

# Interdisciplinary Research: How to get started and find support at MSU



Credit: University of Surrey

**Dr. Nicole Motzer, Director of Research Development**  
**College of EHHD Retreat – August 18, 2022**

# What I hope you gain from this talk

- Greater excitement around interdisciplinary research, including benefits and opportunities
- A better understanding of how to engage and leverage support from the Office of Research Development (plus other internal supports)
- A suite of practical first steps for launching interdisciplinary collaborative efforts

# WHAT IS INTERDISCIPLINARY RESEARCH?

# Defining interdisciplinary research

“...integration of data, methods, tools, concepts, theories, and/or perspectives from multiple disciplines or bodies of knowledge in order to answer a question, to solve a problem, or to address a topic or theme that is too broad or complex to be dealt with by one discipline”

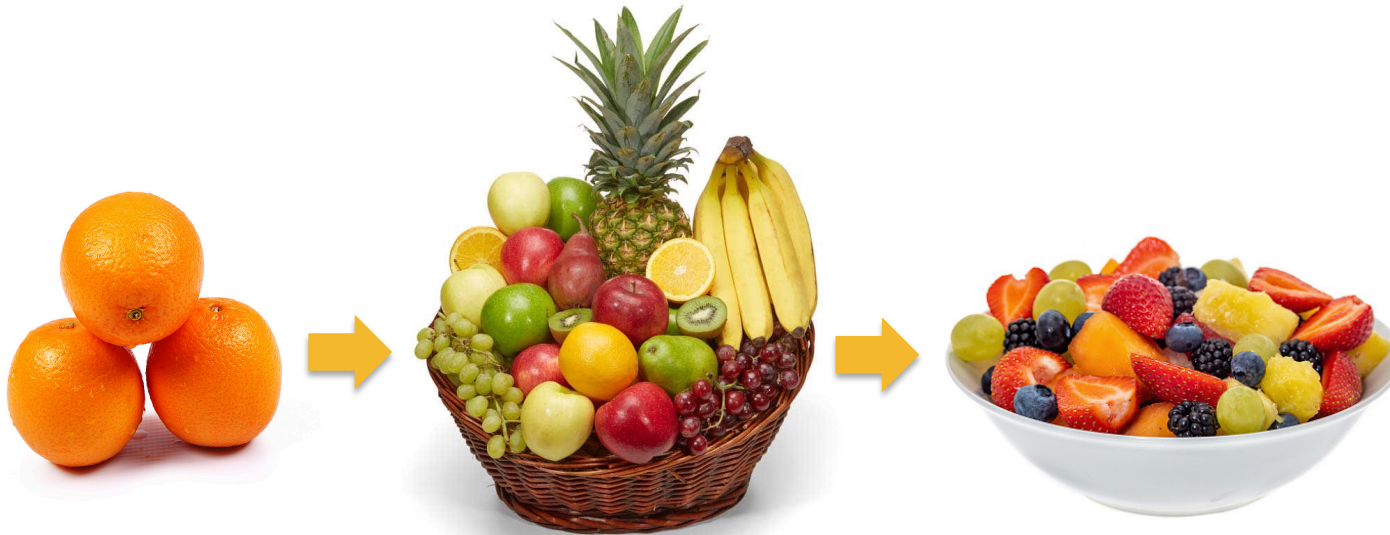
(Klein 2021, p. xviii)

# Defining interdisciplinary research

Disciplinary

Multidisciplinary

Interdisciplinary



Adapted from Nissani (1995)

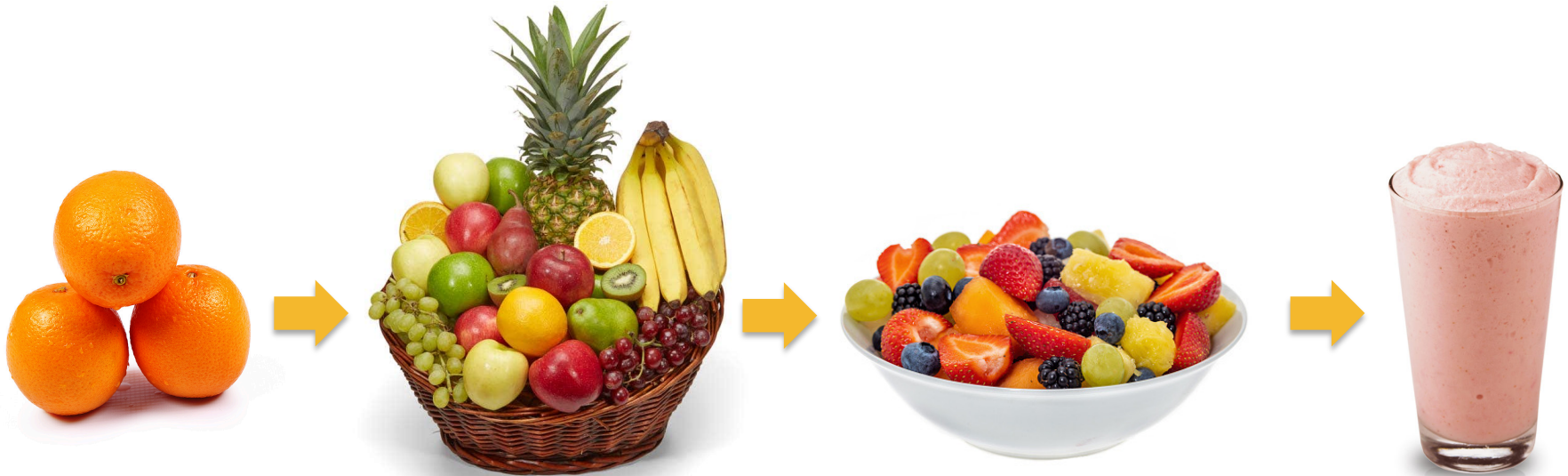
# Defining interdisciplinary research

Disciplinary

Multidisciplinary

Interdisciplinary

Convergence



Adapted from Nissani (1995)



# Defining interdisciplinary research

- Example #1 from within EHHD
  - “Culturally-responsive Energy Engineering Education in Rural/Reservation Schools”
    - PI = Paul Gannon (Engineering); Collaborators = Becky Hammack, Nick Lux, and Sweeney Windchief (Education)
    - Funded by **NSF** - \$600,000 for 5 years
    - This proposal revolves around energy as a unifying research theme because of the obvious local, regional, and global significance and couples engineering and education to enhance elementary school teachers’ abilities to teach about topics such as building energy systems, biomass energy conversion, fluid flow processes in oil refineries and hydroelectric dams, materials for energy conversion systems like fuel cells, batteries, and turbines, and solar, as well as sustainable transportation systems
    - The interdisciplinary nature of this project broadens and intensifies the impact – not just teaching science teachers, but developing interest in elementary school students in the science that underpins development of solutions to address one of if not the most pressing challenges of our time

# Defining interdisciplinary research

- Example #2 from within EHHD:
  - “Fort Peck Reservation (MT) Enhancements to its Northern Great Plains Buffalo Range Walking Trail: Native Food/Medicinal Plants availability, and Related School, Community and K-14 Education”
    - PI = Elizabeth Bird; Collaborators = Mike Everts (Arts and Architecture) and Christine Lux and Christine Stanton (EHHD)
    - Submitted to **National Fish & Wildlife Foundation** - \$5 million
    - This proposal revolves around restoration of the Yellowstone bison to tribal lands and integrates land and buffalo restoration, community education, indigenous foods systems, community health, economic development, and development of K-12 educational materials and tribal college educational programs
    - Combining disciplines in these projects increases impact and innovation
      - synergistic combination that is much stronger and impactful than the sum of the parts



# WHY IS INTERDISCIPLINARY RESEARCH IMPORTANT?

# The value of interdisciplinary research



# The value of interdisciplinary research

Severe drought



High  
temperatures



Low river levels



High angler  
demand



Water pollution



Urban  
development



Credit: NYTimes



# The value of interdisciplinary research

Severe drought



High temperatures



Low river levels



High angler demand



Water pollution



Urban development



Ecosystem disruptions/  
collapse



Significant cultural losses



Threats to MT's  
~\$500 million/  
year sportfishing  
industry



Food insecurity

# The value of interdisciplinary research

Many of today's problems are unprecedented in their **complexity, urgency, scope, and scale**



“...we must hold the complexity and engage with it by **addressing the complexity with an equally complex response**” (Frechtling et al. 2021)

# The value of interdisciplinary research

Many of today's problems are unprecedented in their **complexity, urgency, scope, and scale**



**Pressing need for effective solutions** to these problems that are practical and accepted by a diversity of affected end-users and communities



# The value of interdisciplinary research

“The liminal space between disciplines is required to investigate the **complex problems** that remain unsolved by society ... [and] We cannot get to the **best possible outcomes...** without the bringing together of the liminal, the **differently**



Source: TED

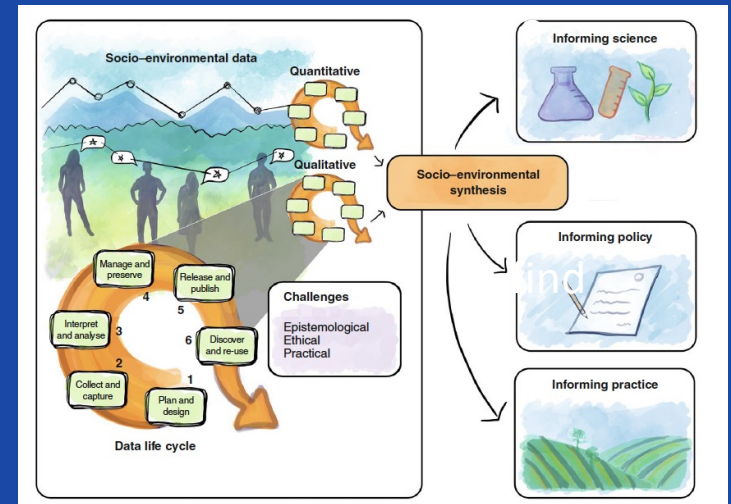
**lived, distinctly experienced, and disparately impacted.** We cannot be the most excellent expression of our **collective genius** without the **full measure of humanity** brought to bear.”

-- Dr. Jedidah Isler

# The value of interdisciplinary research

- Interdisciplinary research benefits

- Diversifies data sources generate “richer, thicker” pictures
  - Fill in data gaps across space and time
  - More robust interpretations of patterns and events with power to *explain*
  - Uncover hidden drivers and consequences
  - Include more diverse lived experiences and perspectives
- Increases likelihood of research relevance, feasibility, and desired outcomes
  - More able to predict problems, find leverage points, recommend solutions
- Mitigates resource and time scarcity
- Strengthens generalizability of outcomes



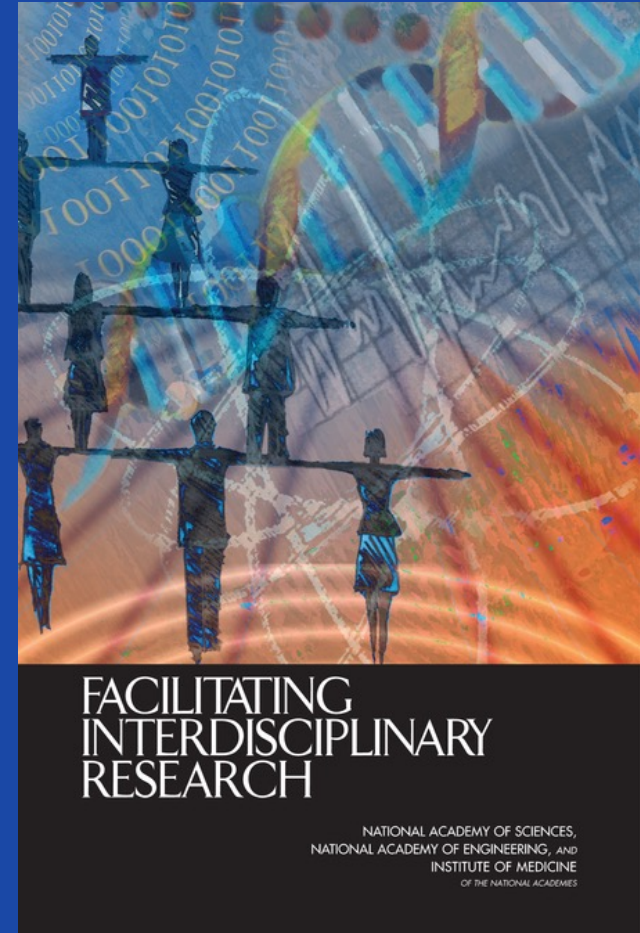
Source: Alexander et al. (2019) “Qualitative data sharing and synthesis for sustainability science”

# The value of interdisciplinary research

- Interdisciplinary research rewards
  - “Innovation dividends” and discoveries (Nielsen et al., 2017)
  - Enhanced creativity and problem solving (Vogel et al., 2013)
  - New lines of inquiry and bigger pictures (Palmer et al., 2016)
  - New insights for complex problems (Miller et al., 2008)
  - Increased scientific productivity (Stipelman et al., 2010)
  - Enhanced likelihood of employment in academia (Millar, 2013)

# The value of interdisciplinary research

- National funding priority (NSF, NIH, NASEM, etc.)
  - NSF Smart and Connected Communities
  - NSF Convergence Accelerator
  - NSF Science & Technology Centers
  - NSF Strengthening American Infrastructure
  - NSF Emerging Frontiers in Engineering Research, and many many more
- Diverse research teams are more likely to produce high-impact, innovative outcomes



# The value of interdisciplinary research

- Yet, interdisciplinarity does not guarantee broader or better impacts (Roessner et al. 2012)
- Resources needed to launch or sustain such efforts can be substantial (National Academies 2005; Hall et al. 2019)

# The value of interdisciplinary research

- Challenges of interdisciplinary teamwork
  - Competing strategies and priorities
  - Miscommunications or misunderstandings
  - Unclear expectations and goals
  - Interdependencies or high reliance on others
  - Conflicting personalities or divergent values and beliefs
  - Perceived inequalities or uneven contributions
  - Integrative complexities
  - Lack of disciplinary base or foundational standards
  - Methodological confusion or mistrust
  - Disciplinary capture or dismissal
  - Complexity of problems...

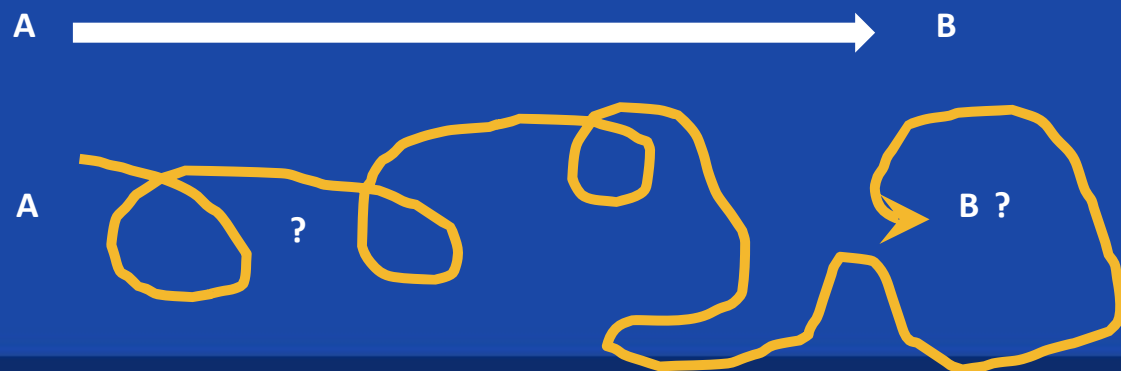


# The value of interdisciplinary research

- Collaborations that cross paradigmatic borders (such as between natural and social sciences) are inherently more difficult and pose special challenges (Fischer et al. 2011; Gardner 2014)
- Failure to bridge these divides can erode trust within a team and derail collaborative projects (O'Rourke et al. 2014), or can simply make this type of work that much time- and labor-intensive

# The value of interdisciplinary research

- Pressure to find linkages and “keep the peace” between disparate goals and ways of knowing
- Uncertainty of operating in “fuzzy,” underdeveloped scientific spaces
  - Novelty of “uncharted territory” (Nash, 2008) limits examples to learn from and requires high degrees of trust
- Complexity of problems
  - Ashby’s Law of Requisite Variety



Adapted from  
Gray, Brown & Macanufo (2010)

?

Mountains & Minds

# FINDING SUPPORT FOR YOUR INTERDISCIPLINARY RESEARCH

# Interdisciplinary research support

- **The Office of Research Development** aims to catalyze innovative and impactful scholarship at Montana State University by **increasing competitiveness for sponsored research, enhancing research capacities, and facilitating cultures of collaboration, inclusivity, and creativity**

# Interdisciplinary research support

## Proposal Development Services

Locating funding

Collecting and coordinating proposal documents

Solidifying a preliminary idea

Consulting on intellectual merit and broader impact

Assessing proposal fit and responsiveness to RFP

Conducting non-technical reviews of proposals

Developing a white paper

Helping develop proposal budgets

Interpreting reviews and strategizing for resubmission

Coordinating limited submissions

Identifying potential collaborators

Strategic planning for major initiatives

Procuring examples of successful materials

Supporting complex, multi-investigator projects

Outlining of proposals

Facilitating external reviews of proposals

Providing templates and boilerplate text

Securing other specialized external proposal support

# Interdisciplinary research support

Search pages & people

## Office of Research Development

[Team Members](#) [Proposal Development](#) [Limited Submissions](#) [Workshops & Events](#) [Resources](#)



Studying butterflies in the Tetons region.

**The Office of Research Development aims to catalyze innovative and impactful scholarship by increasing competitiveness for sponsored research, enhancing research capacities, and facilitating cultures of collaboration, inclusivity, and creativity.**

Montana State University has once again been identified as one of the top Research Universities in the country, achieving R1 distinction with [more than \\$193 million in research expenditures for FY21](#).

Our office provides a comprehensive portfolio of services, spearheads strategic initiatives, hosts seminars and events, fosters community between campus units, and connects researchers across diverse disciplines, institutions, and industries to sustain and grow research excellence at MSU. We are sponsored by the [Office of Research and Economic Development](#).

**Research Funding**



**Frequently Asked Questions**



**Early Career Resources**



**News**

**Request Support**

\$ **Proposal Enhancement Grants**

**ORD Office Hour: Every Thursday!**

No appointment needed! Drop by ORD's virtual "office hour" every Thursday from 10-11 a.m. to discuss grants and proposals.

**Events**

<b>AUG 22</b>	Montana INBRE Scholars Summer Poster Session 2:00pm - 4:00pm
<b>SEP 19</b>	Intro to Grants & Finding Funding 10:30am - 12:00pm
<b>SEP 26</b>	994-Calling! series 4:00pm - 5:00pm
<b>SEP 30</b>	Grant Writing Bootcamp Application due



# Interdisciplinary research support



Search pages & people

## Office of Research Development

- Proposal Development
- Limited Submissions
- Workshops & Events
- Resources
- Meet the Team

## Office of Research Development

Montana State University  
P.O. Box 172460  
Bozeman, MT 59717-2460

**Contact Information**  
ord@montana.edu

**Elizabeth A. Shanahan**  
Associate Vice President for Research  
Development

**Nicole Motzer**  
Director of Research Development

Office of Research and Economic Development / Office of Research Development / request\_form

## Proposal Support Request

MSU-Bozeman researchers and scholars are encouraged to request support using the contact form below. A team member will contact you shortly.

★ denotes required fields.

Name(s) of Principal Investigator(s) ★

MSU Email ★

Unit/Department ★

Type of support needed ★

- Locating funding opportunities (no additional information needed - submit)
- Finding potential collaborators
- Identifying proposal exemplars
- Outlining and/or reviewing a proposal or whitepaper
- Developing a research budget
- Coordinating and uploading proposal documents and/or institutional boilerplate text
- Configuring SPIN infoEd alerts
- Consultation: Idea conceptualization and/or strategic planning and resubmissions
- Consultation: Research data management, research analytics, research sharing and dissemination and/or scholarship outreach
- Consultation: Computational, storage, and data technology resources and budgeting
- Consultation: Research event planning
- Consultation: Team science and research collaboration best practices
- Consultation: Broader impacts

Proposal Type

- Arts & Humanities
- Foundations
- NIH
- NSF
- DOD
- USDA
- DOE
- SBIR/STTR
- Other

Project Title

Link to funding opportunity

Sponsor deadline for submission

Proposal Amount

Submit

# Interdisciplinary research support



Search pages & people

## Office of Research Development

Proposal Development

Limited Submissions

Workshops & Events

Resources

Meet the Team

### Office of Research Development

Montana State University  
P.O. Box 172460  
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### Contact Information

[ord@montana.edu](mailto:ord@montana.edu)

### Elizabeth A. Shanahan

Associate Vice President for Research Development

### Nicole Motzer

Director of Research Development

Office of Research and Economic Development / Office of Research Development / Workshops & Events

## Workshops & Events

### Lunch & Learns



The Office of Research Development organizes a recurring series of educational lunchtime seminars called "Lunch & Learns."

### Intro to Grants



**Monday, Sept. 19,  
10:30 a.m.-12 noon**

New to writing grants? Join us for an interactive session that introduces you to the grant writing process, and the MSU policies and procedures.

### Grant Writing Bootcamp



**Applications DUE BY  
Friday, Sept. 30**

Grant Writing Bootcamp is designed to help grant-interested faculty produce a quality, successful proposal, with valuable information and support from grant-successful facilitators.

### Research Development Day



**Thursday, Jan. 12,  
2023 8 a.m.-5 p.m.**

Details coming soon!

# Interdisciplinary research support

- **Interdisciplinary Research Team Development RFP from the College of EHHD**
  - Supports the launch of an interdisciplinary initiative with at least 1 EHHD member (can be multiple disciplines within EHHD and include members from outside EHHD)
  - Phase 1 grants for starting at ground zero can be up to \$8,000
  - Phase 2 grants with a research proposal target can be up to \$20,000
  - Funds are flexible but might include travel to meetings, facilitating retreats, team building expenses, mentor fees, program officer visits, preliminary data collection and analysis, and other things related to proposal development expenses (not intended to fund teaching reductions)
  - [https://www.montana.edu/ehhd/ord/ehhd\\_internal\\_grants/FY22/InterdisciplinaryResearchTeamDevelopmentRFP.html](https://www.montana.edu/ehhd/ord/ehhd_internal_grants/FY22/InterdisciplinaryResearchTeamDevelopmentRFP.html)

# Interdisciplinary research support

- **Internal grants from the Office of the VP for Research and Economic Development**
  - **Scholarship and Creativity Grant (S&C)**
    - “Funds are intended to support individual HASS faculty research and creative activities as well as research teams seeking to pursue a larger grant (e.g., HASS internal grant or external funding such as NSF or foundation grants).”
    - \$4,000-16,000 over 1 year
      - NEW: summer salary support
    - Open to TT faculty
    - Fall applications due October 3, 2022

# Interdisciplinary research support

- **Internal grants from the Office of the VP for Research and Economic Development**
  - **Humanities, Arts and Social Sciences Grant (HASS)**
    - Funds “communities of scholarship across MSU’s HASS faculty to catalyze a new era of collaborative and impactful interdisciplinary research that leads to fiscal sustainability after the end of internal funding. HASS grants are big idea grants, in contrast to individual research agendas.”
    - \$100,000-150,000 over 2 years
    - Open to TT faculty
    - Annual applications due February 13, 2023

# Interdisciplinary research support

- **Internal grants from the Office of the VP for Research and Economic Development**
  - **Research Expansion Fund (REF)**
    - Funds “support acquisition of new preliminary data or the development of new research methods or procedures that will be used in subsequent proposals to external funding sources.”
    - \$30,000-\$50,000 over one year
    - Open to TT faculty
    - Fall applications due October 3, 2022



# Interdisciplinary research support

- **Internal grants from the Office of the VP for Research and Economic Development**
  - **Proposal Enhancement Grant (PEG)**
    - Program is designed to increase the competitiveness and rates of success for research and scholarship proposals submitted to external sponsors.
    - \$2,000 voucher for enhancement services
    - Open to TT faculty
    - Applications accepted on a rolling basis

# REALIZING INTERDISCIPLINARY RESEARCH

# Realizing interdisciplinary research

- Generating broadly relevant, inviting questions
  - I am studying [X] because I want to find out [Y] in order to better understand [Z] so that [A] might [B].

Adapted from Booth et al. (2016) *The Craft of Research*, 4<sup>th</sup> Ed.

**Scenario: when  
approaching potential  
partners and  
collaborators**

# Realizing interdisciplinary research

**Step 1:** I am studying [X]

**Example 1:** “I am studying post-harvest practices in agricultural fields of Vietnam.”

# Realizing interdisciplinary research

**Step 2: I am studying [X] because I want to find out [Y]**

**Example 2: “I am studying post-harvest practices in agricultural fields of Vietnam because I want to find out how much PM2.5 is emitted into the atmosphere from the burning of rice straw, and thus what agriculture’s relative contribution to fine particulate matter levels is.”**

# Realizing interdisciplinary research

**Step 3:** I am studying [X] because I want to find out [Y] in order to better understand [Z]

**Example 3:** “I am studying post-harvest practices in agricultural fields of Vietnam because I want to find out how much PM2.5 is emitted into the atmosphere from the burning of rice straw, and thus what agriculture’s relative contribution to fine particulate matter levels is in order to better understand where effective interventions can be made for the improvement of air quality.”



# Realizing interdisciplinary research

**Step 4:** I am studying [X] because I want to find out [Y] in order to better understand [Z] **so that [A] might [B].**

**Example 4:** “I am studying post-harvest practices in agricultural fields of Vietnam because I want to find out how much PM2.5 is emitted into the atmosphere from the burning of rice straw, and thus what agriculture’s relative contribution to fine particulate matter levels is in order to better understand where effective interventions can be made for the improvement of air quality **so that millions of people around the world might avoid the poor health outcomes and even premature death that have been linked to adverse environmental conditions.**”

# Realizing interdisciplinary research

What is the emissions load of post-harvest agricultural burning practices in Vietnam?



**In what ways do current post-harvest burning practices affect air quality, and how might future agricultural interventions simultaneously support livelihoods and human well-being?\***

# Realizing interdisciplinary research

What is the emissions load of post-harvest agricultural burning practices in Vietnam?



**In what ways do current post-harvest burning practices affect air quality, and how might future agricultural interventions simultaneously support livelihoods and human well-being?\***

**\*The importance of “appreciate inquiry”: What would it look like if...? Imagine if... How might we...? (Morrison et al., 2019)**

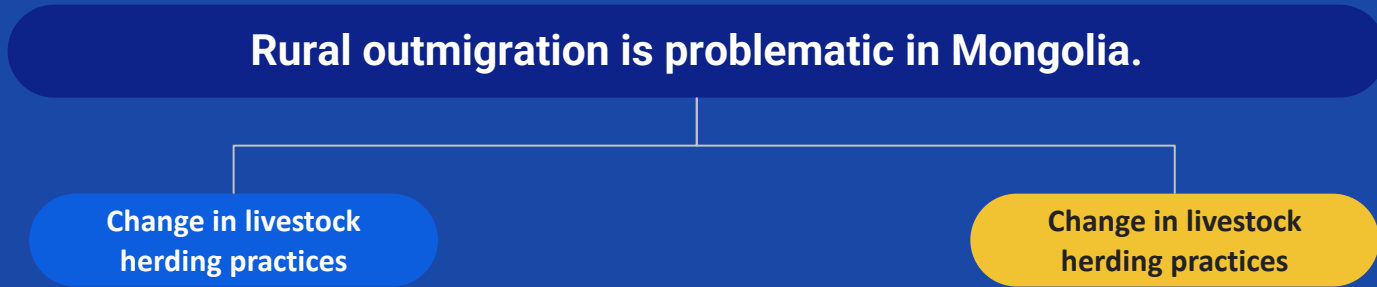
# Realizing interdisciplinary research

- Taking the time for clarity and curiosity about both project and people
  - The “5 Whys Exercise”

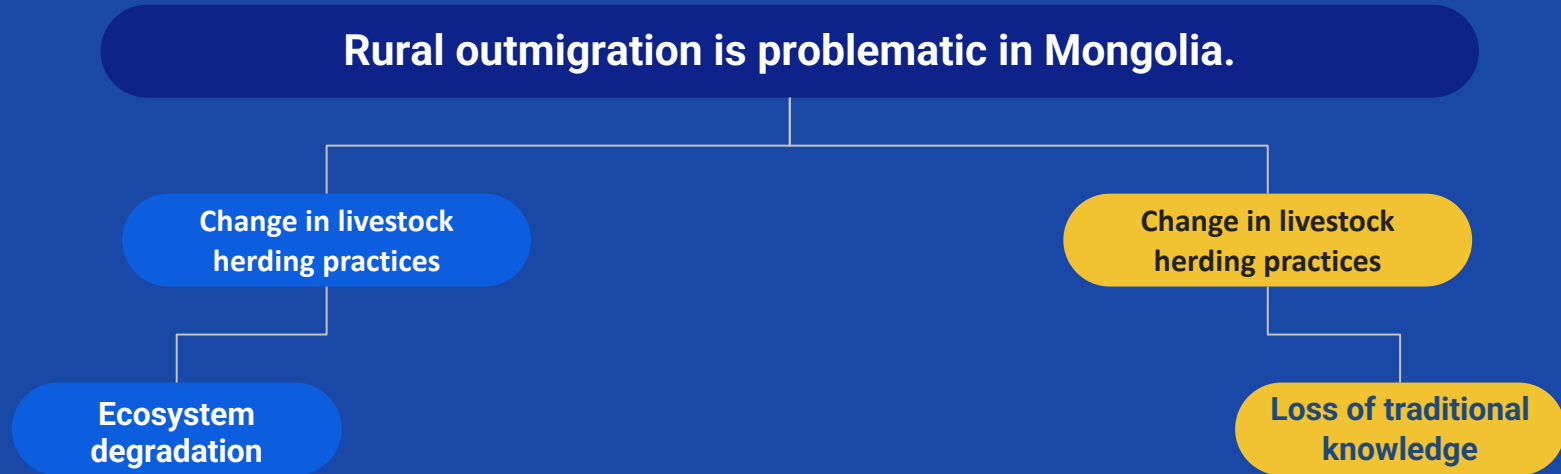
Adapted from Macanuso & Brown (2010) *Gamestorming*

**Scenario: when a shared problem has been identified, but expectations, values, etc. have not**

# Realizing interdisciplinary research

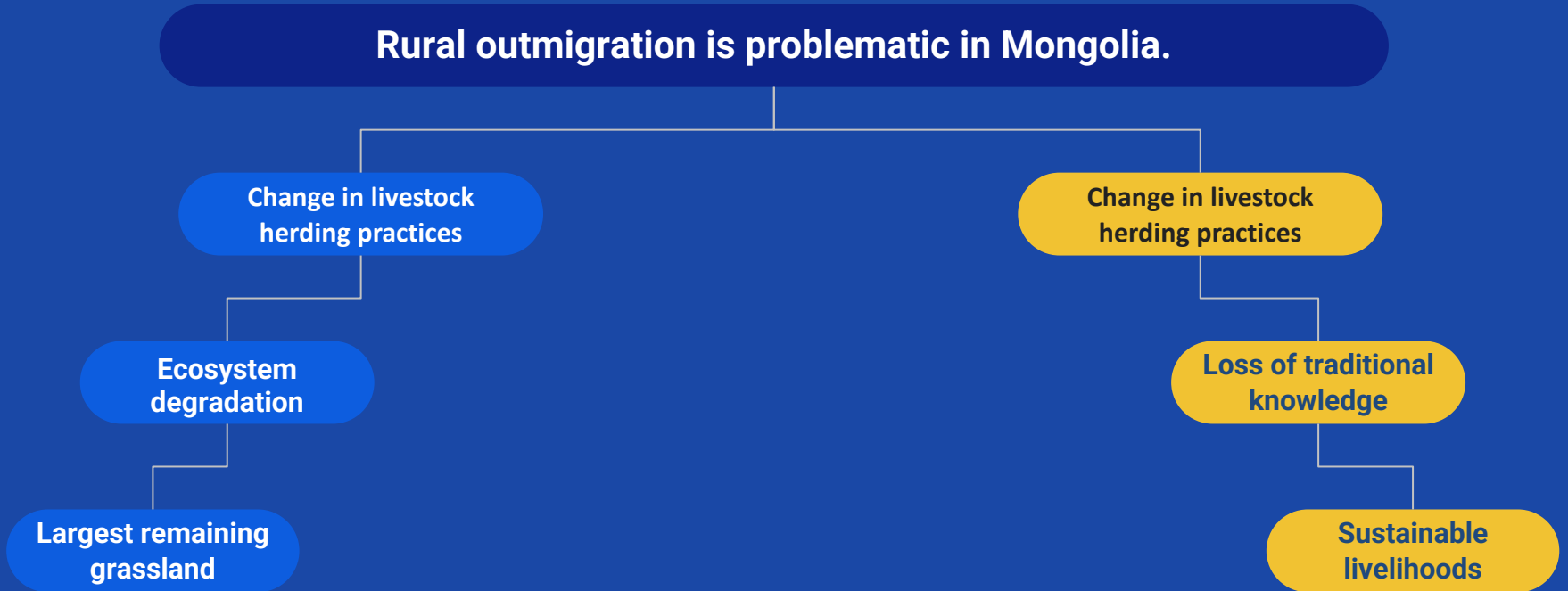


# Realizing interdisciplinary research





# Realizing interdisciplinary research



# Realizing interdisciplinary research

Rural outmigration is problematic in Mongolia.

Change in livestock herding practices

Ecosystem degradation

Largest remaining grassland

Biodiversity

Change in livestock herding practices

Loss of traditional knowledge

Sustainable livelihoods

Human wellbeing 46

# Realizing interdisciplinary research

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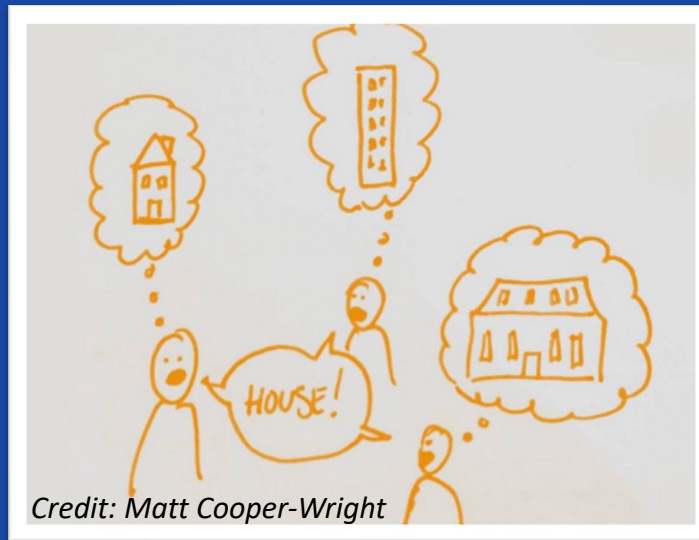
Biodiversity

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Human wellbeing 47



# Realizing interdisciplinary research

Fish Life  
Histories

Urban Renewal

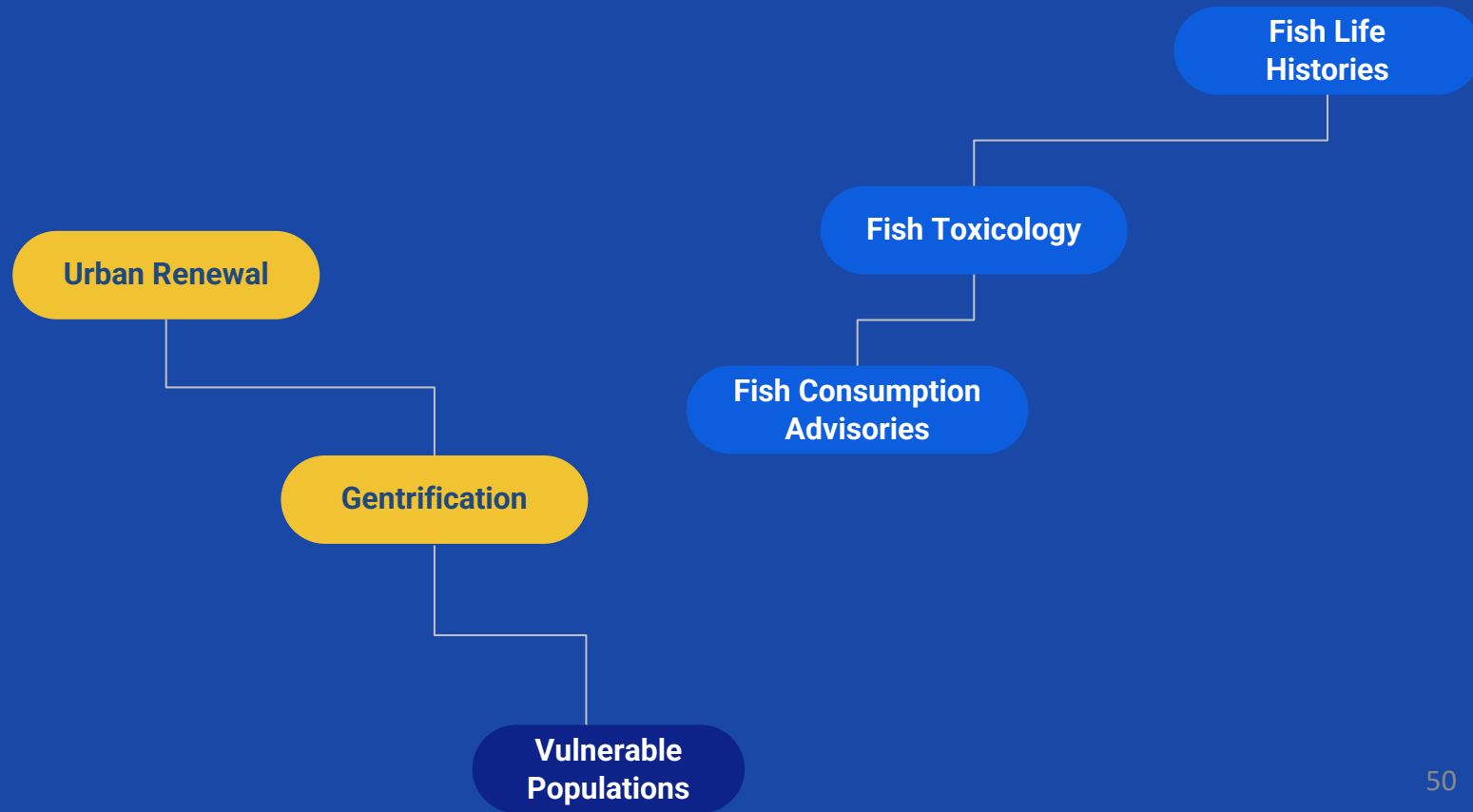
Scenario: when a  
collaboration is desired  
but initially seems  
unlikely

48

# Realizing interdisciplinary research

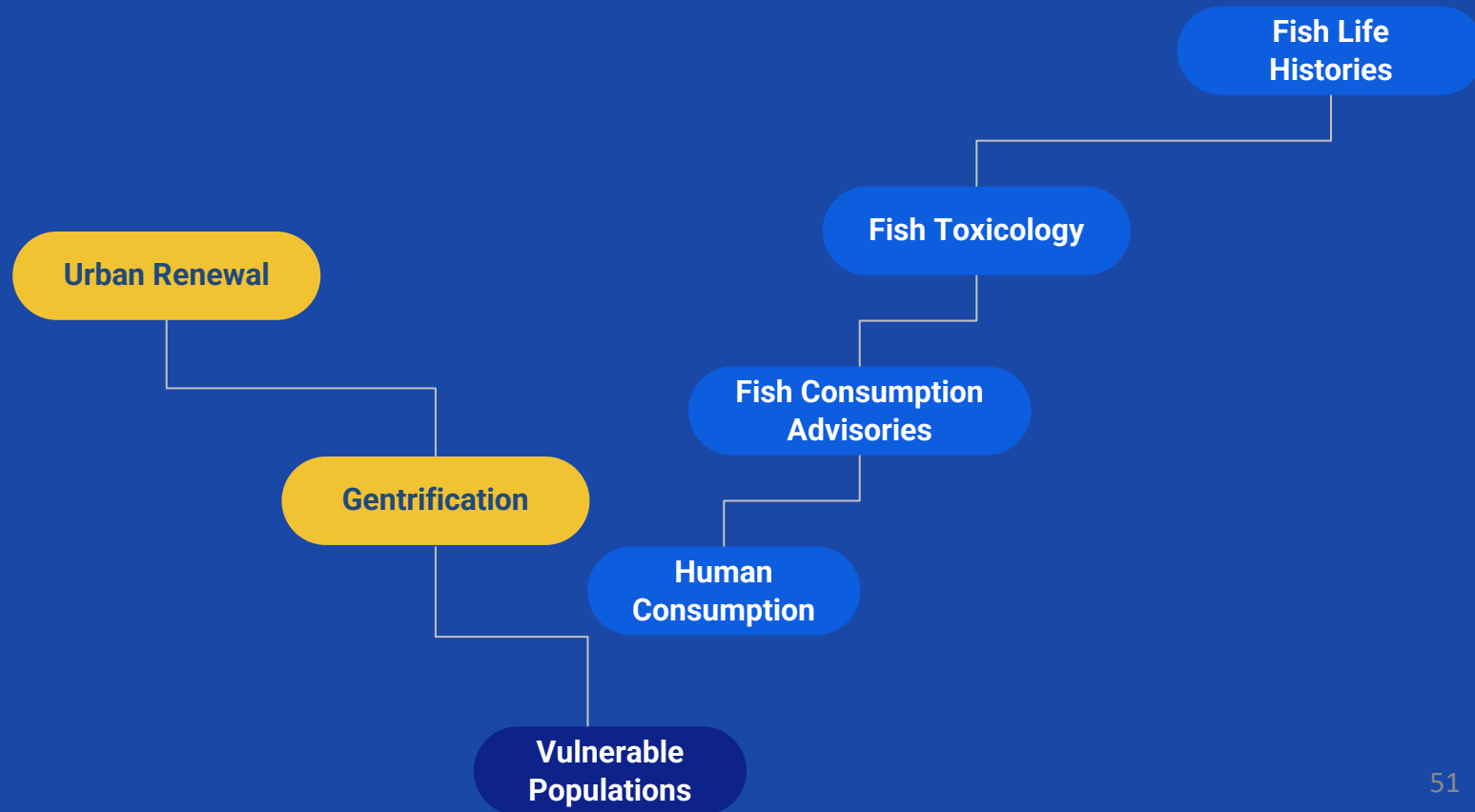


# Realizing interdisciplinary research

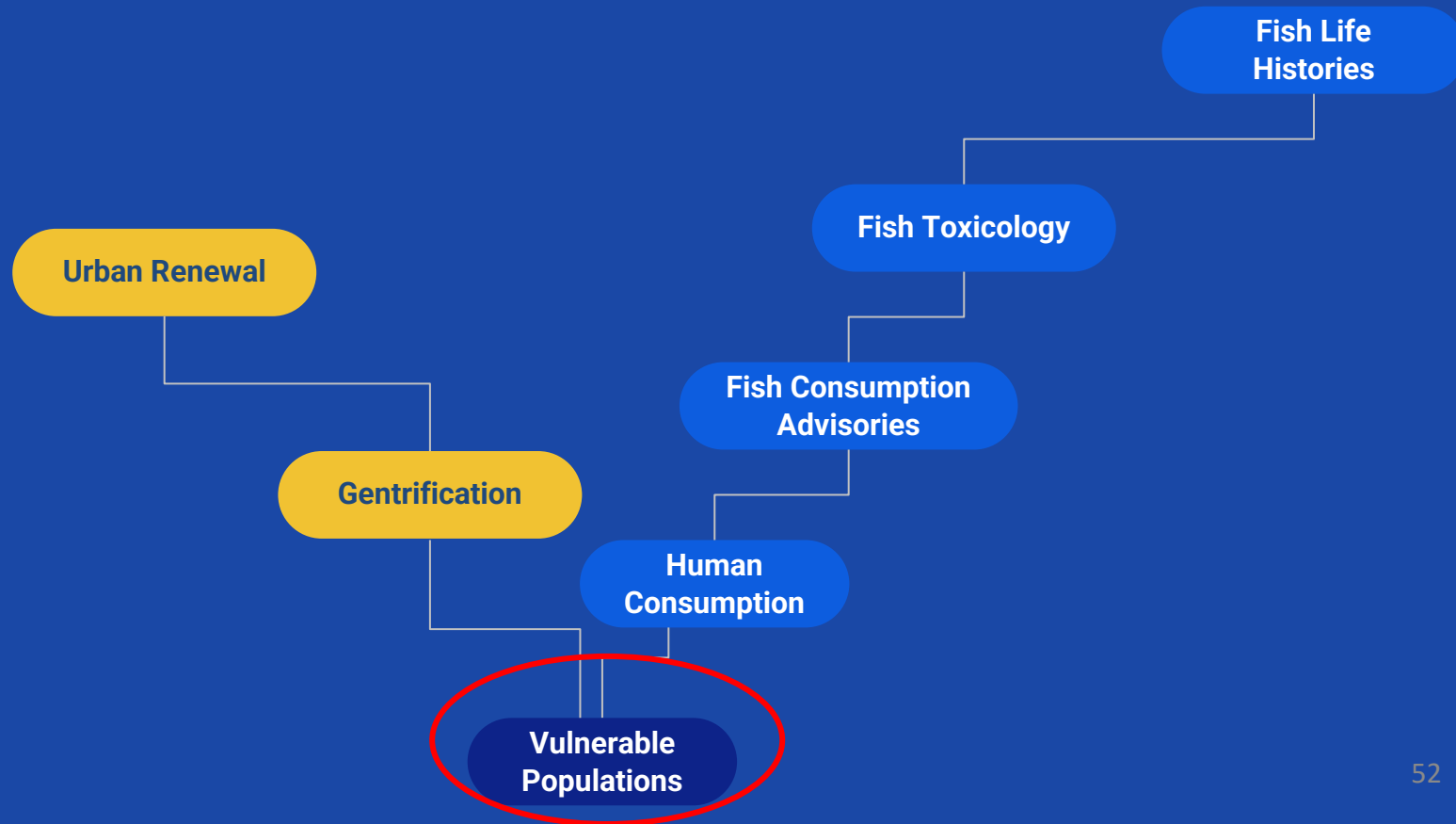




# Realizing interdisciplinary research

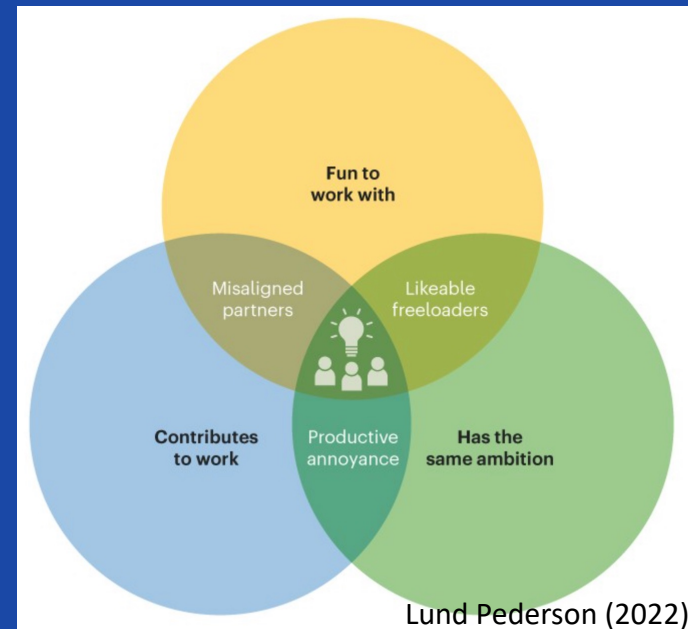
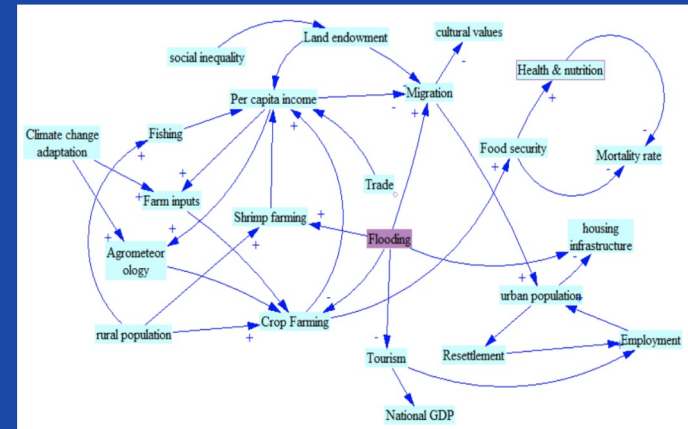


# Realizing interdisciplinary research



# Realizing interdisciplinary research

- Finding (and being) the right collaborators
  - A systems mapping approach
  - “A framework to identify good collaborators”
    - Outward *and* inward applications



# Realizing interdisciplinary research

- Self-reflection example exercise

- In what type of working environment do I thrive?
  - What sorts of situations or environments make me uncomfortable?
  - What do I need to make decisions?
- How do I tend to interact with others in a research setting?
  - How collaborative am I? How argumentative am I?
- What roles am I most comfortable taking on in a research setting?
  - How much of a leadership role do I want to take at this time?
- What do I have to offer a team?
  - What is (are) my most valuable or well-developed skill(s)? Which skill(s) would I most like to improve?
- What am I looking for in a team?
  - What would I like to see in potential collaborators? What do I not want?
- What is my biggest worry about being part of an interdisciplinary research team?
- If I joined a team, am I willing to... Meet a team's expectations and fulfill commitments? Reach consensus or compromise? Accept feedback? Provide feedback? Have difficult discussions?

# Realizing interdisciplinary research

- Equally prioritizing the research and team

**“Top 10 Takeaways” from the Collaboration and Team Science Field Guide (Bennett et al 2018):**

**Trust**

**Vision**

**Self awareness &  
emotional intelligence**

**Leadership**

**Mentoring**

**Team dynamics**

**Communication**

**Recognition and sharing success**

**Conflict and disagreement**

**Navigating and leveraging networks**

# Realizing interdisciplinary research

- Equally prioritizing the research and team

“Top 10 Takeaways” from the Collaboration and Team Science Field Guide (Bennett et al 2018):

Trust

Team dynamics

Vision

Communication

Self awareness &  
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Recognition and sharing success

Leadership

Conflict and disagreement

Mentoring

Navigating and leveraging networks

Not “science” skills

# Realizing interdisciplinary research

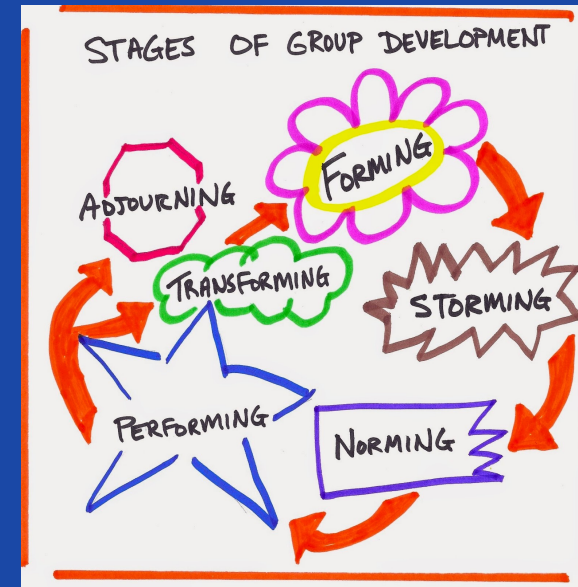
“High performing collaborative research teams are created and maintained when **team diversity is effectively fostered and interpersonal skills are taught and practiced.**”

(Cheruvilil et al., 2014)

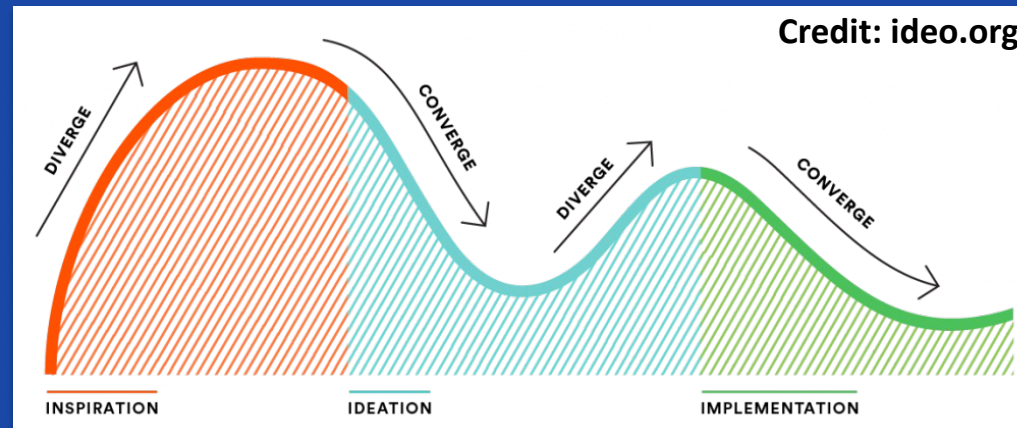


# Realizing interdisciplinary research

- Embracing natural collaborative stages and cycles



Credit: S. Kaner



# Realizing interdisciplinary research

- Documenting and formalizing collaborations (a research “pre-nup”)
  - Clearly defines roles, responsibilities, authorship/IP, decision-making and conflict resolution protocols, etc.
  - Develops shared vision
    - Include a boundary object as an integrative, visual representation
    - Determine what is in and what is out (Bammer 2013)
  - Co-creates team culture and makes values explicit
    - Especially important in highly diverse partnerships and those with perceived or actual power differentials
  - Builds trust and signals good intentions
  - A catalyst for difficult but critical conversations

# CONCLUDING THOUGHTS

# Concluding thoughts

- Interdisciplinary, team-based research and scholarship is not simple or straightforward
  - It requires some unlearning for many of us
  - It necessitates stepping out of our comfort zones
  - It demands “epistemic humility” and vulnerability
  - It takes patience and time
- But, it pays off in many ways

# Concluding thoughts

- There are many resources on campus that are available to catalyze interdisciplinary work, including ORD!
  - Email us at [ord@montana.edu](mailto:ord@montana.edu)
  - Visit our website: [montana.edu/research/ord](http://montana.edu/research/ord)

# Concluding thoughts

“When we try to pick out anything by itself, we find it **hitched to everything else** in the universe.”

-- *John Muir*

# Concluding thoughts

“[Our work] is not **sitting in isolation** and coming up with a **lovely idea**. We can’t do this on our own because **we are in this together.**”

*-- Dr. Jayne Downey, MSU Professor and Director of the Center for Research on Rural Education*





# THANK YOU!

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