Social-Ecological Systems (SES)

Course Syllabus

NRSM 595.02 – Spring 2024
3 credits, CRN# 34154
Monday/Wednesday 9:00-10:20
Jeannette Rankin Hall (JRH) 205

Instructor Info

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Course Description

Biophysical and social scientists across a variety of disciplines have long recognized the need to analyze social and environmental phenomena in an integrated manner to better understand pressing problems related to global change and planetary sustainability. Over the past several decades, scholars have posited a large and often overwhelming number of theoretical frameworks and analytical approaches to achieve cross- and trans-disciplinary integration in studies of human-environment interactions. Myriad fields (e.g. sustainability science, land change science) and subfields (e.g. sociohydrology, translational ecology) have emerged as a result. The term "social-ecological system" (SES) represents a common characterization of the focus of this type of scholarship. Recent research leverages SES frameworks and important related concepts (resilience, adaptation, transformation, regime shifts, Panarchy, etc.) to make meaningful connections between topics as seemingly unrelated as global sediment transport and environmental justice. In this course, students will explore foundational SES scholarship and related literature on resilience, transformation, and environmental governance. Students will also work with each other to leverage their collective disciplinary tools and methods to participate in a collaborative, student-led assessment of a regional SES.

Course Goal, Objectives, Learning Outcomes, and Evaluation Methods

The broad goal of this course is to *engage graduate students in the history, theory, and practice of SES research*. The course is designed to provide students with exposure to broad scholarly approaches and tools that, when applied, can advance understanding of complex SESs.

Course Objectives	Learning Outcomes	Evaluation Methods
Students will explore the history and evolution of the body of contemporary scholarship associated with SESs and social-ecological resilience.	Students will be able to lead discussions among their peers on major concepts related to SES scholarship including but not limited to resilience, governance, regime shifts, and sustainability.	1. In-class discussions 2. Leading a class discussion 3. Generating and articulating weekly discussion questions from course readings
Students will clearly communicate the extent and complexity of challenges inherent in attempts to govern SESs with specific emphasis	Students will be able to plan and undertake a SES assessment using established frameworks. Students will be able to clearly present	1. In-class discussions 2. Literature review and analysis reflection essays

on the role of uncertainty introduced by climate change and increasing human demands on the biophysical environment.	findings and potential implications from a SES assessment to a variety of audiences including segments of the general public(s), environmental and social managers system, and other SES scholars.	3. Group SES analysis project including final presentation
Students will evaluate specific tools and approaches available to assess, characterize, and analyze contemporary SESs.	Students will be able to analyze a contemporary SES by collecting and synthesizing relevant sources of both qualitative and quantitative data and other information. Students will be able to articulate the "state" of an SES in writing and verbally by analyzing the complex history, politics, environmental data, economics, and other information relevant to the SES at a given temporal and spatial scale.	1. In-class discussions 2. Literature review and analysis reflection essays 3. Group SES analysis project
Together with the instructor and various class visitors, students will explore and define what it means to be a "SES thinker" today from multiple perspectives including that of research, management, and practice.	Students will be able to articulate the trends and trajectories of contemporary SES scholarship and practice. Students will be able to demonstrate verbally and in writing how a foundation in SES scholarship relates to a variety of professional career paths beyond graduate school.	1. In-class discussions 2. Literature review and analysis reflection essays 3. Generating and articulating weekly discussion questions from course readings 4. Group SES analysis project

Course Structure and Required Text

This course will involve lecture, discussions, written assignments, and an applied class project with group and individual deliverables. A ***course schedule*** of assigned readings, assignment due dates, and in-class activities will be posted on the Moodle course website and updated periodically as the course progresses. ***No textbook is required*** for this course; all readings will be available on the Moodle at least one week prior to the class period to which they are assigned.

Reading for this Course

Reading and synthesizing peer-reviewed and other academic and technical literature is a critical requirement of any graduate-level course. Each week I expect you to read and be prepared to discuss the equivalent of 4-6 peer-reviewed articles or anywhere between 15k and 40k words. This is not out of the ordinary for a graduate-level course. However, this amount of reading can be onerous and intimidating given what is required of you in your other courses and to progress in your research. Plan ahead, read strategically, and learn techniques for assessing sources quickly and effectively.

Student and Instructor Expectations

Participation

Class discussion is an essential aspect of this course. Enrollment in this course is small and there is a significant amount of material to cover in order to gain a broad understanding of SES frameworks, tools, and research approaches. Discussion and learning from each other is a critical tool for collective synthesis of the complex and often difficult topics we engage in this class. Thus, I expect all students to *read the*

reading assignments prior to class and to also be prepared to discuss the readings each day in class. We will all get out what we put in to group discussions. Thus, please think of your preparation for class and participation during class as showing respect to your fellow students and to me.

Any student who misses class will be held responsible for all materials covered and all announcements made during their absence. The UM "Class Attendance/Absence Policy" can be found in the UM Catalog Academic Policies and Procedures (https://catalog.umt.edu/academics/policies-procedures).

Respect, Inclusiveness and Diversity of Thoughts, Ideas and People
In teaching courses, I believe and act upon the idea that all students are entitled to and deserve respect, courtesy and tolerance, regardless of their race, background, religious affiliation, gender, sexual preference, disability or any other perceived difference. Likewise, faculty, staff and fellow students deserve the same treatment from other students. Therefore, within the bounds of my courses and professional responsibilities as a university instructor, I make every effort to promote and create a safe space for diverse thoughts, regardless of the form of communication. I ask that you do the same. Given the amount of discussion expected in this course, showing respect for others is paramount and is taken very seriously. We will strive towards an engaging, respectful, open forum in which numerous opinions related to the course material can be discussed and explored.

Academic Honesty and Plagiarism
All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code (http://www.umt.edu/student-affairs/community-standards/default.php).

I will not tolerate plagiarism in any form. Students need to be familiar with plagiarism and how to properly cite references and attribute the ideas of others to original sources in their work. More information on plagiarism can be found in the UM Catalog Academic Policies and Procedures (https://catalog.umt.edu/academics/policies-procedures).

Equal Access
The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and the Office for Disability Equity (ODE). If you anticipate or experience barriers based on disability, please contact ODE by phone at (406) 243-2243, by email at ode@umontana.edu, or visit the Office of Disability Equity (https://www.umt.edu/disability/) online for more information. Retroactive accommodation requests will not be honored, so please, do not delay. As your instructor, I will work with you and ODE to implement effective accommodation, and you are welcome to contact me privately if you wish to ask questions and discuss options.

Assignments and Assessment

Attendance, Participation, and Reading Questions (20%)
I expect that you come to class ***on time***, be prepared to discuss the assigned readings for the day, and participate fully in class activities. If you will miss a class, please email me at least 2 days in advance; prior notification would be appreciated if possible. I am flexible if you have extenuating circumstances or emergencies; please be open and communicative with me about your attendance. I reserve the right to subtract a maximum of 1 point (out of 20 total for attendance and participation, see below) per class missed—this will apply to cases where you do not show up for class, you do not communicate with me about your absence prior to class, and/or your absence is not a university excused absence (see above) or essential to pursing your graduate work (e.g., research or conference presentation). ***During some weeks of the semester*** (see course schedule for details), I will ask you to post at least 3 "reading questions" to

Moodle prior to our class discussions. These will generally be questions you had while engaging with the readings prior to class. I will use these questions to structure our class discussions that week with an emphasis on clarifying difficult concepts and expanding your theoretical and practical understanding of the material. Reading questions will be submitted via Moodle as either a quiz or on a discussion forum.

Leading a Class Discussion (20%)
During the semester, you will lead one class lecture and discussion about a major topic area related to SESs. The requirements for leading a class lecture and discussion are threefold:

1. Give a 15–20-minute presentation (including visual aids such as PowerPoint slides, pictures, or a Prezi presentation) to the class about the nuts-and-bolts of the topic, research framework, or lens for analyzing SESs. This presentation should introduce the class to essential background including history and major applications of the concept. I would like you to also discuss strengths and weaknesses of the concept/framework/lens and how it might be applied in an analysis of SESs. Students will use these presentations as a method for judging important concepts to apply to our collective SES assessment during the semester.

2. Develop a set of at least 10 discussion questions about the assigned readings on the topic/concept you have chosen to introduce. Send these to me at least 48-hours prior to date/time you are assigned to lead the class discussion. Lead and moderate a ~30-minute discussion of the readings using the discussion questions you developed, ***and/or develop and lead an interactive class activity of your choice***.

3. Choose one additional reading (a reading not required by me on the course reading schedule) for the class to read and discuss. This reading should be emailed to me one week (7 days) prior to your scheduled presentation/discussion so that I can assign it to the class and post it on Moodle. These readings should be a ***recent*** peer-reviewed article, or a book chapter or a technical document (NGO or agency publication) of similar length. See the extensive reference list at the end of this syllabus for extra reading ideas on the various course topics.

Literature Review Reflection and Analysis Essays (30%)
These individual writing assignments (2) will consist of your responses to a prompt or a series of questions designed to provide you with an opportunity for deeper engagement with SES scholarship. I will provide you with writing prompts for these essays at least two weeks before each assignment is due. Each essay should be approximately 3-5 pages single-spaced and contain a well-developed argument, extensive reference to course readings, and engagement with the SES literature beyond what we have read and reviewed in class. Please submit these assignments via Moodle. You must use in-text citations and provide a reference list. You may site references in any format you like, just please be consistent.

Applying SES Analysis Tools Final Project (30%)
During the second half of the course, I will ask you to engage in a group assessment of a regional SES (the Clark Fork River watershed) using tools and approaches we have reviewed in class as well as any other approaches you determine salient and effective. The sky is the limit with regard to approach, and creativity is encouraged. You may collect some new data, but that aspect should be minimal; mainly, I will ask you rely on published and publicly-available data and information to assess your chosen SES. At the culmination of the course (last week in class), I will invite decision makers and environmental managers from the SES to class so that you can present your findings to them. Further details of this assignment including specific guidelines will be discussed in class.

Grading

This course is graded on the traditional A – F letter grade scale only, it is not offered under the credit/no credit option. Upon completion of the course, your points earned on assignments will be expressed as a percentage of total points possible in the course and translated into a letter grade as follows:

Grading scale	***Points available***
A 93-100% A- 90-92% B+ 88-89% B 83-87% B- 80-82% C+ 78-79% C 73-77% C- 70-72% D+ 68-69% D 63-67% D- 60-62% F 59% and below	Reading questions and class discussion: **20 points** - Including attendance and participation Leading a class: **20 points** Literature reflection & analysis essay #1: **15 points** Literature reflection & analysis essay #2: **15 points** SES analysis group project: 3**0 points** - Includes evaluation of individual engagement, team effort, and assessment of written final group report and in-class presentation. Course Total = **100 points**

Course Topics and Readings

The following is a list of potential readings corresponding with major course topics. Only a selection of these readings will be assigned in class. Please reference the course schedule for assigned readings. This list is meant to serve as a reference for you to use in support of your personal research and practice.

Social-ecological Systems Introduction & Background

Anderies, J. M., Janssen, M.A., and Ostrom, E. 2004. A framework to analyze the robustness of social-ecological systems from an institutional perspective. *Ecology and Society*, 9(1): 18. [online] URL: http://www.ecologyandsociety.org/vol9/iss1/art18/

Berkes, F. and Folke, C. 1998. Linking social and ecological systems for resilience and sustainability. Pages 1-26 in F. Berkes and C. Folke, editors. *Linking social and ecological systems: management practices and social mechanisms for building resilience*. Cambridge University Press, Cambridge, UK.

Colding, J. and Barthel, S. 2019. Exploring the social-ecological systems discourse 20 years later. *Ecology and Society*, 24(1): 2. https://doi.org/10.5751/ES-10598-240102

Cumming, G.S., Cumming, D.H.M., and Redman, C.L. 2006. Scale mismatches in social-ecological systems: causes, consequences, and solutions. *Ecology and Society*, 11(1): 14. [online] URL: http://www.ecologyandsociety.org/vol11/iss1/art14/

Holling, C.S., Berkes, F. and Folke, C. 1998. Science, sustainability and resource management. Pages 342-362 in F. Berkes and C. Folke, editors. *Linking social and ecological systems: management practices and social mechanisms for building resilience*. Cambridge University Press, Cambridge, UK.

Holling, C.S. and Meffe, G.K. 1996. Command and control and the pathology of natural resource management. *Conservation Biology*, 10(2): 328-337.

Leslie, H.M., Basurto, X., Nenadovic, M., Sievanen, L., Cavanaugh, K.C., Cota-Nieto, J.J., Erisman, B.E., Finkbeiner, E., Hinojosa-Arango, G., Moreno-Báez, M. and Nagavarapu, S. 2015. Operationalizing

the social-ecological systems framework to assess sustainability. *Proceedings of the National Academy of Sciences*, 112(19): 5979-5984.

McGinnis, M. and Ostrom, E. 2014. Social-ecological system framework: initial changes and continuing challenges. *Ecology and Society*, 19(2): 30. https://www.ecologyandsociety.org/vol19/iss2/art30/

Ostrom, E. 2007. A diagnostic approach for going beyond panaceas. *Proceedings of the National Academy of Sciences*, 104(39): 15181-15187.

Ostrom, E., 2009. A general framework for analyzing sustainability of social-ecological systems. *Science*, 325(5939): 419-422.

Adaptive Management

Allen, C.R., Fontaine, J.J., Pope, K.L. and Garmestani, A.S., 2011. Adaptive management for a turbulent future. *Journal of Environmental Management*, 92(5): 1339-1345.

Berkes, F., Colding, J. and Folke, C. 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications*, 10(5): 1251-1262.

Gunderson, L. 1999. Resilience, Flexibility and Adaptive Management—Antidotes for Spurious Certitude? *Conservation Ecology*, 3(1): 7. https://www.ecologyandsociety.org/vol3/iss1/art7/

Gunderson, L. and Light, S.S. 2006. Adaptive management and adaptive governance in the everglades ecosystem. *Policy Sciences*, 39(4): 323-334.

Holling, C.S., and Sundstrom, S. 2015. Adaptive management, a personal history. Pages 11-25 in C.R. Allen and A.S. Garmestani, editors. *Adaptive management of social-ecological systems*. Springer, Dordrecht, NL.

Lee, K.N. 1994. *Compass and gyroscope: integrating science and politics for the environment*. Island Press, Washington, D.C.

Lee, K.N. 1999. Appraising adaptive management. *Conservation Ecology*, 3(2): 3. http://www.consecol.org/vol3/iss2/art3/

McCarthy, M.A. and Possingham, H.P. 2007. Active adaptive management for conservation. *Conservation Biology*, 21(4): 956-963.

Pahl-Wostl, C., Sendzimir, J., Jeffrey, P., Aerts, J., Berkamp, G. and Cross, K., 2007. Managing change toward adaptive water management through social learning. *Ecology and Society*, 12(2): 30. https://www.ecologyandsociety.org/vol12/iss2/art30/

Walters, C.J. 1986. Adaptive management of renewable resources. Macmillan Publishers Ltd.

Williams, B.K., Szaro, R.C. and Shapiro, C.D. 2009. *Adaptive management: the US Department of the Interior technical guide.* US Department of the Interior. https://www.doi.gov/sites/doi.gov/files/migrated/ppa/upload/TechGuide.pdf

Williams, B.K., 2011. Adaptive management of natural resources—framework and issues. *Journal Of Environmental Management*, 92(5): 1346-1353.

Complexity Science

Levin, S.A. 1998. Ecosystems and the biosphere as complex adaptive systems. *Ecosystems*, 1(5): 431-436.

Levin, S., Xepapadeas, T., Crépin, A.S., Norberg, J., De Zeeuw, A., Folke, C., Hughes, T., Arrow, K., Barrett, S., Daily, G. and Ehrlich, P. 2013. Social-ecological systems as complex adaptive systems: modeling and policy implications. *Environment and Development Economics*, 18(2): 111-132.

Liu, J., Dietz, T., Carpenter, S.R., Alberti, M., Folke, C., Moran, E., Pell, A.N., Deadman, P., Kratz, T., Lubchenco, J. and Ostrom, E. 2007. Complexity of coupled human and natural systems. *Science*, 317(5844): 1513-1516.

Meadows, D.H. 2008. *Thinking in systems: A primer*. Chelsea Green Publishing.

Resilience of Social-ecological Systems

Baggio, J., Brown, K. and Hellebrandt, D. 2015. Boundary object or bridging concept? A citation network analysis of resilience. *Ecology and Society*, 20(2): 2. https://www.ecologyandsociety.org/vol20/iss2/art2/

Brand, F. and Jax, K. 2007. Focusing the meaning (s) of resilience: resilience as a descriptive concept and a boundary object. *Ecology and Society*, 12(1): 23. https://www.ecologyandsociety.org/vol12/iss1/art23/

Carpenter, S., Walker, B., Anderies, J.M. and Abel, N. 2001. From metaphor to measurement: resilience of what to what? *Ecosystems*, 4(8): 765-781.

Cash, D., Adger, W.N., Berkes, F., Garden, P., Lebel, L., Olsson, P., Pritchard, L. and Young, O. 2006. Scale and cross-scale dynamics: governance and information in a multilevel world. *Ecology and Society*, 11(2): 8. https://www.ecologyandsociety.org/vol11/iss2/art8/

Gunderson, L.H. 2000. Ecological Resilience–in theory and application. *Annual Review of Ecology and Systematics*, 31: 425-439.

Holling, C.S. 1973. Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, 4: 1-23.

Holling, C.S. 1986. The resilience of terrestrial ecosystems, local surprise and global change. Pages 292-317 in W.C. Clark and R.E. Munn, editors. *Sustainable development of the biosphere*. Cambridge University Press, Cambridge, UK.

Holling, C.S. 1996. Engineering resilience versus ecological resilience. Pages 31-44 in P. C. Schulze, editor. *Engineering within ecological constraints*. National Academy Press, Washington, D.C. https://www.nap.edu/read/4919/chapter/4

Holling, C.S. 2001. Understanding the complexity of economic, ecological, and social systems. *Ecosystems* 4:390-405.

Holling, C.S., Gunderson, L.H., and Ludwig, D. 2002. In quest of a theory of adaptive change. Pages 3-22 in L.H. Gunderson and C.S. Holling, editors. *Panarchy: understanding transformations in human and natural systems*. Island Press, Washington D.C.

Holling, C.S., and Gunderson, L.H. 2002. Resilience and adaptive cycles. Pages 25-62 in L.H. Gunderson and C.S. Holling, editors. *Panarchy: understanding transformations in human and natural systems*. Island Press, Washington D.C.

Holling, C.S., Gunderson, L.H., and Peterson, G.D. 2002. Sustainability and Panarchies. Pages 63-102 in L.H. Gunderson and C.S. Holling, editors. *Panarchy: understanding transformations in human and natural systems*. Island Press, Washington D.C.

Walker, B., Gunderson, L., Kinzig, A., Folke, C., Carpenter, S. and Schultz, L. 2006. A handful of heuristics and some propositions for understanding resilience in social-ecological systems. *Ecology and Society*, 11(1): 13. https://www.ecologyandsociety.org/vol11/iss1/art13/main.html

Transformation & Regime Shifts in Social-ecological Systems

Folke, C., Carpenter, S., Walker, B., Scheffer, M., Elmqvist, T., Gunderson, L. and Holling, C.S. 2004. Regime shifts, resilience, and biodiversity in ecosystem management. *Annual Review of Ecology and Evolution Systematics*, 35: 557-581.

Hughes, T.P., Linares, C., Dakos, V., Van De Leemput, I.A. and Van Nes, E.H. 2013. Living dangerously on borrowed time during slow, unrecognized regime shifts. *Trends in Ecology and Evolution*, 28(3): 149-155.

Hughes, T.P., Carpenter, S., Rockström, J., Scheffer, M. and Walker, B., 2013. Multiscale regime shifts and planetary boundaries. *Trends in Ecology and Evolution*, 28(7): 389-395.

Kinzig, A.P., Ryan, P.A., Etienne, M., Allison, H.E., Elmqvist, T. and Walker, B.H., 2006. Resilience and regime shifts: assessing cascading effects. *Ecology and society*, 11(1): 20. https://www.ecologyandsociety.org/vol11/iss1/art20/

Moore, M.L., Tjornbo, O., Enfors, E., Knapp, C., Hodbod, J., Baggio, J.A., Norström, A., Olsson, P. and Biggs, D., 2014. Studying the complexity of change: toward an analytical framework for understanding deliberate social-ecological transformations. *Ecology and Society*, 19(4): 54. https://www.ecologyandsociety.org/vol19/iss4/art54/

Olsson, P., Folke, C. and Hahn, T. 2004. Social-ecological transformation for ecosystem management: the development of adaptive co-management of a wetland landscape in southern Sweden. *Ecology and Society*, 9(4): 2. https://www.ecologyandsociety.org/vol9/iss4/art2/inline.html

Pelling, M. and Manuel-Navarrete, D., 2011. From resilience to transformation: the adaptive cycle in two Mexican urban centers. *Ecology and Society*, 16(2): 11. https://www.ecologyandsociety.org/vol16/iss2/art11/

Scheffer, M., Carpenter, S.R., Lenton, T.M., Bascompte, J., Brock, W., Dakos, V., Van de Koppel, J., Van de Leemput, I.A., Levin, S.A., Van Nes, E.H. and Pascual, M. 2012. Anticipating critical transitions. *Science*, 338(6105): 344-348.

Walker, B., and Meyers, J.A. 2004. Thresholds in ecological and social–ecological systems: a developing database. *Ecology and Society* 9(2): 3. http://www.ecologyandsociety.org/vol9/iss2/art3/

Walker, B., Holling, C.S., Carpenter, S. and Kinzig, A. 2004. Resilience, adaptability and transformability in social–ecological systems. *Ecology and society*, 9(2): 5. https://www.ecologyandsociety.org/vol9/iss2/art5/

Westley, F.R., Tjornbo, O., Schultz, L., Olsson, P., Folke, C., Crona, B. and Bodin, Ö. 2013. A theory of transformative agency in linked social-ecological systems. *Ecology and Society*, 18(3): 27: https://www.ecologyandsociety.org/vol18/iss3/art27/

Resilience-based Governance

Armitage, D., Marschke, M. and Plummer, R. 2008. Adaptive co-management and the paradox of learning. *Global Environmental Change*, 18(1): 86-98.

Chaffin, B.C., Gosnell, H., and Cosens, B.A. 2014. A decade of adaptive governance scholarship: synthesis and future directions. *Ecology and Society*, 19(3): 56. http://www.ecologyandsociety.org/vol19/iss3/art56/

Chaffin, B.C. and Gunderson, L.H. 2016. Emergence, institutionalization and renewal: rhythms of adaptive governance in complex social-ecological systems. *Journal of Environmental Management*, 165: 81-87.

Chaffin, B.C., Garmestani, A.S., Gunderson, L.H., Benson, M.H., Angeler, D.G., Arnold, C.A., Cosens, B., Craig, R.K., Ruhl, J.B. and Allen, C.R., 2016. Transformative environmental governance. *Annual Review of Environment and Resources*, 41: 399-423.

Folke, C., Hahn, T., Olsson, P. and Norberg, J., 2005. Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, 30: 441-473.

Garmestani, A.S. and Benson, M.H. 2013. A framework for resilience-based governance of social-ecological systems. *Ecology and Society*, 18(1): 9. https://www.ecologyandsociety.org/vol18/iss1/art9/

Lebel, L., Anderies, J.M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes, T.P. and Wilson, J. 2006. Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology and Society*, 11(1): 19. https://www.ecologyandsociety.org/vol11/iss1/art19/

Olsson, P., Gunderson, L., Carpenter, S., Ryan, P., Lebel, L., Folke, C. and Holling, C.S. 2006. Shooting the rapids: navigating transitions to adaptive governance of social-ecological systems. *Ecology and Society*, 11(1): https://www.ecologyandsociety.org/vol11/iss1/art18/

Österblom, H. and Folke, C. 2013. Emergence of global adaptive governance for stewardship of regional marine resources. Ecology and Society, 18(2): 4. https://www.ecologyandsociety.org/vol18/iss2/art4/

Schultz, L., Folke, C., Österblom, H. and Olsson, P. 2015. Adaptive governance, ecosystem management, and natural capital. *Proceedings of the National Academy of Sciences*, 112(24): 7369-7374.

Wyborn, C. 2015. Connecting knowledge with action through coproductive capacities: adaptive governance and connectivity conservation. *Ecology and Society*, 20(1): 11. https://www.ecologyandsociety.org/vol20/iss1/art11/

Social Resilience, Adaptation & Vulnerability Studies

Adger, W.N. 2000. Social and ecological resilience: are they related? Progress in Human Geography, 24(3): 347-364.

Adger, W.N., Hughes, T.P., Folke, C., Carpenter, S.R. and Rockström, J. 2005. Social-ecological resilience to coastal disasters. *Science*, 309(5737): 1036-1039.

Adger, W.N., Kelly, P.M., Winkels, A., Huy, L.Q. and Locke, C. 2002. Migration, remittances, livelihood trajectories, and social resilience. *AMBIO: A Journal of the Human Environment*, 31(4): 358-367.

Berkes, F. and Ross, H. 2013. Community resilience: toward an integrated approach. *Society and Natural Resources*, 26(1): 5-20.

Brown, K., 2014. Global environmental change I: A social turn for resilience? *Progress in Human Geography*, 38(1): 107-117.

Christensen, L. and Krogman, N. 2012. Social thresholds and their translation into social-ecological management practices. *Ecology and Society*, 17(1): 5. https://www.ecologyandsociety.org/vol17/iss1/art5/

Cutter, S.L. 2016. Resilience to what? Resilience for whom? *The Geographical Journal*, 182(2): 110-113.

Cutter, S.L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E. and Webb, J. 2008. A place-based model for understanding community resilience to natural disasters. *Global Environmental Change*, 18(4): 598-606.

Marshall, N.A. and Marshall, P.A. 2007. Conceptualizing and operationalizing social resilience within commercial fisheries in northern Australia. Ecology and society, 12(1): 1. https://www.ecologyandsociety.org/vol12/iss1/art1/

Marshall, N.A. 2010. Understanding social resilience to climate variability in primary enterprises and industries. *Global Environmental Change*, 20(1): 36-43.

Tompkins, E. and Adger, W.N. 2004. Does adaptive management of natural resources enhance resilience to climate change? *Ecology and Society*, 9(2): 10. https://www.ecologyandsociety.org/vol9/iss2/art10/

Social-ecological Systems, Resilience & the Law

Cosens, B.A., Ruhl, J.B. and Soininen, N. 2019. Enabling Adaptive Governance: Defining the role of government in new governance. *Vanderbilt Law Review*, Forthcoming.

Fischman, R.L., 2019. Letting Go of Stability: Resilience and Environmental Law. *Indiana Law Journal*, 94: 689-725.

Garmestani, A.S. and Allen, C.R. editors. 2014. *Social-ecological resilience and law*. Columbia University Press, New York, NY.

Garmestani, A., Ruhl, J.B., Chaffin, B.C., Craig, R.K., van Rijswick, H.F., Angeler, D.G., Folke, C., Gunderson, L., Twidwell, D. and Allen, C.R. 2019. Untapped capacity for resilience in environmental law. *Proceedings of the National Academy of Sciences*, 116(40): 19899-19904.

Ruhl, J.B. 2012. Panarchy and the law. *Ecology and Society*, 17(3): 31. https://www.ecologyandsociety.org/vol17/iss3/art31/

Social-ecological Systems & Resilience – The Critics

Beymer-Farris, B.A., Bassett, T.J. and Bryceson, I. 2012. Promises and pitfalls of adaptive management in resilience thinking: the lens of political ecology. Pages 283-300 in T. Plieninger and C. Bieling, editors. *Resilience and the cultural landscape: understanding and managing change in human-shaped environments*. Cambridge University Press, New York, NY.

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