MICRO-STRUCTURAL NETWORK EFFECTS OF COLLABORATION IN CANADIAN CLIMATE CHANGE POLICY NETWORKS

UAS Spring Campus, Freie Universität Berlin
Session: "Social Networks"
April 4, 2019

Adam Howe
University of British Columbia
adam.howe@alumni.ubc.ca

OVERVIEW

- The COMPOM project, and the Canadian case
- Advocacy Coalition Framework & Policy Networks
- Data & Methods
- Results

COMPON & CANADA

- International project, premised on effects of networks and media coverage
- In Canada, changing majority governments since early 2000s
- Current government supports Paris targets, In 2018 purchased TMX pipeline

THEORY– ADVOCACY COALITION FRAMEWORK

ACF, BELIEFS, & POLICY NETWORKS

- ACF holds that people gather into policy coalitions based on shared beliefs
  - A.k.a. belief homophily - tendency for network actors to form more, and stronger, ties with other actors who share similar beliefs

- ACF holds that shared beliefs are a primary driver of collaboration in policymaking networks:

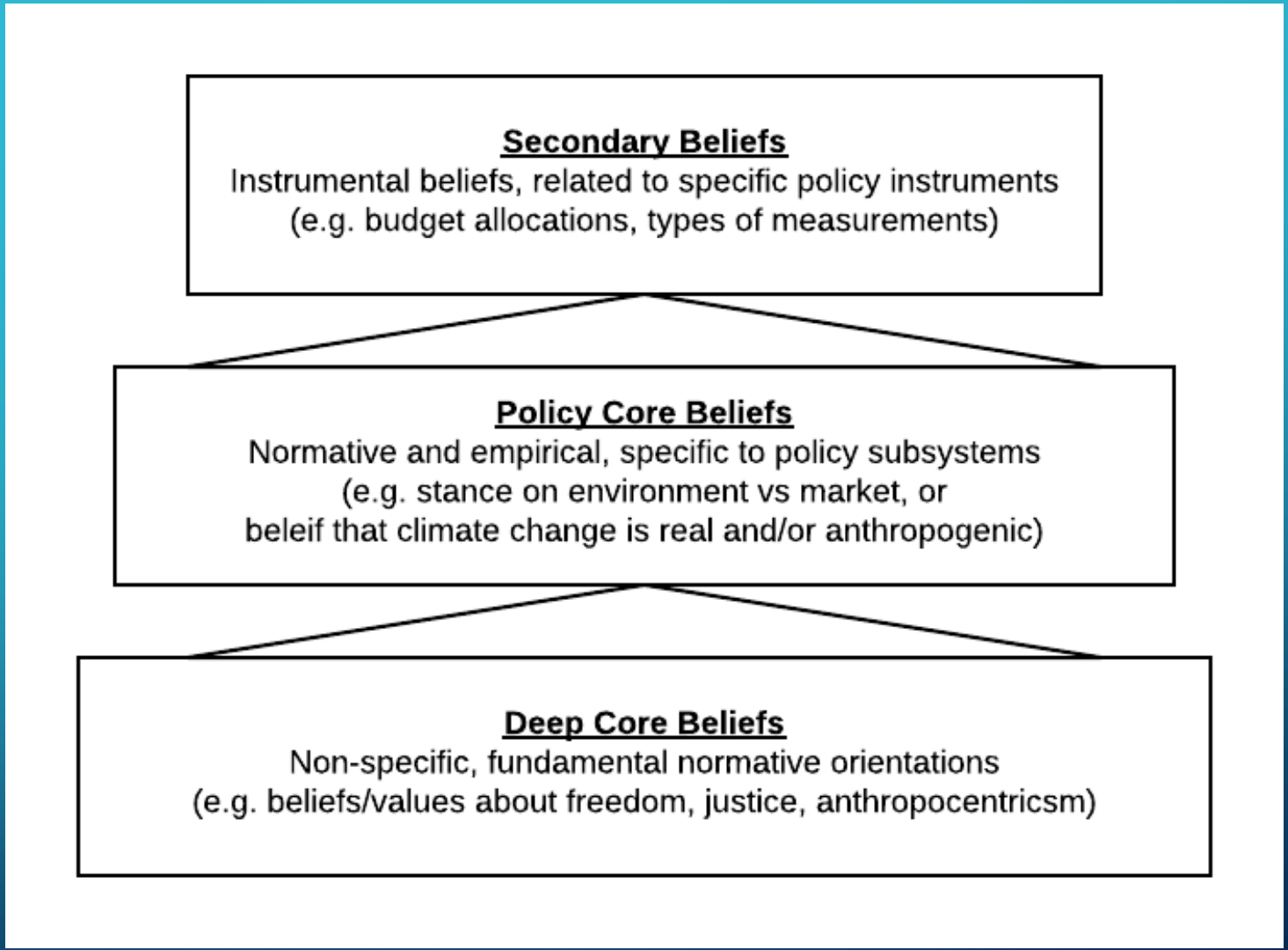
"…actors are politically driven by their beliefs [and] their policies and programs are best thought of as translations of those beliefs"

(Weible & Sabatier, 2011 pp. 2)

"What holds coalition associates together are similar beliefs, worldviews and ideologies"

(Weible & Cairney, 2018 pp. 333)

Fig. 1. Structure of beliefs in the Advocacy Coalition Framework



Adapted from Weible, C. M., & Cairney, P. (2018) and Kukkonen, A., Ylä-Anttila, T., & Broadbent, J. (2017).

DATA

SAMPLE

- Representative sample of actors in Canadian climate change policy domain
- Online survey data used to derive matrices (N=44)
- Relational questions re: policy behavior involving all other actors in the sample
  - Focus herein is on collaboration

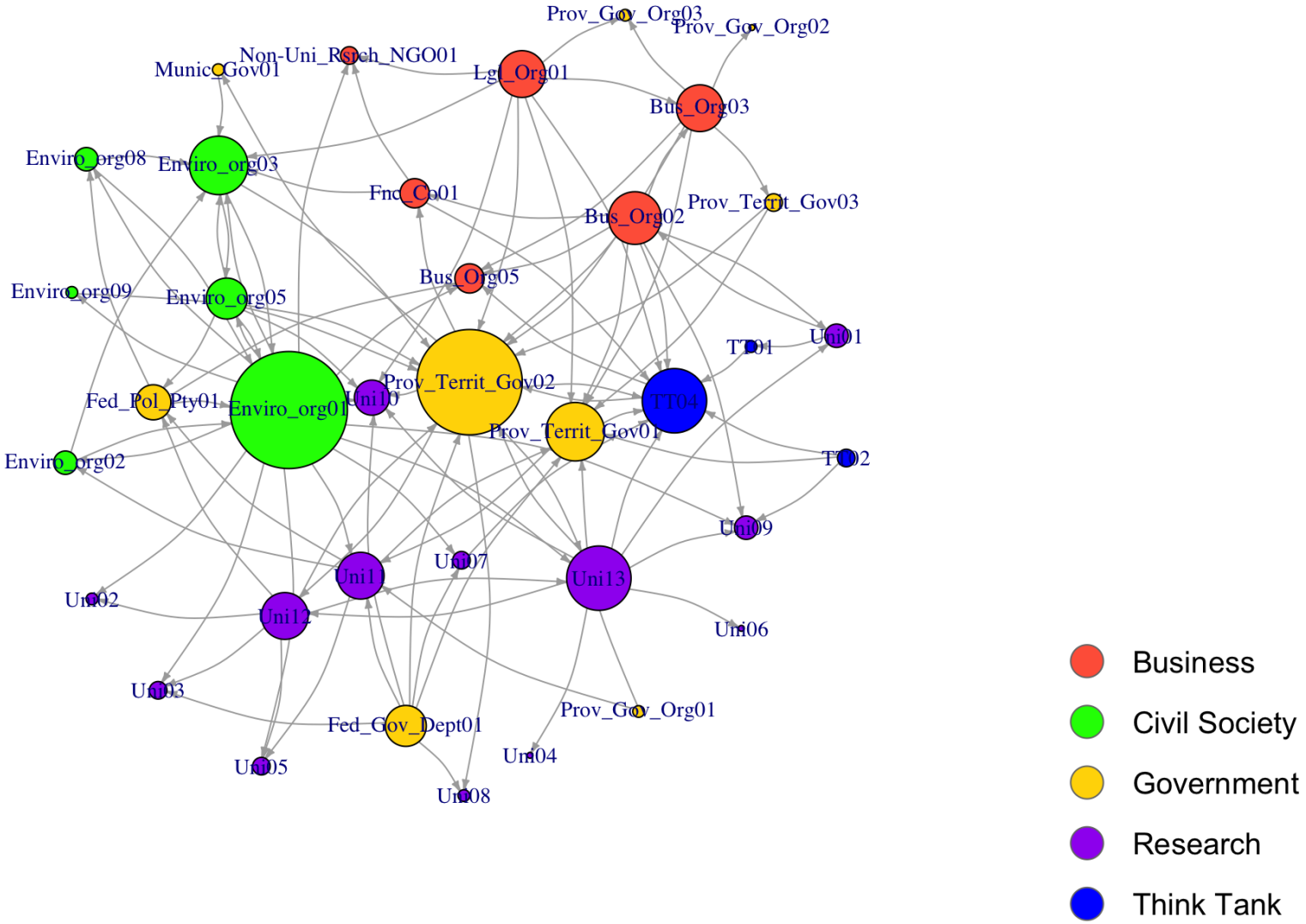
Table 1. Survey sample of collaboration network actors by sector membership (N=44).

Sector	Frequency	Percent	Valid Percent	Cumulative Percent
Business	8	18.2	18.2	18.2
Civil Society	9	20.5	20.5	38.6
Government	10	22.7	22.7	61.4
Research	13	29.5	29.5	90.9
Think Tank	4	9.1	9.1	100
Total	44	100	100.0	

Table 2. ANOVA results for policy-core belief statements, factored by sector membership. (N=44)

Variable Name	Question	F	Sig	Adj R2	Eta2
CC Beneficial	On the whole, current trends suggest climate change will be beneficial for Canada.	3.124	0.036	0.13	0.19
Prioritize CC	Canada should give priority to climate change above other issues (development, security, stability, competitiveness, etc).	7.745	0	0.32	0.37
Voluntary Action	In Canada, business interests are a major obstacle to reducing GHG emissions	3.1	0.037	0.13	0.19
Business Interests	In Canada, business interests are a major obstacle to reducing GHG emissions	3.053	0.039	0.13	0.19
CC Science	Climate change science is still too uncertain to be a basis for	5.572	0.003	0.24	0.3

Fig. 2. Climate Change Policy Collaboration Network, No Isolates (N=37).
Node size scaled to degree, colors represent node sector.



METHODS

EXPONENTIAL RANDOM GRAPH MODELS

- Class of statistical model built to handle dependency inherent to network observations
- ERGMs can be compared to logistic regression
- Use ERGMs to study how network structures affect the likelihood of tie formation between network actors, accounting for actors' beliefs

(McLevey et al., 2018; Wagner & Ylä-Antilla, 2018; Ylä-Antilla et al., 2018; Lusher et al., 2013; Laumann & Knoke, 1987)

NETWORK STRUCTURE MATTERS FOR POLICY

- Micro-structural processes facilitate building consensus/trust required for effective policymaking
- Shape ability of actors to cluster into coalitions based on belief homophily
- Speaks directly to ACF's central proposition regarding beliefs informing policy outputs:
  - Lets us parse out effects of network structures from belief attributes
  - Helps us model coalitions

(Jenkins-Smith et al. 2014; Weible & Sabatier, 2011; Henry, 2011; Sabatier & Jenkins-Smith, 1993; Wagner & Ylä-Antilla, 2018; Ylä-Antilla et al., 2018; Lusher et al., 2013; Laumann & Knoke, 1987)

NETWORKS IMPACT POLICY OUTPUT

- Political science/political economy often concerned with macro structures, formal processes
  - E.g. national political institutions, economy imbued with rational actors, official lobbying activities, etc.
- Network analysis uncovers meso-level informal, day-to-day mechanisms/ understandings behind macro-level phenomenon
  - Rather than macro-level transformation of entire system, network analysis suggests other mechanisms of change

Research on policy networks "*sheds light on what organizations exert influence on policymaking, what beliefs they carry, what kind of coalitions these organizations form to push for their agenda, how they are connected to state organizations and how their opponents are organized*" (Ylä-Anttila et al., 2018 pp. 2).

HYPOTHESES

H1 (Beliefs): Policy core beliefs of actors should be more strongly associated with a collaboration network tie than endogenous network micro-structures.

HYPOTHESES

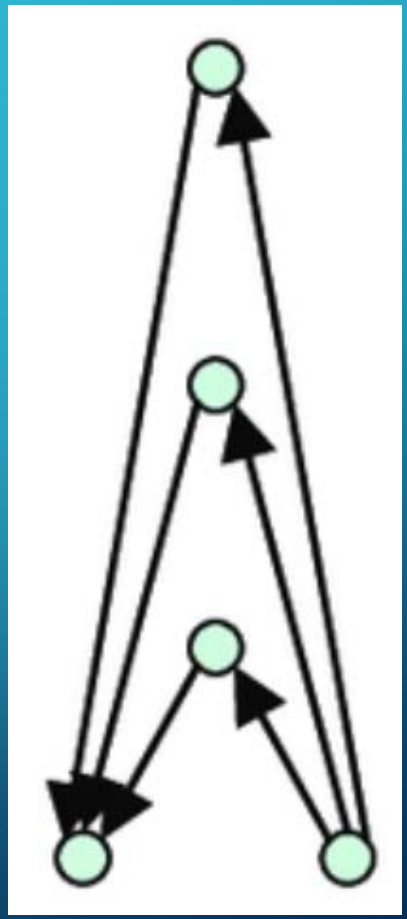
H1 (Beliefs): Policy core beliefs of actors should be more strongly associated with a collaboration network tie than endogenous network micro-structures.

H2 (Micro-Structural): Micro-structural network terms related to coalition formation will be more strongly associated with a collaboration network tie than beliefs.

H2: MICRO-STRUCTURAL

Geometrically-Weighted Dyad-Wise Shared Partners (GWDSP):

- Tendency for two unconnected actors to share collaborators
- More likely to share additional collaboration partners
- The likelihood drops for each additional shared partner
- Models **local connectivity**

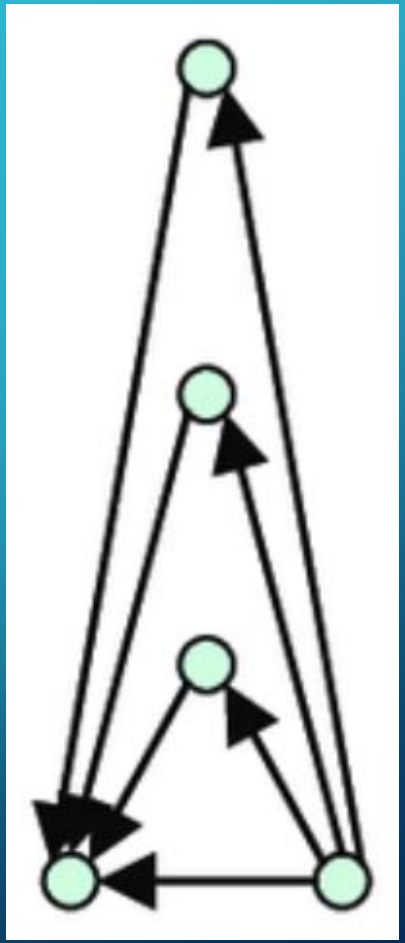


Lusher et al., 2013 pp. 43

H2: MICRO-STRUCTURAL

Geometrically Weighted Edge-Wise Shared Partners (GWESP):

- Tendency for people who share collaboration partners to also be connected
- More likely than chance to have multiple shared collaborators
- The likelihood drops for each additional shared partner
- Models **transitive closure**



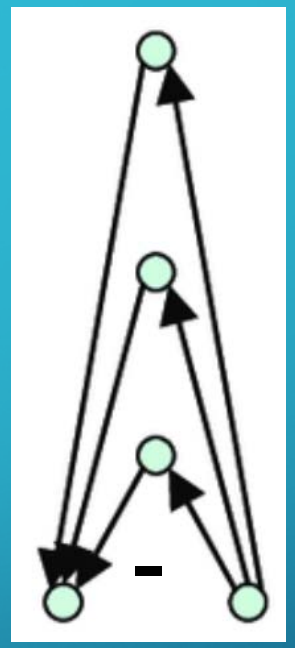
Lusher et al., 2013 pp. 43

MODELLING COALITIONS

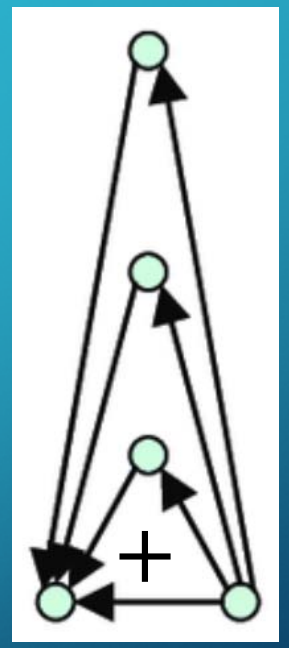
Coalitions (highly connected sub-components) exist if:

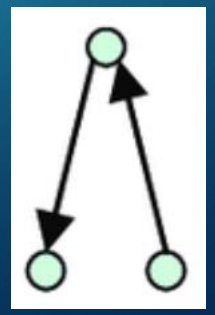
- GWDSP is significantly **negative**
- GWESP is significantly **positive**
- Two-path is base term for both

GWDSP (Negative)



GWESP (Positive)





Two-path

Lusher et al., 2013 pp. 43

ERGM RESULTS

Table 3. Exponential Random Graph Model of COMPON Collaboration Network by Policy Core Beliefs and Micro-Structural Network Effects. (N=44)

	Model 1	**Model 2**
Edges	-4.85***	-4.49***
	(0.42)	(0.50)
Controls		
Reciprocity	0.00	0.92*
	(0.46)	(0.46)
In-Degree	0.24***	0.32***
	(0.05)	(0.06)
Out-Degree	0.23***	0.32***
	(0.03)	(0.05)
Betweenness	-0.00·	-0.00
	(0.00)	(0.00)
Polcy-Core Beliefs		
CC Beneficial	-0.22	-0.22
	(0.16)	(0.15)
Prioritize CC	-0.48***	-0.45***
	(0.14)	(0.13)
Voluntary Action	-0.05	-0.06
	(0.12)	(0.12)
Business Interests	-0.04	-0.07
	(0.11)	(0.11)
CC Science	0.21·	0.19
	(0.13)	(0.13)
Micro-Structural		
Two-Path		-0.94***
		(0.24)
GWDSP		0.75**
		(0.25)
GWESP		0.32
		(0.20)
Isolates		2.05**
		(0.69)
AIC	641.76	579.09
BIC	697.21	656.73
Log Likelihood	-310.88	-275.55

***p < 0.001, **p < 0.01, *p < 0.05, ·p < 0.1

Table 3. Exponential Random Graph Model of COMPON Collaboration Network by Policy Core Beliefs and Micro-Structural Network Effects. (N=44)

	Model 1	**Model 2**
Edges	-4.85***	-4.49***
	(0.42)	(0.50)
Controls		
Reciprocity	0.00	0.92*
	(0.46)	(0.46)
In-Degree	0.24***	0.32***
	(0.05)	(0.06)
Out-Degree	0.23***	0.32***
	(0.03)	(0.05)
Betweenness	-0.00·	-0.00
	(0.00)	(0.00)
Polcy-Core Beliefs		
CC Beneficial	-0.22	-0.22
	(0.16)	(0.15)
Prioritize CC	-0.48***	-0.45***
	(0.14)	(0.13)
Voluntary Action	-0.05	-0.06
	(0.12)	(0.12)
Business Interests	-0.04	-0.07
	(0.11)	(0.11)
CC Science	0.21·	0.19
	(0.13)	(0.13)
Micro-Structural		
Two-Path		-0.94***
		(0.24)
GWDSP		0.75**
		(0.25)
GWESP		0.32
		(0.20)
Isolates		2.05**
		(0.69)
AIC	641.76	579.09
BIC	697.21	656.73
Log Likelihood	-310.88	-275.55

***p < 0.001, **p < 0.01, *p < 0.05, ·p < 0.1

H1

Table 3. Exponential Random Graph Model of COMPON Collaboration Network by Policy Core Beliefs and Micro-Structural Network Effects. (N=44)

	Model 1	**Model 2**
Edges	-4.85***	-4.49***
	(0.42)	(0.50)
Controls		
Reciprocity	0.00	0.92*
	(0.46)	(0.46)
In-Degree	0.24***	0.32***
	(0.05)	(0.06)
Out-Degree	0.23***	0.32***
	(0.03)	(0.05)
Betweenness	-0.00·	-0.00
	(0.00)	(0.00)
Polcy-Core Beliefs		
CC Beneficial	-0.22	-0.22
	(0.16)	(0.15)
Prioritize CC	-0.48***	-0.45***
	(0.14)	(0.13)
Voluntary Action	-0.05	-0.06
	(0.12)	(0.12)
Business Interests	-0.04	-0.07
	(0.11)	(0.11)
CC Science	0.21·	0.19
	(0.13)	(0.13)
Micro-Structural		
Two-Path		-0.94***
		(0.24)
GWDSP		0.75**
		(0.25)
GWESP		0.32
		(0.20)
Isolates		2.05**
		(0.69)
AIC	641.76	579.09
BIC	697.21	656.73
Log Likelihood	-310.88	-275.55

***p < 0.001, **p < 0.01, *p < 0.05, ·p < 0.1

H1

Table 3. Exponential Random Graph Model of COMPON Collaboration Network by Policy Core Beliefs and Micro-Structural Network Effects. (N=44)

	Model 1	**Model 2**
Edges	-4.85***	-4.49***
	(0.42)	(0.50)
Controls		
Reciprocity	0.00	0.92*
	(0.46)	(0.46)
In-Degree	0.24***	0.32***
	(0.05)	(0.06)
Out-Degree	0.23***	0.32***
	(0.03)	(0.05)
Betweenness	-0.00·	-0.00
	(0.00)	(0.00)
Polcy-Core Beliefs		
CC Beneficial	-0.22	-0.22
	(0.16)	(0.15)
Prioritize CC	-0.48***	-0.45***
	(0.14)	(0.13)
Voluntary Action	-0.05	-0.06
	(0.12)	(0.12)
Business Interests	-0.04	-0.07
	(0.11)	(0.11)
CC Science	0.21·	0.19
	(0.13)	(0.13)
Micro-Structural		
Two-Path		-0.94***
		(0.24)
GWDSP		0.75**
		(0.25)
GWESP		0.32
		(0.20)
Isolates		2.05**
		(0.69)
AIC	641.76	579.09
BIC	697.21	656.73
Log Likelihood	-310.88	-275.55

***p < 0.001, **p < 0.01, *p < 0.05, ·p < 0.1

H2

Table 3. Exponential Random Graph Model of COMPON Collaboration Network by Policy Core Beliefs and Micro-Structural Network Effects. (N=44)

	Model 1	**Model 2**
Edges	-4.85***	-4.49***
	(0.42)	(0.50)
Controls		
Reciprocity	0.00	0.92*
	(0.46)	(0.46)
In-Degree	0.24***	0.32***
	(0.05)	(0.06)
Out-Degree	0.23***	0.32***
	(0.03)	(0.05)
Betweenness	-0.00·	-0.00
	(0.00)	(0.00)
Polcy-Core Beliefs		
CC Beneficial	-0.22	-0.22
	(0.16)	(0.15)
Prioritize CC	-0.48***	-0.45***
	(0.14)	(0.13)
Voluntary Action	-0.05	-0.06
	(0.12)	(0.12)
Business Interests	-0.04	-0.07
	(0.11)	(0.11)
CC Science	0.21·	0.19
	(0.13)	(0.13)
Micro-Structural		
Two-Path		-0.94***
		(0.24)
GWDSP		0.75**
		(0.25)
GWESP		0.32
		(0.20)
Isolates		2.05**
		(0.69)
AIC	641.76	579.09
BIC	697.21	656.73
Log Likelihood	-310.88	-275.55

***p < 0.001, **p < 0.01, *p < 0.05, ·p < 0.1

H2

H1: ACF & POLICY CORE BELIEFS

- Our data represents a single coalition
- Consistent with ANOVA tests on belief survey questions (most were non-sig)
- Prioritization question consistent with policy context outlined earlier

H2: MICRO-STRUCTURAL

- Also supports ACF
- Local connectivity is stronger than we would expect by chance (GWDSP)
- Lack of transitive closure (GWESP) consistent with single coalition
- Can try to plot local connectivity using cluster coefficient
  - Larger coefficient means actors ego tied to are more highly clustered than expected

Fig. 3. COMPON Collaboration Network, Nodes Scaled by Cluster Coef. (coef=1 for colored nodes. N=37.)

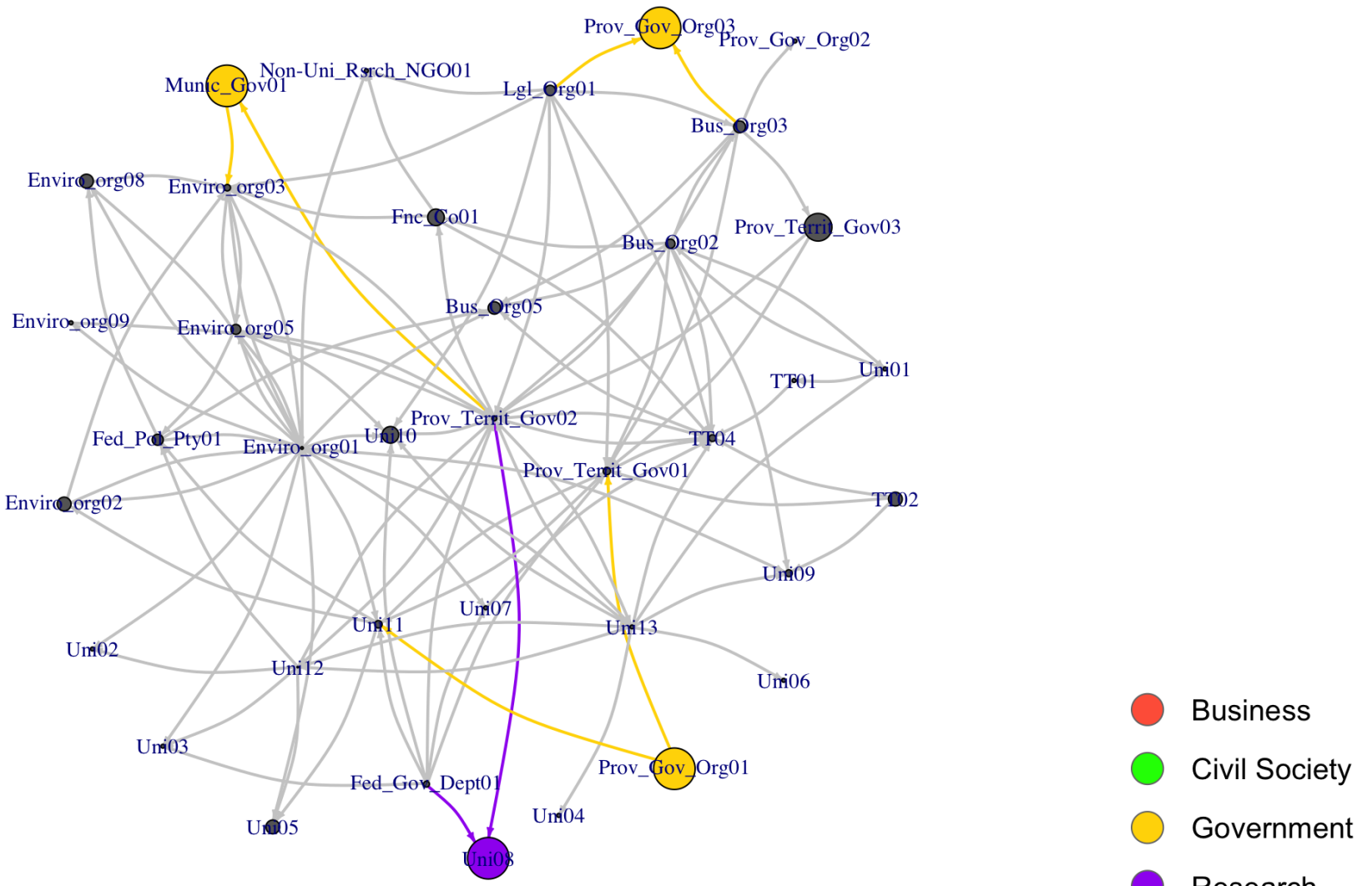
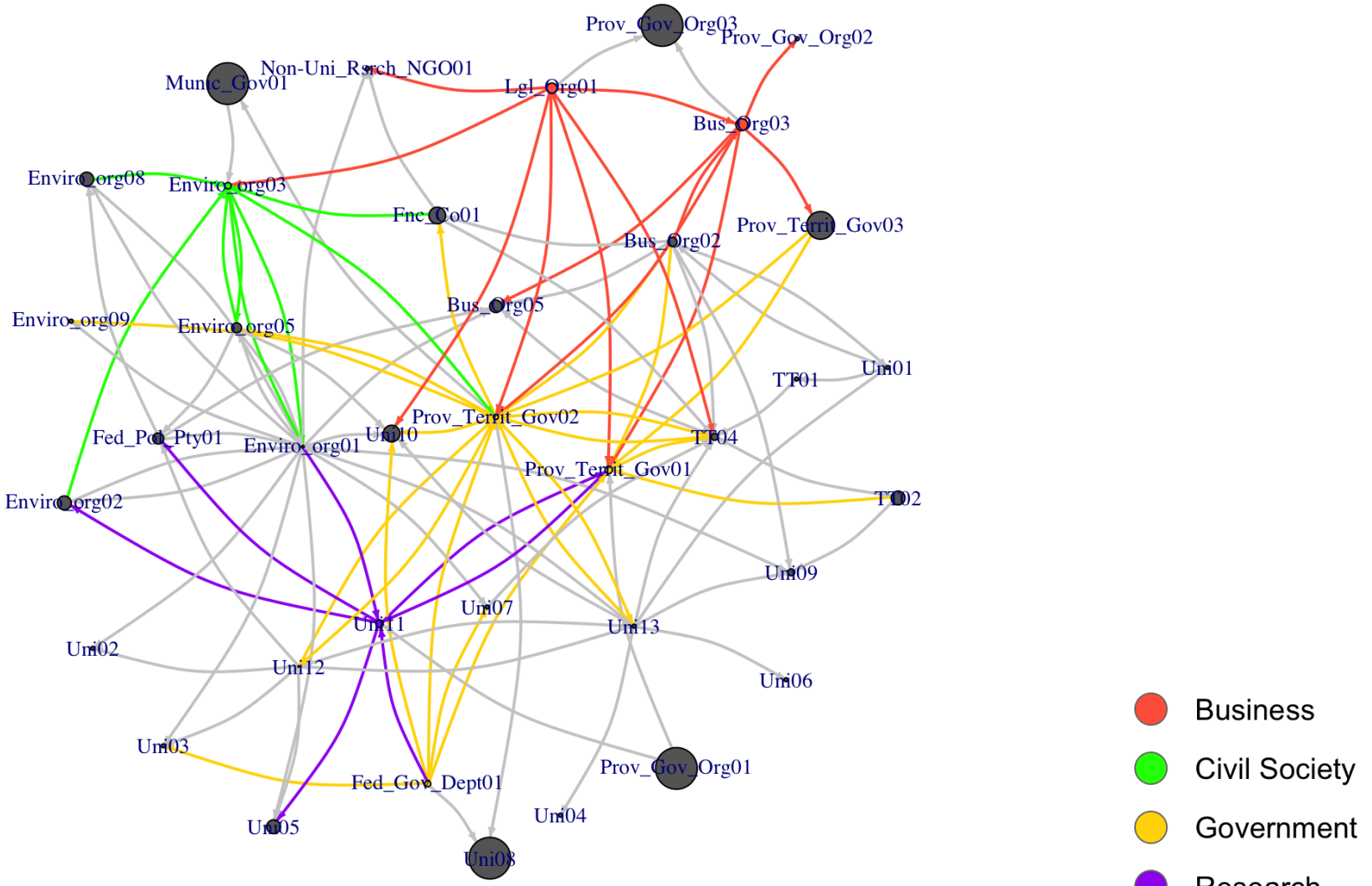


Fig. 4. COMPON Collaboration Network, Nodes Scaled by Cluster Coef, Highly-Connected Subgraph in Color (N=37)



MOVING AHEAD

- Detailed study of core-periphery, faction analysis, etc.
- Analyze influence networks similarly
- Multiplexity
- Next stage – scrape twitter follower/retweet networks of policy actors

MANY THANKS!

REFERENCES

Ylä-Anttila, T., Gronow, A., Stoddart, M. C. J., Broadbent, J., Schneider, V., & Tindall, D. B. (2018). Climate change policy networks: Why and how to compare them across countries. *Energy Research & Social Science*, *45*(November 2017), 258–265. https://doi.org/10.1016/j.erss.2018.06.020

"CCPI 2019 Country Scorecard: Canada" (Accessed March 18 2019). https://www.climate-change-performance-index.org/sites/default/files/documents/canada_scorecard_ccpi_2019_0.pdf

Weible, C. M., & Cairney, P. (2018b). Practical lessons from policy theories. *Policy & Politics*, *46*(2), 183–197. https://doi.org/10.1332/030557318X15230059147191

Kukkonen, A., Ylä-Anttila, T., & Broadbent, J. (2017). Advocacy coalitions, beliefs and climate change policy in the United States. *Public Administration*, *95*(3), 713–729. https://doi.org/10.1111/padm.12321

Weible, C. M., & Sabatier, P. A. (2011). Advocacy Coalition Framework. In B. Badie, D. Berg-Schlosser, & L. Morlino (Eds.), *International Encyclopedia of Political Science* (pp. 34–37). Thousand Oaks: SAGE.

Ingold, K., Fischer, M., & Cairney, P. (2017). Drivers for Policy Agreement in Nascent Subsystems : An Application of the Advocacy Coalition Framework to Fracking Policy in Switzerland and the UK. *Policy Studies Journal*, *45*(3), 442–463. https://doi.org/10.1111/psj.12173

Gronow, A., & Ylä-Anttila, T. (2016). Cooptation of ENGOs or Treadmill of Production? Advocacy Coalitions and Climate Change Policy in Finland. *Policy Studies Journal*, *00*(00), 1–22.

Jenkins-Smith, H. C., Nohrstedt, D., Weible, C. M., & Sabatier, P. A. (2014). The Advocacy Coalition Framework: Foundations, Evolution, and Ongoing Research. In P. A. Sabatier & C. M. Weible (Eds.), *Theories of the Policy Process* (3rd ed., pp. 183–224). New York: Westview Press.

Calanni, J. C., Siddiki, S. N., Weible, C. M., & Leach, W. D. (2015). Explaining Coordination in Collaborative Partnerships and Clarifying the Scope of the Belief Homophily Hypothesis. *Journal of Public Administration Research and Theory*, *25*(3), 901–927. https://doi.org/10.1093/jopart/mut080

McLevey, J., Graham, A. V, McIlroy-Young, R., Browne, P., & Plaisance, K. S. (2018). Interdisciplinarity and insularity in the diffusion of knowledge: an analysis of disciplinary boundaries between philosophy of science and the sciences. *Scientometrics*, *8*. https://doi.org/10.1007/s11192-018-2866-8

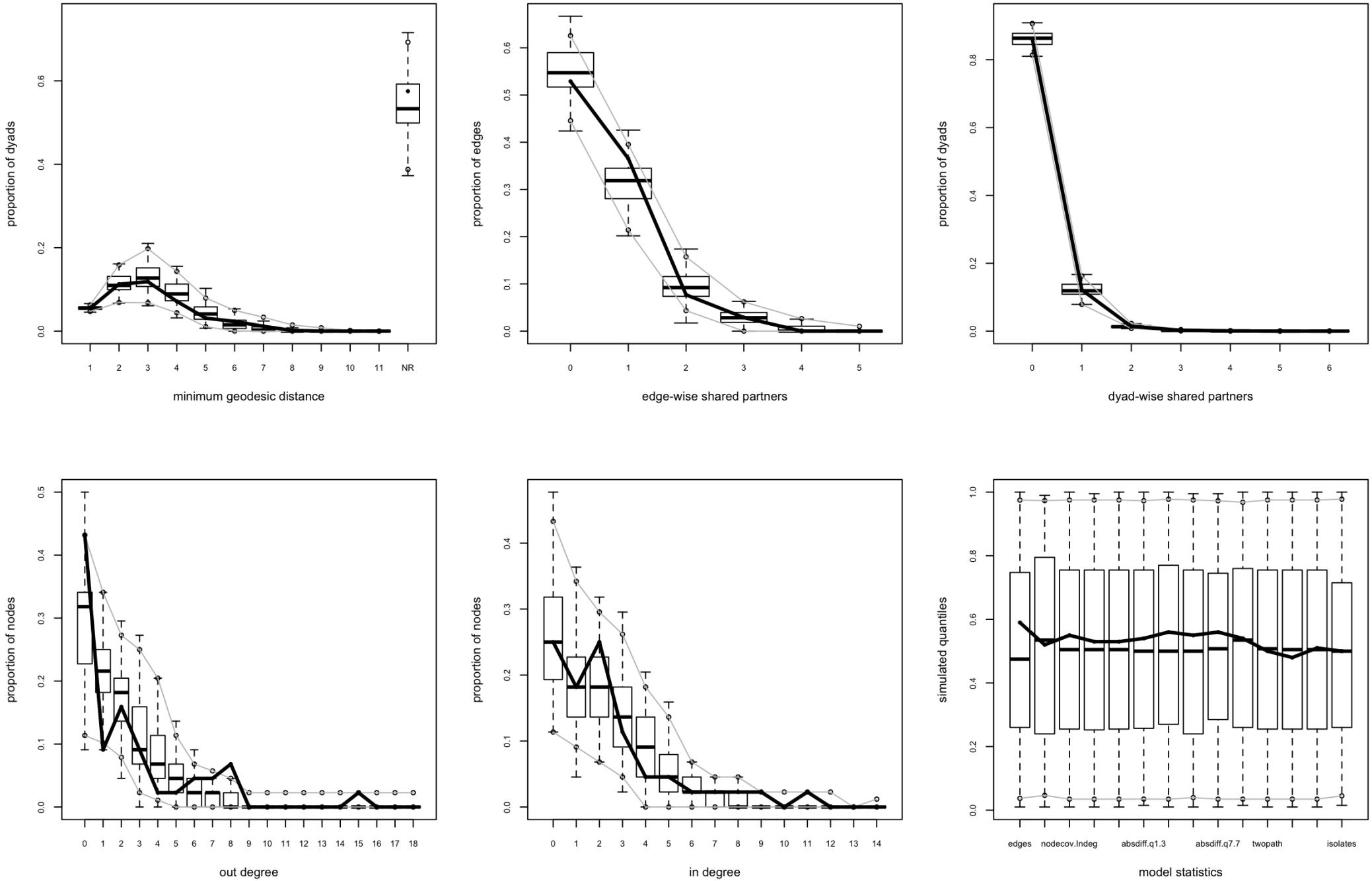
Lusher, D., & Robins, G. (2013). Formation of Social Network Structure. In D. Lusher, J. Koskinen, & G. Robins (Eds.), *Exponential Random Graph Models for Social Networks: Theory, Methods, and Applications* (pp. 16–28). New York: Cambridge University Press.

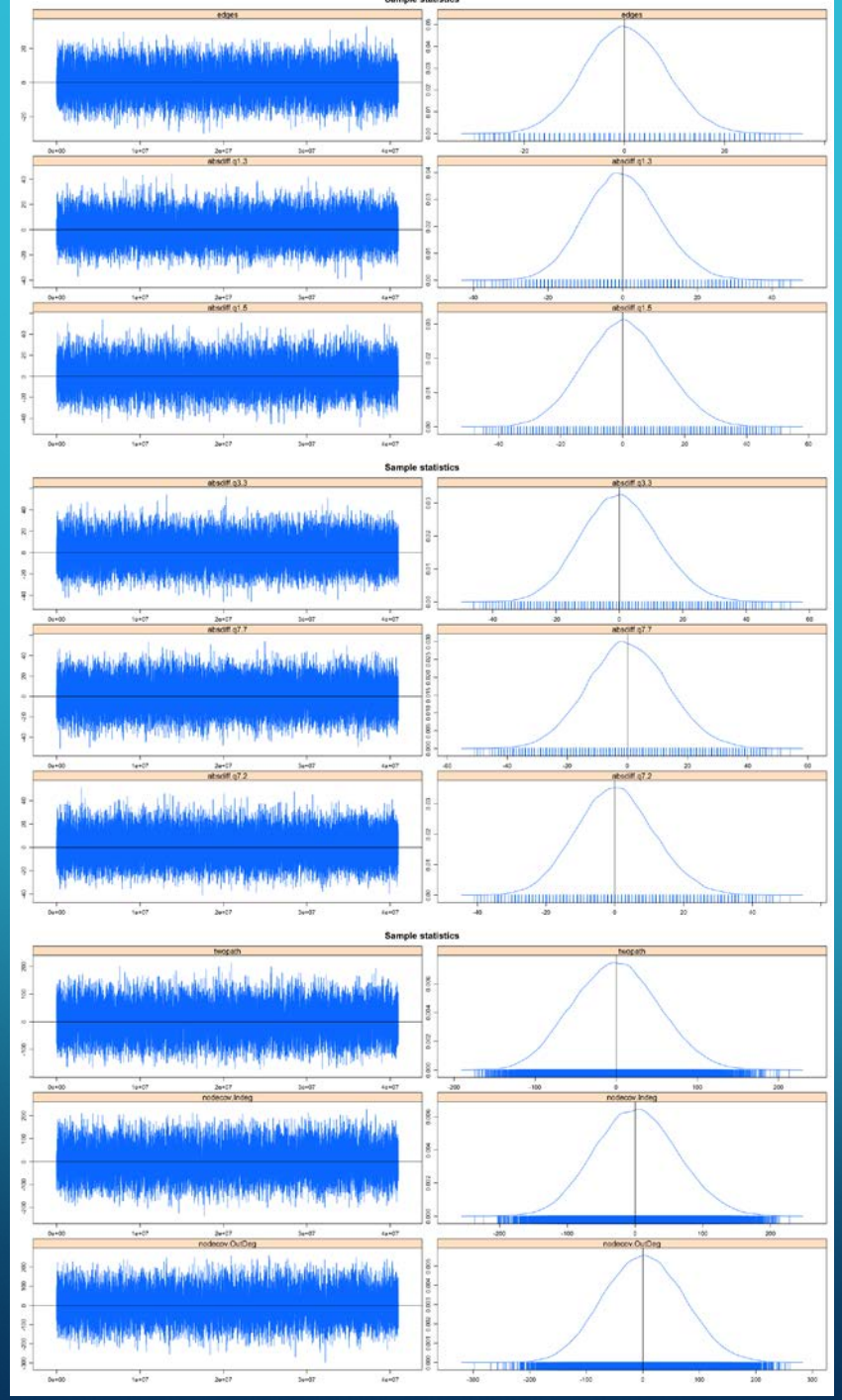
SAMPLE CRITERIA

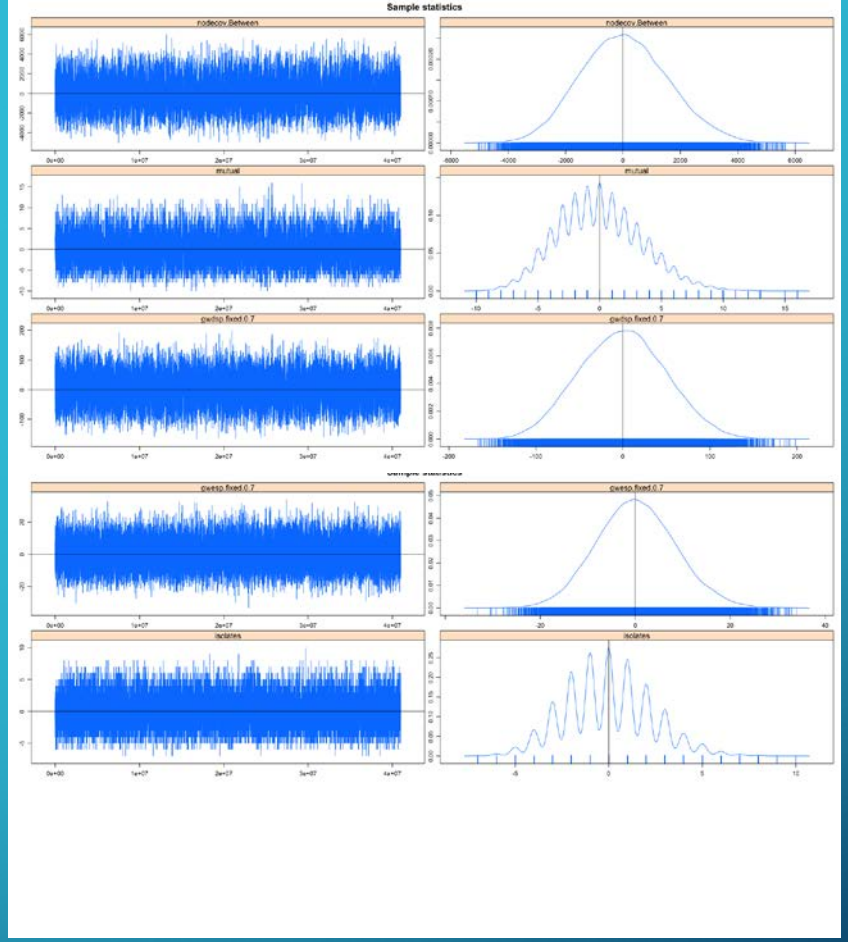
Four Criteria, minimum of three appearances in any:

- COP
  - international; official delegates and registered NGO observers
- Testimony about climate bills
  - domestic; committee members or presenters, SCESD & SCEENR re: comprehensive climate bills (C-288; C-311; C-377)
- National Roundtable on Environment and the Economy
  - Expert advice; roundtable members or witnesses in climate-related reports
- National Newspaper Coverage (Globe & Mail, National Post)
  - Mass media influence; mentions in climate-related articles

Fig. 3. Goodness of Fit Diagnostics for Full ERGM Model.




edges
absdiff.g1.3
absdiff.g1.5
Sample statistics
absdiff.g3.3
absdiff.g7.7
absdiff.g7.2
Sample statistics
twopath
nodecov.Indeg
nodecov.OutDeg


Sample statistics
nodecov.Between
mutual
gwdsp.fixed.0.7
gwesp.fixed.0.7
isolates

	model.1
Edges	-4.44***
	(0.50)
Policy Secondary	
Paris Targets	-0.03
	(0.15)
Kyoto	-0.35*
	(0.15)
Federal Carbon Price	0.06
	(0.13)
Expand Natural Gas	-0.30·
	(0.15)
Restrict Oil Sands	-0.21·
	(0.12)
Expand Renewables	-0.03
	(0.12)
Centrality	
Two-Path	-0.97***
	(0.24)
In-Degree	0.35***
	(0.06)
Out-Degree	0.34***
	(0.05)
Betweenness	-0.00·
	(0.00)
Micro-Structural	
Reciprocity	0.79·
	(0.48)
GWDSP	0.77**
	(0.25)
GWESP	0.27
	(0.20)
Isolates	1.83**
	(0.70)
AIC	571.02
BIC	654.20
Log Likelihood	-270.51

***p < 0.001, **p < 0.01, *p < 0.05, ·p < 0.1

Exponential Random Graph Model of COMPON Collaboration Network by Secondary Beliefs, Structural Position and Micro-Structural Network Effects. N=44