Telecoupling 101: Concepts, Terminology, and Published Case Studies

Francesco Tonini, PhD
Geospatial Data Scientist

February 19th, 2019

Webinar series
Telecoupling: A New Frontier for Global Sustainability

Ciara Hovis
PhD Student @ MSU

Telecoupling: A New Frontier for Global Sustainability

- **February 19th, 2019: Telecoupling 101: Concepts, Terminology, and Published Case Studies**
- **February 26th, 2019: Telecoupling Toolbox: Integrated Tools for Sustainability Science**
- **March 12th, 2019: Telecoupling GeoApp: Cloud-based Platform Overview and Widgets**
- **March 19th, 2019: Telecoupling GeoApp: Case Studies with Story Maps**

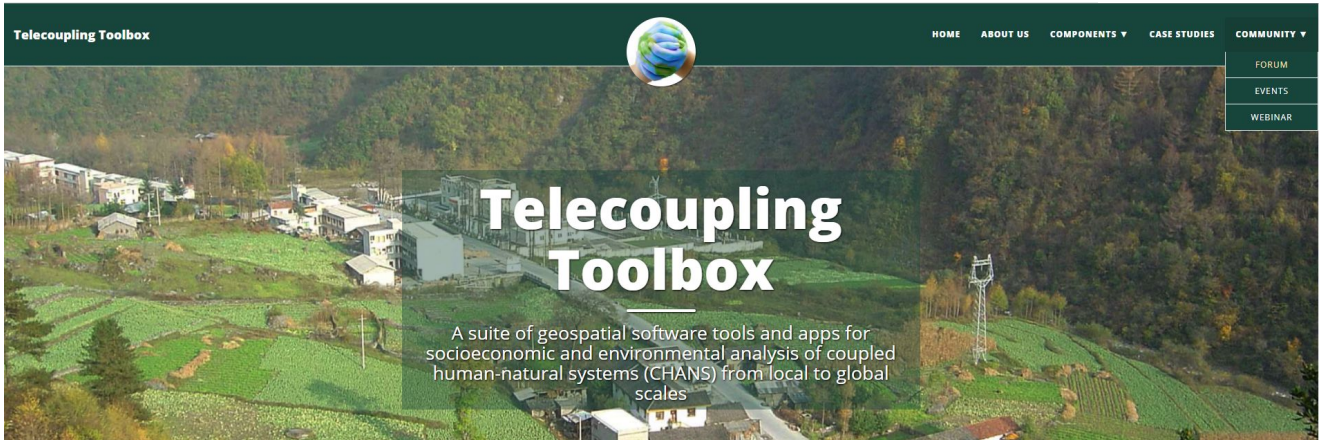
WEBINAR REGISTRATION AVAILABLE @

https://telecouplingtoolbox.org/webinar

POLL

Online Presence

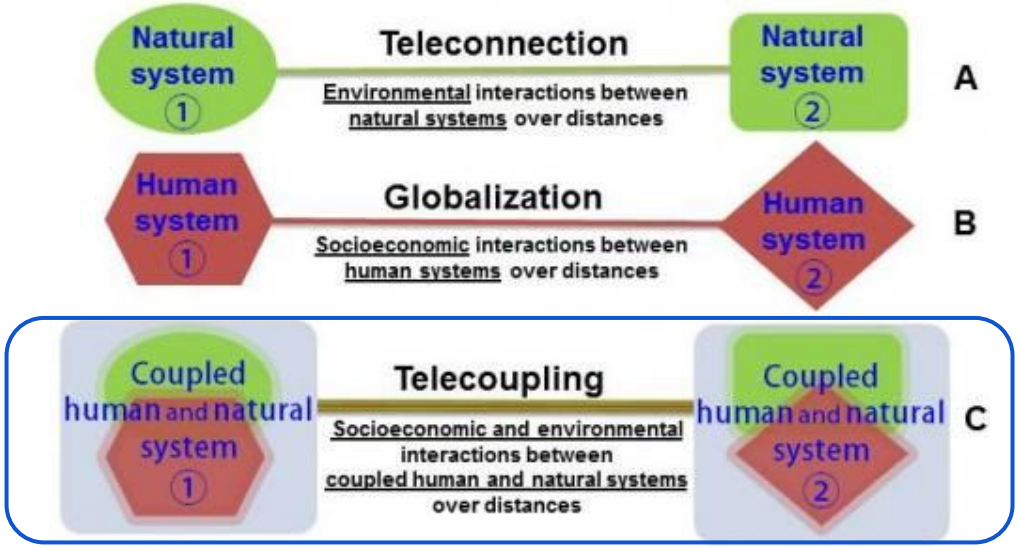
- http://csis.msu.edu/telecoupling
- https://telecouplingtoolbox.org/



OPEN COMMUNITY FORUM

slack

What is Telecoupling?



Socioeconomic and environmental interactions between coupled humans and natural systems over distances

Coupled Human-Natural Systems (CHANS)

- Social-Ecological Systems
- Socio-Environmental Systems
- Socioeconomic-Ecological Systems
- Ecological-Economic Systems
- Human-Environmental Systems
- Population-Environmental Systems
- Social-Economic-Natural Complex Systems

...

Several terminologies, same concept!

UN Sustainable Development Goals

https://sustainabledevelopment.un.org/sdgs

SDGs (adopted in 2015) articulate a road map to "the future we want" in terms of human welfare and environmental sustainability

Global assessment of biodiversity and ecosystem services

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

ipbes
Science and Policy for People and Nature

https://www.ipbes.net/

Telecoupling is featured in the upcoming report on global assessment of biodiversity and ecosystem services

Telecoupling Research: The First Five Years

Kapsar et al. 2019. *Sustainability.*

The Beginning

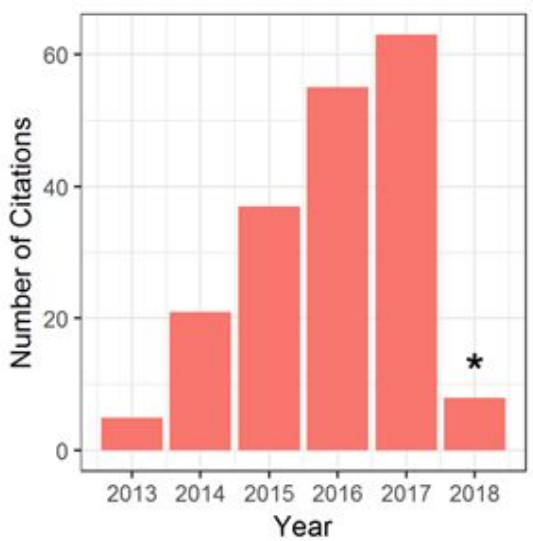
- Jianguo (Jack) Liu and 22 co-authors
- Introduced the Telecoupling **Framework**
- 399 citations (Google Scholar)

Liu, J., V. Hull, M. Batistella, R. DeFries, T. Dietz, F. Fu, T. W. Hertel, R. C. Izaurralde, E. F. Lambin, S. Li, L. A. Martinelli, W. J. McConnell, E. F. Moran, R. Naylor, Z. Ouyang, K. R. Polenske, A. Reenberg, G. de Miranda Rocha, C. S. Simmons, P. H. Verburg, P. M. Vitousek, F. Zhang, and C. Zhu. 2013. Framing sustainability in a telecoupled world. *Ecology and Society* **18**(2): 26. http://dx.doi.org/10.5751/ES-05873-180226

Synthesis

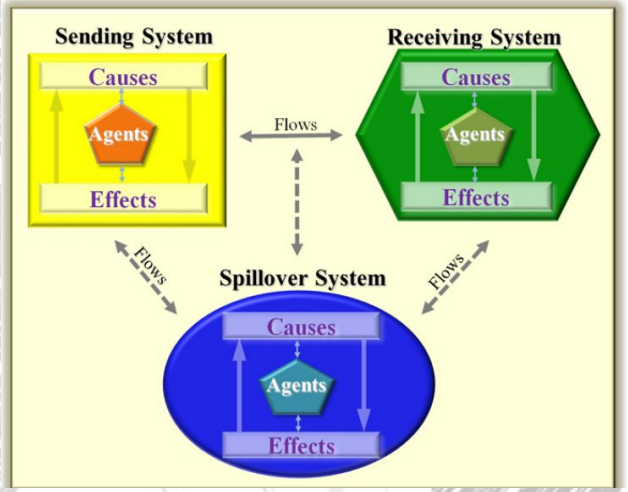
Framing Sustainability in a Telecoupled World

Jianguo Liu[1], Vanessa Hull[1], Mateus Batistella[2], Ruth DeFries[3], Thomas Dietz[1], Feng Fu[4], Thomas W. Hertel[5], R. Cesar Izaurralde[6], Eric F. Lambin[7], Shuxin Li[1], Luiz A. Martinelli[8], William J. McConnell[1], Emilio F. Moran[1], Rosamond Naylor[7], Zhiyun Ouyang[9], Karen R. Polenske[4], Anette Reenberg[10], Gilberto de Miranda Rocha[11], Cynthia S. Simmons[1], Peter H. Verburg[12], Peter M. Vitousek[7], Fusuo Zhang[13] and Chunquan Zhu[14]



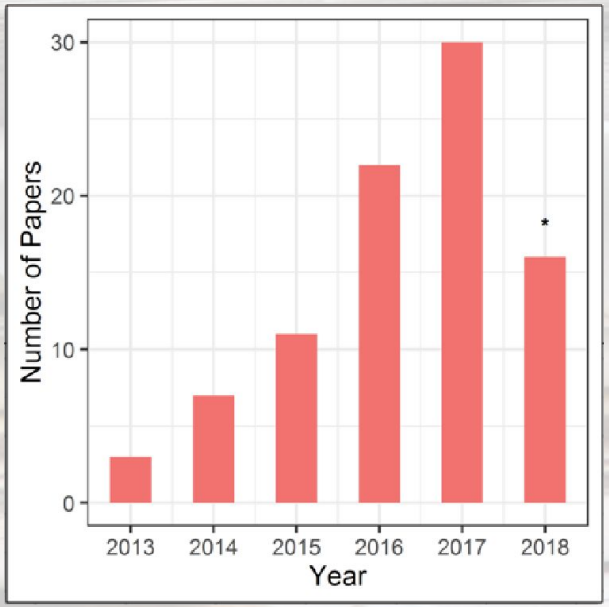
* Data extend through 1 July 2018.

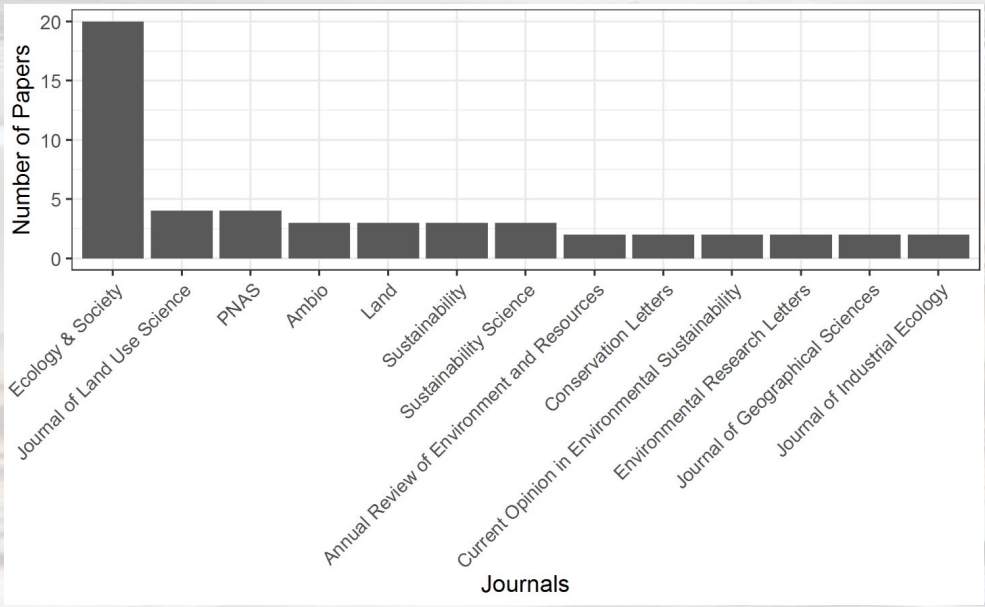
Kapsar et al. 2019. *Sustainability*.



Telecoupling Literature Review

- Web of Science
- 89 Publications
- 47 journals/books
- Systematically coded and classified





sustainability

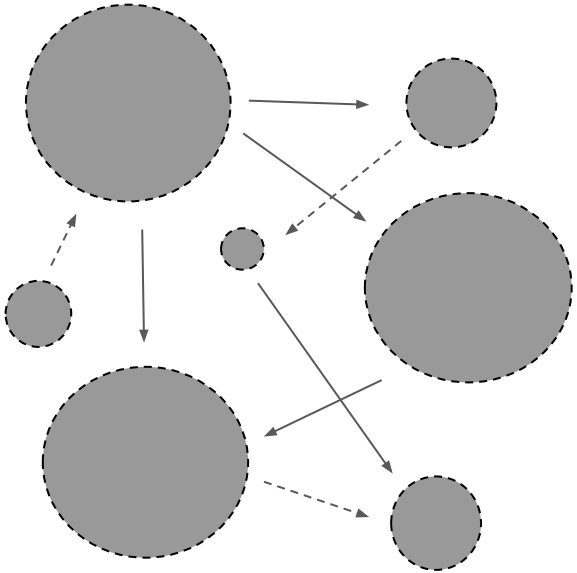
MDPI

Review

Telecoupling Research: The First Five Years

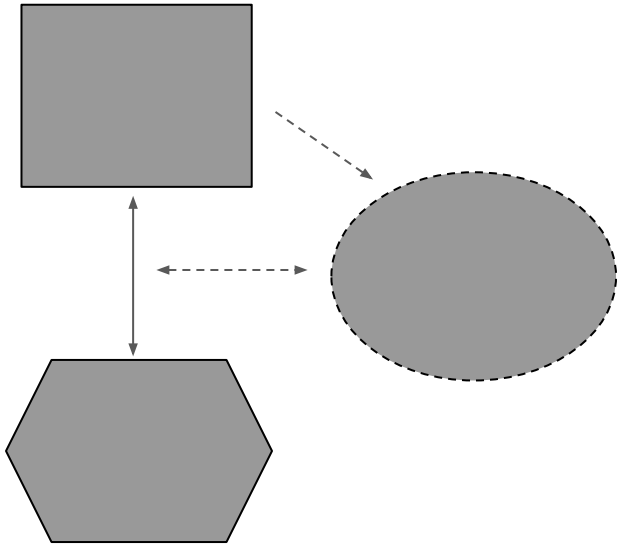
Kelly E. Kapsar [1,*,†], Ciara L. Hovis [1,*,†], Ramon Felipe Bicudo da Silva [2], Erin K. Buchholtz [3], Andrew K. Carlson [1,4], Yue Dou [1], Yueyue Du [5], Paul R. Furumo [6], Yingjie Li [1,7], Aurora Torres [8,9], Di Yang [10], Ho Yi Wan [11], Julie G. Zaehringer [12] and Jianguo Liu [1]

Telecoupling Phenomenon



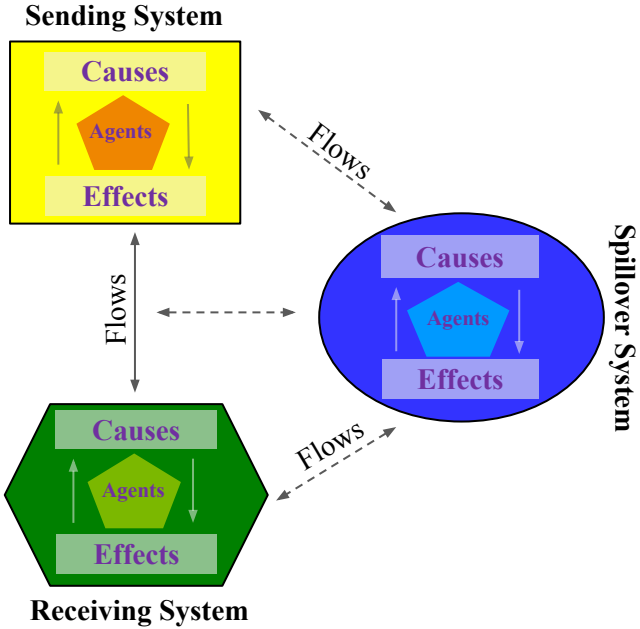
The acknowledgement of connections between distant places. Boundaries and roles of places not clearly defined. Synonym for globalization.

Telecoupling Concept



Phenomena are characterized as a telecoupled process, with some boundaries defined. However, the specific terminology of the telecoupling framework is not used.

Telecoupling Framework



Explicit usage of the unifying language of the telecoupling framework with boundaries and system roles defined.

Telecoupling Phenomenon

- Acknowledgment of distal connections, but no boundaries
- Synonym for globalization, keyword

Ambio 2017, 46:706–716
DOI 10.1007/s13280-017-0906-x

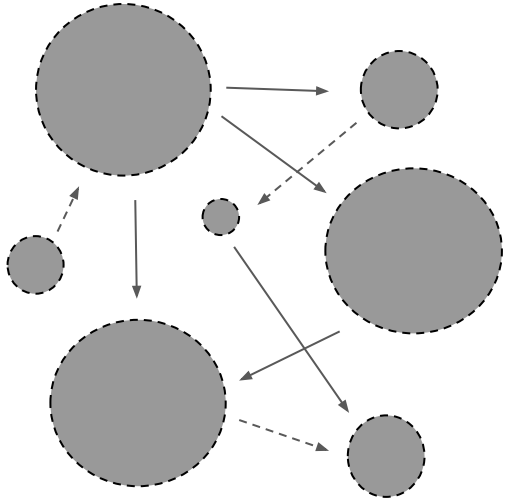
KUNGL. VETENSKAPS AKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES

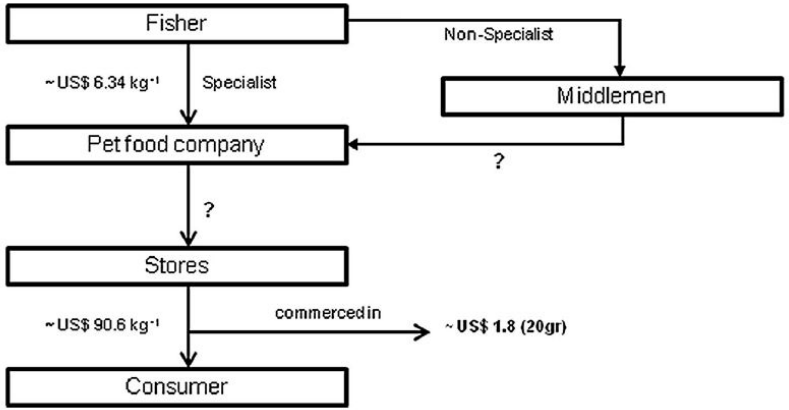
CrossMark

REPORT

Distal impacts of aquarium trade: Exploring the emerging sandhopper (*Orchestoidea tuberculata*) artisanal shore gathering fishery in Chile

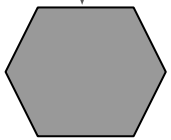
Sebastián Tapia-Lewin, Karina Vergara, Christian De La Barra, Natalio Godoy, Juan Carlos Castilla, Stefan Gelcich

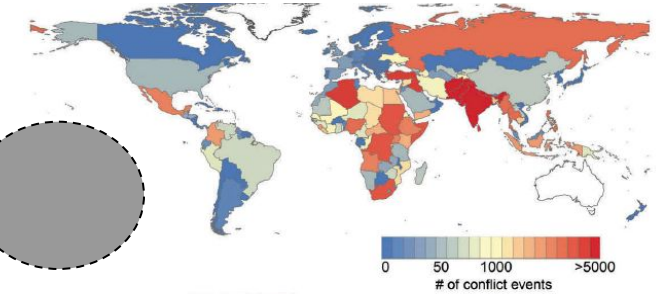


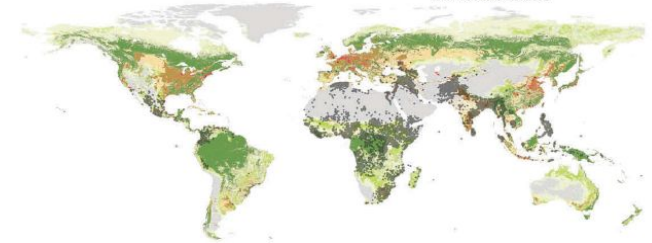


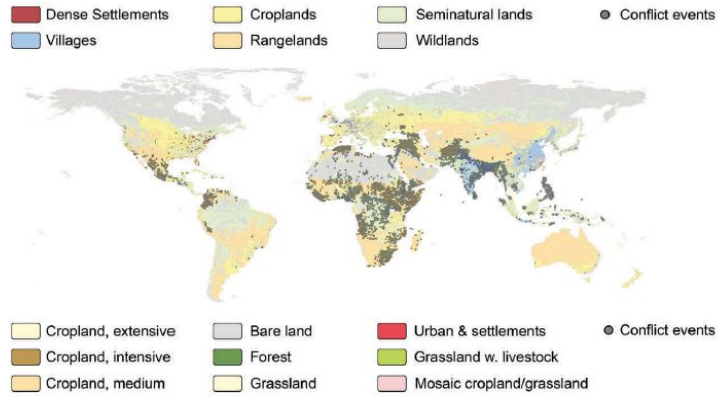
Telecoupling Concept

- System components characterized as impacted by a telecoupled process
- Boundaries somewhat defined
- Framework terminology not applied









Taylor & Francis
Taylor & Francis Group

Journal of Land Use Science

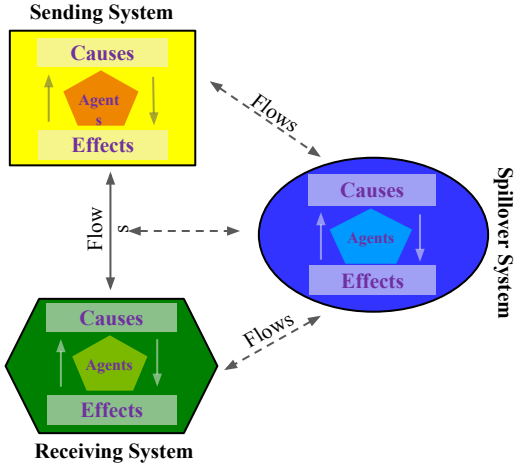
ISSN: 1747-423X (Print) 1747-4248 (Online) Journal homepage: https://www.tandfonline.com/loi/tlus20

The impacts of warfare and armed conflict on land systems

Matthias Baumann & Tobias Kuemmerle

Telecoupling Framework

- Explicit usage of the telecoupling language with boundaries and system roles defined



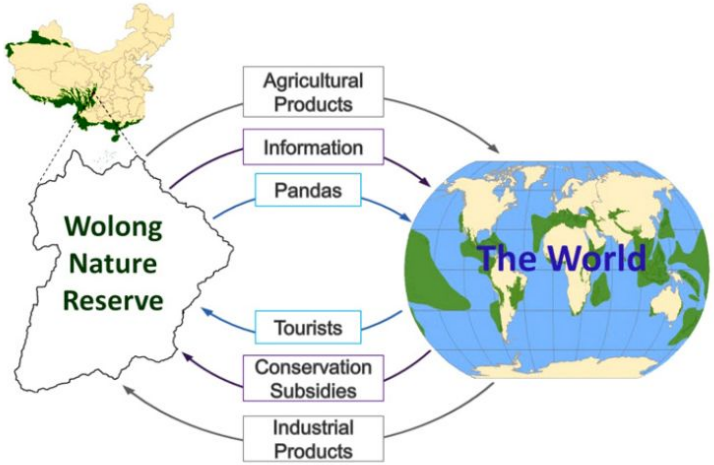
Liu, J., V. Hull, J. Luo, W. Yang, W. Liu, A. Viña, C. Vogt, Z. Xu, H. Yang, J. Zhang, L. An, X. Chen, S. Li, Z. Ouyang, W. Xu and H. Zhang 2015. Multiple telecouplings and their complex interrelationships. *Ecology and Society* **20**(3):44. http://dx.doi.org/10.5751/ES-07868-200344

E&S

Research

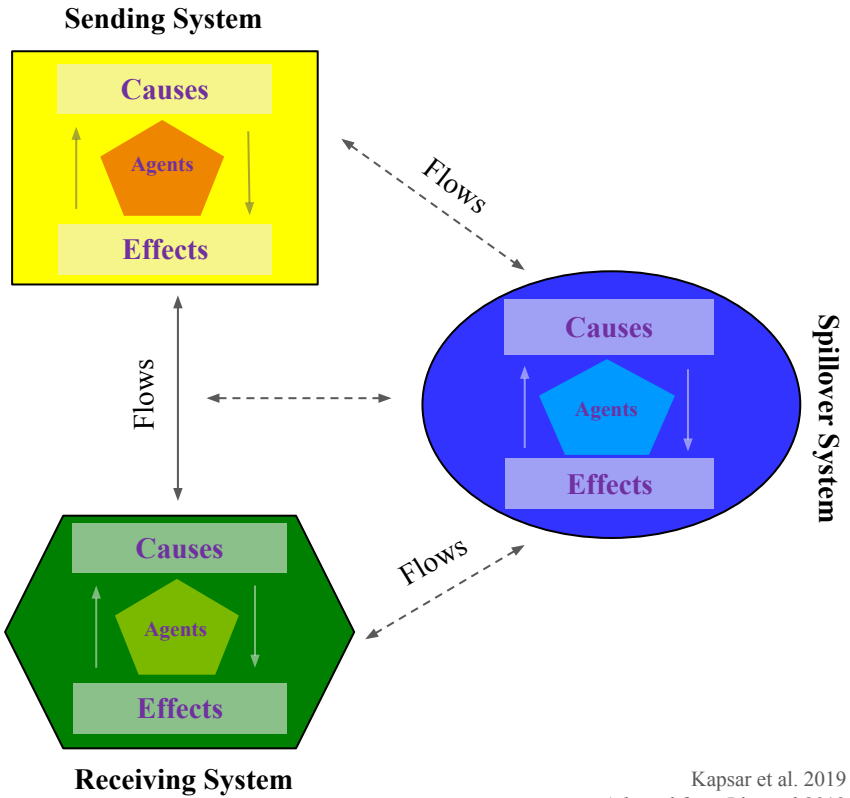
Multiple telecouplings and their complex interrelationships

Jianguo Liu[1], *Vanessa Hull*[1], *Junyan Luo*[1,2], *Wu Yang*[1,3], *Wei Liu*[1,4], *Andrés Viña*[1], *Christine Vogt*[5], *Zhenci Xu*[1], *Hongbo Yang*[1], *Jindong Zhang*[1], *Li An*[6], *Xiaodong Chen*[7], *Shuxin Li*[1], *Zhiyun Ouyang*[8], *Weihua Xu*[8] and *Hemin Zhang*[9]



Telecoupling Basics

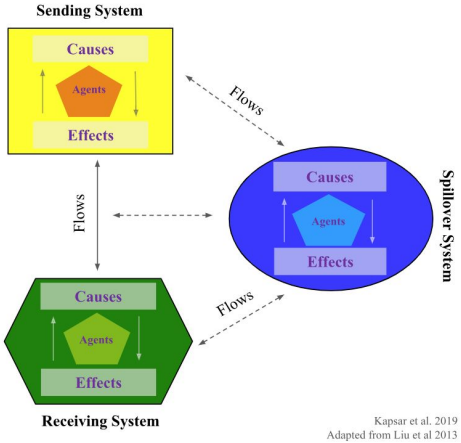
- Boundaries
- Sending System
- Receiving System
- Spillover System
- Flows
- Agents
- Causes
- Effects



Kapsar et al. 2019
Adapted from Liu et al 2013

Telecoupling Basics - Boundaries

- Crucial!
- Flexible
- Context important



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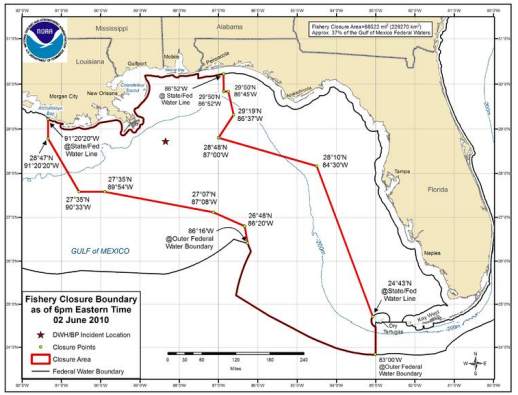
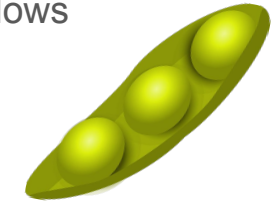
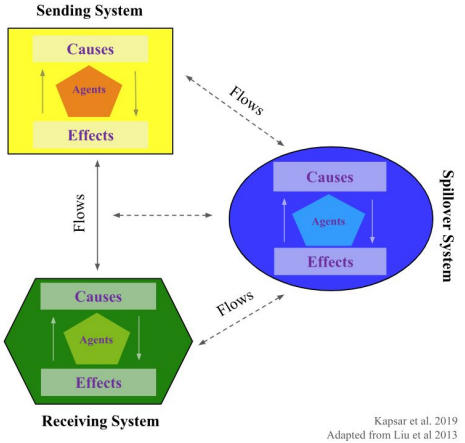
Adapted from Liu et al 2013



Telecoupling Basics - Sending System

- Outward direction of flows
- Origin or source
- Ex: Exporting country





Kapsar et al. 2019
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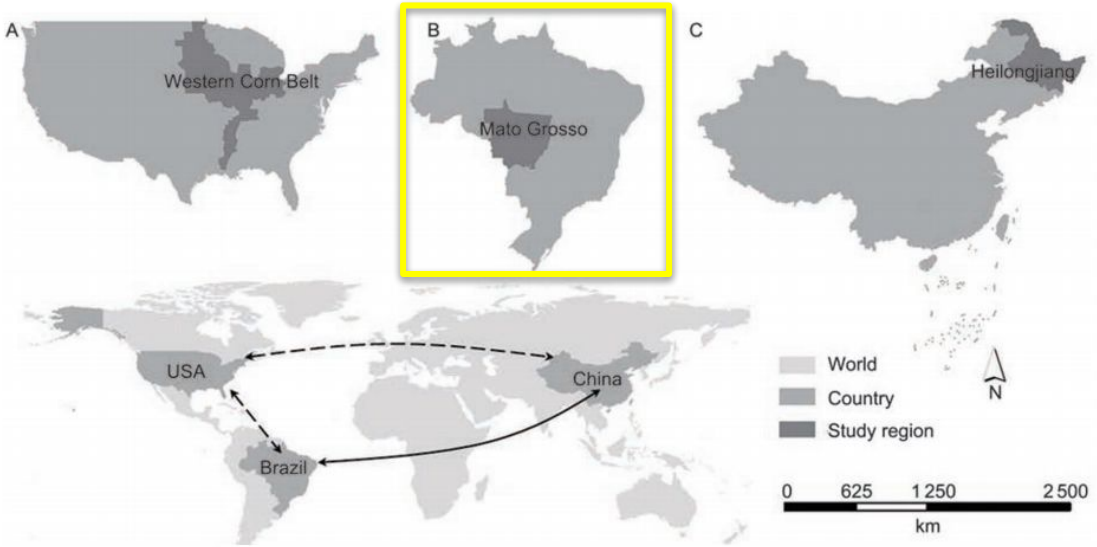

Journal of Integrative Agriculture 2017, 16(2): 368–376

Available online at www.sciencedirect.com

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JIA

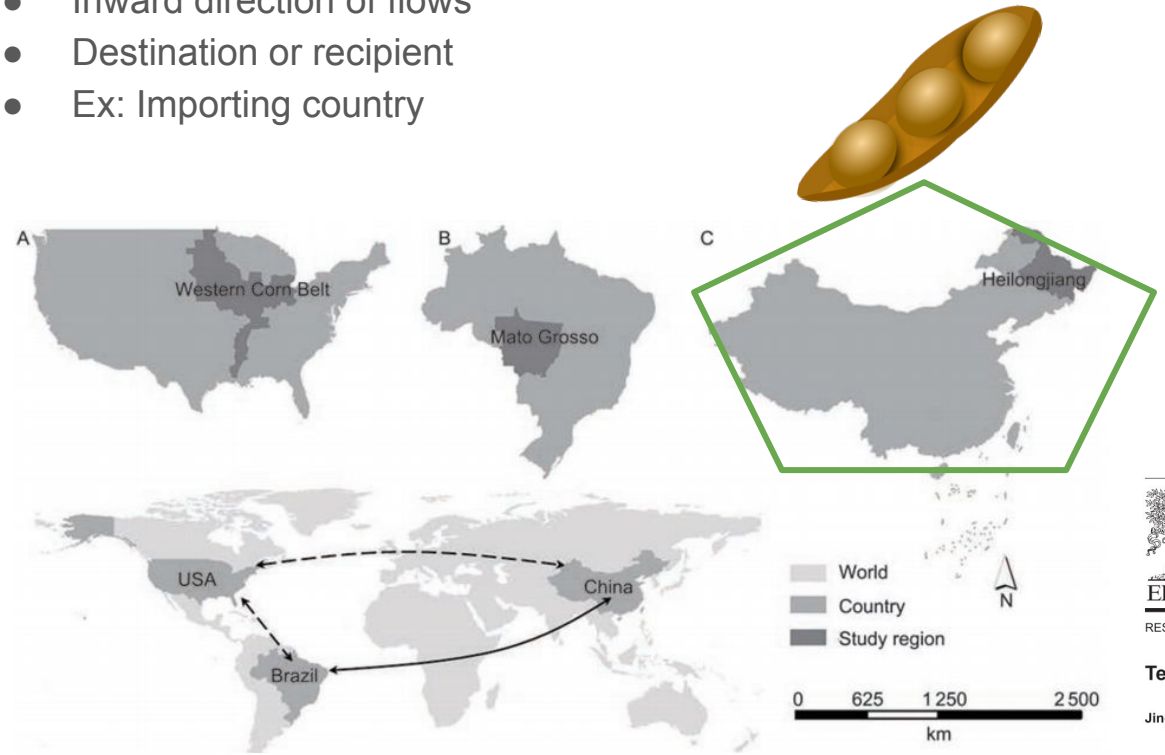
RESEARCH ARTICLE

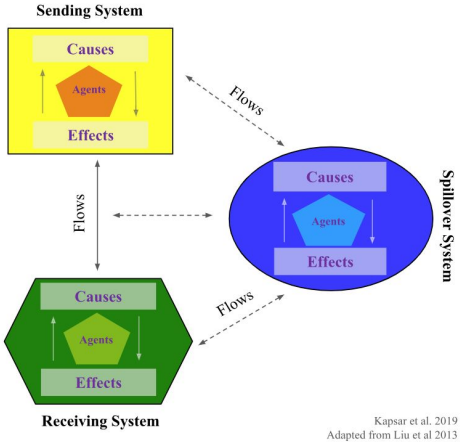
Telecoupled land-use changes in distant countries

Jing Sun[1], TONG Yu-xin[2], Jianguo Liu[1]

Telecoupling Basics - Receiving System

- Inward direction of flows
- Destination or recipient
- Ex: Importing country





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Journal of Integrative Agriculture 2017, 16(2): 368–376

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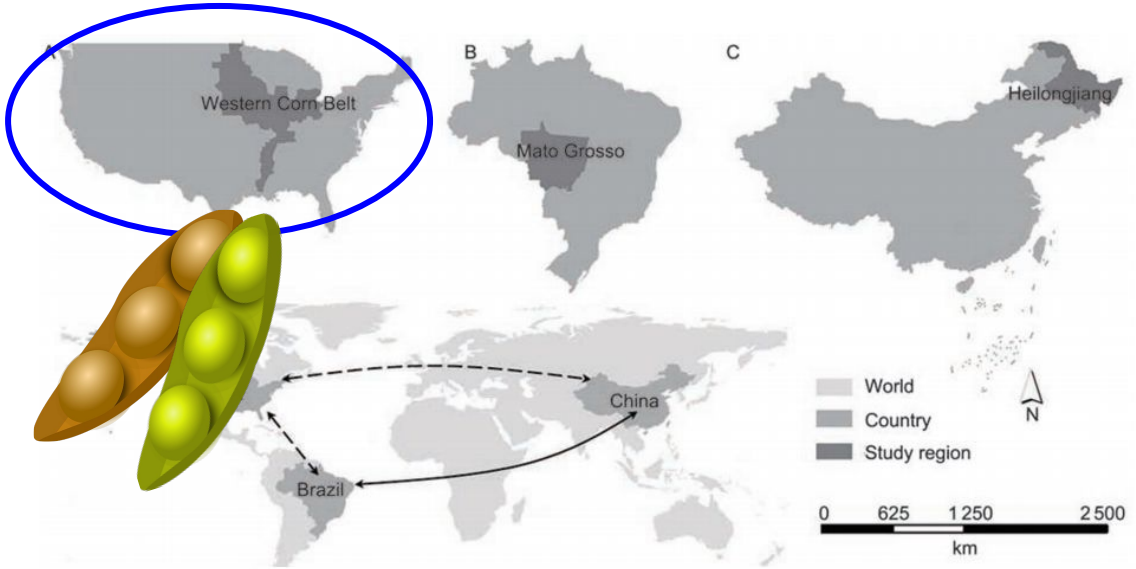
RESEARCH ARTICLE

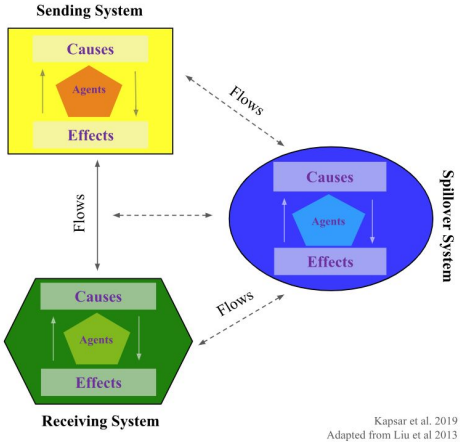
Telecoupled land-use changes in distant countries

Jing Sun[1], TONG Yu-xin[2], Jianguo Liu[1]

Telecoupling Basics - Spillover System

- Affect and/or are affected by flows between sending and receiving systems
- Stopover, third party





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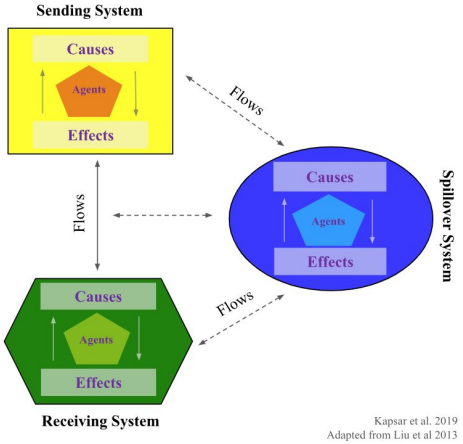
RESEARCH ARTICLE

Telecoupled land-use changes in distant countries

Jing Sun[1], TONG Yu-xin[2], Jianguo Liu[1]

Telecoupling Basics - Flows

- Movements of material, energy, or information
- Result from actions from agents
- Unidirectional or bidirectional
- Infrastructure networks dictate paths



Kapsar et al. 2019
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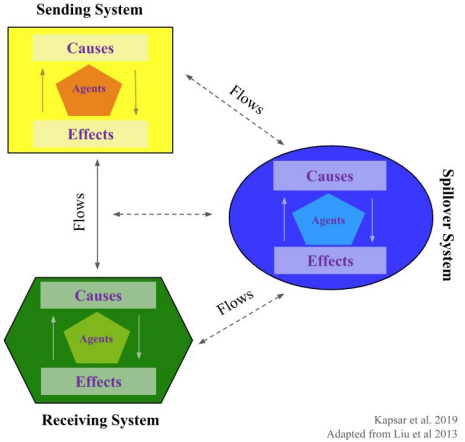
Telecoupling Basics - Flows



Kapsar et al. 2019
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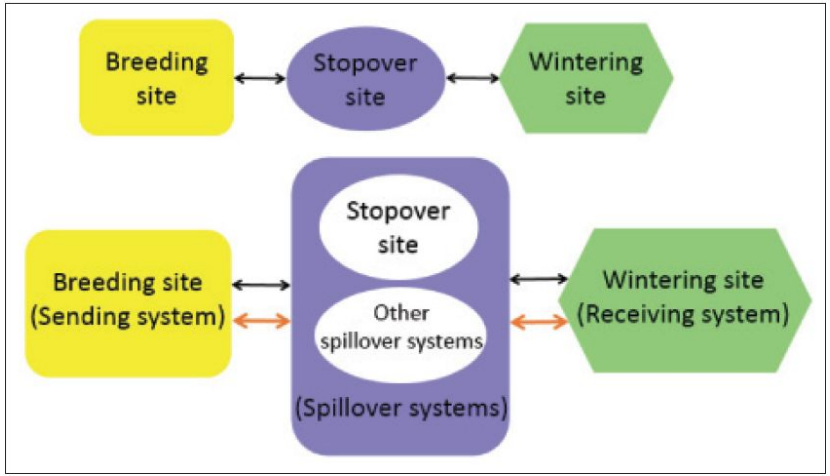


ELEMENTA
Science of the Anthropocene

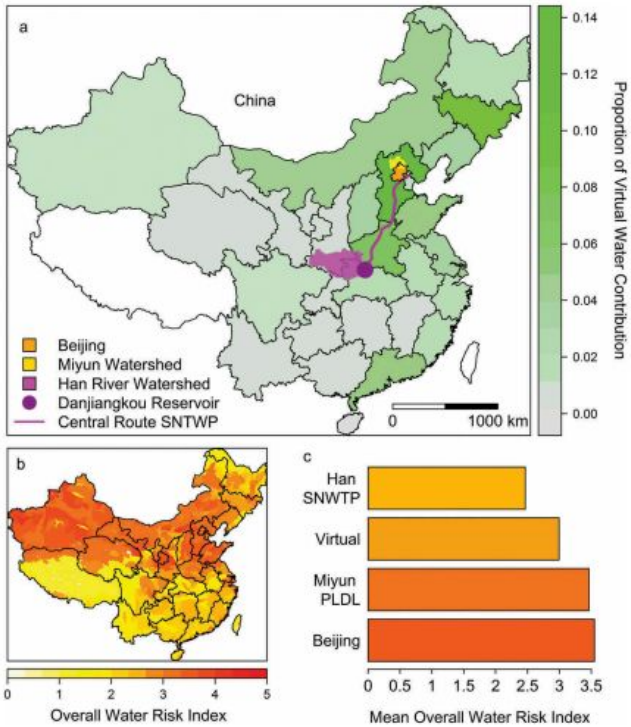
Hulina, J et al 2017 Telecoupling framework for research on migratory species in the Anthropocene. *Elem Sci Anth*, 5: 5, DOI: https://doi.org/10.1525/elementa.184

RESEARCH ARTICLE

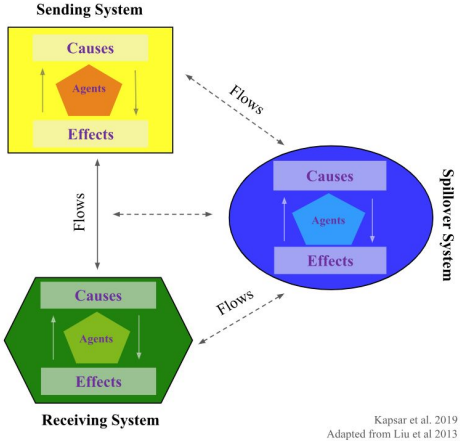
Telecoupling framework for research on migratory species in the Anthropocene

Jacqueline Hulina*, Carol Bocetti†, Henry Campa III‡, Vanessa Hull*, Wu Yang*,§ and Jianguo Liu*

Telecoupling Basics - Flows



ure 2. The demonstration city, Beijing, and its water sources. (a) Receiving and sending syst



Kapsar et al. 2019
Adapted from Liu et al 2013

Water International

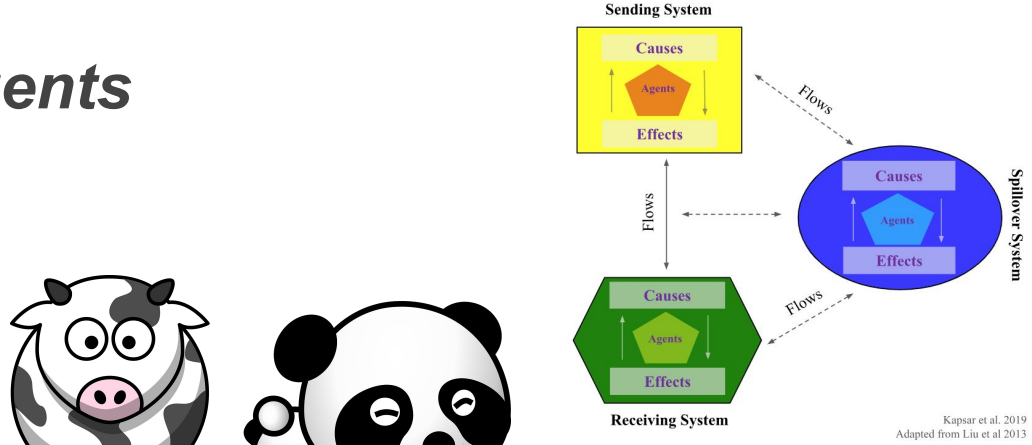
ISSN: 0250-8060 (Print) 1941-1707 (Online) Journal homepage: https://www.tandfonline.com/loi/rwin20

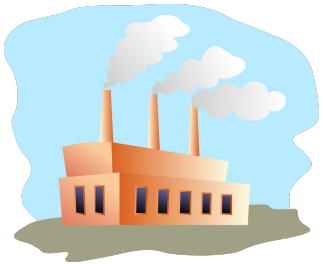
Telecoupling in urban water systems: an examination of Beijing's imported water supply

Jillian M. Deines, Xiao Liu & Jianguo Liu

Telecoupling Basics - Agents

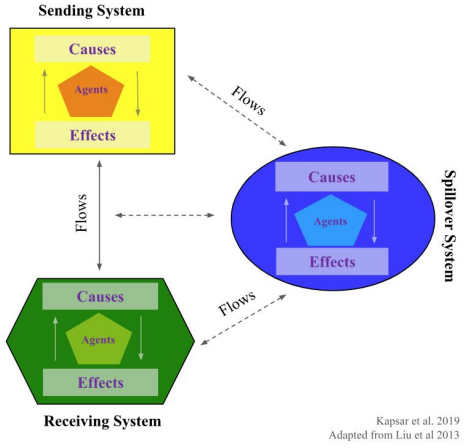
- Actors in a system
  - Can be an individuals or entity
- Direct or indirect
- Human or animal





Telecoupling Basics - Causes & Effects

- Causes & Effects
  - Defined within a system
  - Research/context specific
  - Linked via feedbacks

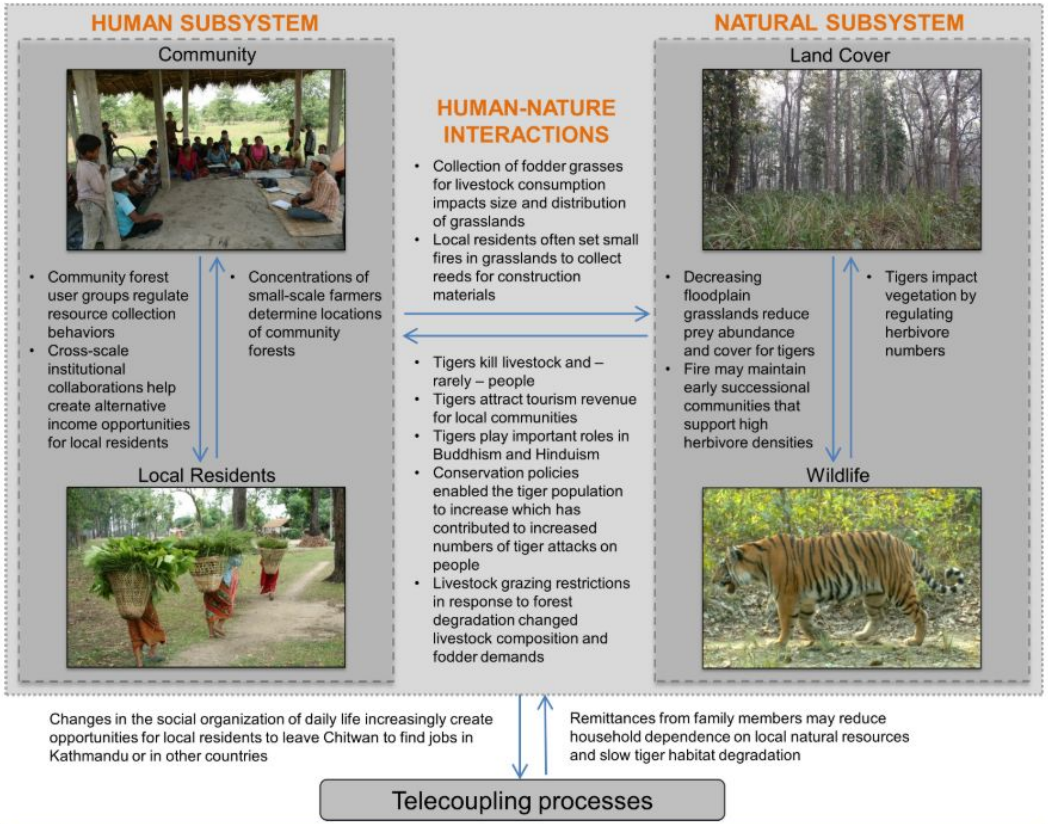


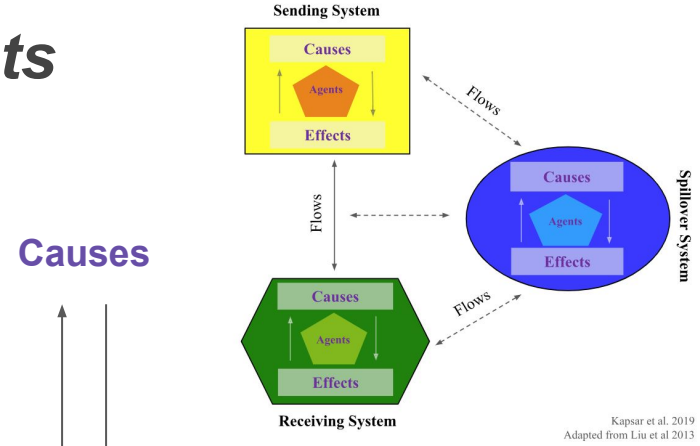
Kapsar et al. 2019
Adapted from Liu et al 2013

Causes
- Influence the emergence and dynamics of telecouplings
- Proximate or ultimate

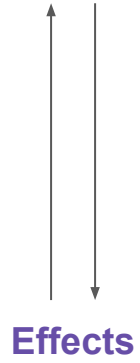
Effects
- Consequences of telecoupling
- Socioeconomic and environmental

Telecoupling Basics - Causes & Effects





Kapsar et al. 2019
Adapted from Liu et al 2013

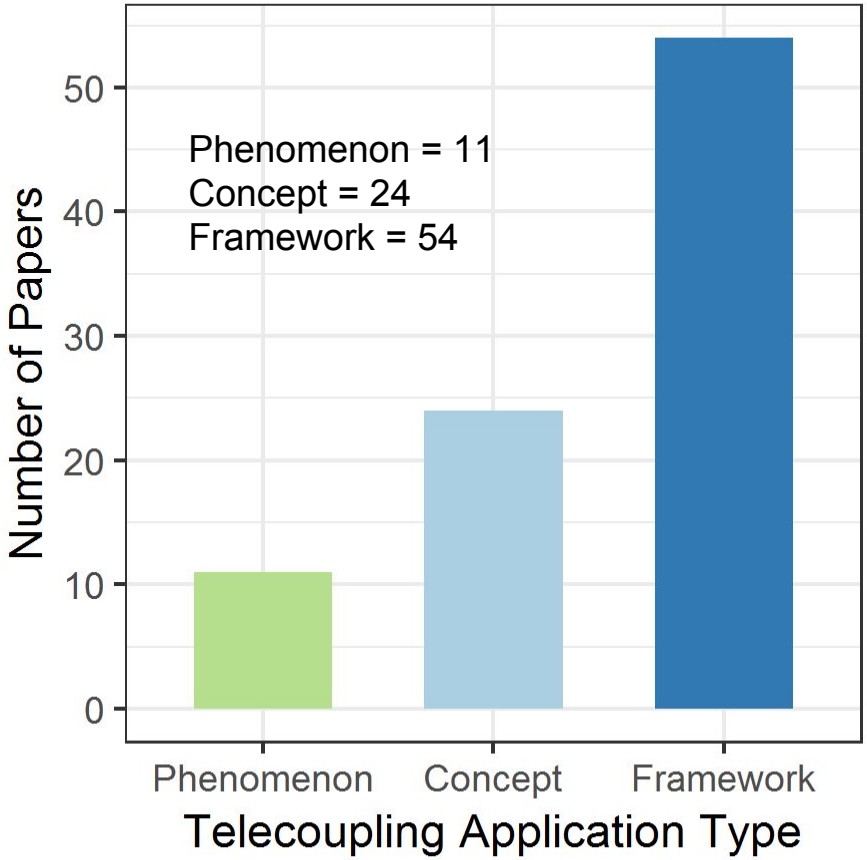


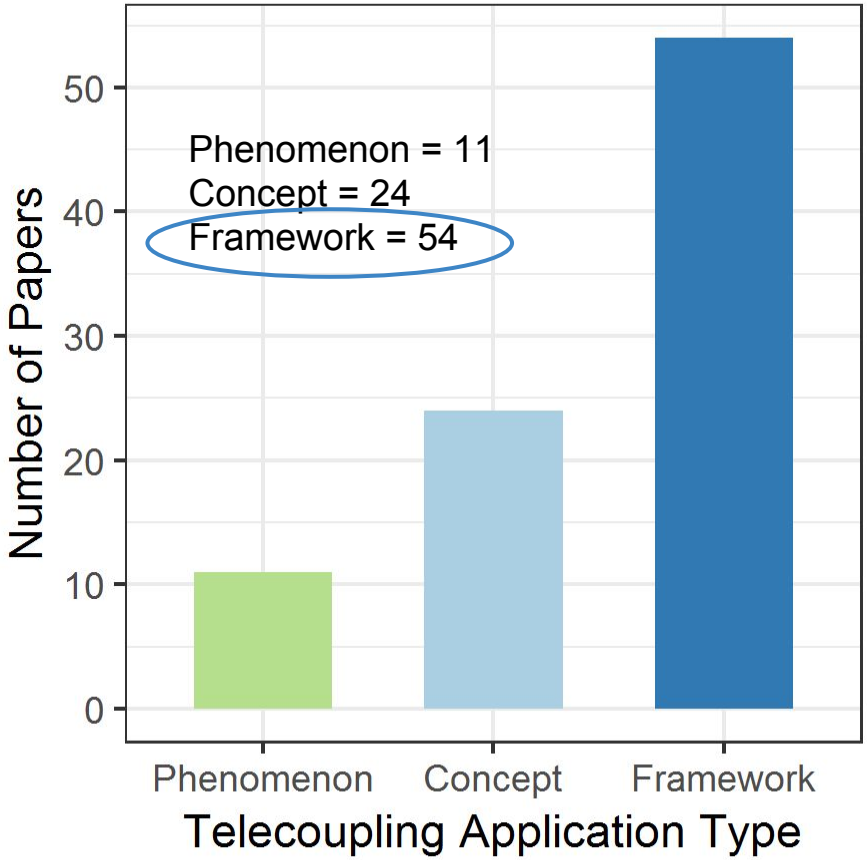
Carter, N. H., A. Viña, V. Hull, W. J. McConnell, W. Axinn, D. Ghimire, and J. Liu. 2014. Coupled human and natural systems approach to wildlife research and conservation. *Ecology and Society* **19**(3): 43. http://dx.doi.org/10.5751/ES-06881-190343

Synthesis

Coupled human and natural systems approach to wildlife research and conservation

Neil H. Carter[1], Andrés Viña[2], Vanessa Hull[2], William J. McConnell[2], William Axinn[3], Dirgha Ghimire[3] and Jianguo Liu[2]


Phenomenon = 11
Concept = 24
Framework = 54
Number of Papers
0
10
20
30
40
50
Phenomenon
Concept
Framework
Telecoupling Application Type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Concept = 24
Framework = 54
Number of Papers
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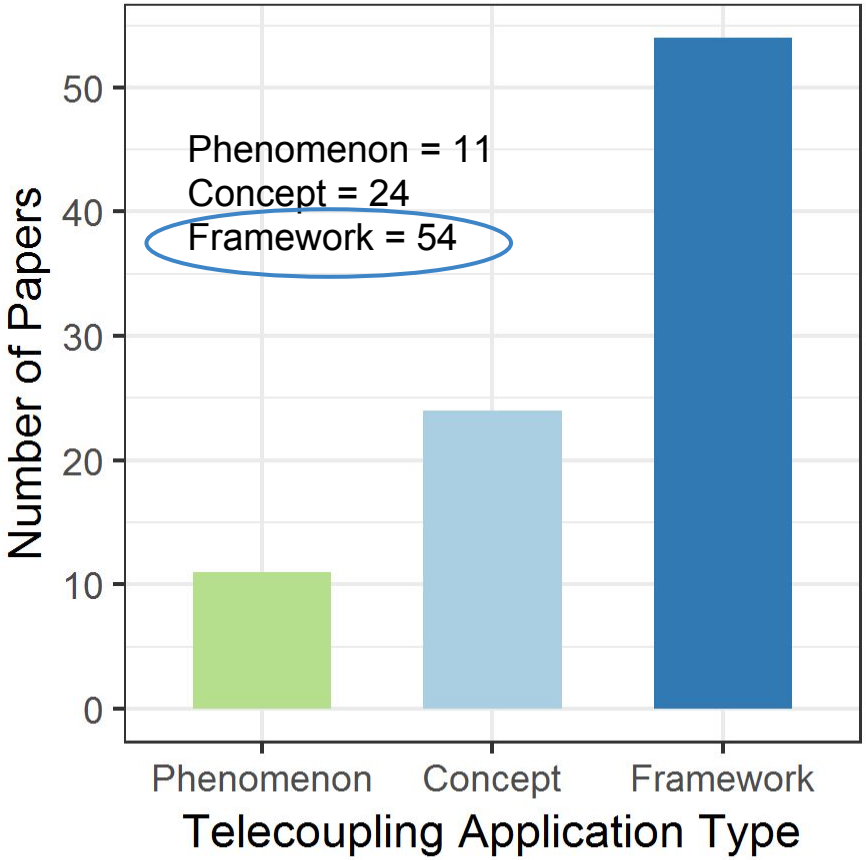
10
20
30
40
50
Phenomenon
Concept
Framework
Telecoupling Application Type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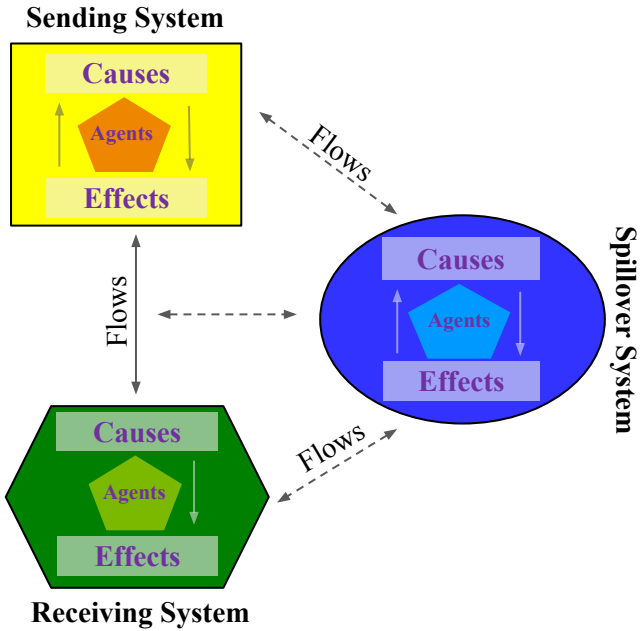
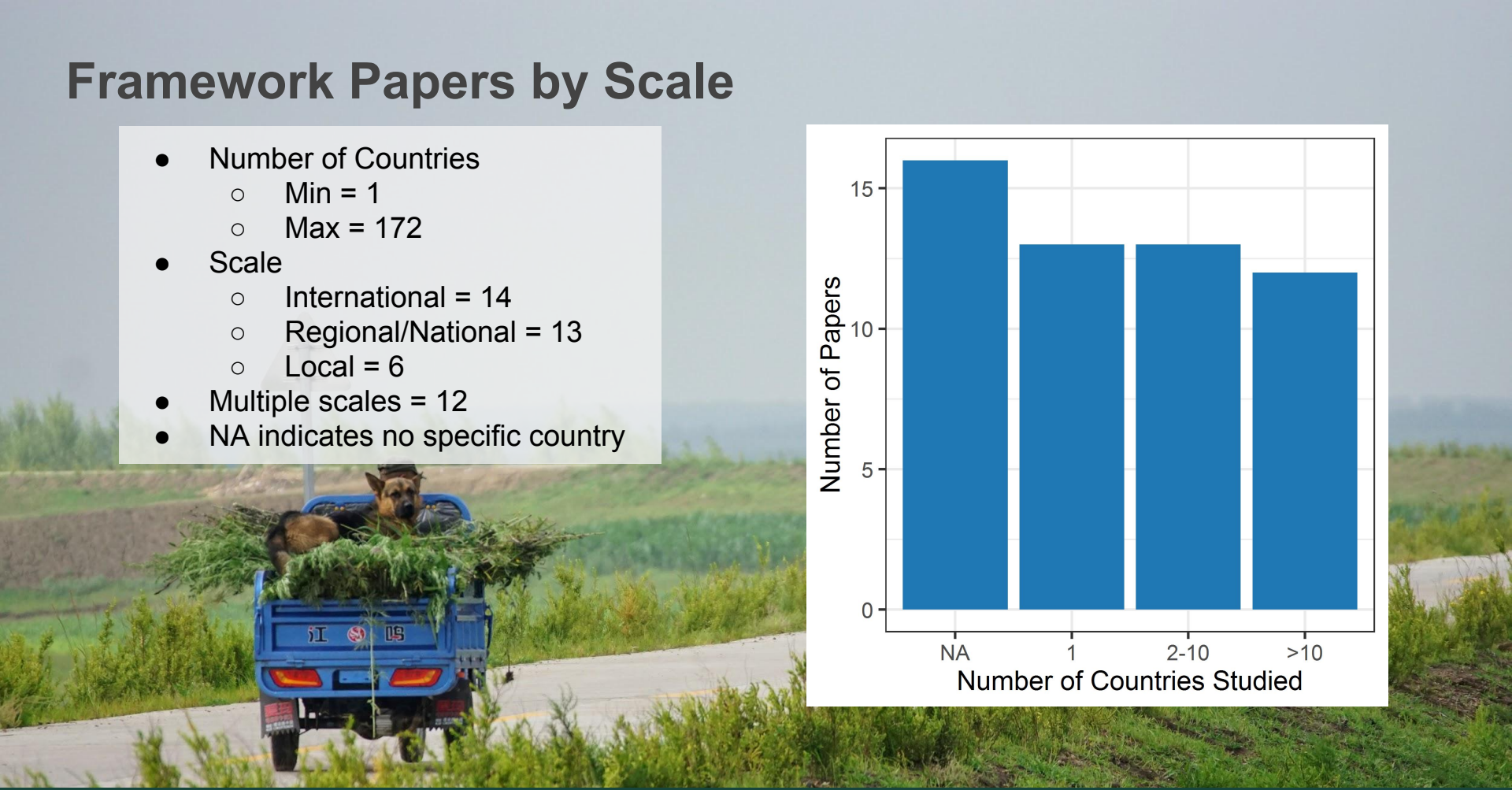
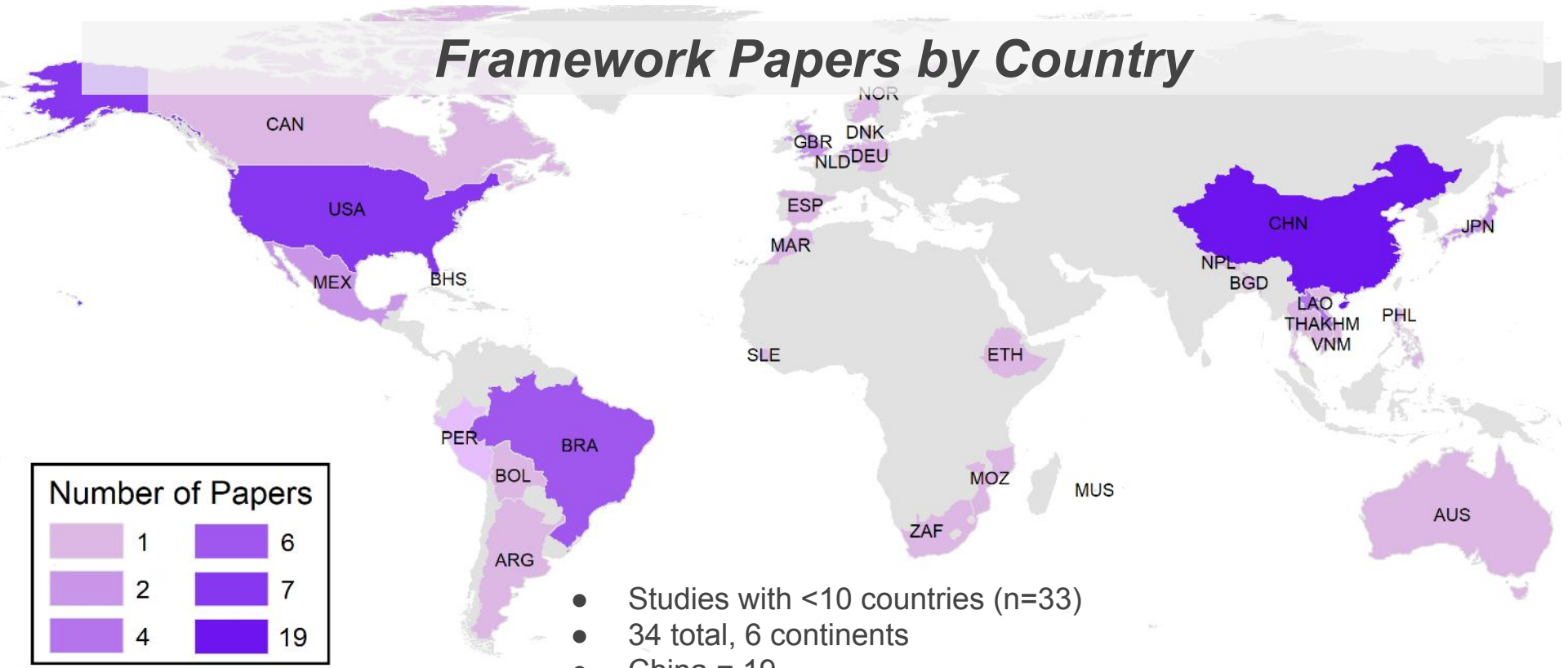

Sending System
Causes
Agents
Effects
Flows
Flows
Causes
Agents
Effects
Spillover System
Causes
Agents
Effects
Flows
Receiving System

Framework Papers by Scale

- Number of Countries
  - Min = 1
  - Max = 172
- Scale
  - International = 14
  - Regional/National = 13
  - Local = 6
- Multiple scales = 12
- NA indicates no specific country



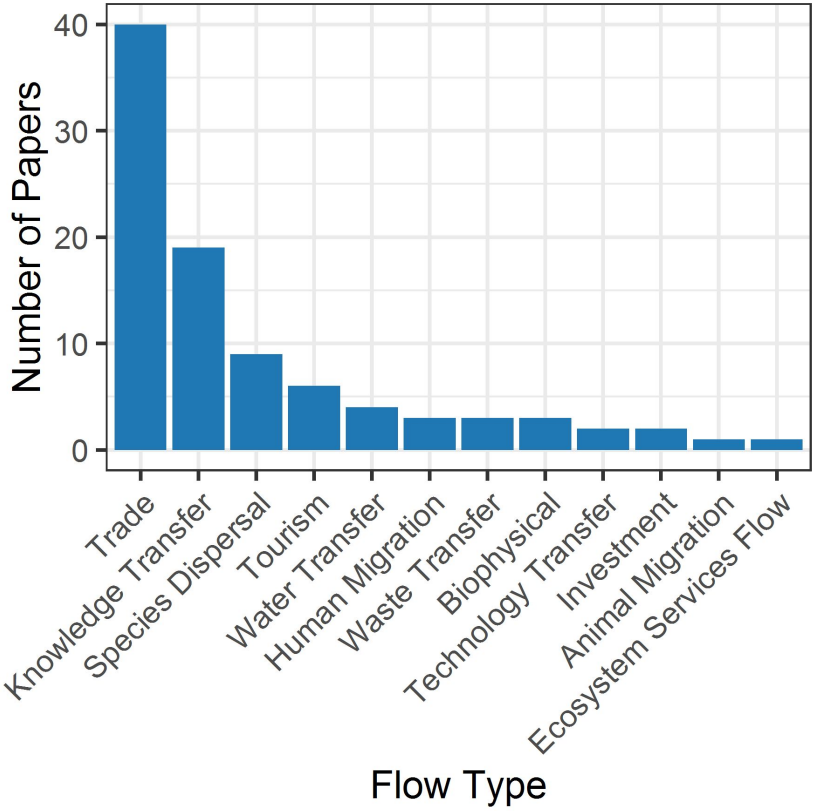
Framework Papers by Country



- Studies with <10 countries (n=33)
- 34 total, 6 continents
- China = 19
- USA = 7
- Brazil = 6
- Laos = 4

Framework Papers by Flow

- **Trade** = 74%
- Knowledge transfer = 33%
- Species dispersal = 17%



Future Directions of Telecoupling Research

- Focus on Spillover Systems
- Cross-disciplinary analyses
- Processual commonalities
- Causality
- Telecoupling and Governance

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Future Directions of Telecoupling Research

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- Cross-disciplinary analyses
  - “paper series”
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- Causality
- Telecoupling and Governance


Contents lists available at ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

Economic drivers of telecoupling and terrestrial carbon fluxes in the global soybean complex

Guolin Yao*, Thomas W. Hertel, Farzad Taheripour


Conservation Letters

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POLICY PERSPECTIVE

The Coupling of South American Soybean and Cattle Production Frontiers: New Challenges for Conservation Policy and Land Change Science

Nestor Ignacio Gasparri[1] & Yann le Polain de Waroux[2]

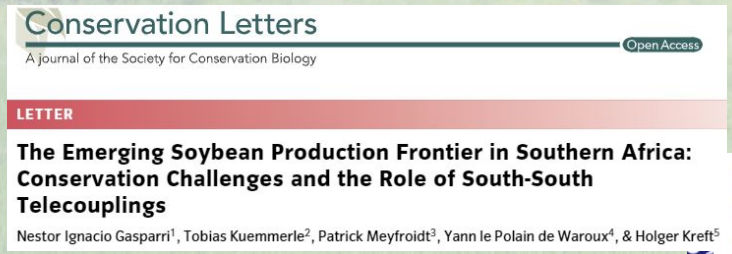

land

MDPI

Article

The Sino-Brazilian Telecoupled Soybean System and Cascading Effects for the Exporting Country

Ramon Felipe Bicudo da Silva [1,*], Mateus Batistella [1,2], Yue Dou [3], Emilio Moran [3,4], Sara McMillan Torres [4] and Jianguo Liu [3]


Conservation Letters

A journal of the Society for Conservation Biology

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LETTER

The Emerging Soybean Production Frontier in Southern Africa: Conservation Challenges and the Role of South-South Telecouplings

Nestor Ignacio Gasparri[1], Tobias Kuemmerle[2], Patrick Meyfroidt[3], Yann le Polain de Waroux[4], & Holger Kreft[5]


Importing food damages domestic environment: Evidence from global soybean trade

Jing Sun[a,b], Harold Mooney[c,1], Wenbin Wu[a], Huajun Tang[a], Yuxin Tong[d], Zhenci Xu[b], Baorong Huang[e], Yeqing Cheng[f], Xinjun Yang[g], Dan Wei[d], Fusuo Zhang[h], and Jianguo Liu[b,1]

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Future Directions of Telecoupling Research

- Focus on Spillover Systems
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- Processual commonalities
  - *Governing the Commons,* Ostrom
- Causality
- Telecoupling and Governance

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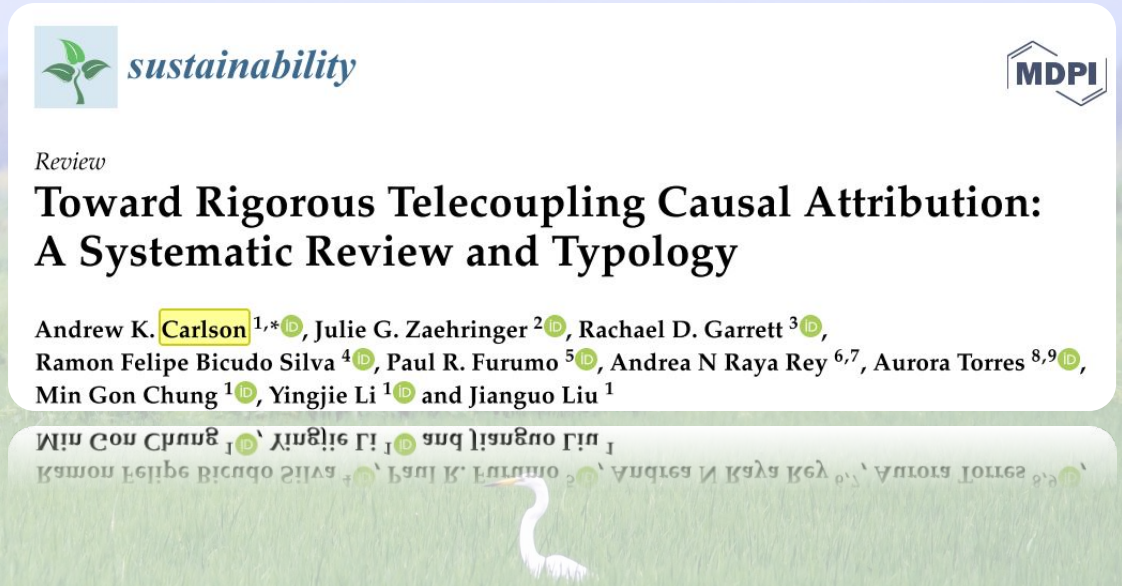

Future Directions of Telecoupling Research

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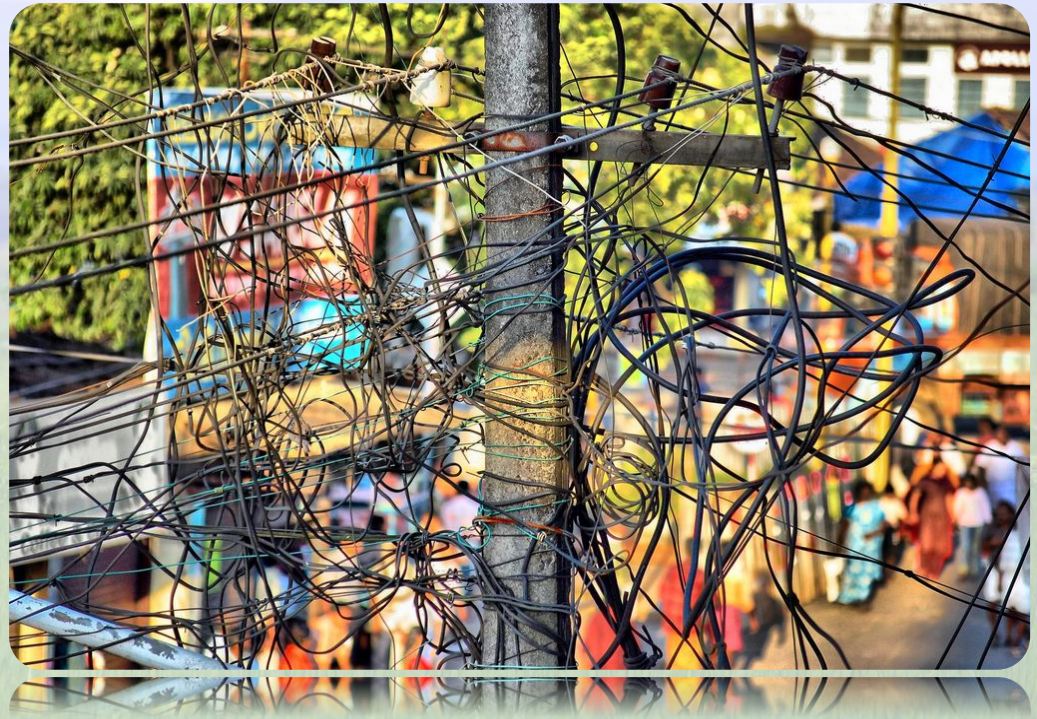

Thank you!
Q&A

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Telecoupling: A New Frontier for Global Sustainability

- **February 19th, 2019: Telecoupling 101: Concepts, Terminology, and Published Case Studies**
- **February 26th, 2019: Telecoupling Toolbox: Integrated Tools for Sustainability Science**
- **March 12th, 2019: Telecoupling GeoApp: Cloud-based Platform Overview and Widgets**
- **March 19th, 2019: Telecoupling GeoApp: Case Studies with Story Maps**

WEBINAR REGISTRATION AVAILABLE @

https://telecouplingtoolbox.org/webinar

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