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Geography and the study of human–environment relations

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Overview of human–environment geography

Human–environment geography, comprised of forms of knowledge that integrate the in-depth analysis of *both* human–social conditions in their interactions with the environment *and* the dynamics of the biogeophysical world, is also referred to as environmental, nature–society, and environment and society geography (Castree, Demeritt, and Liverman 2009). By integrating across the discipline’s human–environment divide, these forms of knowledge are distinct relative to other subfields (Zimmerer 2007, 2010). Human–environment geography often combines in-depth empirical research with the synthesis of information through conceptual frameworks and models. One of the leaders of human–environment geography, B.L. Turner II, has referred to this defining characteristic as the “specialist-synthesis merger.” (Turner’s works, and those of others, establish the use of the dash in human–environment geography.) The realm of human–environment studies in geography incorporates a diverse range of actively evolving approaches and interests. Variety and depth of the new knowledge systems in this realm are expanding amid the intensifying

interactions and complex new relations of human societies and environments.

The accelerated intensification and potentially novel forms of current human–environment interactions are indicative of pronounced change as well as a sign of the expanded importance of this subfield. These trends are resulting in both a further strengthening of the core nodes of topical and thematic interest and, also, the rise of new issues and approaches. The factors that influence human–environment geography’s current phase include neoliberal globalization, urbanization, global environmental changes (e.g., biodiversity loss, climate change, food security issues), industrial ecology (e.g., energy and mining), population dynamics including the size, movement, and gendering of demographic factors (e.g., migration), the politics of so-called environmental security, and the growth of environment-related citizenship and social movements.

Several of the human–environment approaches responding to current changes are termed blended studies and hybrid sciences. These knowledge systems are synthesizing information, analytics, and interpretation across multiple areas of human–environment study. Such “blended human–environment studies” are characteristic of state-of-the-art knowledge and are a response, in part, to the unprecedented social urgency and complexity of environmental issues being encountered in the Anthropocene.

The Anthropocene is a term under consideration by leading scientific institutions (such as the Geologic Society of London and the Geologic Society of America) to demarcate the new geologic epoch distinguishable through the magnitude of human impacts on the Earth’s environments. The term Anthropocene also evokes

the graphic image of planetary environmental boundaries, in which it is estimated that three of the eight most important global environmental systems currently approximate or exceed the limits of planetary sustainability (biodiversity, climate, and the nitrogen cycle) as the result of human activities. At least a couple others, namely water and land use, are significantly nearing the planetary environmental limits. Regardless of the eventual nomenclatural decision – whether or not the term Anthropocene is officially designated to denote the current geologic epoch (i.e., to follow the Holocene epoch) – it is clear that the scope of human–environment interactions has gained importance.

As a result of the aforementioned factors, the existing elements of human–environment inquiry and understanding are varied and dynamic within contemporary geography. Taken together, these human–environment approaches are clustered into nine identifiable nodes. The contours of this expansive human–environment terrain in geography are shaped principally through research and scholarship. Other influences in the coalescence of these nine nodes include the analysis and implementation of “real-world” environmental governance at multiple scales, practical applications to resource management, and environmental activism and public awareness.

This surge of interest, ideas, debate, and practice is transforming the range of human–environment knowledge systems as they seek to respond to ongoing changes beyond geography per se. Major influences currently reshaping various parts of human–environment geography range from the pivotal reconfiguring of post-structural theory in the academy to the amassing impacts of anthropogenic environmental changes leading to major societal challenges and uncertainty. Tracing the outlines of these influences can begin with the significant expansion and

diversification of the human–environment sciences and scholarship through the restructuring of the academy during the 1990s and 2000s to the present (Turner 2002; Zimmerer 2010). The academic “restructuring” in these accounts refers to the influential expansion and consolidation of powerful interdisciplinary fields, such as environmental studies, the environmental sciences (including such offshoots as sustainability science), and ecological approaches incorporating social analysis as well as concomitant changes in the structure and organization of research funding. These academic shifts are leading to both new blended approaches that have recently arisen (see below) and the nodes of specialization in human–environment geography.

The contours of current human–environment geography also have significant influences outside the boundaries of academe per se. These influences stem from the increased awareness of abrupt, socially disruptive environmental changes associated with biogeophysical systems (e.g., climate change, ocean acidification, water shortage, and storm intensity). “Biogeophysical” is an appropriate term that reflects a view of the environment made up of biogeographic, geosystem, and physical geographic factors. Powerful influences arise from the policy, politics, and social issues of human–social endeavors concerning the environment. Recent trends of human–environment geography highlight the need to situate the dynamic biogeophysical changes in interacting scales of space and time. Human–environment geography is focused on the biogeophysical elements of change from a perspective centered on the interactions and entanglements with modern human societies, political economies, environmentalism, and environmental movements. Such forces exert major direct influences on human–environment studies.

The dynamism of human–environment studies has contributed to its widespread recognition as vital in the contemporary discipline of geography. In general, two disciplinary structures predominate. First is the view of human–environment geography as a kind of overlapping connective tissue across the skeletal disciplinary structure of human geography and physical geography. This treatment of human–environment geography tends to rely on a framework in which nature serves as backdrop to the analysis of social, economic, and political dynamics (in the case of human geography) or as a kind of triggering release that produces impacts on the dynamics of environmental systems (in the case of physical geography).

In a second predominant mode of disciplinary configuration the treatment of human–environment geography – which is used synonymously with “nature–society geography” (see Zimmerer 2010) – is situated as a principal and discrete core of the four-field or five-field framework of the discipline. The four-field framework, for example, recognizes human–environment geography (or nature–society geography as it is sometimes called) in conjunction with physical geography, human geography, and GIScience, with the last mentioned encompassing cartography and visualization. A five-field approach to the discipline also implemented, spreads human geography into multiple subcategories that include economic geography and regional development.

While the abovementioned modes of disciplinary configurations are distinct, each recognizes and highlights the role of human–environment geography as crucial to the potential of far-reaching *intradisciplinarity* within geography. Extended also to radical *intradisciplinarity*, this trend recognizes the major role of human–environment interactions and nature–society relations within diverse undertakings

in contemporary geography (Zimmerer 2007). Whether viewed as “borderlands” or “embeddedness” the intellectual space of human–environment studies enables synapses across many highly active areas of current geography (Table 1).

Overall, a trend toward intellectual diversification is characteristic of the current status of human–environment geography. This diversification is reflective of the general pattern of multi-strand branching and transformations in areas of thought in human–environment geography, albeit in the absence presently of a single or small number of dominant paradigms. By contrast, much of the history of human–environment geography was previously distinguished by the existence of preeminent paradigms. The delineations of cultural ecology and human ecology, which became popular in the 1960s and 1970s, have continued to evolve and diversify in the context of geography as well as other disciplines and interdisciplinary fields. “Cultural ecology” is now used to refer to human–environment studies with a significant component of cultural studies, as in the works of Doolittle, Head, Knapp, Mathewson, and others; human ecology is focused on a systems-based view of human–environment interactions. Works by Brush, Butzer, Moran, and others delineate the lineage and current usage of human ecology.

As noted below, the strengths of cultural ecology and human ecology subsequently fueled the rise of such major human–environment approaches as social-ecological, land, sustainability, and coupled natural-human system sciences as well as political ecology and environmental history. These approaches have expanded prodigiously since 1990. The approach of political ecology, also rooted in cultural ecology and human ecology, has particularly burgeoned. It includes a subgroup that is focused on

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Table 1 Topical and thematic areas in relation to intra-disciplinarity *within* geography.

Topical and thematic area of human–environment geography	Proximate intellectual relations within human–environment geography	Most important proximate intellectual relations within the discipline of geography (outside human–environment geography)	Generally important intellectual relations within the discipline of geography (outside human–environment geography)
Environmental hazards, risk, vulnerability, and resilience	Social-ecological and coupled human–environment systems	Climatology; hydrology; fluvial geo-systems	Physical geography
Land use, land systems, land change, and biodiversity	Social-ecological and coupled human–environment systems; political ecology; livelihoods and agricultural landscapes	GIScience; remote sensing	Physical geography
Social-ecological and coupled human–environment systems	Land use, land systems, land change, and biodiversity; livelihoods and agricultural landscapes; political ecology	Highly varied	Physical geography
Political ecology and environmental governance	Resource political economy, management, and politics	Political economy; economic geography; social geography; cultural geography	Human geography
Livelihoods and agricultural landscapes	Political ecology; land use, land systems, land change, and biodiversity; environmental landscape history; political ecology	Cultural geography; economic geography	Human geography; physical geography
Resource political economy, management, and politics	Political ecology; landscape environmental history	Economic geography; social geography	Human geography
Food, health, and bodies in relation to the environment	Political ecology; livelihoods and agricultural landscapes	Social geography; health geography; economic geography	Human geography
Environmental landscape history and ideas	Political ecology; knowledge concepts	Historical geography; social geography	Human geography
Knowledge concepts in environmental management and policy	Political ecology; environmental landscape history; resource management	Social geography; economic geography; historical geography	Human geography

Table 2 Topical and thematic areas in relation to interdisciplinarity (with fields outside geography).

Topical and thematic area of human–environment geography	Most important proximate intellectual relations to human–environment fields outside geography	Generally important intellectual relations to human–environment fields outside geography
Environmental hazards, risk, vulnerability, and resilience	Geosciences; meteorology; anthropology	Justice and legal issues
Land use, land systems, land change, and biodiversity	Forestry and remote sensing; conservation; resource management; anthropology	Global change modeling (e.g., climate change, biogeochemical cycles)
Social–ecological and coupled human–environment systems	Resource and development; economics; anthropology; political science	Environmental conservation; ecology; global change modeling
Political ecology and environmental governance	Environmental sociology; anthropology; political science; political economy; literary theory	Environmental conservation; resource management; politics; posthumanist theory
Livelihoods and agricultural landscapes	Rural sociology; agroecology; agrarian studies	Development studies; food studies
Resource political economy, management, and politics	Development studies; rural sociology; urban studies	Global studies; urban ecology; industrial ecology
Food, health, and bodies in relation to the environment	Sociology; nutrition; food studies; anthropology	Psychology; environmental studies
Environmental landscape history and ideas	History; archaeology; anthropology; urban studies	Environmental studies; ecology
Knowledge concepts in environmental management and policy	Environmental science; environmental history; ecology; anthropology	Social studies of science; environmental studies

human–environment interactions. This inclusion grew from the founding text of political ecology, *Land Degradation and Society*, that was authored in 1987 by Piers Blaikie and Harold Brookfield. Subsequently, political ecology was advanced in the series of texts that were launched in the late 1990s and early 2000s by authors such as Bryant and Bailey, Forsyth, Hecht, Martínez-Alier, McCarthy, Neumann, Robbins, Rocheleau and Thomas-Slayer, Schroeder, Sullivan and Stott, Wolford, and Zimmerer and Bassett among

others. Each of these works includes an emphasis on human–environment relations.

Subsequent developments of human–environment geography (2005–2015, detailed below) have taken hold as a result of the influences of both fields outside geography as well as disciplinary particulars. Consequently, human–environment studies in geography must be viewed as closely related to state-of-the-art developments in other disciplines and interdisciplinary fields. For example,

the extensive interdisciplinary dimension of human-environment geography is key to the suggested reinvention of US geography as an “interdisciplinary discipline.” This suggestion revolves around the idea of strengthening the discipline-based integrity of geography while emphasizing its interdisciplinary connectivity. Leaving aside the specific pros and cons, as well as the general feasibility, this suggestion is important with regard to underscoring the highly interdisciplinary nature of human-environment studies.

Important parallels to the high level of interdisciplinarity of human-environment geography are also found in the related fields of ecology, economics, sociology, anthropology, archaeology, history, political science, and landscape architecture. Active authors of major works based in these other human-environment fields include Belsky, Besky, Bieling, Blesch, Brondizio, Brosius, Carey, Clark, Collins, Craib, Cronon, Curran, Dove, Durham, Escobar, Fischer, Fischer-Kowalski, Foley, Friedmann, Goldman and Schurman, Grau, Hinrichs, Ingold, Irwin, Kirch, Kloppenburg, Langston, Loos, J. Liu, McMichael, Matson, Mittman, Moran, Morrison, Nadasdy, Nazarea, Nelson, Padoch, Peluso, Perz, Plieninger, Rhoades, T. Roberts, Rudel, A. Sachs, Saito, Scoones, Stedman, Tucker, and R. White. Some of the major interdisciplinary fields important to human-environment geography are those of ecology and society initiatives, environmental studies, environment science, development studies, food studies, global studies, urban studies and urbanization sciences, and programs focused on climate change, biodiversity conservation and conservation biology, human ecology, social ecology, political ecology, and environmental policy and management (Table 2).

Prominent instances of the successful interdisciplinarity of human-environment geography involve a number of the approaches mentioned above – such as the ones focusing

on sustainability, social-ecological systems, vulnerability and resilience, land systems, and coupled natural-human system sciences. Geographic authors active and influential in these interdisciplinary human-environment domains include Adger, Aspinall, Bassett, Bebbington, Brannstrom, D. Brown, K. Brown, Chowdhury, Coomes, Cutter, DeFries, Eakin, Evans, Haase, Hostert, Kasperson, Kates, Kreutzmann, Kümmerle, Liverman, Lambin, McSweeney, Mertz, Moseley, Munroe, Radel, Reenberg, Seto, Southworth, Tschakert, B.L. Turner II, M. Turner, Vad-junec, Walker, Walsh, Wilbanks, Young, and Zimmerer, among many others. In addition to journals in geography and other fields, these works appear in high-impact science journals such as *Nature*, *Science*, and the US *Proceedings of the National Academy of Sciences (PNAS)* as well as other interdisciplinary journals with central emphasis on human-environment interactions, such as *Global Environmental Change*, *Annual Review of Environment and Resources*, *Society and Natural Resources*, *Regional Environmental Change*, and *Ecological Applications*.

In conjunction with these previous developments new insights are now addressing the challenges and potential tradeoffs of pronounced interdisciplinarity as it relates to human-environment geography. One possible tradeoff is the attenuation of cohesiveness of human-environment geography as a center within the discipline. The discussion of such potential tradeoffs has become vital in geography as well as other disciplines, such as anthropology, where interdisciplinarity has become vital and integral to the discipline itself. Internationally the influence of interdisciplinarity on human-environment geography, along with the discipline of geography in general, can vary significantly in extent and degree. In the United

States, for example, where geography is a discipline of small to moderate size, interdisciplinary influences are prevalent in human–environment studies. The influences include the role of the National Research Council and its major reports on geography in 1997 and 2010. A lesser degree of interdisciplinarity tends to occur in Britain where the discipline of geography enjoys significantly greater size and strength, and can therefore draw to a greater degree on intradisciplinarity in human–environment studies. The relative extents of environmental interdisciplinarity and intradisciplinarity have also become varied in the diverse countries of Europe, Asia, Africa, and Latin America.

Continuities and abiding influences also remain important to the understanding of human–environment studies in the discipline of geography and other fields. This theme of continuities can be used as a guide to uncover influential legacies. Viewed historically, a pair of well-defined channels of human–environment endeavors had long shaped the characteristic landscape of geography, especially in the US context of the discipline (Zimmerer 2010). One brings together landscape approaches based upon a cultural–historical framework. The other consists of the studies of recent human and social interactions with environmental changes. It has tended to focus on floodplain and other forms of resource management along with other practical applications.

The former is often referred to as the Berkeley or Sauerian School while the latter is termed the Chicago School. The Sauerian School used ecological science in order to offer cultural and historical interpretations, and thus can be thought of as adopting a cultural–historical ecology. The Chicago School used ecology explicitly in models of human–ecological interaction. As a whole, ecology was both a cornerstone and a chimera in these human–environment approaches since

its usage could range from being central, mechanistic, metaphorical, or, at the other extreme, almost entirely implicit and unacknowledged. Nonetheless, this pair of parallel channels defined much of the landscape of human–environment studies in geography, especially between the early twentieth century and the 1960s. The depth and continuity of these approaches can be traced to current major nodes, such as environmental landscape history and ideas (Sauerian School influence) and the focus areas of environmental hazards, risks, vulnerability and resilience (Chicago School influence).

This pair of predominant traditions, the Sauerian and Chicago Schools, functioned for decades as a defining intellectual landscape seemingly comprised of twin gorges incised ever more deeply in geography’s intellectual landscape, each with ample depth and continuity, into the 1980s. Subsequent recontouring occurred in a transition to multiple, diverse approaches to human–environment studies in geography that continue today. This transition evokes the image of a braided stream with multiple channels. Braided-stream topography is an apt metaphor for the combined distinctness and interconnect-edness of multiple topical and thematic nodes within current human–environment geography. The braided-stream image also provides the connotations of directionality and crossing-over – anastomosing in stream geomorphology – that reflects the reality of several co-existing current trends, as well as the ample continuity that can be traced to the powerful precedence of earlier flows where upstream intellectual topography continues to exert major influences. The twin channels of the intellectual landscape serve as an important complement to another spatial metaphor of human–environment geography, namely the image of spirals, bridges, and tunnels put forth in the work of B.L. Turner II.

Topics and approaches in human-environment geography

Well-established topical and thematic nodes of research and understanding are characteristic of human-environment geography. These core areas tend to cluster around nine nodes: (i) human-environment interactions in hazards, risk, vulnerability, and resilience; (ii) land use, land systems, land change, and biodiversity; (iii) social-ecological and coupled human-environment systems; (iv) political ecology, environmental governance, and human-environment relations; (v) human-environment relations in livelihoods and agricultural landscapes; (vi) resource political economy, management, and politics; (vii) food, health, and bodies in relation to the environment; (viii) environmental landscape history and ideas; and (ix) knowledge concepts in environmental management and policy.

Each node is distinct yet related and often intersecting significantly, as described in the examples mentioned below and illustrated in Table 2. In addition, the core areas can be loosely grouped into a pair of general thematic areas *within* human-environment geography, namely “human-environment interactions” and “nature-society relations.” Each individual node of human-environment geography is differentially situated with respect to this pair of thematic areas, and tends to reflect distinct and differentiated intellectual locations with regard to methodological and conceptual domains in human geography, physical geography, and GIScience. As discussed below, for example, the general theme of human-environment interactions tends to ally most fully with environmental hazards, risk, vulnerability, and resilience and, also, to the area of land use, land systems, and land change. In general, it ties to physical and economic geography. On the other hand, the

general theme of nature-society relations is associated most closely with political ecology, with defining connections to human geography.

Human-environment relations in hazards, risks, vulnerability, and resilience

One prominent core of human-environment geography is comprised of the studies of environmental hazards, risks, vulnerability, and resilience. Environmental hazards and risks are significant themes that have continued to evolve in the context of accelerated global biogeophysical and socioeconomic changes and their human-environment interactions manifest in response to such disruptive environmental events as drought and floods as well as price shocks and the collapse of institutions. Vulnerability and resilience have become increasingly widespread concepts incorporating human-environment interactions. For example, combined social and environmental dynamics of vulnerability have become a cornerstone recognized within human-environment geography as well as geography in general (Cutter 2003). Such works tend to establish a view of vulnerability, hazards, and risks as processes involving the behaviors and multilayered networks of social actors and institutions.

At the same time, environmental shocks, such as climate-driven effects, can lead to the utilization of adaptive capacities whereby the institutional capabilities mobilized in human-environment interactions can result in significant socioeconomic benefit, such as was the case among certain forest-dwelling smallholder land users in Central America in the wake of Hurricane Mitch in 1998 (McSweeney and Coomes 2011). Equally important, the social conditions and power dynamics underlying vulnerability lead to a prevalent use of political ecology (see critique in Mustafa 2005), with attention to

such issues as social “winners and losers” in these processes and spatial patterns. Additional prominent authors in this topical and thematic area of human–environment geography include Adger, Barnes, Birkenholtz, Cutter, Downing, Eakin, Krueger, Leichenko, Liverman, Montz and Tobin, Mertz, Mortimore, O’Brien, Polsky, Ribot, Smit, Tschakert, and B.L. Turner II. This area shows close connections to various interdisciplinary fields (Table 2).

Land use, land systems, land change, and biodiversity

This topical and thematic area is focused to date on human–environment dynamics involving the spatial and temporal properties of vegetative cover, principally forests and urban spaces. It is closely associated with land change science, which has been subject to influential definitions and conceptual framework-building in the interdisciplinary scientific literature by human–environment authors such as Aspinall, D. Brown, Chowdhury, Crews-Meyer, DeFries, Evans, Hostert, Kümmerle, Lambin, Manson, Moran, Munroe, Parker, Reenberg, Rindfuss, Rudel, Seto, B.L. Turner II, Verberg, and Walsh. Methodologically this focus area tends to make extensive use of the combination of remotely sensed imagery, surveys of land users, and census data. The observation of major shifts of vegetative cover is considered in the context of spatial land-use systems (sometimes referred to as “land systems”) and land-cover change. Significant attention and insight thus far has focused on the entwined spatial and socioeconomic processes of deforestation involving conversions to pastureland and agriculture, as well as the regrowth of forest through so-called secondary forest transitions. Linkages to biodiversity are sometimes inferred in these studies, while they hold considerable future promise

with increased use of methods incorporating the human–environment, ecological, and taxonomic assessments of biodiversity.

The changes of vegetative cover areas are linked to models of micro- and macrolevel economic and political factors ranging from household labor availability to national and international economic policies (Coomes, Barham, and Takasaki 2004). Several important studies have been located in regions of the world’s major tropical forests (especially the tropical humid forests or “tropical rain forests”), such as the Amazon Basin of Brazil and neighboring countries (e.g., Bolivia, Peru, Ecuador, Colombia) and Mexico and Central America. Forest areas of other tropical regions in Africa and Asia as well as temperate-zone forests (e.g., Europe and the United States), have also been the subject of these studies. Global market integration and postsocialist transitions, to name only a couple, are commonly incorporated as factors on the human–social side. Influential authors that have offered significant advances to this topical and thematic area, in addition to those persons mentioned above, include Aide, Arrima, Caldas, Chowdhury, Evans, Hostert, Klepeis, Kümmerle, Kreutzmann, Millington, Müller, Munroe, Ramankutty, Redo, Southworth and R. Walker. Human decision-making, social movements, governance preferences and disputes, and the active alteration of land use (“agency”) exert feedbacks whereby these modifications and activities contribute to the subsequent reworking of human–social conditions (“structure”). Human–environment interactions are understood explicitly as bidirectional and central to this framing. Here the concept of so-called structuration is being used to understand the bidirectional linkages of land use. Authors of major works on this use of the structuration theme in human–environment

geography include Chowdhury and B.L. Turner II as well as Neumann and Zimmerer.

Social-ecological and coupled human–environment systems

The frameworks of social-ecological systems (SES) and coupled human–environment systems are conceptual cornerstones in interdisciplinary human–environment studies that connect a thriving interdisciplinary domain to a focus within geography. SES is focused on human–social systems and the management and governance of resources. It owes much to the contributions of Nobel Prize winner Elinor Ostrom and to the legacy of earlier works examining the “tragedy of the commons” not as a demographically and culturally driven *fait accompli* but rather through social institutional processes. The SES framework often focuses also on interactions across the realms of humans and nonhumans. One chief SES contribution in human–environment geography is the development of ideas and examples of resilience, vulnerability, and adaptive capacity. These are being applied, for example, to the analysis of biodiversity in agroecosystems undergoing intensification and livelihood diversification (Zimmerer 2013; see also Beymer-Farris, Bassett, and Bryceson 2012).

The framework of coupled human–environment systems, also termed coupled natural–human systems (CNHS), is built upon the defining idea of coupled drivers emanating from human–social factors and feedbacks from natural systems. The coupled system CNHS perspective was initially proposed by Liu and others in the early 2000s. In human–environment geography the CNHS framework has been applied principally to the use and management of water resources and forests. Major authors in the topical and thematic areas of SES and

CNHS, who come to these frameworks from the perspective of human–environment geography, include Bury, Eakin, Evans, French, Leichenko, López-Carr, and O’Brien, B.L. Turner II, and Wrathall.

Political ecology and human–environment relations

Political ecology is a burgeoning field covering many areas that include human–environment relations and interactions. It is a significant albeit minor portion of political ecology that undertakes the integration of environmental and ecological analysis (Zimmerer 2015). At the same time, the major share of political ecology is focused on nature–society relations, especially social power relations in resource conflict and coordination, environmental representations, and the roles of multiple environmental knowledge systems.

One productive subset of political ecology centered on human–environment interactions is the analysis of global climate change in relation to policy initiatives and political issues associated with sustainability, globalization, and neoliberal management (Liverman 2004). This work combines a perspective on human–environment interactions and the biogeophysical dynamics of climate change in order to better understand multiscale governance amid dominant political economic regimes, in particular neoliberal globalization. Another noteworthy subset is concerned with the multiscale political and environmental dynamics of national and international governance along with the community- and user-based management of fisheries, marine organisms, and forest and range resources. Technological change in these resource systems is often fundamental to the issues of environmental governance and to the forms of social and political coordination and contestation that arise.

Human–environment interactions involving fisheries, grazing, and forest resources are often explicitly territorial and thus well-suited to studies that incorporate the geographic themes of territory-making and territoriality.

Still another subset of political ecology studies is concerned with the governance of water resources though social power dynamics involving planning, climate change, agriculture and land use, and international relations. Here too spatial and territorial designs are often explicit in such initiatives as the increased privatization of water supplies occurring in neoliberal globalization. Urban political ecology is notable for its examination of the roles of social and political power of the human–environment interactions involving water resources. Gendered dimensions of social power are often influential in determining control and access to water resources. Not coincidentally, the approach of feminist political ecology (FPE) has been productive and influential in understanding the human–environment geography of water resources. It is also opening new vistas that include major connections to such resource systems as biodiversity management, forest resources, and energy systems. Major geographic authors in the topical and thematic area described thus far in this subsection – in addition to those mentioned in the general introduction – include Baka, Bakker, Bassett, Bell, Birkenholtz, C. Brown, Bridge, Campbell, Carr, Emel, L. Harris, Hecht, Heynen, Huber, Kaika, Mutersbaugh, Mansfield, McCarthy, Neumann, Nightingale, O'Reilly, Perreault, Rocheleau, St Martin, Shapiro, Sneddon, Sultana, Swyngedouw, M.D. Turner, Wolford, and others.

Biodiversity management and environmental conservation are also a focus of human–environment analysis in political ecology. This focus is often centered on environmental management in the design of protected areas (PAs) (see Environmental management). The spatial

extent and number of protected areas have increased worldwide in significant ways since the widespread accounting and monitoring of these units began a few decades ago. Diversity of environmental management schemes is also much increased within protected areas. One reason for this additional complexity is that protected areas have become more commonly designated in categories associated with human use and activities (e.g., “buffer zones”), rather than being strict set-asides intended to eliminate or prevent the presence of humans. As a result of these trends, human–environment geography and the recognized role of these interactions are now increasingly important to the environmental management of protected areas globally.

Still another topical and thematic area is concerned with the mix of issues related to agriculture, food security, land tenure, policy-related land change, pesticide use and transgenics, and agrarian reform and policy institutions, including urban and peri-urban food systems and land use. This mix has become part of a significant emphasis on agri-food systems, both expanding global industrial agriculture that is based on biotechnology and that incorporates a growing corporate organic sector, as well as alternative and local systems that include efforts to conserve agricultural landscapes and biota. The topics and themes mentioned in this paragraph and that preceding are being productively investigated through the perspective of human–environment geography by such authors as W. Adams, Bassett, Braun, Bezner-Kerr, Brannstrom, Buck, Campbell, Carney, Freidberg, Galt, Guthman, Graddy, Jarosz, Jepson, B. King, Kosek, McAfee, Medley, Mosely, Naughton, Neumann, Roth, Sayre, Schroeder, Wainwright, Wolford, Young, and Zimmerer.

The topical and thematic area of political ecology, as synopsized here, is illustrative of

the cross-cutting among the nine nodes identified in this section. This particular subsection contains a major emphasis on environmental governance and its influence through the forces and dynamics of political economy. Environmental governance, as it is broadly defined by Agrawal, Bulkeley, Heynen, Lemos, Liverman, McCarthy, Perreault, Prudham, Timmons, O. Young, and others, refers to environment-related institutions, plans, knowledge, management, decision-making, and practices. Yet the focus of political ecology on environmental governance is widely shared and must be appreciated as an example of cross-cutting topical and thematic influences. This theme is addressed as a major focus in several of the other principal topical and thematic areas currently active within human-environment geography. For instance, social-ecological systems (SES), mentioned above, are also focused extensively on environmental governance.

Other topical and thematic nodes identified here also evidence the significant focus on environmental governance. These include environmental hazards, risks, vulnerability, and resilience; land-use systems, land change, and biodiversity; environmental landscape history and ideas; and scientific concepts in environmental management and policy. In sum, each of these areas addresses environmental governance in a distinct and important way that needs to be distinguished in current human-environment studies. Another cross-cutting focus is concerned with the human-environment concepts of adaptation, resilience, and vulnerability. While adopted most extensively within the area of social-ecological and coupled systems, the concepts of adaptation, resilience, and vulnerability are also part of an expanding focus in political ecology by such authors as Bassett and Fogelman (2013), Beymer-Farris, Bassett, and Bryceson (2012), Ribot (2011), M.D. Turner (2014),

and Zimmerer (2013). Butzer, Cote, Eakin, Nightingale, M. Taylor, Tschakert, and Watts, among others, have also authored important contributions in this area.

Livelihoods and agricultural landscapes

This topical and thematic area has arisen partly as a result of global-scale shifts to part-time land use and the importance of diversified livelihoods among the 2.0–2.5 billion smallholders who continue to engage in food production amid major multiscale changes in socioeconomic and environmental conditions. Emphasis on agri-food landscapes and agri-food systems owes in part to the fact that these smallholders include many of the world's most food-insecure populations. Another important focus involves the extensive empirical analysis and understanding of the increasing roles of urbanization, livelihood diversification, and development on land use. These drivers incur complex human-environment relations involving agriculture, food, and the cover of anthropogenic forests. Diversified livelihoods, including the phenomenon of vast peri-urban peripheries and the “new rurality” (defined as the predominance of livelihood diversification, urban connections, and consumptive economic values in the countryside) now impinge directly on large swaths of landscapes and involve the livelihoods of much of the world's population.

Integration with product and labor markets under neoliberal globalization, including the formation of extensive informal sectors and urban/peri-urban areas, drives many of the human-environment dynamics of development, peri-urban places, and the impacts of the new rurality (Carney 2008; Zimmerer, Carney, and Vanek 2015). The world's 2.0–2.5 billion smallholder land users are as equally an emphasis as large corporate industrial agriculture. At

the same time, the rise of alternative and local food networks is leading to potentially novel agri-food systems and landscapes in various kinds of places. These networks may exert a sustainability enhancing influence on agriculture and food landscapes in the management of such environmental factors as soil nutrients, food and woodland biodiversity, and farm woodlands. Such human–environment interactions are presently a major priority of new research and understandings being developed and debated in human–environment geography. Authors of major human–environment works on topics and themes covered thus far in this subsection include Baker, Bassett, Bebbington, Carney, Denevan, Doolittle, Galt, L. Gray, Hecht, Hedberg, Lerner, McMichael, Moseley, Price, Radel, Rangan, Rocheleau, Shillington, WinklerPrins, and Zimmerer.

Current human–environment research suggests that the widespread and growing use of migration remittances and other factors linked to part-time land use can exert complex and sometimes favorable influences on environments, forests, and food-growing landscapes. The complex pathways of migration can lead to either the disintensification or intensification of food-producing landscapes, along with either increase or decrease in measures of social equity and environmental quality. In other words, a priori assumptions of determinacy no longer govern the investigation and interpretation of these human–environment dynamics. Instead, research scholars, policymakers, and planners are seeking to understand the conditions under which certain relatively favorable outcomes occur with regard to both migration and the environment.

The array of diverse mechanisms producing these varied human–environment interactions, ranging from labor withdrawal to the intensification of food-producing landscapes, are found to depend on the migration-related

factors of remittance and the gendering of decision-making that can impact the specific properties of forest cover and biodiversity. The biodiversity in these food-producing landscapes often incorporates the variation of the biota of food assemblages (“managed agrobiodiversity”) and agroecosystems encompassing below-ground and uncultivated elements (“associated agrobiodiversity”). The geographic range of these food-producing and consuming landscapes, which include gardens, interstitial spaces, and connections among rural, peri-urban, and urban locales, adds further to their complexity (Zimmerer, Carney, and Vanek 2015). Major geographic authors in this area – in addition to those mentioned above – include Coomes, Doolittle, Eakin, Graddy-Lovelace, C. Gray, L. Gray, Hecht, Knapp, Lerner, Momsen, Radel, Schmook, Torres, Vanek, and WinklerPrins.

Human–environment relations in resource political economies, management, and politics

The political economies and politics of many issues of resource governance and politics extend across national and global scales and frequently entail the role of combined urban–rural spaces. The resource systems and the institutions range from minerals and hydrocarbons involving major multinational corporations to urban, village-based, social justice, and industrial issues that are related to water, environmental quality, and waste. Areas of emphasis in human–environment geography include the social dynamics of resource extraction, land and resource grabs, and management as well as related resource and agrarian issues. These social dynamics often entail the role of active social movements with alternative visions of development and social justice. Studies have revealed the complex dynamics and often unanticipated outcomes

of certification programs that appear to foster environmental sustainability outcomes using such resource management as sustainable forestry certification and fair-trade coffee.

Social justice aims may sometimes be incorporated in these programs with such goals as supporting poorer neighborhoods or small-holder farmers. While in certain cases they are well-intentioned, such initiatives may, in fact, not function as hoped, for their desired environmental and social benefits may be either undermined or suffer unintended negative consequences. Contributors of major human-environment research and publications on the range of issues mentioned thus far in this section include Bebbington, Bridge, Bury, Bryant, Calvert, Castree, Emel, Hindery, Huber, Humphreys, Klooster, Labban, Le Billon, Liu, S. Moore, Mutersbaugh, Perreault, Pulido, Silva, Valdivia, Watts, and Wolford.

Trenchant critiques in this area have highlighted the powerful influence of innovative neoliberal policies in prevalent environmental management policies and approaches. Examples include the ecosystem service frameworks that are being applied to reduce deforestation and hopefully invigorate sustainable forest management, to mitigate and manage wetlands while compensating for loss resulting from real estate development, and to restore freshwater stream morphologies and ecological habitats. Market-based environmentalism has become a particularly powerful form of environmental governance under the dominance of neoliberal policies. The spatial design of this governance is one reason among several for the significant increase of human-environment study on urban locales and multiple research sites spanning the Global North and the Global South (Schroeder, St Martin, and Albert 2006). Still other findings are focused on the functioning and environmental impacts of markets as sites of complex activities

that may not be distilled entirely into neoliberal logics but rather may be distinguished by embedded relations of trust and knowledge that can support environmentally friendly outcomes. Leading authors in this topical and thematic area include Bakker, Klooster, Keleman and Hellin, Hinrichs, Lave, McAfee, Robertson, and Shapiro.

Human-environment relations: food, health, and bodies

The bodies, health, and nourishment of humans and nonhuman organisms are seen increasingly as being embedded in the matrix of resources and the environment created through human societies. It is an important new topical and thematic area in human-environment geography. Much of the expanding interest in this area is designed to treat issues of health, disease, and the body related to environmental interactions. It is frequently centered on the role of agri-food and fisheries systems that integrate the consumption choices of individuals, communities, and societies together with the transportation networks and agro-ecologies of production systems. The vast majority of consumption, transformation, and production occur through the global corporate, industrial food system. At the same time, growing interest surrounds whether and how the dominant food system is contested and challenged through alternative and local food networks. For example, alternative and local food networks may demonstrate “embeddedness” in which cultural practices and links to ecological landscapes (e.g., conservation agriculture) are considered as simultaneously market-based and potentially involving dimensions that extend beyond economic transactions per se, such as social trust and ethics of care and responsibility.

Hybrid food systems, such as those of peri-urban and urban areas, are also central

to this area of human–environment study. The new direction in human–environment geography described here is also being amplified through new works on the political ecology of health and wellbeing. It includes potential new human–environment insights on bodies in health and disease dynamics linked to the multifaceted role of genetics that is subject to major increases of information and scrutiny. Technological as well as theoretical advances in genetics now highlight the powerful influence of so-called epigenetic effects that result in humans and other organisms being thoroughly embedded in environments in far more extensive and previously unanticipated ways (Guthman and Mansfield 2013). Major geographic authors active in the area covered in this subsection include Bryant, Carter, Durham, Freidberg, Galt, Guthman, Hayes-Conroy, King, Lerner, Mansfield, Morris and Kirwin, Mutersbaugh, Sage, and St Martin.

Environmental landscape history and ideas

The history of environmental landscapes is a major core of human–environment geography that is rooted in a productive past and rapidly evolving productive present state. This topical and thematic area has become transformed in recent years as the result of widespread scientific findings and interpretive shifts, such as postcolonialism. It is being re-invigorated in the light of today's recognition of global environmental change. This recognition tends to intersect in illuminating ways with influential re-framings of the so-called end of nature and the treatment of the current geologic epoch as the Anthropocene. The history of human–environment interactions in particular landscapes is providing important new insights on the nature of these changes as combined resilience, change, transformation, and, in some cases, the collapse of human societies owing to combined human–environment

factors (Butzer and Endfield 2012). The insights extend to a cascade of human–environment works in geography using historical frameworks to demonstrate and detail both the transformation and the resilience of environmental landscapes under anthropogenic change across the time spans of multiple centuries and millennia. They tend to detail chronologies that combine episodes of catastrophic change typically driven through powerful drivers on both sides of human–environment interactions.

The abovementioned findings are often presented as a contrasting and compelling counter-interpretation to purportedly cataclysmic environmental events and narratives of intrinsic marginality that accompanied the earlier interpretations of European colonialism and Euro-American domination of many of the world's landscapes. Historical resilience of traditional-appearing land use, for example, is shown to also offer potentially innovative contributions to the design of human–environmental sustainability. Leading current authors and established leaders in this topical and thematic area include Beach, Bell, Biehler, Brannstrom, Butzer, Carney, Carter, Colten, D. Davis, Doolittle, Denevan, Dunning, Endfield, Gade, Lightfoot, Lowenthal, Luzzadder-Beach, Myers, Offen, Rangan, Sluyter, B.L. Turner II, Vale, M. Williams, Wilson, and Zimmerer.

Concepts of landscape, including those created through ideas and institutions of environmental governance, are as important as the force of biogeophysical processes on the understandings of this topic. For example, the idea of a “pristine myth,” of nature created in the arts and literature of the Romantic movement in Europe and North America during the nineteenth century, has exerted tremendous albeit misleading influence on environmental understanding. Environmental interpretations steeped in the pristine myth tended to assume the

absence of significant pre-European impacts on the biogeophysical nature of landscapes. While ironically a complete opposite-tending political message, the “empty land” interpretation, an early colonial precursor to the pristine myth (the latter become predominate in the nineteenth century) tended likewise to assume certain ideas about the absence of indigenous presence on the landscape. The legacies of the pristine myth and empty land notions persist to the present, though they are now seen as both more complex and more influential in their spatial and environmental dimensions. For example, they often imply not only the treacherous entwining of the enclosing and erasures of non-Western peoples and their presence but also the creation of relational landscapes comprised of the geographic pairing of unsettled and settled areal expanses suited to European expansions in conjunction with the subjugation of indigenous peoples.

Urban spaces are increasingly understood as having highly dynamic human-environment histories whereby changes, functioning, and morphology of built environments are forged through institutional ideas of resources and landscape. The case of colonial water management in the 1500s in the urban center of Lima, Peru, for example, depended on extensive environmental governance and institutional ideas of resource dynamics and access (Bell 2015). This topical and thematic area can overlap significantly with the approach termed historical political ecology.

Human-environment knowledge concepts in environmental management and policy

Knowledge concepts in environmental management and policy comprise an important topic of human-environment geography that spans the diverse domains of advanced science and technology and those of citizen science and local knowledge systems. The history of scientific

concepts and ideas has gained new salience amid a broad spectrum of applications in these studies. They have probed and offered insights on such topics as ecological science and concepts related to human-environment dynamics and livelihoods (e.g., the nonequilibrium models of the “new ecology”), the hydrologic cycle, biological conservation corridors, carrying capacity, the science of back-to-nature farming, and scientific forestry management and politics. Technology has also become an area of increased focus in the human-environment analysis of such topics as hydrologic dams and irrigation tube wells that have been spread across large landscape areas (Swyngedouw 1999). These works illustrate the power of scientific ideas and technological tools as deriving from both their geographic dimensions and their usefulness to environmental management as so-called boundary concepts and place-based sites of interaction, negotiation, and dispute.

The concept of hybrid knowledge systems and spaces has become particularly important to human-environment studies. It is advanced in understandings of such issues as the political ecology of water resources, the production and perception of “invasive” trees in modern forest management, and the territorial designs of networks of protected areas intended for environmental management and conservation use (Zimmerer 2000). Citizen science, based on local knowledge systems, is increasingly promoted in understanding human-environment interactions and the evolving role of the environmental and ecological sciences. Indeed, it appears that citizen science may become a characteristic approach of the Anthropocene as it becomes more widely deployed in myriad projects devoted to understanding present-day environments and human-environment interactions. Important leading authors in the aforementioned topical

and thematic area of human–environment geography include Baird, Bassett, Birkenholtz, Braun, Carney, Forsyth, Goldman, Ingram, Kaika, Linton, Mehta, O’Riordan, Prudham, Raymond, J. Rice, Robbins, Rocheleau, Sayre, Swyngedouw, M. Turner, Whatmore, and Zimmerer.

New trends in human–environment geography

The accelerating influx of new scientific findings, ideas, and conceptual and theoretical orientations has become a defining characteristic of human–environment geography. Most notable is the increasing rate and scope of anthropogenic environmental change and transformation that now lead human–environment geography, together with other fields, to focus at the intersections of socially vital issues. These topics include the influence and impacts of global climate change on such human–environment systems as water resources, energy, food, health, biodiversity, land systems, and the roles of neoliberal globalization, urbanization, and migration. Framing issues at scales that encompass the global level has become *de rigueur* in the research design and analysis of human–environment interactions.

Urbanization is also an increasingly predominant theme. For example, new human–environment geography is now focused more extensively on urbanization related to climate change (Leichenko 2011) and also global changes of land systems in a rapidly urbanizing world. Long-distance interactions, referred to as telecoupling, are increasingly found to link global land and resource use to urbanization impacts and transformations. The powerful influence of these forces of urbanization and industrial expansion has contributed to the important role of cities

as sites of much human–environment geography. Leading geographic authors on the kinds of issues mentioned in this paragraph include Braun, Chen, Chowdhury, DeFries, Heynen, Holyfield, Keil, Livermore, Meyers, Munroe, Pelling, Reenberg, Seto, and Swyngedouw.

A second nexus of new intersecting issues is concerned with agri-food systems. This expanded direction in human–environment geography stems in large part from the growing recognition and policy prioritization of the importance of food quality and ecologically sustainable intensification. Major global fora and policy initiatives are being focused on agri-food systems through such high-profile human–environment formulations as sustainable intensification (SI) and ecological intensification (EI) that seek to increase food security while not incurring damage to the environment. Human–environment geography is taking a significant role in addressing these issues through the analysis of converging concerns (Sage 2011; Zimmerer, Carney, and Vanek 2015). One example is the intersecting focus on land systems that, as described above, uses existing methodological designs, tools, and conceptual frameworks to examine land use, its spatial and social organization, and the analysis of land cover and change. Until recently much of the work on land systems dealt principally with deforestation in tropical lowland and temperature areas of tree cover with insights linked to potential biodiversity impacts and climate impacts through influences on carbon stocks and sequestration. Major geographic works addressing these kinds of human–environment issues are authored by Carney, Galt, Moseley, Radel, Sage, Schmook, B.L. Turner II, and Zimmerer, among others.

Agri-food and environmental transformations are also increasingly recognized as integral, often in complex ways, to the human–environment geographies of health and disease (Carter 2014).

Here food and environment mix with political economies and social power dynamics to provide new insights into wellbeing or the lack thereof, since disease dynamics are often wrought through a constellation of similar factors. Agri-food issues are also being expanded in human-environment studies related to the social, spatial, and biogeophysical footprints of energy development, with the emergence of multiple new “energy geographies” highlighting connections to water resources and climate change as some of the latter’s most powerful cause-effect anthropogenic pathways.

Intersections with climate change lead to the most prevalent overarching concern invoked in the current framing of human-environment geography around intersectional issues. Climate change is unleashing growing impacts on such issues as agri-food, health and disease, and energy. These connections are redefining human-environment studies in the discipline of geography as well as more broadly across interdisciplinary endeavors. Impacts of the issue of climate change are also deeply impacting other human-environment disciplines such as anthropology. Major current contributions to the kinds of issues addressed here are authored by Agrawal, Barnes, Brondizio, Calvert, Crate, Dove, Liverman, Moran, Nelson, Orlove, Redman, and Ribot.

The combination of reflexive and instrumental elements is a trend characteristic of works in human-environment geography. Reflexive here refers to the element of critique and broadly defined social analysis that draws on growing social studies of the science, with the latter broadly defined to range from ecology and toxicology to genetics and human biology (Zimmerer 2015). The meaning of instrumental in these examples refers to the practice and application of science and scholarship in human-environment analysis (e.g.,

identifying the causes and consequences of anthropogenic climate change). Consideration of the reflexive-instrumental integration is a topic of works authored by Forsyth, Goldman, and Turner, among others, that have helped understand and advance this important new trend. Additional significance of this trend stems from the writings of major current social analysts – such as Bruno Latour and Michael Burawoy – who have recently advocated for combined reflexive-instrumental forms of environmental and social knowledge systems.

Examples of the integrated reflexive-instrumental perspective include the studies within human-environment geography that are engaged with the rapidly evolving role and use of ecological and environmental science in political ecology. In addition, the reflexive-instrumental perspective is proving fruitful in developing, using, and critically reflecting on several of the leading current theories and concepts within human-environment geography, especially those of resilience, adaptation, and vulnerability (Bassett and Fogelman 2013; Beymer-Farris, Bassett, and Bryceson 2012; Ribot 2011; Turner 2014). Such studies are able to respond to the increasing social content of scientific concepts amid the accelerating and widening influence of global socioeconomic and environmental changes in such issues as climate change and water resources. Additional leading researchers and authors currently active in this field are Birkenholtz, Lave, McCarthy, Nightingale, Sayre, and Sultana.

Understanding the human-environment impacts and social dynamics of neoliberalism operating across multiple spatial and temporal scales is another trend that defines current human-environment geography. New studies and understandings emphasize the powerful influence on human-environment systems of the political economy, politics, and subjectivities

of constantly evolving neoliberal configurations. The human–environment implications of neoliberalism incorporate factors that range from major global commodity booms (minerals and hydrocarbon-based energy, as well as soy and oil palm) to neoliberal-inflected environmental management and science. The influence of neoliberalism extends also to the protest and social movements among worker, citizen, and peasant groups arising in response to these developments.

Even such alternative movements as those associated with Living Well, which is cast as an alternative to neoliberal development, are unfolding amid the latter’s influences. Neoliberalism’s vast reach in the realm of resources and the environment thus extends from explicit “market environmentalism” and sustainability payment schemes to extractive industries and far-reaching subjectivities contained in prevailing ideas of citizenship and, more generally, one’s sense of community belonging and modernization. Major current contributions to the kinds of issues addressed here are authored by Bakker, Lave, McAfee, McCarthy, Prudham, and Wolford, among others.

Important insights are being revealed in the pronounced influence of neoliberalism – often evidenced through its logics of accounting, metrics, and fungibility – pronounced in such mainstream approaches to environmental management as ecosystem services and territorial designs for nature protection (such as protected areas). Agri-food systems also show the powerful effects of neoliberalism in the dynamic evolution of corporate, industrial systems that effectively utilize global supply chains and consumers’ choices on a daily basis. Similar to the examples mentioned in the previous paragraph the neoliberal development of agri-food systems is also unleashing potential alternatives. The

human–environment dimension of the international trade in illicit drugs can also be seen as symptomatic of the far-reaching scope of neoliberal market influences. It exerts significant influence on land systems and biodiversity impacts in extensive areas. Major current contributions to the kinds of issues addressed in this pair of paragraphs are authored by Galt, Guthman, McSweeney, and Steinberg.

An additional trend is the productive unfolding of the engagement with concepts of embodiment and perspectival frames. It stems from such diverse influences as technological transformations (e.g., cyborgs) and feminist critiques of science and human–environment studies (e.g., feminist political ecology). These insights are reshaping such foundational concepts as the dualistic assumption underlying human–environment interaction and the “chain of explanation” of interlinked scales of influence in human–environment interactions (Rocheleau and Roth 2007). The existing precepts hinge, respectively, on assumptions of the categorical distinction of humans and the environments as well as non-overlapping scalar processes. Rather than binary-based interactions and neatly nested scales, the new works build on insights resembling human–environment geography’s early clarion call to examine the “inner-actions.” Rocheleau and her colleagues have written leading publications in this area, which builds on important prior insights by researchers and writers such as Michael Watts.

Theories and concepts of hybridization, socionatural entanglement, and epigenetics have also become central to understanding the multifaceted, reciprocal, and relational intermingling of the natural and social (Guthman and Mansfield 2013; Zimmerer 2000). The process of intermingling among human and nonhuman elements, which is less structured than the earlier image of co-production, bears

broad-brush similarities to the interests and influence of assemblage theory, which likewise strives to incorporate human and nonhuman actors and elements. The new direction in human-environment geography described here is contributing also to rethinking issues of scale and the patterns and processes of scaling that are central to human-environment studies. Important active writers across the areas mentioned in this paragraph include Anderson and McFarlane, Braun, Heynen, McCarthy, Neumann, Rice, Sayre, Shillington, Swyngedouw, Whatmore, and Yeh, among others.

Promise and peril: beyond binaries in human-environment geography

Human-environment geography is currently being defined through a multiplicity of topics and trends. These developments hold both promise and peril for its future. They have been spurred through a remarkable growth of the productivity of research scholarship. While numerical estimates are difficult, one coarse approximation demonstrates a roughly four-fold increase in the 1990s alone with the impression of a similar rate of continued growth in these studies to the present (Zimmerer 2010). To be sure, the arena of human-environment studies was already active in much of the mid-twentieth century. Still it was decidedly thinner and less diverse, being dominated by the two-channel intellectual landscape described above. By the 1970s and 1980s the accelerating developments within human-environment geography foreshadowed a diversification of topics that nowadays ranges widely across global, national, and local levels, urban, peri-urban, and rural spaces, formally regulated and highly informal sectors, from the intensely domesticated to the mostly wild, and multiscale areas of focus from

microscale effects at the genome level to the scale of planetary systems.

Mixed methods and matching designs of research methodology have become integral to human-environment geography. Corresponding to its topical and thematic diversification, a swell of research has flooded human-environment geography with an exceptionally broad suite of choices of methods. Both quantitative and qualitative techniques are widely used. Similarly a mix of positivist and varied nonpositivist theoretical orientations has become common, with this critical pluralism emerging through the rapid growth and diversification of human-environment geography. The utility of this “critical pluralism” resonates with the abiding pragmatism of human-environment geography addressed by Wescoat and others. Yet such mixing of methods and concepts does not detract from the importance of generalized distinctions and differentiating theoretical commitments. For example, the large-scale, remote sensing-based human-environment modeling of land use and vegetative cover is often undertaken through the use of knowledge systems quite distinct from that of discourse, whether the latter is global or local in scope (Turner and Robbins 2008). At the same time, there are human-environment works that can and do seek to bridge these gaps, both methodologically and conceptually (Castree, Demeritt, and Liverman 2009; Zimmerer 2015).

In sum, this study’s design has highlighted the intellectual landscape of human-environment geography. A conspicuous feature is the noticeable shift away from the earlier intellectual landscape of binary intellectual spaces. It traces the emergence of the distinctly multistrand configuration of human-environment geography that began in earnest in the 1970s and 1980s and that has flourished since the 1990s. This shift to the post-binary intellectual spaces of human-environment geography has been

entwined with the growth of this area and new efforts to locate its intellectual endeavors within the discipline. This expansion of human–environment geography (or its broad designation as nature–society geography) has helped create the growth of a distinct subfield and intellectual space in the design of so-called four-field or five-field geography. Recent debate and contestation over this distinctness reflects a continued healthy level of intellectual activity in this area of study.

One such central and vigorous debate concerns the degree of distinctness among human–environment and nature–society epistemic centers, and whether and how these knowledge domains may be overlapping in a sense that enables mutual use and possible synergism. For example, a moderate or high level distinctness is illustrated in the depiction of human–environment studies as holding the key to the larger scale of analysis (e.g., global-scale studies) while nature–society is local and based on place-specific case studies (Turner and Robbins 2008). In that research, human–environment studies are represented by sustainability science while the approach of political ecology is used to illustrate a nature–society framework.

It may also be suggested the distinction of these epistemic centers is likely to reside principally in the extensive social and discursive analysis characteristic of nature–society geography. More to the point is the potential value to works that seek to integrate elements of the human–environment epistemic center (e.g., ecological systems, land use, land systems, and remote sensing) and that of nature–society relations (e.g., political ecology). Such integration has been a central, recurring emphasis of various works (e.g., Zimmerer and Bassett 2003). Additional authors of major works that focus on this interface are Bassett, Brannstrom, Beymer-Farris, Chowdhury, B.L. Turner II, M. Turner, and Vadjunec.

Similar ongoing debate concerns the disciplinary niche and openness of human–environment studies. On one hand, this area benefits from active exchanges with interdisciplinary realms as diverse as ecological sciences, urban studies, and environmental studies and philosophy, in addition to development studies, world systems, and political economy. Intellectual borderlands are also vibrant with regard to the other geographic subfields. Related physical geography, for example, incorporates human activities as triggers of disturbance events and management activities that induce the biogeophysical processes and pathways of vegetative, geomorphic, and climate-driven conditions and changes. Many productive interactions are similarly promised in the interconnections of human–environment studies of land and climate change to human geography in general and economic geography in particular.

A signal of concern does attach to the otherwise positive prospect of future human–environment studies in geography. It suggests the ongoing success, demonstrated through its diversification and expansion amid the recognition of the Anthropocene, may potentially entail tradeoffs. Such developments could lead to a scenario of human–environment issues becoming more widespread as topics of interest while potentially diluting points of specific, concentrated research and understanding. Strengthening coherence and intellectual rigor, while continuing to embrace a characteristic openness and critical pluralism, is both a challenge and opportunity that must be engaged. Doing so is necessary to address the rapidly evolving roles of human–environment geography. Actively engaging such challenges and opportunities must become a priority, both in the discipline of geography and in the broader realms of interdisciplinary environmental studies and sciences.

SEE ALSO: Agricultural environments; Berkeley School; Biodiversity; Chicago School; Climate change adaptation and social transformation; Conservation and capitalism; Development; Energy resources and use; Environment and development; Environment and migration; Environment and urbanization; Environmental degradation; Environmental discourse; Environmental education; Environmental governance; Environmental hazards; Environmental health; Environmental history; Environmental (in)justice; Environmental knowledges and expertise; Environmental management; Environmental policy; Environmental science; Food security; Health and wellbeing; Human ecology; Land change science; Land degradation; Landscape; Livelihoods; Natural resources; Neoliberalism and the environment; Political ecology; Population and natural resources; Resource extraction; Resources and development; Social-ecological transformation; Social resilience and environmental hazards; Social vulnerability and environmental hazards; Sustainability science; Sustainable development; Urban political ecology; Vulnerability; Water resources and hydrological management

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