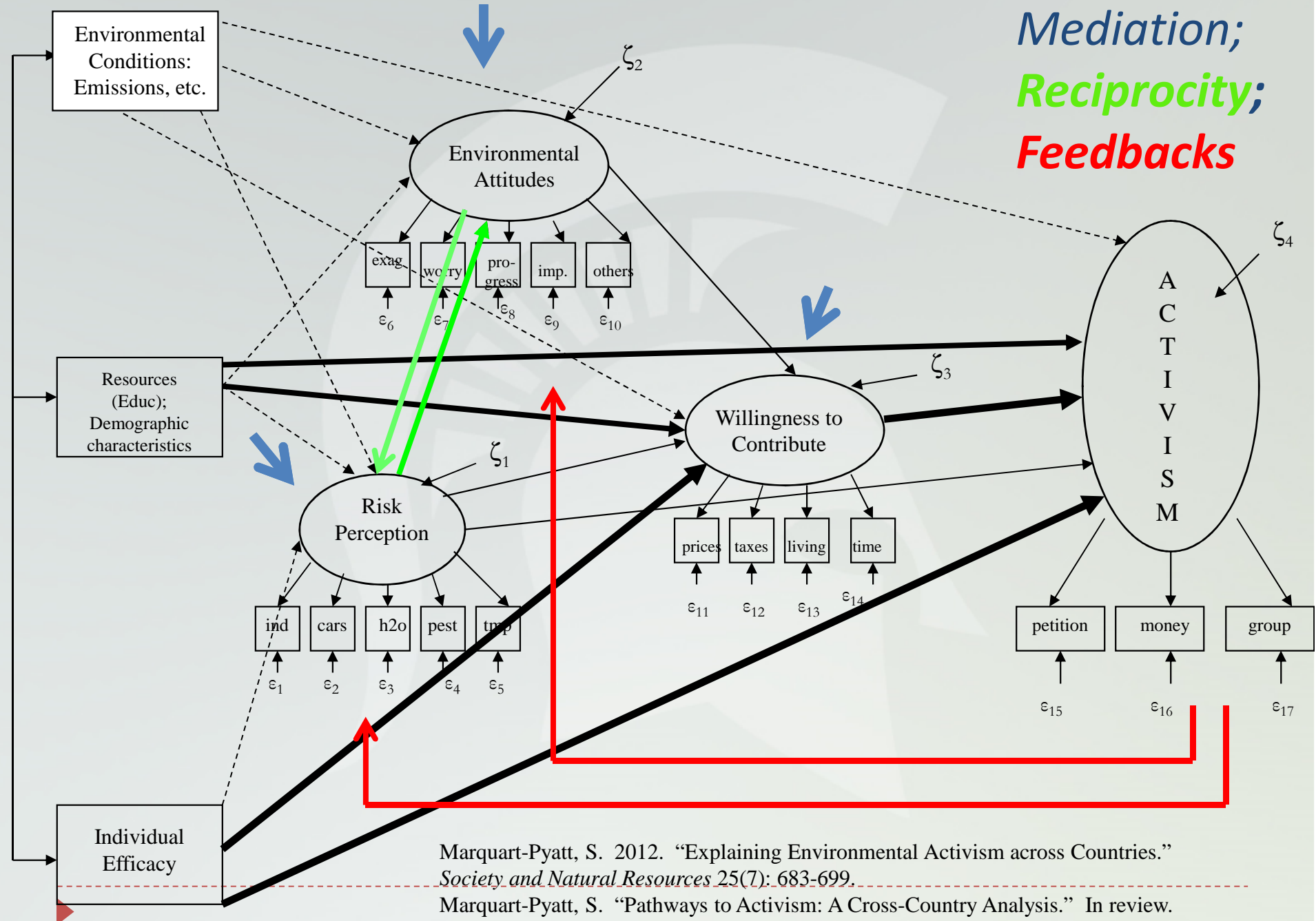


# Environmental Activism Over Time & Place

- ISSP data from 1993, 2000, & 2010
- Sample sizes of about 1,000 cases for between 22 and 37 countries
- Model building, validation, evaluation, verification
- SEM to account for complexity
- Path model of activism: direct and indirect effects, reciprocal relations, latent constructs

# REVISED Path Model of Environmental Activism

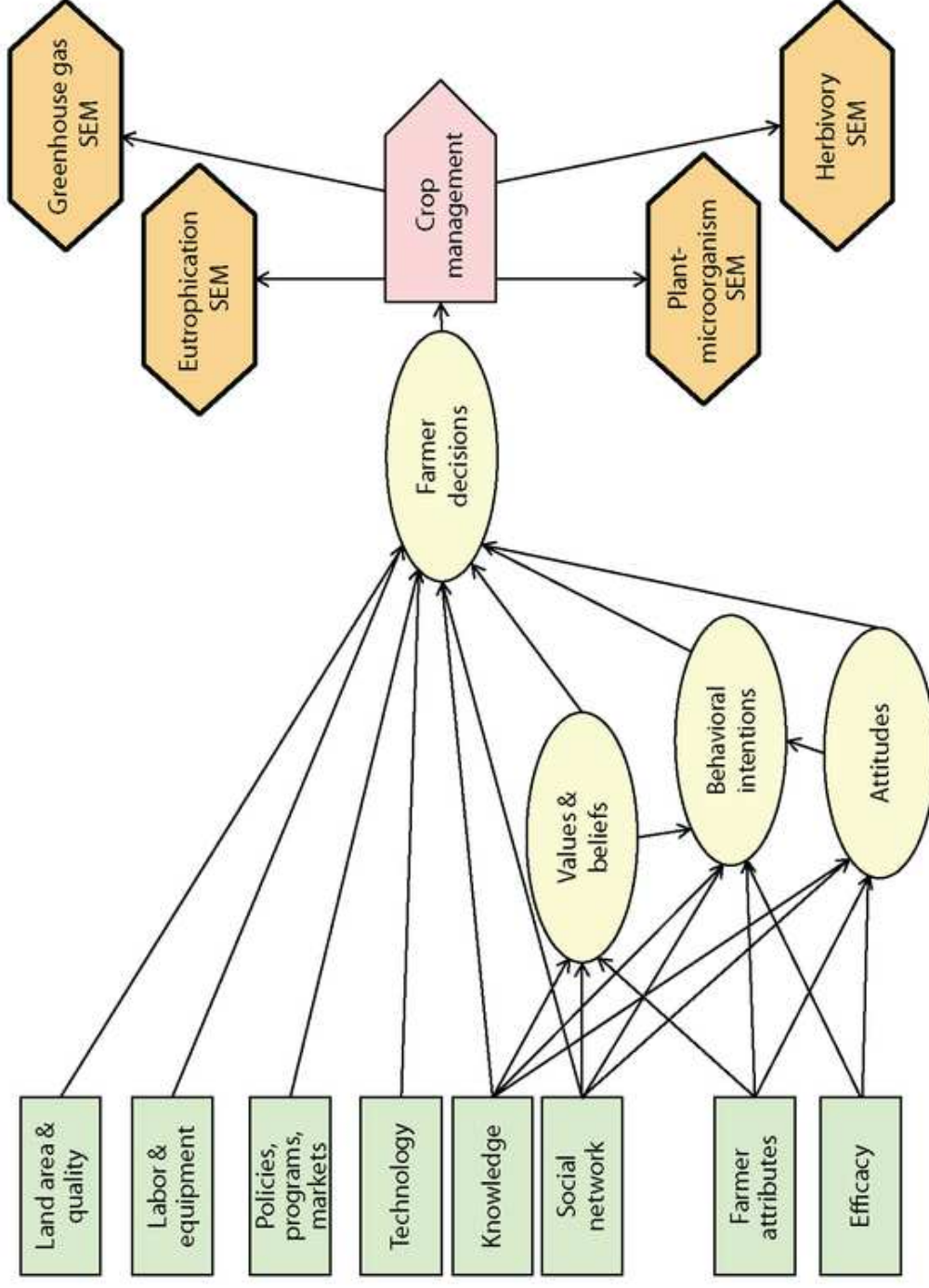
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## Farmer Decision-making Metamodel



# GHG and N Leaching Metamodel

