Table S1. A list of academic journals that include "sustainability" in their titles or subtitles (data obtained using the Online Public Access Catalog).

Journal title	Founding year	Open access	Publisher	SCI* by 2017
1. Journal of Environmental and Sustainability Law	1993	No	University of Missouri	No
2. Environment, Development and Sustainability	1999	No	Springer	No
3. International Journal of Sustainability in Higher Education	2000	No	Emerald Group Publishing Limited	No
4. International Journal of Agricultural Sustainability	2003	No	Taylor & Francis	Yes
5. Proceedings of the ICE - Engineering Sustainability	2003	No	Institution of Civil Engineers	Yes
6. Journal of Strategic Innovation and Sustainability	2005	No	North American Business	No
7. Sustainability: Science, Practice, & Policy	2005	Yes	Taylor & Francis	No
8. PNAS Sustainability Science*	2006	No	National Academy of Sciences	Yes
9. Sustainability Science	2006	No	Springer	Yes
10. Journal of Teacher Education for Sustainability	2008	No	De Gruyter Open	No
11. Journal of Urbanism: International Research on Placemaking and Urban Sustainability	2008	No	Taylor & Francis	No
12. Sustainability	2009	Yes	MDPI	Yes
13. Current Opinion in Environmental Sustainability	2009	No	Elsevier	Yes
14. New Perspectives on Sustainability	2009	No	Open Journals Systems	No
15. Critical Studies on Corporate Responsibility, Governance and Sustainability	2010	No	Emerald Group Publishing Limited	No
16. Journal of Sustainability Education	2010	Yes	Prescott College Ph.D. Program in Sustainability Education	No
17. Sustainability Accounting, Management and Policy Journal	2010	No	Emerald Group Publishing Limited	No
18. Journal of Management for Global Sustainability	2011	No	International Association of Jesuit Business Schools	No
19. Energy, Sustainability and Society	2011	Yes	Springer	No
20. International Journal of Environmental Cultural Economic and Social Sustainability	2011	No	Common Ground Publishing	No
21. Journal of Water Sustainability	2011	No	University of Technology, Sydney	No
22. The International Journal of Environmental Sustainability	2012	No	Progressive Sustainable Developers Nepal	No
23. Challenges in Sustainability	2013	Yes	Librello	No

24.	Sustainability of Water Quality and Ecology	2013	No	Elsevier	No
25.	Journal of Materials Chemistry A: Materials for Energy and Sustainability	2013	No	Cambridge	No
26.	Ecosystem Health and Sustainability	2015	Yes	Taylor & Francis	No
27.	The International Journal of Sustainability Education	2015	No	Common Ground Publishing	No
28.	Textiles and Clothing Sustainability	2015	Yes	Springer	No
29.	Nature Sustainability	2018	No	Springer Nature	No

Notes: An SCI (Science Citation Index) journal is a journal indexed in the source publication list of Web of Science (http://mjl.clarivate.com/publist_sciex.pdf). Although Sustainability Science is only a section in *Proceedings of the National Academy of Sciences of the United States of America* (PNAS), it has played a major role in the development of sustainability science. Therefore, it was also included in this table.

Table S2. A list of 43 definitions and characterizations of sustainability science. GS refers to Google Scholar, WoS refers to Web of Science.

Year	Source	Definition or characterization	Times cited	
			GS	WoS
1997	Dodds [1]	"The 'science of sustainability'--delineated as the study of human agency and well-being in the context of enmeshed economic, social and biophysical systems. The constrained optimization problem of this science of sustainability would be to identify social institutions and attitudes that optimize present human well-being within social and biophysical limits, while maintaining the ability of future generations to enjoy no less a level of well-being and satisfying our ethical obligations to the non-human world."	148	35
1999	NRC [2]	The NRC report proposed "three priority tasks for advancing the research agenda of what might be called 'sustainability science': 1. Develop a research framework for the science of sustainable development that integrates global and local perspectives to shape a place-based understanding of the interactions between environment and society. 2. Initiate focused research programs on a small set of understudied questions that are central to a deeper understanding of those interactions. 3. Promote better utilization of existing tools and processes for linking knowledge to action in pursuit of a sustainability transition."	625	-
2001	Kates et al. [3]	"A new field of sustainability science is emerging that seeks to understand the fundamental character of interactions between nature and society. Such an understanding must encompass the interaction of global processes with the ecological and social characteristics of particular places and sectors."	2622	956
2003	Clark & Dickson [4]	"Sustainability science is not yet an autonomous field or discipline, but rather a vibrant arena that is bringing together scholarship and practice, global and local perspectives from north and south, and disciplines across the natural and social sciences, engineering, and medicine."	1020	410
2003	Turner et al. [5]	Sustainability science "builds toward an understanding of the human environment condition with the dual objectives of meeting the needs of society while sustaining the life support systems of the planet."	2753	1147
2004	Swart, Raskin, & Robinson [6]	"Sustainability science would seek to illuminate the interactions between nature and society at different geographic scales from global to local. It would address the behavior of complex self-organizing systems and responses of the combined nature-society system to multiple and interacting stresses, involving different social actors. It would develop tools for monitoring key environmental and social conditions, and guidance on effective management systems."	473	206
2005	Reitan [7]	Sustainability science refers to "the cultivation, integration, and application of knowledge about Earth systems gained especially from the holistic and historical sciences (such as geology, ecology, climatology, oceanography) coordinated with knowledge about	51	-

		human interrelationships gained from the social sciences and humanities."		
2006	Komiyama & Takeuchi [8]	"Sustainability science must therefore adopt a comprehensive, holistic approach to identification of problems and perspectives involving the sustainability of these global, social, and human systems."	384	142
2006	Martens [9]	"Sustainability science is not an independent profession, let alone a discipline. It is rather a vital area in which science, practice, and visions of North and South meet one another, with contributions from the whole spectrum of the nature sciences, economics, and social sciences."	269	269
2007	Clark [10]	"Sustainability science is a field defined by the problems it addresses rather than by the disciplines it employs. In particular, the field seeks to facilitate what the National Research Council has called a 'transition toward sustainability,' improving society's capacity to use the earth in ways that simultaneously 'meet the needs of a much larger but stabilizing human population, . . . sustain the life support systems of the planet, and . . . substantially reduce hunger and poverty' [2]."	569	211
2007	Rapport [11]	"Sustainability science is, at root, a transdisciplinary effort to come to grips with one of the most perplexing issues of our time: how to achieve a symbiotic relationship between biological and social–cultural systems so that future options are not foreclosed."	82	35
2007	Blackstock, Kelly, & Horsey [12]	"Sustainability science is embedded within broader social processes of understanding and applying sustainability, thus sustainability science contributes to socio-political decision making processes through information provision (especially analyses of risks and consequences) derived from emergent interdisciplinary inquiry [13]."	320	131
2007	Ostrom, Janssen, & Anderies [15]	"If sustainability science is to grow into a mature applied science, we must use the scientific knowledge acquired in the separate disciplines of anthropology, biology, ecology, economics, environmental sciences, geography, history, law, political science, psychology, and sociology to build diagnostic and analytical capabilities."	749	318
2009	Jäger [16]	"Sustainability science focuses on the design and running of processes linking knowledge with action to deal with persistent problems of unsustainability and to foster transitions to sustainability."	22	-
2009	Matson [17]	"The substantive focus of sustainability science is on the complex dynamics of the coupled human–environment system. The field reaches out to embrace relevant scholarship on the fundamental character of interactions among humans, their technologies, and the environment, and on the utilization of that knowledge by decision makers to address urgent problems of economic development and environmental and resource conservation."	28	15
2010	Levin & Clark [18]	"Science of sustainability focuses on the narrower but essential task of sustainability science: characterizing the needs for fundamental work on the core concepts, methods, models, and measurements that, if successful, would support work across all of those sectoral applications."	43	-

2010	Turner [19]	"Sustainability science has emerged as the intellectual umbrella for addressing human–environment problems and practice arising from those research communities closely aligned with global climate and environment change. These communities, and thus sustainability science, maintain substantial interests in questions of vulnerability and resilience."	260	122
2010	Weinstein [20]	"Sustainability science seeks real world solutions to sustainability issues and aims to break down artificial and outdated disciplinary gaps between the natural and social sciences through the creation of new knowledge and its practical application to decision making [6, 23, 24]."	24	-
2010	Ness, Anderberg, & Olsson [25]	"The emerging field of sustainability science is a major attempt to bridge the divides and fill the many knowledge gaps."	93	40
2010	Pearson & Gorman [26]	"It is now widely documented that science for sustainability needs integrated problem-focused research that is by nature trans-disciplinary [11, 27-29]."	17	12
2011	Ahern [30]	"SS is problem-solving focused. It addresses the dynamic interactions between nature and society, considering both how social change influences the environment and how environmental change shapes society. SS aims to provide knowledge co-produced by scholars and practitioners to inform decision making for sustainable development [6]."	286	103
2011	Kates [29]	"Sustainability science, as described by the PNAS website, is '. . .an emerging field of research dealing with the interactions between natural and social systems, and with how those interactions affect the challenge of sustainability: meeting the needs of present and future generations while substantially reducing poverty and conserving the planet's life support systems.'"	231	91
2011	Aronson [30]	"Sustainability science is a vast field, surveying-in a scientific fashion-all the interactions of humans and our environment, and our ability to keep those interactions along sustainable trajectories [5]."	20	8
2011	Spangenberg [31]	"Characterized more by its research purpose than by a common set of methods or objects, sustainability science can be subdivided into the more traditional disciplinary-based science for sustainability and the transdisciplinary science of sustainability. Science for sustainability can be mono-disciplinary or multidisciplinary, but it must be at least 'interdisciplinary-ready', conducted with the broader picture of sustainability in mind, and therefore ready for integration with results from other disciplines. The science of sustainability addresses what [10] has called the 'core sustainability science research program', namely 'understanding the complex dynamics that arise from interactions between human and environmental systems'. In the quest for applicable and problem-solving solutions, it searches for a generalizable scientific understanding of sustainability, with research based on conceptual models and methods built at the interface of	172	82

		disciplines."		
2012	Sala, Farioli, & Zamagni [32]	Sustainability science is a "solution-oriented discipline that studies the complex relationship between nature and humankind, conciliating the scientific and social reference paradigms which are mutually influenced-and covering multi temporal and spatial scales. The discipline implies a holistic approach, able to capitalize and integrate sectorial knowledge as well as a variety of epistemic and normative stances and methodologies towards solutions' definition."	90	44
2012	Burger et al. [33]	"Sustainability science (is) an emerging field of research dealing with the interactions between natural and social systems, and with how those interactions affect the challenge of sustainability: meeting the needs of present and future generations while substantially reducing poverty and conserving the planet's life support systems" (Proceedings of the National Academy of Sciences of the USA [PNAS], http: //www. pnas.org/site/misc/sustainability.shtml).	83	36
2012	Lang et al. [34]	"As a problem-and solution-oriented field, sustainability science is inter alia inspired by concepts of post-normal, mode-2, triple helix, and other science paradigms that employ corresponding research practices, such as trans-disciplinary, community-based, interactive, or participatory approaches."	665	288
2012	Wu [35]	"Three salient characteristics seem essential to sustainability science. Sustainability science is multidimensional and transdisciplinary, multi-scaled and hierarchically linked in space and time, emphasizes use-inspired, placed-based research."	18	-
2012	Sander Van der Leeuw et al. [36]	"Since its inception, sustainability science has evolved to become a problem- and solution-oriented field inspired by the post-normal science philosophy that adopts transdisciplinary and participatory research practices [4]."	60	20
2013	Wu [37]	Sustainability science is "a transdisciplinary science focusing on the dynamic relationship between society and nature at the local, regional, and global scales [2,3]."	278	151
2013	McGreavy et al. [38]	"Sustainability science represents a response to the increasingly urgent call to recognize and understand these complex interlinked problems and identify novel solutions that effectively move knowledge into action [39]."	29	14
2013	Miller [40]	Sustainability science is "a new field that seeks to understand the fundamental character of inter- actions between nature and society and enhance society's capacity to guide those interactions along more sustainable trajectories [3]."	112	48
2013	Salas-Zapata, Rios-Osorio, & Trouchon-Osorio [41]	"Sustainability science is at an early stage of progress. It is not yet an independent field or discipline [9], and it is not a 'science by any usual definition' [11]. So far, it has been described as a mode of doing science: mode-2 science [9]."	12	7
2014	Miller et al. [42]	"Kates et al. (2001) laid the foundation for sustainability science, defining three core objectives: (1) understanding the fundamental interactions between nature and society; (2) guiding these interactions	169	63

		along sustainable trajectories; (3) promoting social learning necessary to navigate the transition to sustainability."		
2015	Bremer & Funtowicz [43]	"Sustainability science, which seek to more effectively harness science in addressing the grand challenges of our time [3], has emerged from (and is arguably synonymous with) the broad and dynamic field of 'science for sustainability', and brings together elements of different approaches and perspectives from across this field."	10	4
2015	Wiek et al. [44]	"Sustainability science still struggles with transitioning from problem-focused to solution-oriented endeavors that yield positive impacts on mitigating sustainability challenges."	18	10
2015	Ruppert-Winkel et al. [45]	"In contrast to disciplinary perspectives on the study of sustainability (mode-1 science) [32], mode-2 sustainability science is performed in inter- and transdisciplinary ways. We name this kind of science transdisciplinary sustainability science (TSS). TSS integrates different disciplinary knowledge as well as scientific and nonscientific knowledge."	11	6
2015	Koenig [46]	"Sustainability science relies on problem-driven interdisciplinary research focusing on the interaction between nature and society, and takes account of complexity and uncertainty by adopting a systems perspective and a close link to practice [3, 6, 47]."	9	2
2015	Martin-Lopez & Montes [48]	"Sustainability science aims to understand the interactions between ecosystems and social systems with a focus on real problems [29]. In this sense, sustainability science is thought as neither 'basic' nor 'applied'; but as 'useable' and 'actionable' science [10]."	19	9
2016	Shahadu [49]	"Sustainability science is a problem inspired, interdisciplinary science of systematic enquiry into the interconnections and relations between the past, present and future of life and its support systems, with the goal of keeping the productive capacity of life support systems in harmony with the demands placed on them, at all times."	3	0
2016	Thorén & Breian [50]	"Sustainability science is an interdisciplinary field aimed at producing knowledge to aid in the transition towards sustainability. This task, it is widely believed, requires both interdisciplinary integration (especially across the natural/social science divide) and the integration of scientific and non-scientific knowledge [3, 51]."	5	-
2016	Partelow [52]	"Sustainability science is often defined as research in the context of SES [10]. The number of researchers and practitioners pursuing inter- and transdisciplinary collaborations have increased significantly since the foundations of sustainability science began in the early 2000s [3]. Within its' core agenda, empirical research aims to be problem-driven and solution oriented [4]."	7	2
2017	Hall et al. [53]	Sustainability science is "an interdisciplinary applied science. It is motivated by understanding (1) human-nature interactions within complex social-ecological systems, (2) social transitions towards sustainability, and (3) generating use-inspired knowledge for problem [54-56]."	1	0

Table S3. Codebook for coding the definitions and characterizations of sustainability science.

Life supporting systems	
Description	The natural systems of the planet that support lives on the earth.
Inclusion Criteria	Use of "life support systems" or similar terms.
Exclusion Criteria	
Typical Exemplars	• With the dual objectives of meeting the needs of society while sustaining the life support systems of the planet. • Meeting the needs of present and future generations while substantially reducing poverty and conserving the planet's life support systems. • With the goal of keeping the productive capacity of life support systems in harmony with the demands placed on them, at all times.
Atypical Exemplars	
Close but no	

Human well-being	
Description	A condition in which human can determine and meet their needs from a range of choices.
Inclusion Criteria	Use of the terms "human well-being" or "meet human needs".
Exclusion Criteria	
Typical Exemplars	• Meeting the needs of society. • Sustainability science has reached out with focused problem-solving efforts targeted to urgent human needs. • Meeting the needs of present and future generations.
Atypical Exemplars	
Close but no	

Future generations	
Description	Take the needs of future generations into consideration.
Inclusion Criteria	Use of the term "future generations" or phrases of the same meaning.
Exclusion Criteria	
Typical Exemplars	• Meeting the needs of present and future generations. • Maintaining the ability of future generations to enjoy no less a level of well-being.
Atypical Exemplars	• With the goal of keeping the productive capacity of life support systems in harmony with the demands placed on them, at all times.
Close but no	

Strong sustainability	
Description	Strong sustainability is a paradigm that views economic activities as part of the social domain, and both economic and social actions are constrained by the environment.
Inclusion Criteria	Emphasizing the need to sustain or conserve life supporting systems in the process of development; recognizing the limits of life supporting systems.
Exclusion Criteria	
Typical Exemplars	• Meeting the needs of society while sustaining the life support systems of the planet.

	• Meeting the needs of present and future generations while substantially reducing poverty and conserving the planet's life support systems.
Atypical Exemplars	• This science of sustainability would be to identify social institutions and attitudes that optimize present human well-being within social and biophysical limits. • With the goal of keeping the productive capacity of life support systems in harmony with the demands placed on them.
Close but no	

Human–environment interactions

Description	Human well-being depends on the environment, and the environment is affected by human activities at the same time.
Inclusion Criteria	Use of the term "human–environment interactions" or other phrases with the same meaning, such as relationship between nature and society, and coupled human–environment systems.
Exclusion Criteria	
Typical Exemplars	• Understand the fundamental character of interactions between nature and society. • Understanding of the interactions between environment and society. • Understanding of coupled human–environment systems. • Illuminate the interactions between nature and society. • Addresses the dynamic interactions between nature and society. • Dealing with the interactions between natural and social systems. • Understanding the complex dynamics that arise from interactions between human and environmental systems. • Studies the complex relationship between nature and humankind.
Atypical Exemplars	
Close but no	

Emergent properties

Description	Emergent properties are the properties of complex human–environment systems, such as resilience, vulnerability, adaptability, etc.
Inclusion Criteria	Use of the term "emergent properties"; or mention of the detailed properties such as "vulnerability", "resilience", "adaptability", and "complexity".
Exclusion Criteria	
Typical Exemplars	• These communities, and thus sustainability science, maintain substantial interests in questions of vulnerability and resilience.
Atypical Exemplars	• It would address the behavior of complex self-organizing systems and responses of the combined nature–society system to multiple and interacting stresses.
Close but no	

Linking knowledge to action

Description	Sustainability science is intended to produce actionable knowledge for decision-making to solve real world problems.
Inclusion Criteria	Use of the term "linking knowledge to action"; mention of knowledge production and the usage of the knowledge at the same time.

Exclusion Criteria	
Typical Exemplars	• Promote better utilization of existing tools and processes for linking knowledge to action in pursuit of a sustainability transition. • Sustainability science relies on problem-driven interdisciplinary research focusing on the interaction between nature and society, and takes account of complexity and uncertainty by adopting a systems perspective and a close link to practice.
Atypical Exemplars	• Sustainability science is "the cultivation, integration, and application of knowledge about Earth systems gained especially from the holistic and historical sciences." • SS aims to provide knowledge co-produced by scholars and practitioners to inform decision making for sustainable development. • The field reaches out to embrace relevant scholarship on the fundamental character of interactions among humans, their technologies, and the environment, and on the utilization of that knowledge by decision makers to address urgent problems of economic development and environmental and resource conservation.
Close but no	

Interdisciplinary	
Description	Interdisciplinary involves several disciplines in a way that forces them to cross subject boundaries. The involved disciplines integrate disciplinary knowledge to create new knowledge and theory and achieve a common research goal.
Inclusion Criteria	Use of the term "interdisciplinary"; mention of cross boundaries between different disciplines for creating new knowledge and achieving a common research goal.
Exclusion Criteria	
Typical Exemplars	• Sustainability science contributes to socio-political decision making processes through information provision (especially analyses of risks and consequences) derived from emergent interdisciplinary inquiry. • The number of researchers and practitioners pursuing inter- and transdisciplinary collaborations have increased significantly. • Sustainability science is an interdisciplinary field aimed at producing knowledge to aid in the transition towards sustainability. This task, it is widely believed, requires both interdisciplinary integration and the integration of scientific and non-scientific knowledge.
Atypical Exemplars	• Bringing together disciplines across the natural and social sciences, engineering, and medicine. • Sustainability science emerged as a solution-oriented arena that transcends disciplinary boundaries.
Close but no	

Transdisciplinary	
Description	Transdisciplinary research involves academic researchers from different disciplines as well as non-academic participants, such as land managers, user groups, and the public, aiming to create new knowledge and research a common question
Inclusion Criteria	Use of the term "transdisciplinary"; or mention of cooperation between academics from different disciplines and non-academic participants.

Exclusion Criteria	
Typical Exemplars	• A transdisciplinary science focusing on the dynamic relationship between society and nature at the local, regional, and global scales. • Sustainability science can be subdivided into the more traditional disciplinary-based science for sustainability and the transdisciplinary science of sustainability. • Sustainability science is now characterized widely as a transdisciplinary field motived by problem-solving. • Field inspired by the post-normal science philosophy that adopts transdisciplinary and participatory research practices. • Sustainability science is multidimensional and transdisciplinary, that is by nature trans-disciplinary. • We name this kind of science transdisciplinary sustainability science (TSS). TSS integrates different disciplinary knowledge as well as scientific and nonscientific knowledge.
Atypical Exemplars	• Bringing together scholarship and practice, global, and local perspectives from north and south.
Close but no	

Use-inspired

Description	Sustainability research is often inspired by specific use.
Inclusion Criteria	Use of the term "use-inspired".
Exclusion Criteria	
Typical Exemplars	• Sustainability science is neither basic nor applied research, but rather an enterprise centered on use-inspired basic research. • Generating use-inspired knowledge for problem.
Atypical Exemplars	
Close but no	

Problem-driven

Description	Sustainability research is often driven by certain problems.
Inclusion Criteria	Use of the term "problem-driven", or mention of similar phrases.
Exclusion Criteria	
Typical Exemplars	• Sustainability science has reached out with focused problem-solving efforts targeted to urgent human needs. • Seeks to involve non-scientists in resolving the complex, multi-dimensional problems facing humanity. • The first is concerned with analyzing problems in coupled human–environment systems, whereas the second conducts research on practical solutions to those problems. • "Since its inception, sustainability science has evolved to become a problem- and solution-oriented field." • On the utilization of that knowledge by decision makers to address urgent problems of economic development and environmental and resource conservation.
Atypical Exemplars	• Initiate focused research programs on a small set of understudied questions that are central to a deeper understanding of those interactions.

	• Sustainability science must therefore adopt a comprehensive, holistic approach to identification of problems and perspectives involving the sustainability of these global, social, and human systems. • Sustainability science has emerged as the intellectual umbrella for addressing human–environment problems.
Close but no	

Solution-oriented

Description	Sustainability research is often intended to provide solutions to real world problems.
Inclusion Criteria	Use of the term "solution-oriented", or mention of similar phrases.
Exclusion Criteria	
Typical Exemplars	• As a problem-and solution-oriented field. • Sustainability science is problem-solving focused. • In the quest for applicable and problem-solving solutions, it searches for a generalizable scientific understanding of sustainability. • Sustainability science has emerged as a solution-oriented arena that transcends disciplinary. • Sustainability science is a solution-oriented discipline. • Whereas the second conducts research on practical solutions to those problems. • Since its inception, sustainability science has evolved to become a problem- and solution-oriented field.
Atypical Exemplars	
Close but no	

Scale-multiplicity

Description	Sustainability research should be conducted at multiple scales: from local scale to global scale.
Inclusion Criteria	Use of the term "scale-multiplicity"; mention of more than one specific scale.
Exclusion Criteria	
Typical Exemplars	• Sustainability science would seek to illuminate the interactions between nature and society at different geographic scales. • Conciliating the scientific and social reference paradigms which are mutually influenced-and covering multi temporal and spatial scales. • Sustainability science is multidimensional and transdisciplinary, multi-scaled, and hierarchically linked in space and time.
Atypical Exemplars	• Such an understanding must encompass the interaction of global processes with the ecological and social characteristics of particular places and sectors. • Bringing together scholarship and practice, global and local perspectives from north and south. • A transdisciplinary science focusing on the dynamic relationship between society and nature at the local, regional, and global scales.
Close but no	

Place-based

Description	Sustainability research should consider concrete contexts for solving real world problems.
Inclusion Criteria	Use of the term “place-based”, or mention of similar phrases.
Exclusion Criteria	
Typical Exemplars	• Local perspectives to shape a place-based understanding of the interactions between environment and society. • Emphasizes use-inspired, placed-based research.
Atypical Exemplars	• Such an understanding must encompass the interaction of global processes with the ecological and social characteristics of particular places and sectors. • Bringing together scholarship and practice, global, and local perspectives from north and south.
Close but no	

Table S4. A list of 70 questions of sustainability science compiled from Kates et al. 2001, Levin and Clark 2010, Sustainability Science DGS 2010, Clark 2010, and Kates 2011.

Research themes	Research questions	Sources
Sustainability	1. Defining sustainability: how to integrate the diversity of views on what well-being means into a unified, comparable, and legitimate measurement of sustainability?	Sustainability Science DGS 2010
	2. Human well-being reconsidered: is the current definition of well-being adopted by neoclassical economics theory appropriate and sufficient for the normative SS core questions?	Sustainability Science DGS 2010
	3. "What are we talking about?" - A plea for consistent definitions	Sustainability Science DGS 2010
	4. Definitions of sustainability	Clark 2010
	5. How to make sustainability science more easily understood?	Sustainability Science DGS 2010
Knowledge systems (data, metrics, models, methods, and theories)	6. How to better characterize complex human–environment systems?	Levin and Clark 2010
	7. A new generation of models for the study of sustainable development	Levin and Clark 2010
	8. How can analysis contributing to decision-making about the sustainable development of human–environment systems be improved?	Levin and Clark 2010
	9. Models	Clark 2010
	10. How can theory and models be formulated that better account for the variation in human–environment interactions?	Kates 2011
	11. Observations / data (storage, utilization)	Clark 2010
	12. How can today's operational systems for monitoring and reporting on environmental and social conditions be integrated or extended to provide more useful guidance for efforts to navigate a transition toward sustainability?	Kates et al. 2001
	13. What should be measured and monitored to understand and evaluate our progress towards sustainability and improved human well-being?	Levin and Clark 2010
	14. Creating, maintaining and using long-term, place-based observations to measure progress toward or movement away from sustainability	Levin and Clark 2010
	15. Metrics of SD and intergenerational equity: How current decisions affect the fan of available choices for future generations?	Sustainability Science DGS 2010
	16. Sustainability evaluations from participatory-action research: How do they compare with those derived from standard indicators in their ability to reflect ecological and social properties?	Sustainability Science DGS 2010
	17. How can the "sustainability" of alternative pathways of environment and development be evaluated?	Kates 2011
	18. How can today's relatively independent activities of research planning, monitoring, assessment, and decision support be better integrated into systems for adaptive management and societal learning?	Kates et al. 2001

	19. Knowledge systems for sustainable development	Levin and Clark 2010
	20. Knowledge systems (i.e., integrated research planning, monitoring, assessment, for decision support, policy, innovation)	Clark 2010
	21. What strategies related to consumption could enhance sustainable development?	Levin and Clark 2010
	22. How can technological innovation be induced and harnessed to support sustainable development?	Levin and Clark 2010
Sustainability challenges	23. Ecosystem restoration: How can sustainability science help balance competing demands on landscapes from both humans and nonhumans?	Sustainability Science DGS 2010
	24. Industrial transitions: How can sustainability concerns become endogenized in socio-technical transition processes?	Sustainability Science DGS 2010
	25. Agro-ecological systems: Which could be the consequences, in terms of their sustainability, for divergent versus convergent models?	Sustainability Science DGS 2010
	26. Agro-ecological systems: What other priorities for agriculture are important to evaluate, and what are the tradeoffs and all of the possible relationships between agriculture and other priorities?	Sustainability Science DGS 2010
	27. Strategic questions and grand challenges	Clark 2010
Long-term trends, social-ecological feedback loops, and non-intervention future scenarios	28. How are long-term trends in environment and development, including consumption and population, reshaping nature–society interactions in ways relevant to sustainability?	Kates et al. 2001
	29. How can the dynamic interactions between nature and society–including lags and inertia–be better incorporated into emerging models and conceptualizations that integrate the Earth system, human development, and sustainability?	Kates et al. 2001
	30. The WEHAB plus transitions of the Longue Duree: Powerful drivers towards and away from sustainability	Levin and Clark 2010
	31. Driving forces of the long-term trends of HESs	Clark 2010
	32. What shapes the long-term trends and transitions that provide the major directions for this century?	Kates 2011
Human–environment trade-offs and synergies	33. Characterizing tradeoffs in HESs	Levin and Clark 2010
	34. Tradeoffs between human welfare and ecosystem services: how well do we understand the costs to ecosystem services and life support systems that our well-being imposes?	Sustainability Science DGS 2010
	35. What are the principal tradeoffs between human well-being and the natural environment?	Kates 2011
	36. Complementarities: How can we address co-benefits?	Sustainability Science DGS 2010
	37. Equity: How to parameterize equity into socio-environment system analysis?	Sustainability Science DGS 2010
	38. Equity: What are the consequences of global sustainable resource transitions in terms of distributional justice and human development?	Sustainability Science DGS 2010
Human values and sustainability visions	39. The sustainability transition: Alternative science-based scenarios of the moving target of sustainability	Levin and Clark 2010
	40. What should be the human use of the earth?	Clark 2010
	41. What kind of nature do modern societies want?	Clark 2010

	42. What values relevant to sustainability do we in fact have?	Clark 2010
	43. Valuing human well-being and the natural environment	Clark 2010
Leverage point for interventions	44. What determines the vulnerability or resilience of the nature–society systems in particular kinds of places and for particular types of ecosystems and human livelihoods?	Kates et al. 2001
	45. How does the variability and history of CHES influence their resilience?	Sustainability Science DGS 2010
	46. Emergent properties of CHES: How can we use long-term data sets to establish baselines for various human and environmental indicators (GDP, population, biodiversity, climate, etc.)?	Sustainability Science DGS 2010
	47. Emergent system: dynamical patterns, teleconnections, feedback loops, etc.	Clark 2010
	48. Impacts and response (vulnerability, resilience, adaptation)	Clark 2010
	49. What determines the adaptability, vulnerability, and resilience of human–environment systems?	Kates 2011
	50. Can scientifically meaningful “limits” or "boundaries" be defined that would provide effective warning for human–environment systems?	Kates et al. 2001
	51. Critical transitions: Early warnings of "tipping points" of complex adaptive systems change	Levin and Clark 2010
	52. Thresholds: What are the critical thresholds in social and natural systems, and how do they impact each other?	Sustainability Science DGS 2010
	53. Can scientifically meaningful “limits” be defined that would provide effective warning for human–environment systems?	Kates 2011
Sustainability transition	54. What assumptions does (should) the field of sustainability science make about human beings as decision makers?	Sustainability Science DGS 2010
	55. How does affect (emotional response) affect behavior, judgment, and decision-making?	Sustainability Science DGS 2010
	56. The relationship between beliefs, norms, and behavior	Sustainability Science DGS 2010
	57. What systems of incentive structures--including markets, rules, norms, and scientific information--can most effectively improve social capacity to guide interactions between nature and society toward more sustainable trajectories?	Kates et al. 2001
	58. How to incentivize against unwanted outcomes that may arise from the aggregate of many small-scale decisions that individually work towards a positive goal?	Sustainability Science DGS 2010
	59. What and why are the relationships between collective social phenomena and sustainable development?	Levin and Clark 2010
	60. Local adaptive responses and their global consequences	Levin and Clark 2010
	61. Adaptive governance systems for sustainability	Levin and Clark 2010
	62. Decision making as social choice	Levin and Clark 2010
	63. Dynamic decision support	Levin and Clark 2010
	64. Institutions: Operationalizing Ostrom	Sustainability Science DGS 2010
	65. Institutions: How do motivations aggregate to affect the formation of institutions?	Sustainability Science DGS 2010
	66. Institutions: What is the relationship between human capital and successful implementation?	Sustainability Science DGS 2010

67. Institutions: How to create effective markets for sustainability?	Sustainability Science DGS 2010
68. Guidance/Institutions and incentives (governance, institutions)	Clark 2010
69. Designing management systems for sustainability under uncertainty	Levin and Clark 2010
70. How can society most effectively guide or manage human environment systems toward a sustainability transition?	Kates 2011

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