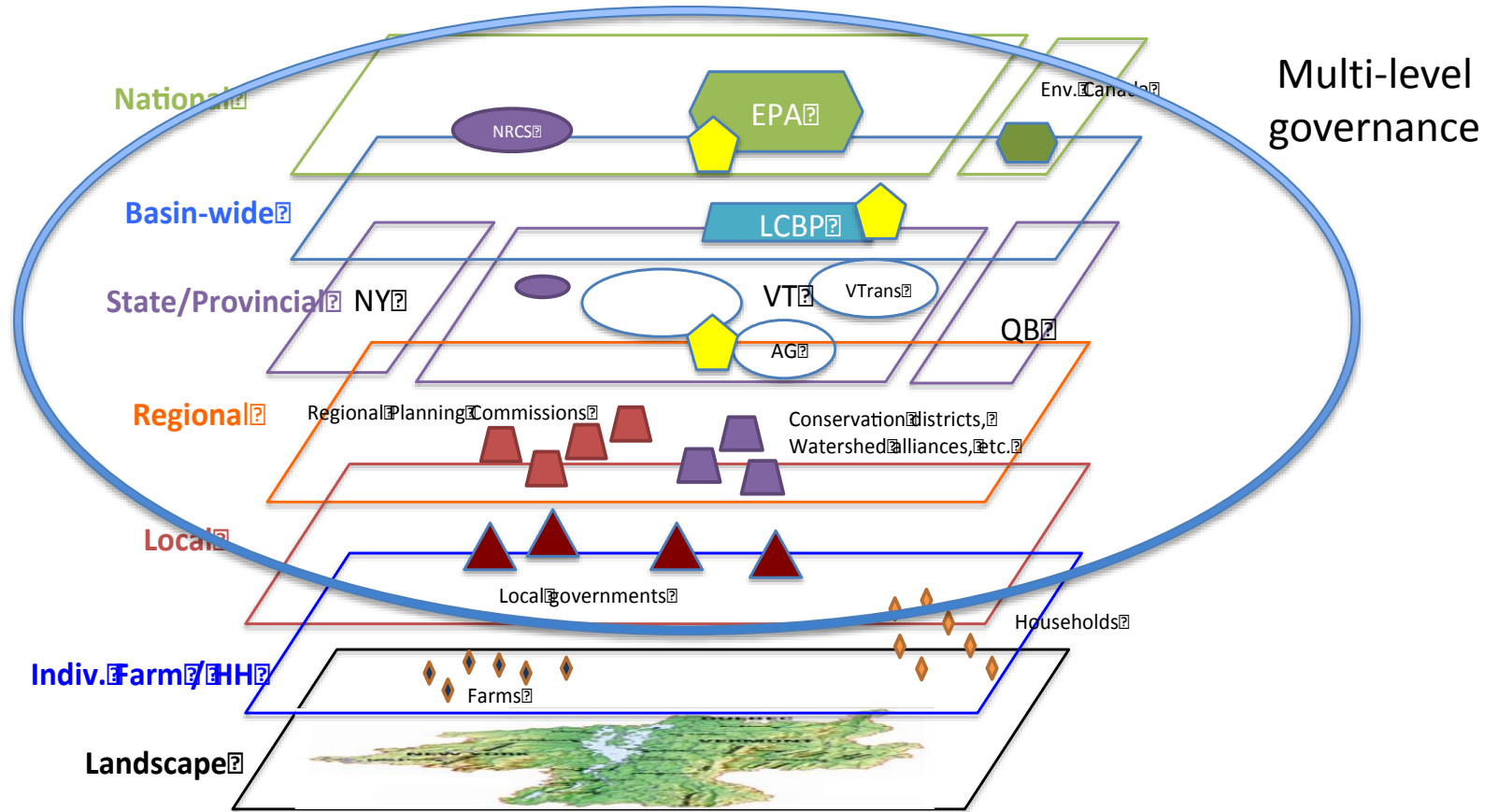


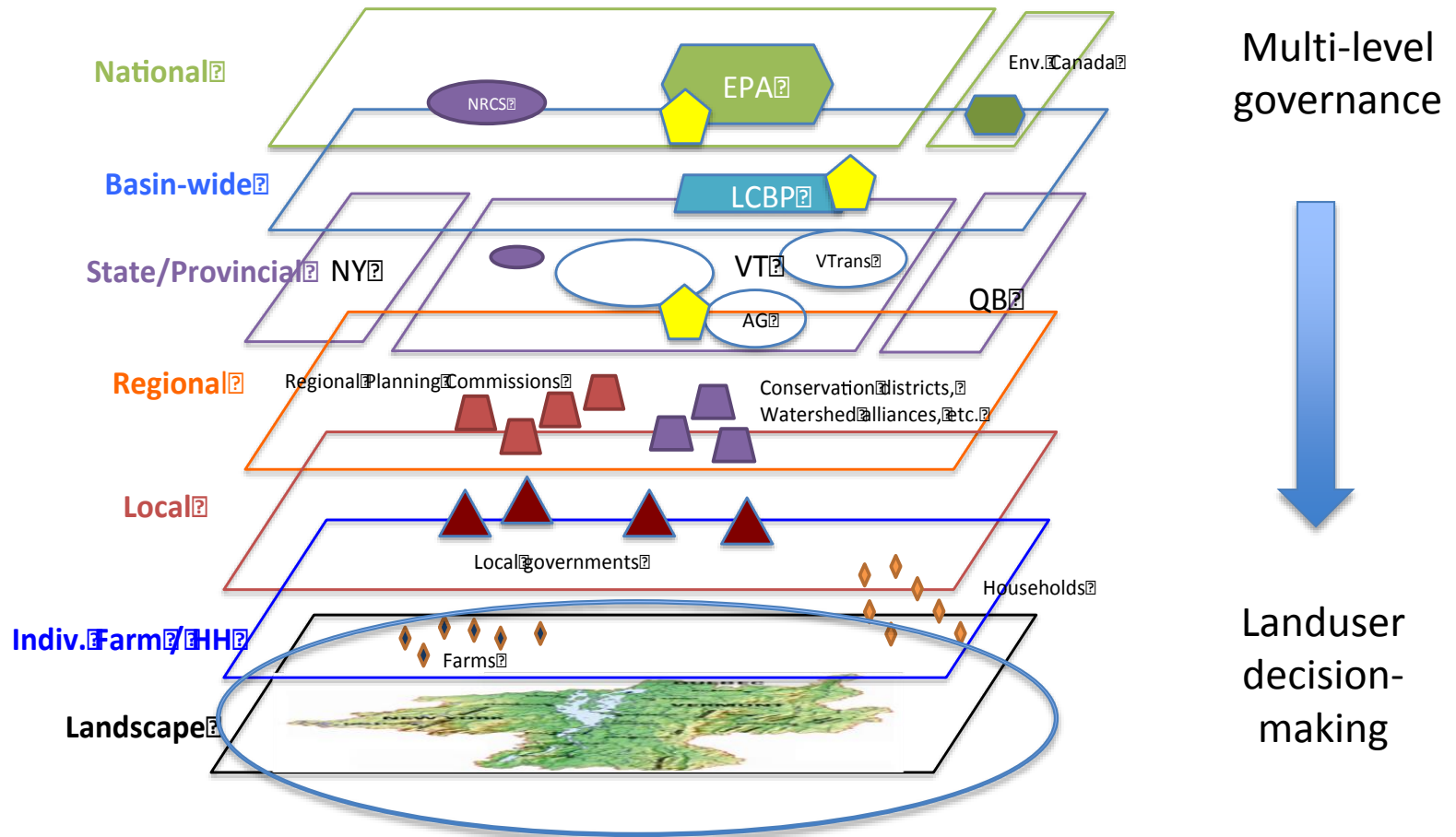
Modeling the Relationship between Governance Networks and Land Use Decisions in the Northeastern Segment of the Lake Champlain Basin

Christopher Koliba, Asim Zia, Steve Scheinert, Scott Merrill
University of Vermont

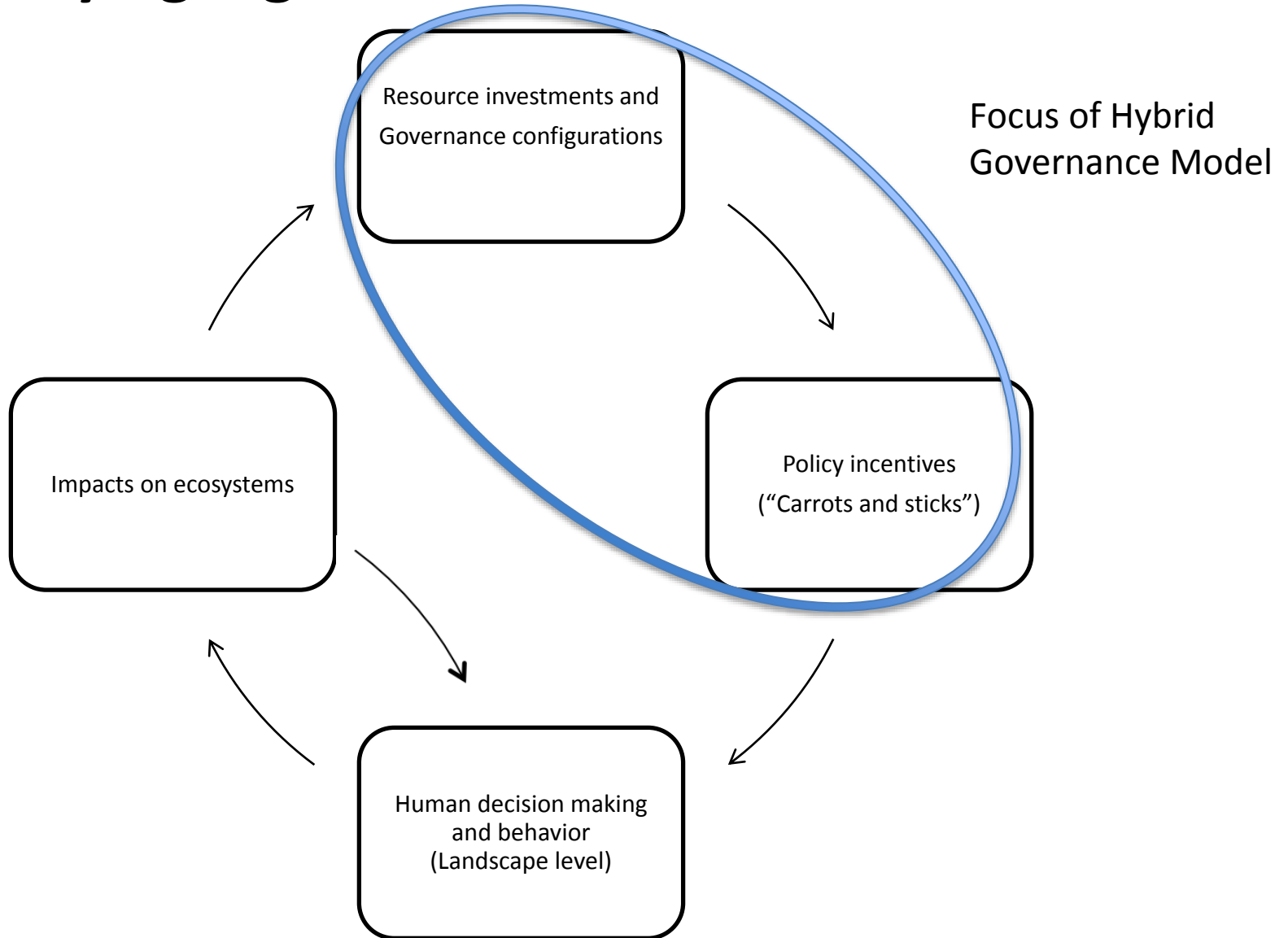
The Social Ecological System Being Modeled



The Social Ecological System Being Modeled



Underlying logic of our SES Model



Critical Policy & Governance Questions:

How much money do we need?

Where should it be directed?

How can it be spent wisely and efficiently?

How will interventions be politically feasible?

E.g.: Funding, capacity and will?

Selected characteristics of nodes empirically observed:

- **Jurisdiction**

- Watershed
 - State
 - County
 - Municipal

- **Policy Domain**

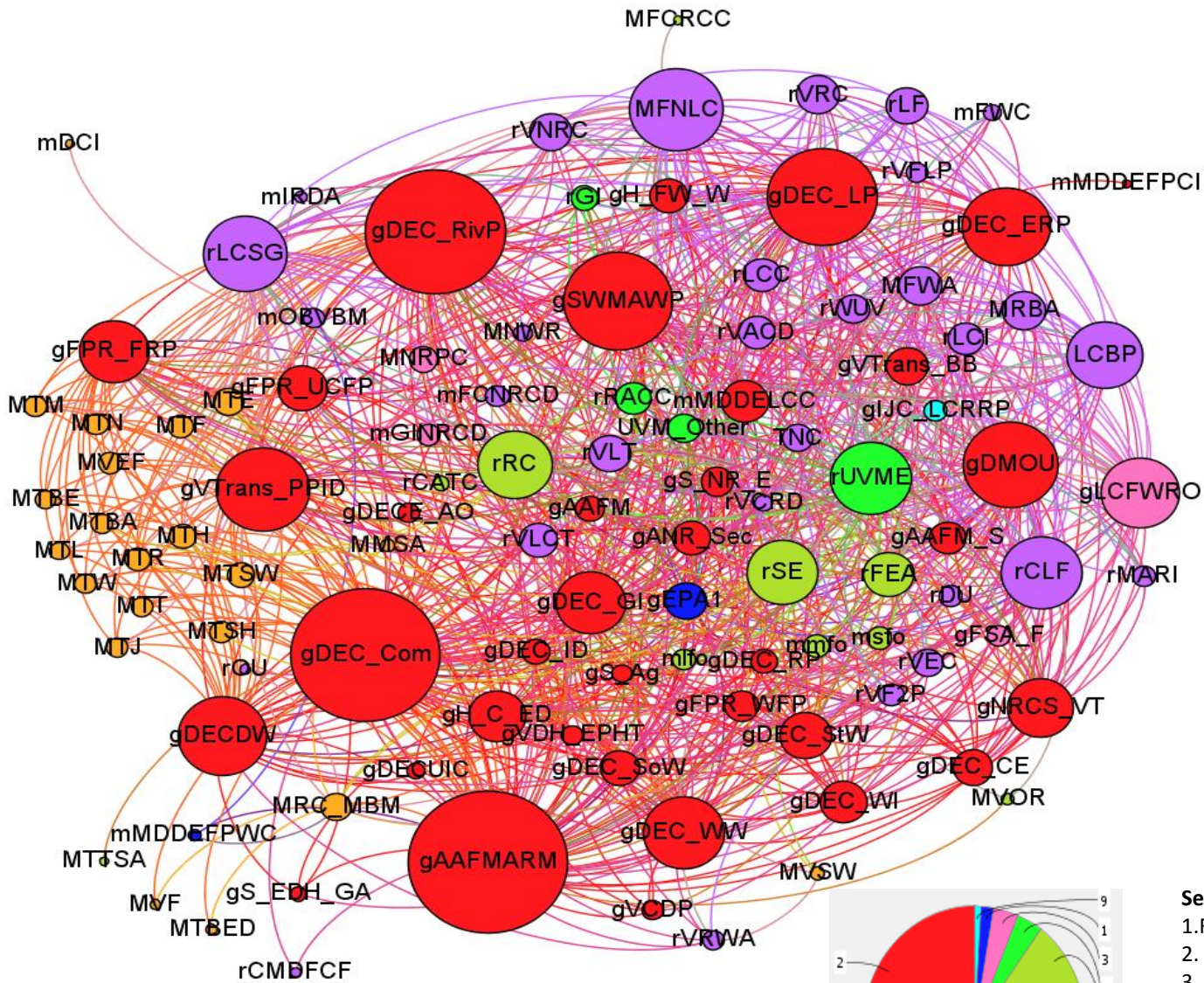
- Storm water
 - Wastewater
 - Agriculture
 - Development
 - River corridor
 - Forestry

- **Policy Tool** (Salamon, 2002)

- Grants
 - Contracts
 - Cost share
 - Permits
 - Easements
 - Technical assistance

- **Action Arena** (Ostrom, 1990)

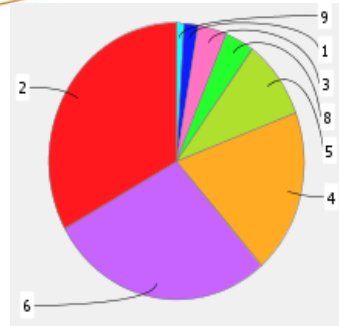
- Tactical Basin Plan
 - Regional Plan
 - TMDL
 - Agriculture technical assistance



MRK

2014 Water Quality Network for Missisquoi Watershed

Scheinert et al., 2014;
Produced using Gephi



Sector Label Key:

1. Federal Governing Actors
2. State/Provincial Governing Actors
3. Regional/Geo-governing Actors
4. Local/Municipal Governing Actors
5. Private (For-Profit) Enterprise
6. Non-Governmental and Non-Profit Org.
7. Citizen Actors
8. Research Actors
9. International Governing Actors

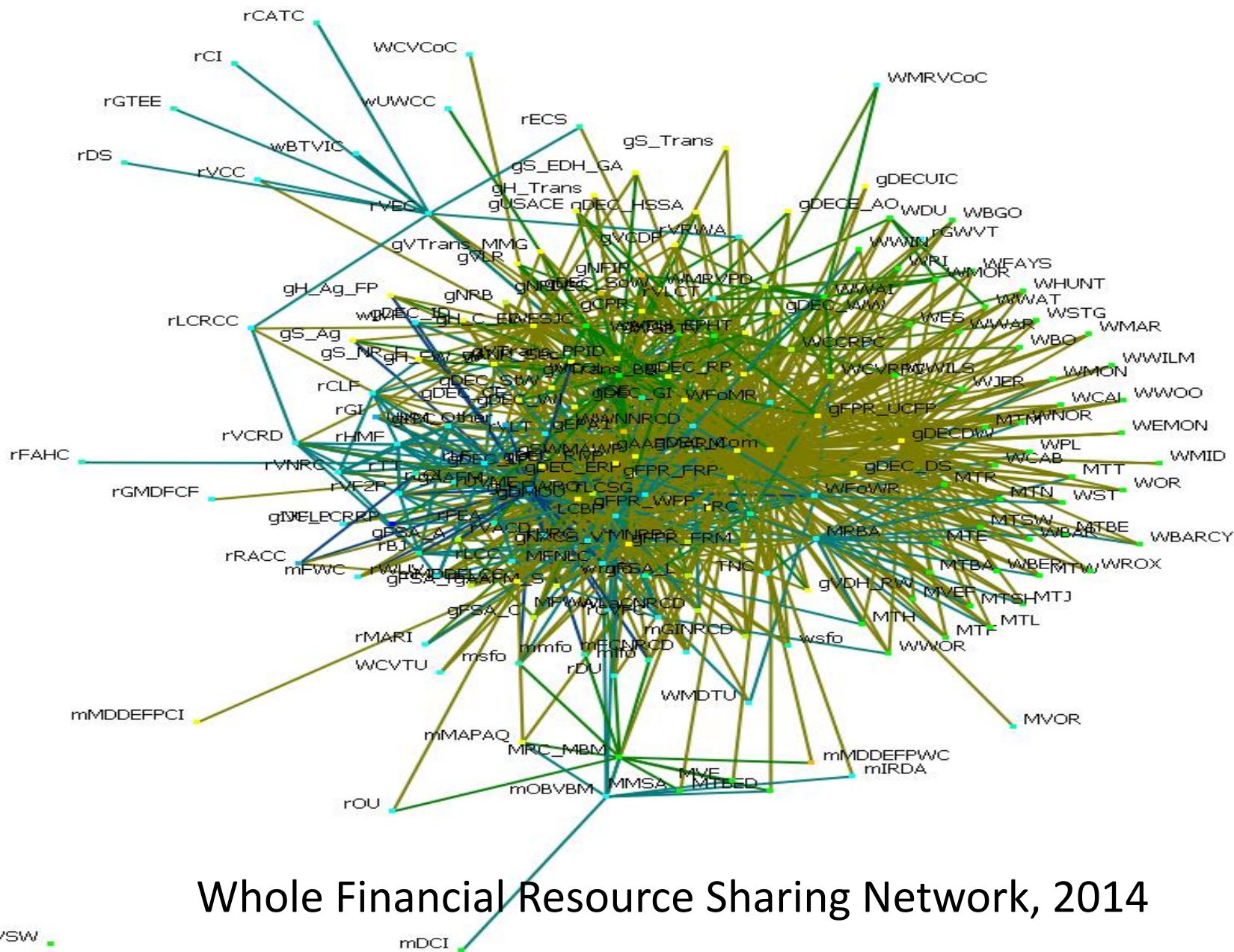
Where does money for water quality mitigation come from?



Jurisdiction	Agency	Department	Program
Vermont	AAFM	ARM	Agrichemical Management
Vermont	AAFM	ARM	ARM Enforcement
Vermont	AAFM	ARM	Engineering
Vermont	AAFM	ARM	Laboratory
Vermont	AAFM	ARM	Plant Industry
Vermont	AAFM	ARM	Water Quality
Vermont	ANR	DEC	Compliance & Enforcement
Vermont	ANR	DEC	Enforcement Services
Vermont	ANR	DEC	Connecticut Valley Flood Control Compact
Vermont	ANR	DEC	Public Drinking Water Engineering and Financial Services
Vermont	ANR	DEC	Public Drinking Water Operations/Compliance/ Planning
Vermont	ANR	DEC	Indirect Discharge
Vermont	ANR	DEC	Underground Injection Control
Vermont	ANR	DEC	Regional Permits
Vermont	ANR	DEC	Permit and Compliance Assistance
Vermont	ANR	DEC	Pollution Prevention
Vermont	ANR	DEC	Laboratory Services
Vermont	ANR	DEC	ANR Engineering Services
Vermont	ANR	DEC	Pollution Control Projects Implementation
Vermont	ANR	DEC	Water System Project Implementation
Vermont	ANR	DEC	Dam Safety
Vermont	ANR	DEC	Vermont Geological Survey
Vermont	ANR	DEC	Hazardous Waste
Vermont	ANR	DEC	Sites Management
Vermont	ANR	DEC	Hazardous Sites Settlement Accounts
Vermont	ANR	DEC	Solid Waste
Vermont	ANR	DEC	Hazardous Material Spills Response
Vermont	ANR	DEC	Underground Storage Tanks
Vermont	ANR	DEC	VT Agricultural Environmental Management (AEM) Program
Vermont	ANR	DEC	Public Water System Resource Management
Vermont	ANR	DEC	Lakes and Ponds
Vermont	ANR	DEC	Surface Water Monitoring, Assessment & Watershed Planning
Vermont	ANR	DEC	Riparian Corridor
Vermont	ANR	DEC	Stormwater
Vermont	ANR	DEC	Direct Discharge
Vermont	ANR	DEC	Residuals
Vermont	ANR	DEC	Wetlands
Vermont	ANR	Fish & Wildlife	Fisheries
Vermont	ANR	Fish & Wildlife	Law Enforcement
Vermont	ANR	Fish & Wildlife	Outreach
Vermont	ANR	Fish & Wildlife	Wildlife
Vermont	ANR	FPR	Administration

Jurisdiction	Agency	Department	Program
Vermont	ANR	FPR	Forest Product Utilization and Marketing
Vermont	ANR	FPR	Private Forest Land Management
Vermont	ANR	FPR	State Forest Land Management
Vermont	ANR	FPR	Forest Resource Protection
Vermont	ANR	FPR	Urban and Community Forestry
Vermont	ANR	FPR	Lands Administration
Vermont	ANR	FPR	State Park Operations
Vermont	ANR	FPR	Forest Highway Maintenance
Vermont	VTrans	Program Development	Better Backroads
Vermont	VTrans	Environmental	Municipal Mitigation Grants
Vermont	NRB	N/A	Land Use Panel
Vermont	NRB	N/A	Water Resources Panel
Federal	USDA	Farm Service Agency	Conservation Reserve Enhancement Program (CREP)
Federal	USDA	Farm Service Agency	Conservation Reserve Program (CRP)
Federal	USDA	NRCS	Farm and Ranch Lands Protection Program (FRPP)
Federal	USDA	NRCS	Agricultural Management Assistance (AMA)
Federal	USDA	NRCS	Environmental Quality Incentive Program (EQIP)
Federal	USDA	NRCS	Wildlife Habitat Incentives Program (WHIP)
Federal	USDA	NRCS	Conservation Technical Assistance (CTA)
Federal	EPA	Office of Wastewater Management	National Pollutant Discharge Elimination System (NPDES)
Federal	FEMA	N/A	National Flood Insurance Program (NFIP)

60 + FEDERAL AND STATE PROGRAMS

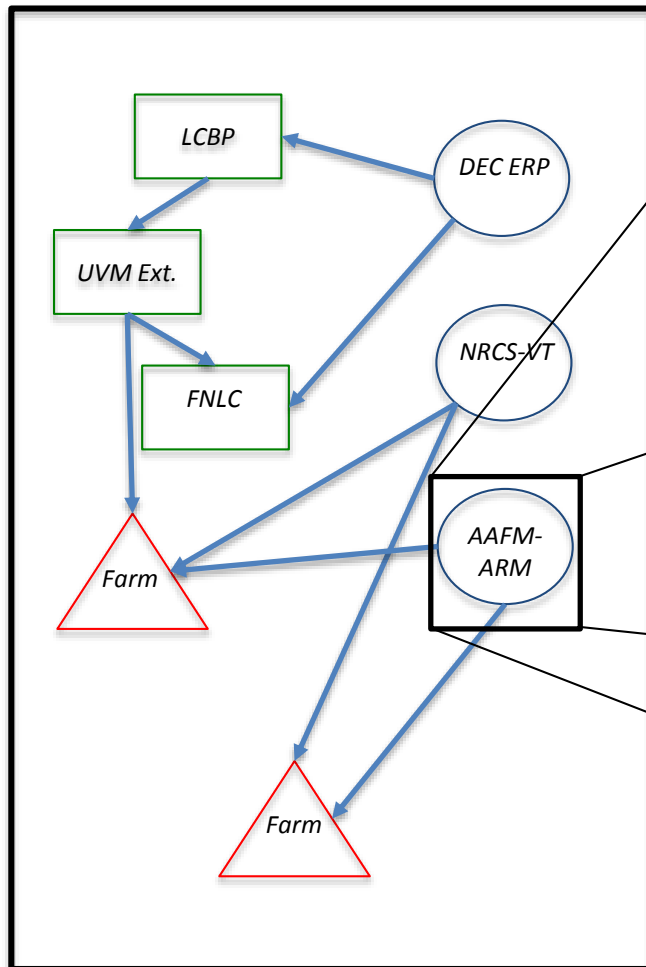


Whole Financial Resource Sharing Network, 2014

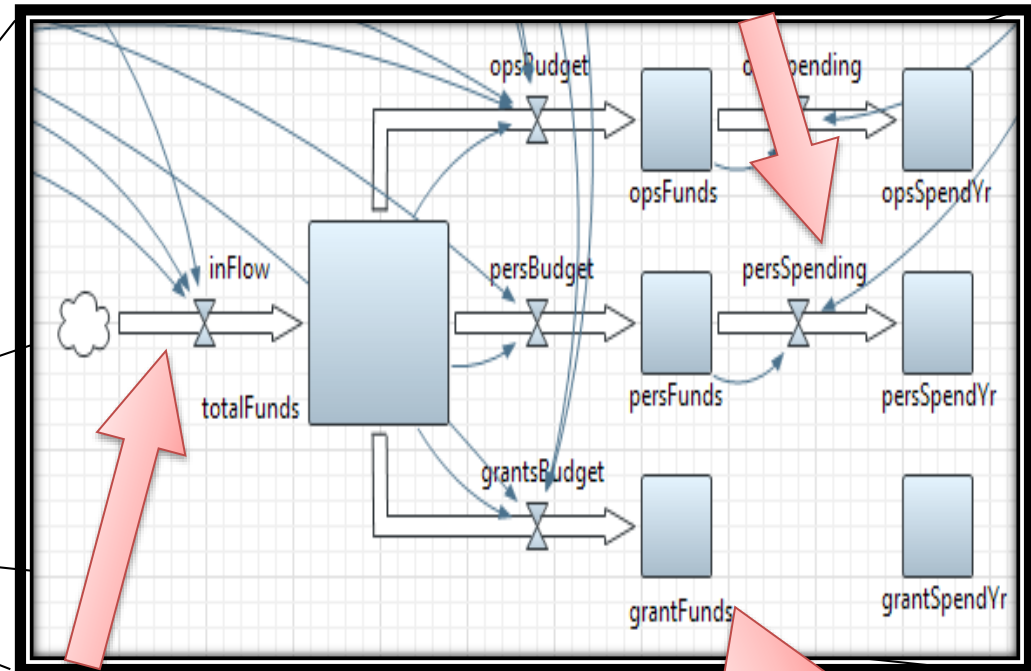
VWSW

mDCI

Example: Network Links and Resource Flows



Based on historic spending



Every organization has an independent source of funds, either tax or sales receipts, or fund raising

Transfer budget: What is transferred Across the network's links

Designing using scenarios ...

Water Quality Governance v3.2

Political Decision Parameters and Tool Weights Control Panel

Policy Domains and Programs Setup

1) Number of Policy Domains

1 2 3 4 5 6

2) Total Number of Programs

1 2 3 4 5 6 7 8 9 10

3) Number of Federal Programs

0 1 2 3 4 5 6 7 8 9 10

Percentage of Funding to be Used on Each Tool

1) Legal/Regulatory Enforcement

min value max

2) Cost Sharing

min value max

3) Permitting

min value max

4) Technical Assistance

min value max

5) Outreach

min value max

Financial Settings

1) Federal Program Funding Level

min value max

2) State Program Funding Level

min value max

3) Non-Governmental Organization (NGO) Funding Level

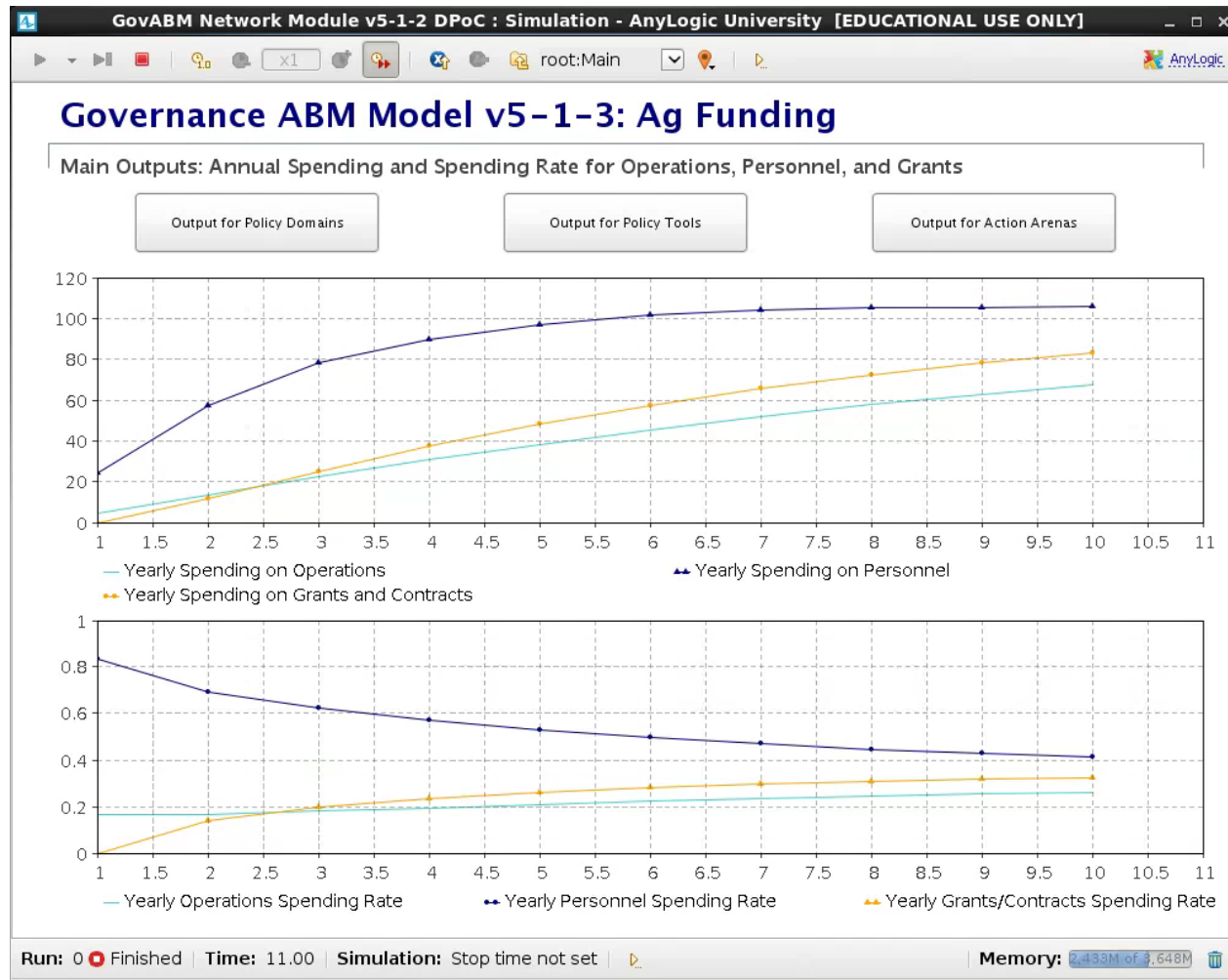
min value max

Run the Model

Authors: Steve Scheinert (Vermont EPSCoR: RACC)
Chris Koliba (University of Vermont)
Asim Zia (University of Vermont)

Acknowledgement: Thank you to Yuan Tian (University of Saskatchewan) and Asim Zia (University of Vermont) for access to their Intergovernmental Project Prioritization (IPP) Model. Many of the simulation interface structures and functionality for this model were taken from the IPP Model and adapted to function in this model. For reference, see:

BAU: Operations, Personnel, and Transfers



Financial resource flows may be tracked according to:

- **Policy Domain**

- Storm water
- Wastewater
- Agriculture
- Development
- River corridor
- Forestry

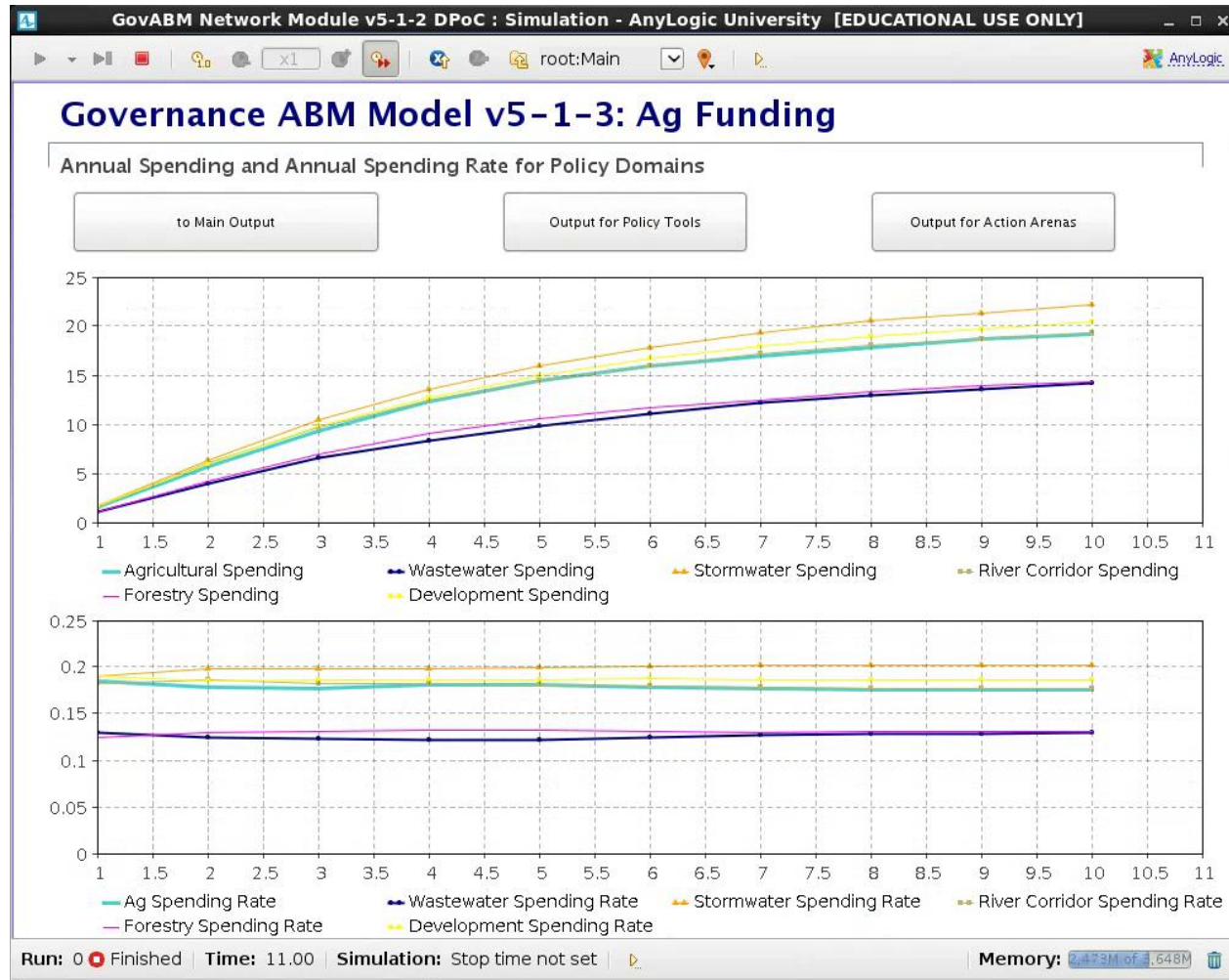
- **Policy Tool**

- Grants
- Contracts
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- Permits
- Easements
- Technical assistance

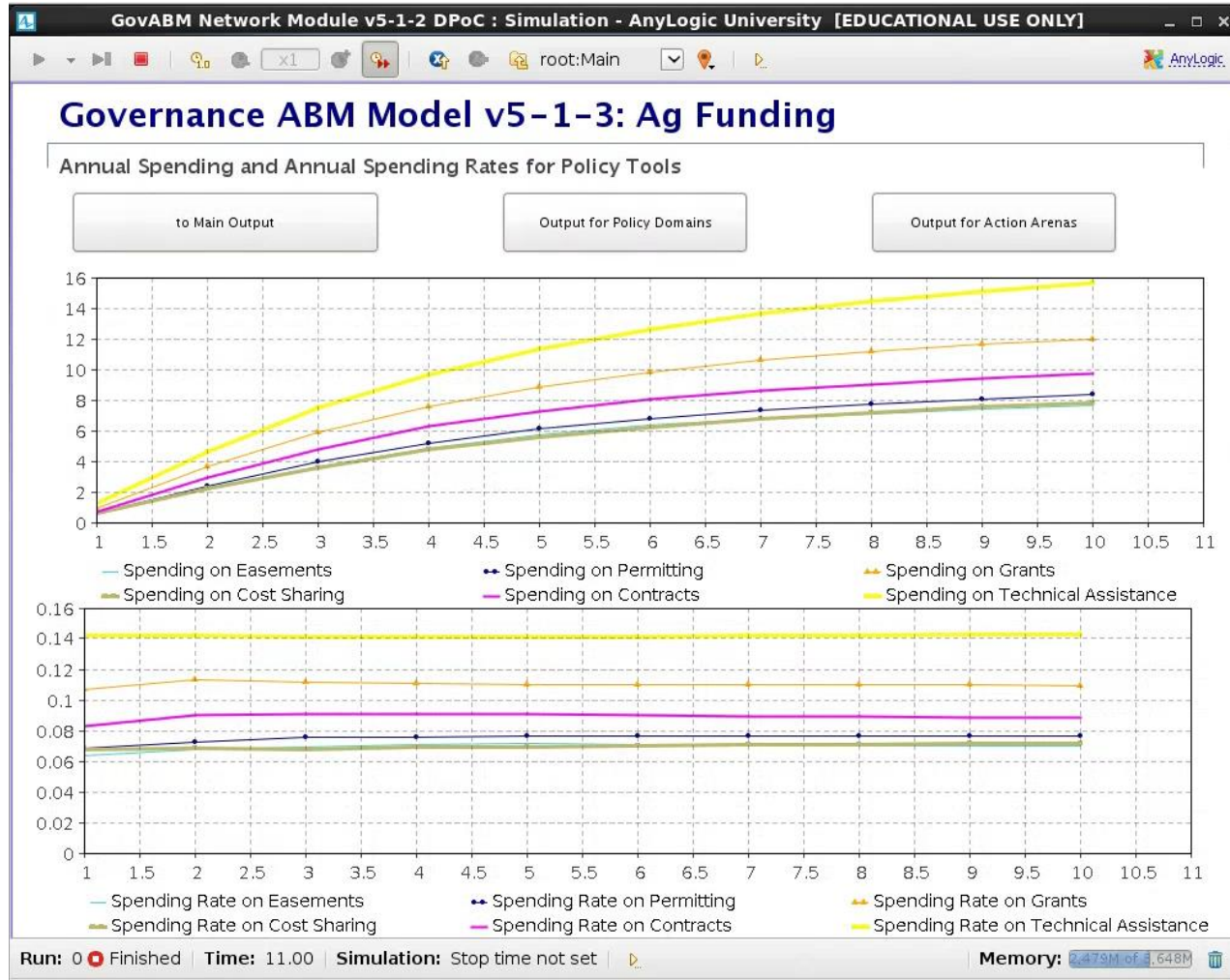
- **Action Arena**

- Tactical Basin Plan-Regional Plan
- TMDL
- Agriculture technical assistance

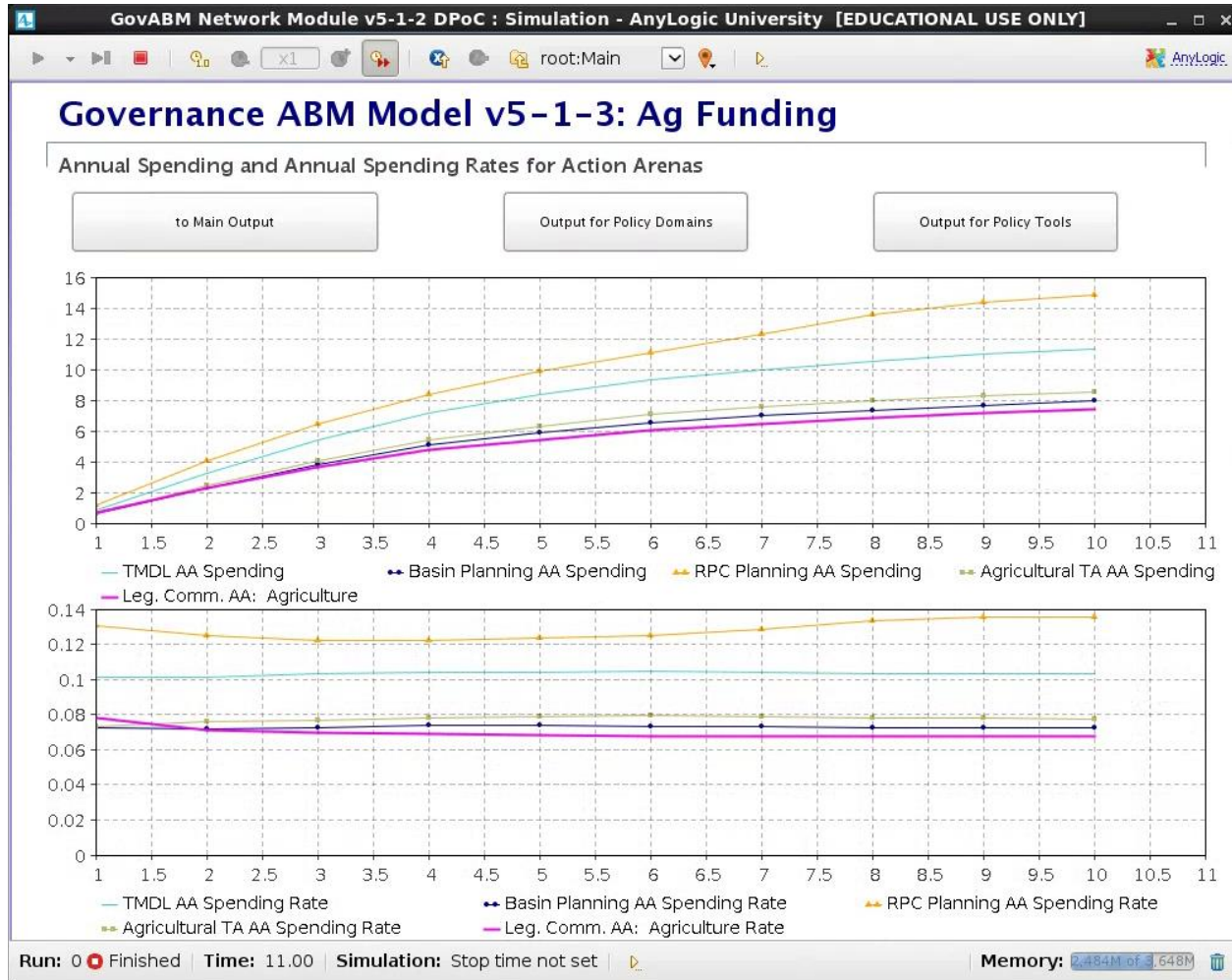
BAU: Policy Domains



BAU: Policy Tools

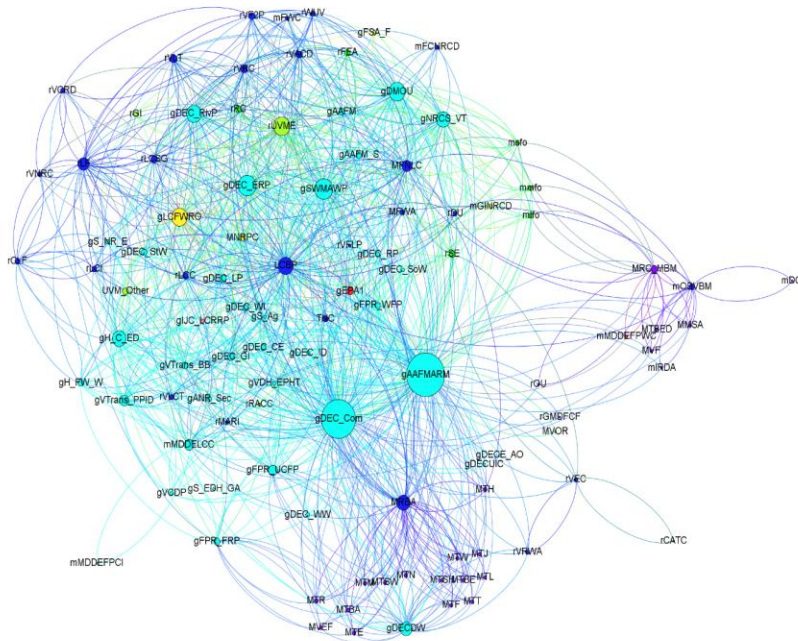


BAU: Action Arenas

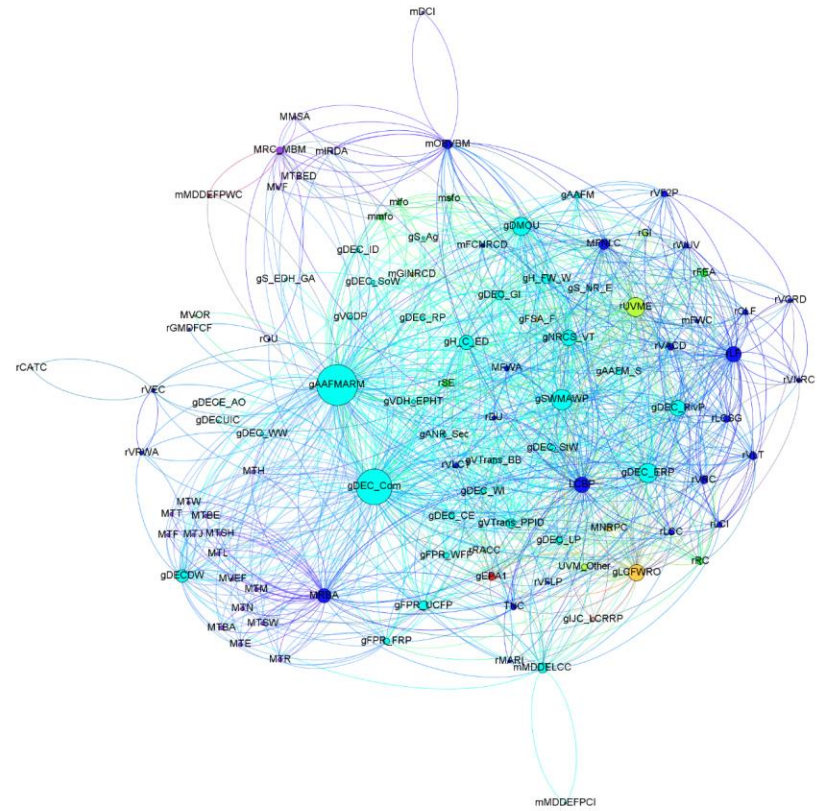


Assessment of Capacity to Implement: **Agricultural BMP Incentivization** for Missisquoi Watershed

Current

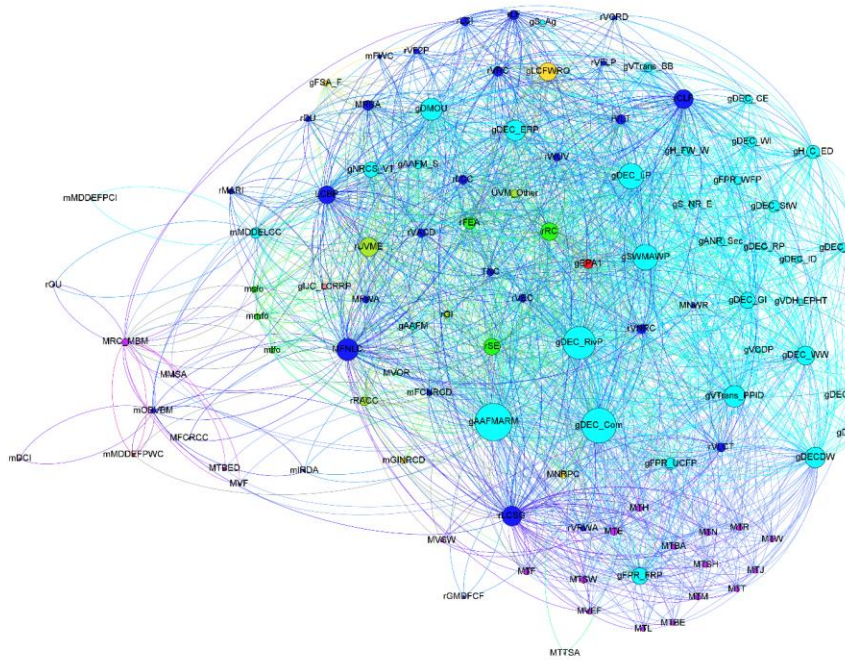


Needed(?)

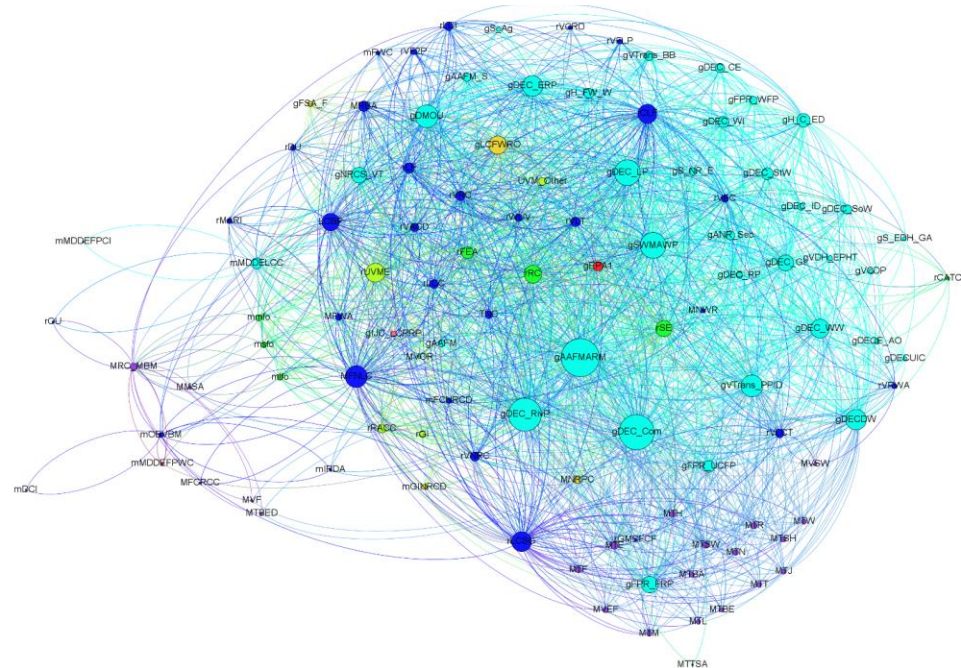


Assessment of Capacity Implement: **Agricultural Technical Assistance** for Missisquoi Watershed

Current

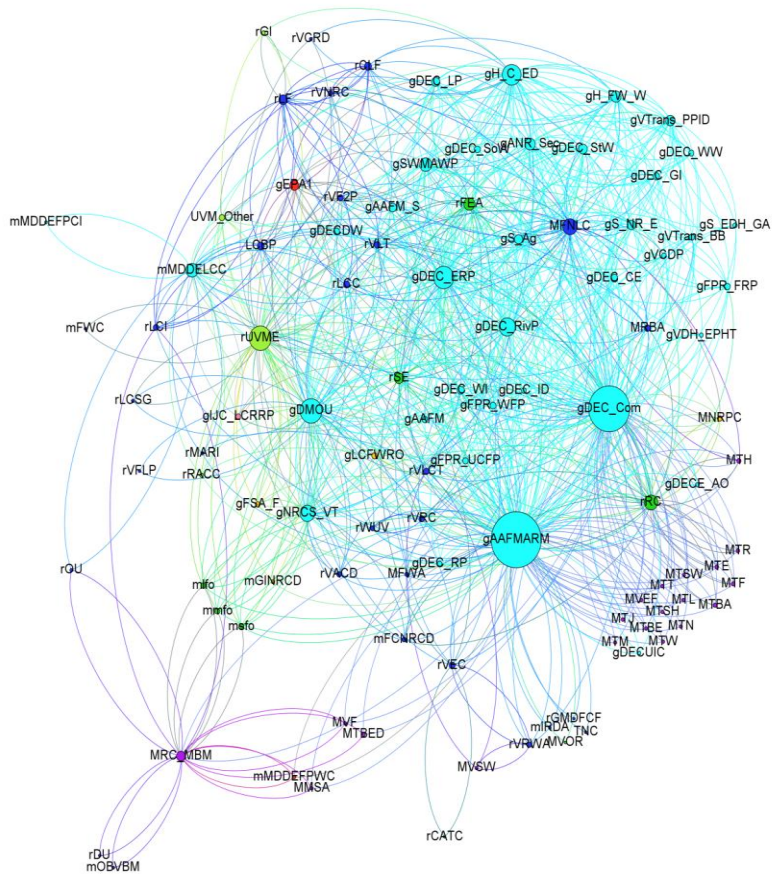


Needed(?)

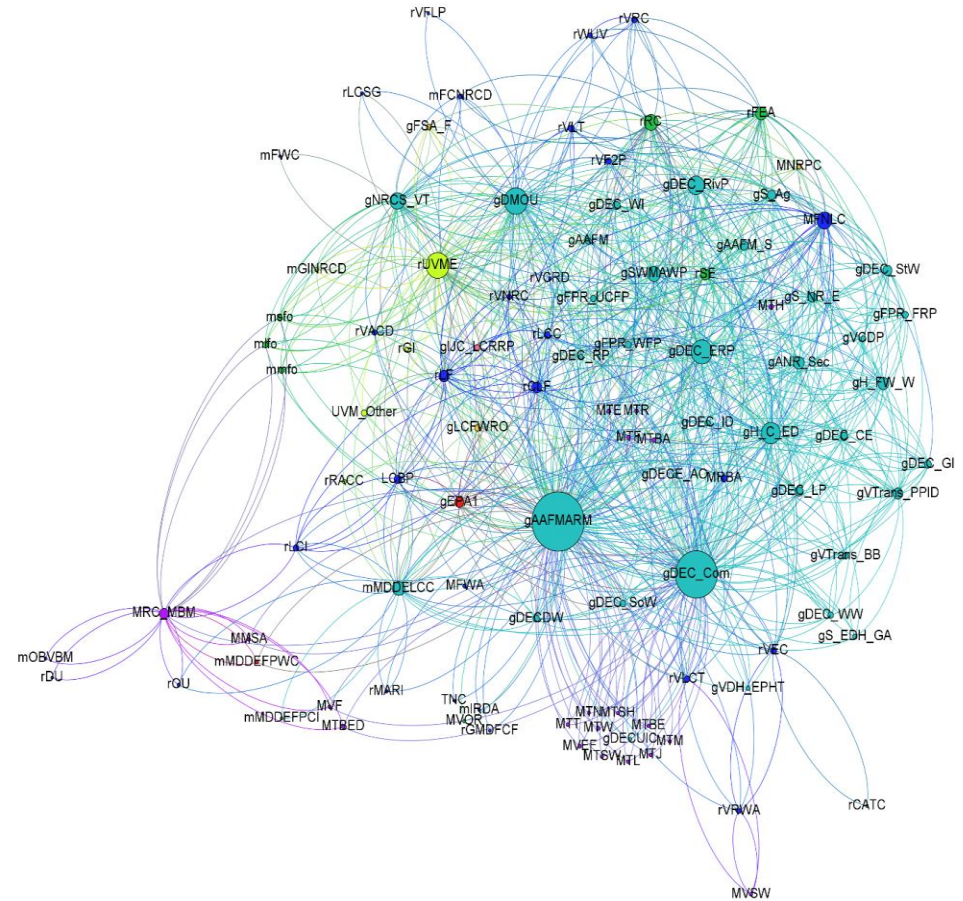


Assessment of Capacity to Implement: Regulation of Agricultural BMPs in Missisquoi Watershed

Current



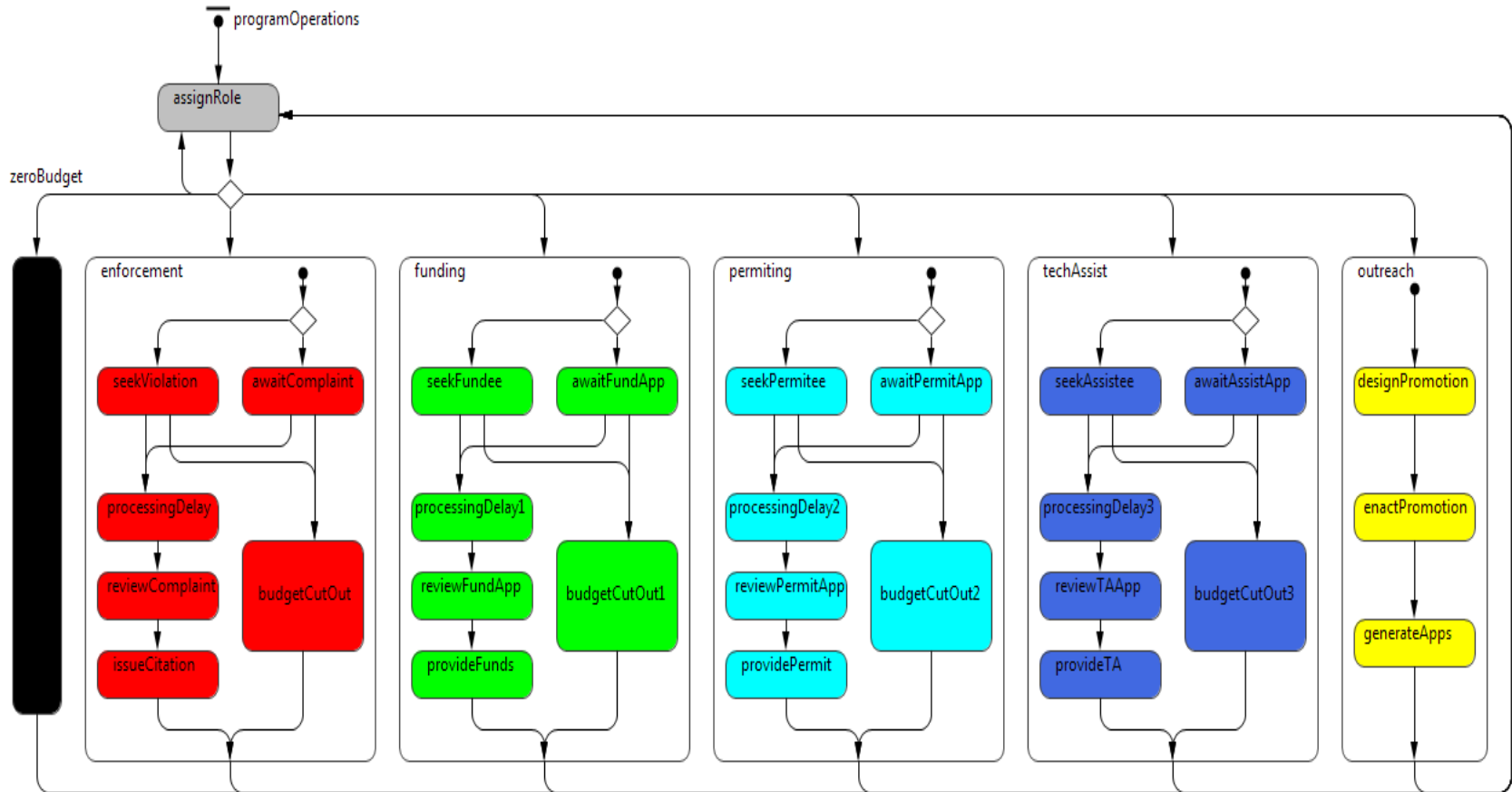
Needed(?)



Governance Capacity and Resource Allocations Will Impact BMP Adoption Such as:

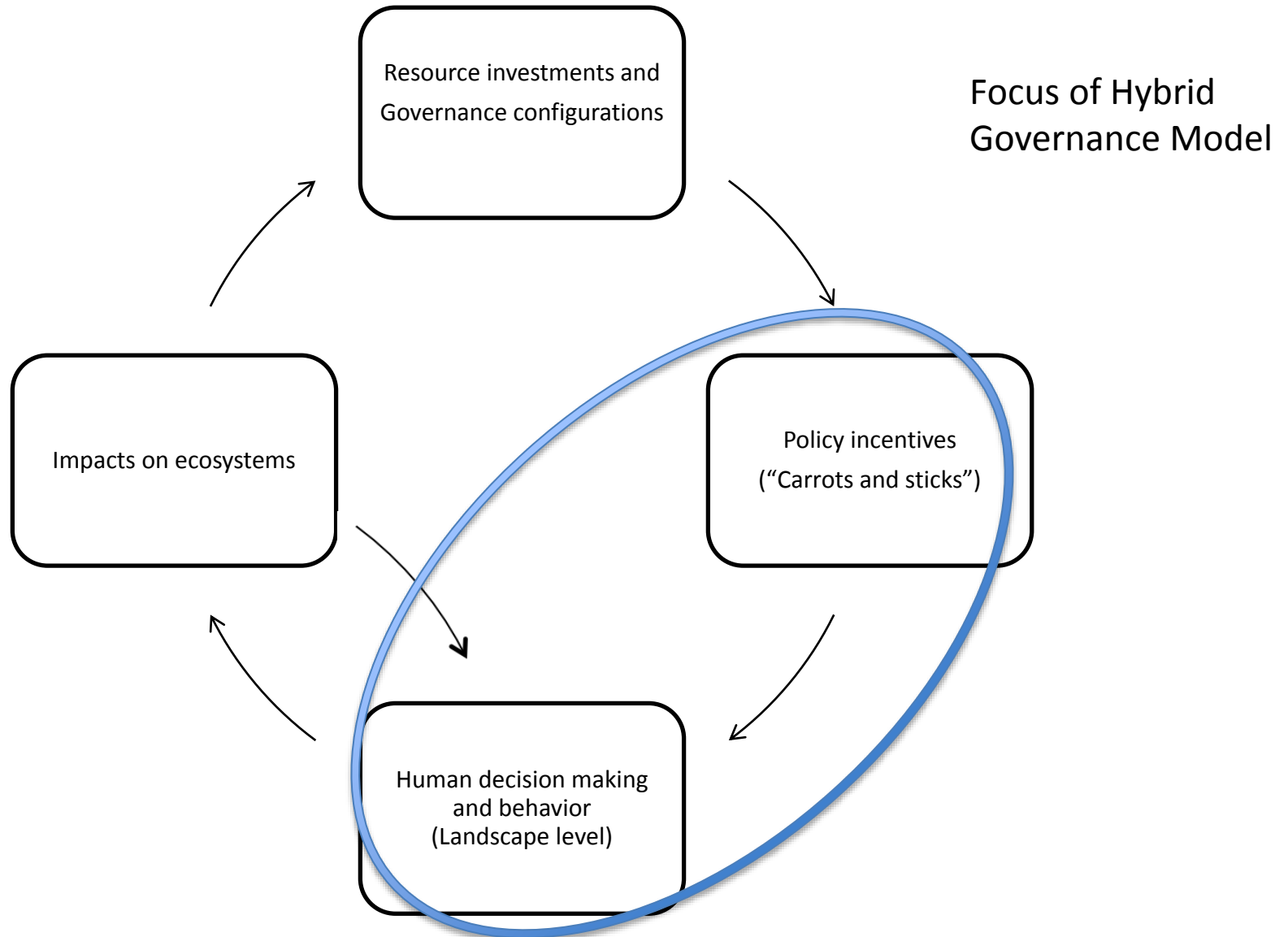
Strategy
1. Crop rotation to 20% (CR20)
2. Crop rotation to 80% (CR80)
3. Cover cropping to 20% (CC20)
4. Cover cropping to 80% (CC80)
5. Reduced tillage to 20% (RT20)
6. Reduced tillage to 80% (RT80)
7. Riparian buffers to 20% (RB20)
8. Riparian buffers to 80% (RB80)
9. Tax fertilizers and feed (TFF)
10. Transition dairy to pasture (PD)
11. Smart growth (SG)
12. Act 250 (A250)
13. Prohibit new dev. in flood plain (NFP)
14. Disinvest new dev. in flood plain (DFP)
15. Prohibit wetland dev. in 80% (WL)
16. Expand use of conservation easements (CE80)
Total

Relationship between policy tools, resource allocations and landuser decisions



Farmer Agent

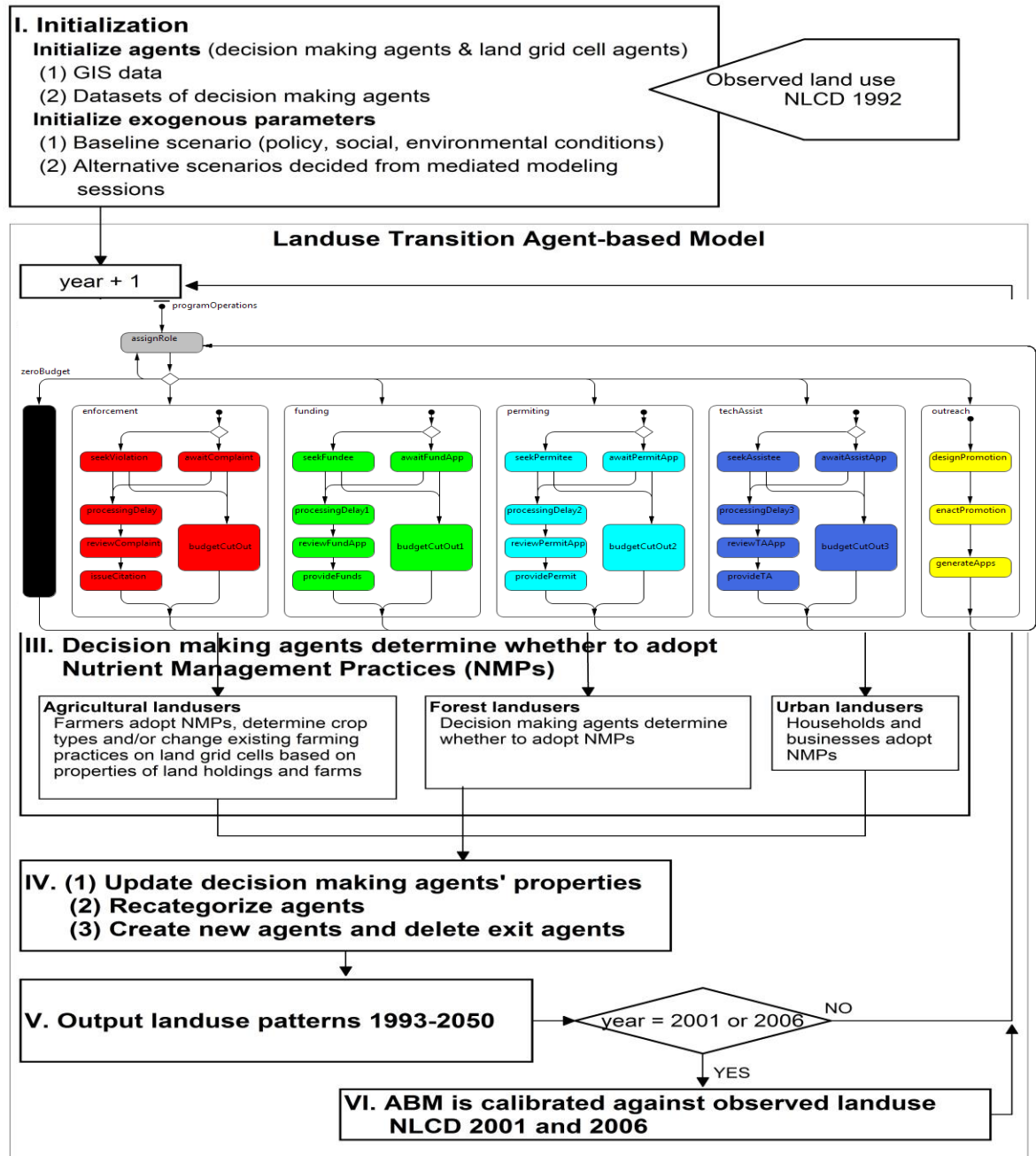
Underlying logic of our SES Model



Land Use and Land Cover Transition ABM

(Tsai et al., 2015)

See Asim Zia's talk earlier in the CCS



Thank you

ckoliba@uvm.edu



Grant #: EPS 1101317

