

The Geography of the Commons: The Role of Scale and Space

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The “tragedy of the commons” is a concept familiar to students of resource management, and many academic disciplines have devoted considerable attention to its understanding and solution. Despite a long tradition of concern with issues directly related to the problem, the field of geography has been relatively silent in the commons literature, especially on the theoretic front. The present article attempts to address this shortcoming by applying geographic methodologies—particularly as related to scale and space—to an understanding of the phenomenon. The article first demonstrates the role of sociopolitical scale in defining the commons problem and then develops a typology classifying common resources into one of three categories—open access, fugitive, and migratory—based on spatial relationships between resources and resource users. The article shows that the geographic nature of the commons problem for any particular resource depends on the sociopolitical scale at which it is assessed, and suggests that solutions to commons problems should vary both by scale and by spatial nature. *Key Words:* *common property, open access, resource management, scale, transboundary.*

This article examines an issue fundamental to natural resource allocation and use: the issue of rights. It has long been recognized that unowned resources can be especially subject to misuse and degradation, a condition that has come to be termed the “tragedy of the commons” after a well-known and now controversial article by Hardin (1968).¹ The theory of common good use and misuse has been best developed in such fields as economics, anthropology, and political science (see, respectively, Gordon 1954; McCay and Acheson 1987; and Ostrom 1990). However, the commons problem is in many respects fundamentally geographic in nature, in that the phenomenon is predicated on the relationships between the spatial domains of resources and resource users. Indeed, the role of spatial relationships in the commons problem has been recognized across a variety of disciplines, including economics, international relations and hydrology (e.g., Netanyahu 1998; Wolf 1998; Richey 2000). Nonetheless, such research has focused on particular resources, and not on the development of theory relating spatial characteristics to commons problems across the full range of resource types.² Too, geographers have tended not to focus on a systematic understanding of the commons problem, especially at the theoretic level, despite the fact that resource issues (Zimmerman 1933; Harvey 1977), human/environmental interaction (Spate 1960), and spatial relations (Pattison 1964; Taaffe 1974) have all formed long and important traditions in geographic thought.

The present article partially addresses this shortcoming by using geographic perspectives to develop a scale- and

space-explicit theory of the commons. After demonstrating the role of sociopolitical scale³ (e.g., household, village, or nation-state) in defining “common,” the article develops a typology dividing common resources into three categories—open access, fugitive, and migratory—based on the spatial relationships between resources and resource users. It then shows that the nature of the commons problem for any particular resource depends in part on the scale at which it is assessed. Finally, the article examines the relationship between the geography of the commons and resource management, along with implications for policy and future research.

Geography and the Commons

At its most fundamental level, the problem of the commons revolves around humans, their environment, and the spatial relations between the two. Human-environment interaction, formerly known as the man-land tradition, has long formed a core element of American geographic thought. The impacts of the environment on humans (Semple 1903; Barrows 1923), as well as of humans on their environment (Marsh [1864] 1965; Sauer 1925) were both well-established subjects in the geographic literature by the early twentieth century. While formal consideration of geography as a “spatial” subject probably began with a 1953 publication by Schaefer, the importance of areal relations within geography had clear origins in the decades prior to World War II (Hartshorne 1939) and arguably much earlier (see Pattison 1964).

More recent geographic literature is replete with work focusing on resources typically associated with the commons problem. For example, in the field of land use, Bassett and Crummey (1993) compiled a study of land utilization in Africa that addressed elements of the commons; Schroeder (1997) studied the gender-influenced distribution of newly reclaimed land in The Gambia; and Dougill, Thomas, and Heathwaite (1999) addressed the impact of land-use practices on the Kalahari region. Similar attention has been given to water resources (Bradley and Carpenter 1986; Roberts and Emel 1992; Emel and Roberts 1995; Wolf, Yoffe, and Giordano 2003), the atmosphere (Comrie 1994), forest resources (Allen and Barnes 1985; Hosier 1988), fisheries and wildlife (Kay 1979; Reed 1995), and integrated resource/environmental studies (Kasperson, Kasperson, and Turner 1995). Other geographers have focused, not directly on resource issues, but rather on conceptual matters related to the commons, including property rights (Clark 1982; Emel and Brooks 1988; Mitchell 1995; Price 1995; Saff 1996) and spatial relations (James 1952; Sack 1973, 1983; Peuquet 1988; Blomley 1994).

Despite the substantial body of geographic scholarship surrounding the commons, few, if any, authors have addressed the problem itself from a conceptual or theoretic perspective. In fact, as Young (2001, 284) stated in a recent study of fisheries in Mexico, geographers “have devoted surprisingly little attention to the role of the commons and their management.” This article attempts a first step at overcoming this deficiency by using the perspectives and tools of geography to address the commons problem, using scale concepts within a spatially explicit framework.

Property Rights, Scale, and the Commons

The solution to resource allocation problems, including the problem of the commons, involves the concept of rights, a concept that can include, among other things, privileges to use, access, and management. According to Furubotn and Pejovich (1972, 1139), there is general agreement between Roman law, common law, and the work of Marx and Engels that property rights determine a “set of economic and social relations defining the position of each individual with respect to the utilization of scarce resources.” It is critical to note the use of the word “set” in this definition. The property-rights concept is not singular in nature; rather, it refers to a bundle of rights that may vary by resource, time, and place. As Ciriacy-Wantrup and Bishop (1975, 714) state, “Different rights (strands of the bundle) may be distributed in various combinations

among natural and legal persons, groups, and several publics, including the many units of government.” A number of scholars have created typologies for dissecting the general idea of a property right for a given resource into its component parts. Dales (1968) created a bifurcation between rights of exclusivity and transferability; Tietenberg (1992) broke rights into categories of universality, exclusivity, transferability, and enforceability; and Schlager and Ostrom (1992) distilled full rights into groupings of access and withdrawal, management, exclusion, and alienation.

Myriad examples can be found to illustrate variation in the allocation of strands in the property rights bundle. For example, food in the United States is typically allocated between competing consumers using price coupled with monetary-exchange mechanisms, while game meat in areas of central Zambia is given by hunters to their elders and redistributed based largely on kinship relations (Marks 1984, 88). U.S. law vests mineral rights with the owner of land under which the minerals lie, whereas wildlife is typically the property of the state, regardless of location. In contrast, Zimbabwean wildlife now belongs to the owner of land on which it resides, while mineral rights are the province of the state.⁴ Unlike most Western legal systems, Koranic law apportions land to communities and bases use on possession coupled with payment of taxes (Watts 1983, 73), and water cannot be owned.⁵ Despite clear variations in approach, a uniting theme in each of these examples is the existence of a recognized system for apportioning some set of resource rights amongst competing interests.

One of the conditions for the existence of a commons problem is the lack of well-defined property rights. In the paradigm of neoclassical economics, property rights promote efficiency in part because they invest in the holder the incentive for optimal resource use.⁶ Long before this economic argument was formulated, however, it was recognized that resources for which property rights are not established are subject to overexploitation. Aristotle noted “that which is common to the greatest number has the least care bestowed upon it” (*Politics* II.III)⁷; Roman law recognized the problems with management of commonly held resources and codified restrictions on their use (Adams 1993); and an imperial Chinese gazetteer commented that where a mountain was owned “industrious owners plant pine, Cunninghamia, tung oil, and tea oil, earning themselves considerable profits,” but on Crown land, with no rights for use established, “Any branches or twigs that grow are burned or taken away, and [people] even dig up the roots to use as cooking fuel so that nothing can grow again and the mountains become barren” (quoted in Menzies 1994, 91). In more recent

decades, this correlation between ill-defined ownership and overexploitation has been the basis for numerous studies, and it provided the foundation for Hardin's "tragedy of the commons" thesis.

Common ownership and nonownership, however, are not equivalent concepts. A resource may be held in common within a group, and the group may define rules concerning members' rights and obligations towards the resource's use—cooperatively or otherwise. In such cases, the group members have, in effect, created property-rights conditions amongst themselves, and they may exclude nonmembers from use.

By way of example, consider a family home in the United States. The house may be owned or rights to its use shared communally amongst family members. However, members of the household typically agree—at least implicitly—on the rights and responsibilities of each occupant concerning major aspects of the home's use. Thus, one tends not to worry about "household degradation," despite communal ownership. In contrast, depletion of fish stocks in the open seas is a serious source of concern unless effective agreements or treaties can be formulated to convert the fishery to one available only to a "household" of fishers or nations. In both examples, the resource in question may be considered "common" in the sense that multiple individuals possess use rights. However, in the case of the household, access and use are limited to a defined set of individuals, while in the case of the fishery, no exclusion principles apply.

A significant portion of the commons literature, especially before the mid-1980s, failed to differentiate between communal resource ownership and true lack of ownership (see Schlager and Ostrum 1992 for a discussion and examples). In fact, it has been shown that the confusion between open access and common property has led to policy prescriptions that de facto withdrew property rights from resources previously managed under communal property regimes.⁸ In their oft-quoted article, Ciriacy-Wantrup and Bishop (1975) articulated the fundamental differences between commonly owned and unowned resources, and considerable effort has since been devoted to further clarification of the issue (Schlager and Ostrom 1993). Numerous empirical studies have also attempted to demonstrate cases in which communal ownership is more efficient than "private," as well as the general conditions under which this might be the case (e.g., Netting 1976). Because of this work, more exacting authors tend to differentiate between private, communally owned, and open-access (common-pool) resources, though definitional confusion persists.

Nonetheless, at least two important issues related to a rigorous understanding of the commons remain. First, the

contrast between owned resources—privately or communally—on the one hand and unowned, open-access resources on the other implies that the primary issue in defining the necessary conditions for the existence of a "commons" problem is one of access to or exclusivity over a given resource. As the above discussion of property rights points out, however, exclusivity is but a single element within the property-rights framework. Furthermore, as highlighted below, a focus on exclusivity ignores the commons problem as related to transboundary resources—that is, resources such as fluvial water and migratory wildlife that, by nature, leave the geographic or otherwise defined zone of access of one resource-user and move to the zone of another. For these resources, the primary issue in managing the "commons" is not one of establishing exclusivity in access, but rather one of creating use rights, regardless of resource location.

Second, the division of resources using a neat typology of ownership (i.e., private, communal, and open-access) masks a continuous gradation existing in reality.⁹ In the largely capitalist United States, the term "private property" only occasionally implies ownership by a single individual. In U.S. tax code, for example, the individual can constitute the basic unit for assessment, but households and corporations—which can, in principle, be constituted of any number of individuals—are also legal candidates. In other circumstances, civic organizations, local governments, nongovernmental organizations, and nation-states can be considered as singular legal entities possessing property rights. Likewise, in more "traditional" societies, the primary unit of ownership may be the individual, the extended family, or the tribe. Simply stated, a variety of ownership units exists to which property rights can be assigned; each of these ownership units is singular, but each may be composed of single or multiple individuals. The range of ownership units can be examined along a continuum, or scale, gradated by social, legal, or political level (see Figure 1). Since property rights can be assigned not only to individuals but also to entities, strictly private (possession by one) and strictly common (possession by all) resources exist only at the extremes of the continuum. Between these extremes, where the majority of cases are likely to be located, "private" property rights may exist within communal organizational structures.

These distinctions have direct relevance to a full understanding of the commons, because the problem for any given resource must be defined for a particular sociopolitical scale if its nature is to be fully articulated. For example, problems of international commons are frequently addressed between sovereigns through treaties. However, a treaty that successfully addresses open-access

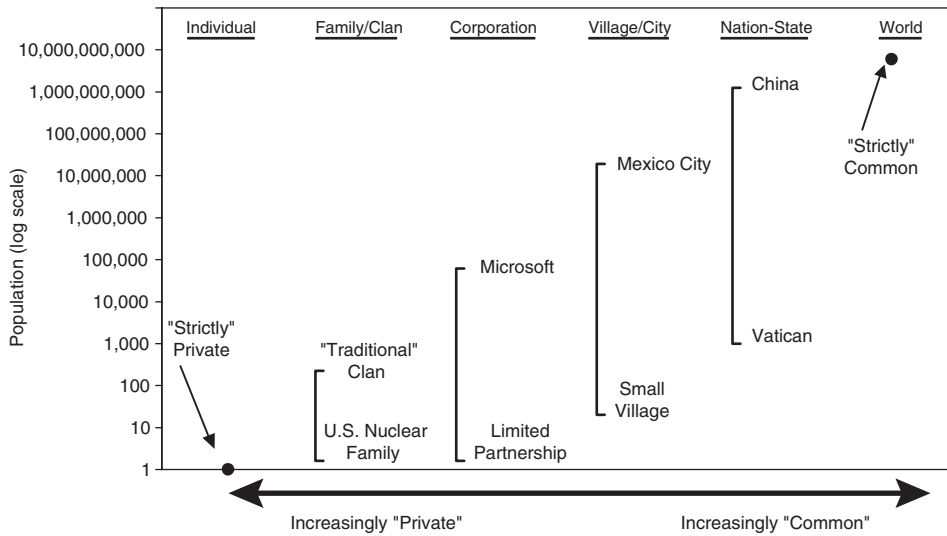


Figure 1. The ownership continuum and the commons: selected administrative units and associated population ranges.

issues at the international scale will not necessarily solve remaining problems at smaller scales. The United States and Canada confronted perceived overharvest of Pacific salmon through the Pacific Salmon Treaty (1469 U.N.T.S. 357), which clearly defines many of the rights and responsibilities of each sovereign with respect to salmonid management and use.¹⁰ Despite the treaty and the clear demarcation of harvest rights for the nations involved, debate continues in the United States as to salmon allocations within the remaining *national* “commons” used by competing domestic fishing interests—namely, commercial, sport, and tribal. Thus, even given a solution at the national scale, allocation must still be resolved at smaller scales.¹¹ In the U.S. case, commercial allocations are handled through season limitations; sport fishing allocations are limited by daily quotas, seasonal limitations, and gear restrictions; and harvests for tribe members are influenced at least in part by the allocation of fishing sites along the Columbia and other rivers.

Figure 2 shows a generalization of this concept. The circle represents the domain of some resource, and may be thought of in terms of either spatial extent or quantitative measure (e.g., number or weight). If the resource domain can be utilized by at least two parties (analogous to the United States and Canada in the example above), a commons problem may exist. A first-order solution to the problem can be achieved through a division of resource-use or other rights between the parties—for example, by providing one party with the resources associated with semicircle I and the other with the resources associated with semicircle II.¹² However, a second-order commons problem may still exist at a lower political scale if, at this lower scale, more than one entity can still “access” either

of the subdivisions of the original resource domain. This problem may be solved by again dividing the resource domain—for example, into slices A, B, and C (analogous to the case of commercial, sport, and tribal salmon fisheries in the above example). Clearly, though, further subdivisions at yet smaller scales—such as those indicated by areas C₁ and C₂—may still be necessary until the level of the individual is reached.¹³

While the preceding discussion highlights the potential existence of the commons problem for any particular resource at a multitude of scales, the issue of scale also has direct relevance to the question of efficiency and equity of common resource use. The literature seeking to define the conditions under which private rights are superior to

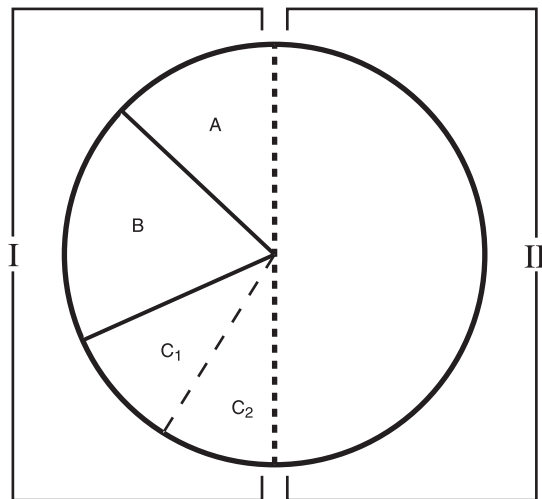


Figure 2. Stylized division of a common resource space at three socio-political scales.

communal rights and vice versa often implicitly assume that the appropriate criteria for assessment is some measure of total output derived from the resource (e.g., annual yield in a fishery, milk production from a given pasture, etc.). However, once output is produced in a communal system, it must be distributed to the individuals making up the system. Ciriacy-Wantrup and Bishop (1975) stated that in systems of communal ownership, all members are coequals; in their discussion, they cited examples, such as Nery's Swiss grazing commons, in which output is divided equally amongst members.¹⁴ In reality, members of a communal ownership system can rarely expect to be coequals, a fact which has now been made abundantly clear through gender-oriented research. In countries in which material and intellectual well-being are clearly correlated with gender—such as India, where female literacy is half that of male and life expectancy is lower for women than for men—the proposition that women would generally share coequally in the output of a communal production system appears dubious. Thus, while total output of some resource—be it fish, milk, or forest products—may be higher under communal than under strictly private management, it is not clear that *all* members of the communal structure are better off than they would have been under a strictly private ownership system. Unless each member is able to opt out of the communal structure through the free exchange of membership rights, we cannot know a priori if the communal system is more efficient than the strictly private system, or if it simply produces more output. In other words, the possibility exists that a communal ownership system may be *more* productive than a purely private system—but it may also be *less* equitable, an outcome counter to that frequently suggested by both sides of privatization arguments.

Space and the Commons

The commons problem is, in the simplest terms, a general resource problem with particular spatial characteristics related to resource domains and rights assignment. This idea can be illustrated using a loose derivation of James' (1952) characterizations of areal relationships between the spatial domains of phenomena, originally applied to the study of regional geography. We can consider the relationships between two phenomena the spatial extents of which occupy exactly the same area as “coincident,” relationships in which the spatial extent of the two phenomena overlap imperfectly as “intersecting,” and the relationships between phenomena with no areal overlap as “independent”¹⁵ (see Figure 3).

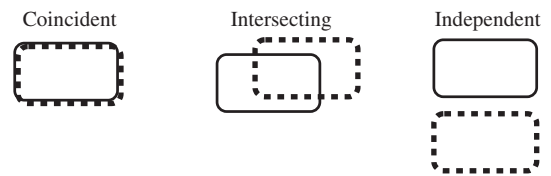


Figure 3. Relationships between spatial phenomena as related to the commons (inspired by James, 1952).

The commons problem occurs when the natural domain of a resource has some degree of intersection with domains in which at least two entities have the right or ability to exploit the resource.¹⁶ Put another way, the commons problem occurs when a *resource* domain is coincident with or intersects the *rights* domains of two or more resource users. These ideas can be more formally illustrated with a stylized description.

Consider a case with two resource users, A and B, and a single resource. Assume also that A and B act independently of one another. Each user has the right, within his or her domain, to utilize the resource. Clearly, the users' rights are executable only if their domains of rights correspond to some degree with the domain of the resource. In Figure 4A, A's domain of rights is coincident with the resource domain. Thus A may exploit the resource, enjoying all benefits and paying all costs arising from the exploitation, while B is excluded. In this case, the resource is essentially privatized, and the property rights condition necessary for “efficient” resource use is met.¹⁷ Figure 4B gives a counterexample. In this case, both A and B are able to exploit the resource, since the resource domain intersects with the rights domains of both parties. The full benefit of any act of exploitation falls to the party undertaking the exploitation, but A and B share at least some of the costs—for example, in terms of atmospheric degradation or future reductions in harvestable stocks. Since each party gets the full benefit from its own exploitation, but the cost of that exploitation is shared between both, the incentive for overexploitation exists.¹⁸ This is the essence of the commons problem and illustrates the spatial mechanism behind the classic example of common grazing lands.

The next two parts of Figure 4 illustrate the spatial aspects of a second commons type, transboundary resources (i.e., resources that cross the domains of two or more users). In Figure 4C and D, the rights domains of A and B are independent, though both domains still intersect with the resource domain. Since a resource's domain is the extent of the area in which it moves to fulfill its natural function, the resource may clearly still be considered common, because the resource itself moves through the rights domains of both users (a reversal of our

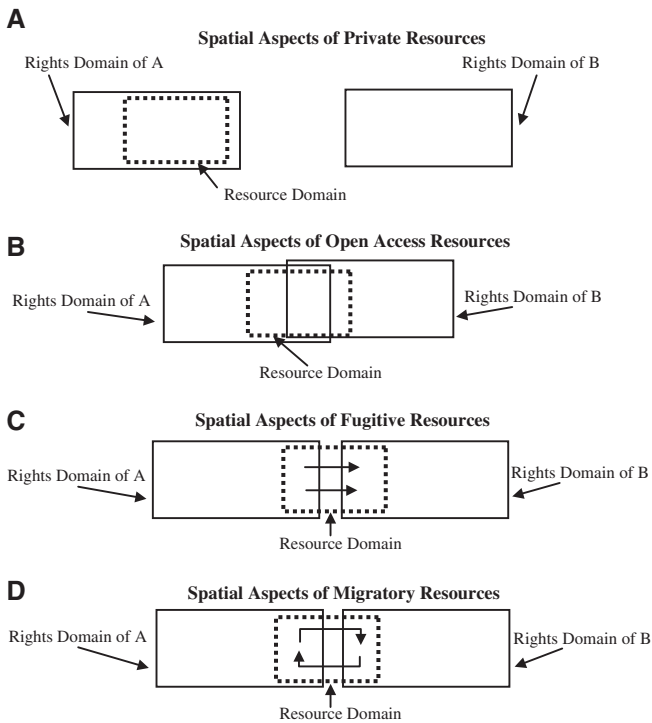


Figure 4. Spatial aspects of (A) private, (B) open access, (C) fugitive and (D) migratory resources.

prior example, in which the two users could be thought of as moving into the domain of the resource). Thus, the incentive for overexploitation exists, since at least one of the users gains full advantage from exploitation while potentially sharing some costs of exploitation with his/her counterpart.

The nature of resource movement between A's and B's domains, however, will influence exploitation outcomes. In the case of fugitive resources where movement is unidirectional—for example, where the direction of movement is always from the rights domain of A to the rights domain of B, as shown in Figure 4C—the initial user gains all benefits from exploitation but, to the extent the costs of exploitation move with the resource, may not bear all costs.¹⁹ By way of example, one may consider the case of fluvial pollution. An upstream riparian—A, in our example—gets full “benefit” from any pollution put into the river. However, A does not pay the full costs of that pollution, since the pollution will move from A's domain downstream to the domain of B. A need not consider the interests of B, since A will not pay the full costs of the pollution, nor will A share in any benefits B would receive had B been able to exploit unpolluted water.

If the movement of the transboundary resource is migratory,²⁰ as in Figure 4D, the incentives for action by the two parties will vary from the last example. To illustrate the point, one may consider the case of waterfowl breeding

in the domain of A and wintering in the domain of B, a situation analogous to a subset of North American waterfowl with respect to Canada and the United States. If waterfowl are harvested by A, fewer move to B's domain to winter, and so B will bear part of the costs of A's actions through lower potential harvest numbers, but a correspondingly lower number will return to A the following year for breeding. Likewise, if B harvests the waterfowl when they are in the domain of B, a lesser number will be available for A, and a correspondingly lower number will return to B the following year.

In the basic model just presented, one may observe a simple dichotomy in outcomes between the fugitive resource condition, on the one hand, and the open-access and migratory conditions, on the other. In the former case, the initial resource user does not share in the costs of use, while in the latter two s/he does. Further consideration, however, suggests that though the basic forces driving open-access and migratory resource use are equivalent, other factors, such as risk and temporal perception, may influence actual outcomes. For example, users of migratory resources may estimate exploitation rates of competing harvesters differently than do users of open access resources. This may result in differences in individual or group perceptions of their own optimal harvest rates. Such differences may be especially likely if information levels, such as the number of competing users or their off-take rates, are not equivalent between the systems. Similarly, open-access resources may be more likely to be perceived as part of static systems, while migratory resources, with their inherent periodicity in movement, may be more likely to be perceived as part of dynamic systems. This, too, may influence perceived optimal resource-use rates by individual users.

Resource Management and the Geography of the Commons

A basic insight from the analysis presented here is that commons problems exist when, for a given sociopolitical scale, the rights domain of a single resource user is not exclusively coincident with the domain of the resource in question. This idea is not new and has long been applied in defining management regions, especially in the field of water resources. John Wesley Powell, one leader of the “Great Surveys” from 1866 to 1879, noted that optimal management of rivers in the Western United States required an understanding of resource space, and advocated the establishment of political and administrative units coincident with river basins (Reiser 1986). These ideas were later taken up by Harlan Barrows and Gilbert White and employed in the design of the Tennessee Valley

Authority (TVA) (Teclaff 1996). The TVA had management authority over a geographic region roughly coincident to the Tennessee River basin. The TVA's architects clearly recognized the interrelationship of social, economic, and other factors within the resource "space" of the Tennessee basin, and they designed the TVA's mandate to correspond with that space. The same idea has been applied more recently through the use of an "ecoregion" concept, in which management regimes for particular resources are structured to fit the biogeographic characteristics of the resources in question (Omernik 1987).

Other research has pointed to differences in resource-use outcomes resulting from variation in the spatial characteristics of common resources. For example, Dales (1968) noted that whereas U.S. residents tended to live on rivers flowing to the ocean, Canadians had a higher propensity to reside on lakes, or rivers flowing into lakes, in which pollutants were sequestered over long time periods. Therefore, Americans tended to pollute their downstream neighbors, whereas Canadians "tend[ed] to pollute themselves." As a result, "The economics of Canadian water pollution is . . . quite different from the economics of American water pollution" (Dales 1968, 793). What Dales described, using a different rhetoric, was variation in the nature of a resource-management problem associated with variation in the geography of the commons—in this case, between a fugitive resource (U.S. waters) and an open-access resource (Canadian waters). This variation in commons geography resulted in differences in water-management regimes, as well as differential progress in the development of water-management institutions (Dales 1968). Variation in commons geography may also explain why rights regimes used to govern rivers (fugitive resources) may differ from those used to govern the anadromous fish (migratory resources) they contain (Giordano forthcoming).

Differences in the geography of the commons may also help to explain the nature of cooperation in the solution of commons problems. If, for example, a downstream riparian wished to receive unpolluted water from his or her upstream counterpart, s/he might be expected to voluntarily compensate the upstream riparian, despite the lack of legally defined rights.²¹ This is analogous to the outcome of the 1961 Columbia River Treaty (15 U.S.T. 1555), in which the United States paid Canada to modify the Columbia's flow regimes (rather than pollution levels) in order to increase U.S. hydropower production and reduce flooding. In essence, the commons problem of a fugitive resource was solved by mutual cooperation, resulting in a transfer of funds—and, since the 1990s, electrical energy—to Canada. In treaties between Canada and the United States concerning salmon and water-

fowl—examples of migratory resources—fundamentally different principles were used in negotiations and in final treaty outcomes.²²

It is important to note that the geographic nature of a particular common resource, such as the waterfowl just mentioned, also depends on sociopolitical scale. For example, while U.S./Canadian waterfowl agreements are driven by the transboundary nature of migratory birds, the management issue at national refuges within the United States is not transboundary but open-access in nature: how to control the number of hunters wishing to hunt ducks on the refuge on a given day. Thus, different rights principles (e.g., lottery-rationed access, daily bag limits) are applied to the taking of waterfowl on U.S. refuges than those used in setting overall waterfowl harvest levels between the United States and Canada.

Up to this point, the analysis has focused on the geographic dimensions of the commons at moments in time. In fact, however, the natural domains of resources and the rights domains of resource users are not static, but vary temporally. The relationship between time and the geography of the commons can be seen using Jones' (1954) work on a unified field theory for geography. Jones noted that fields—or domains, in the sense used in this article—tend to change in size over time, and that this change can have tangible impacts on the phenomena involved. For example, he noted that the administrative domains constructed for newly designated capital cities are often outgrown as the cities expand. The functional area of the city, which can be thought of as analogous to the resource domain, soon falls outside the city government's administrative boundary, which can be considered analogous to the rights domain. The problem for urban areas is, then, "to make the political area fit the field [domain]" (Jones 1954, 120). In other words, the challenge is to solve a variation of the commons problem by making resource and rights domains coincident over time. Cohen (1991) later considered trends in the global economic and political systems and saw a transformation of the world from a relatively independent set of states towards an integrated world. He then examined how those trends changed the appropriate spatial units at which the world should be considered and hypothesized "a system that progresses spatially in stages" (Cohen 1991, 561). A recognition that rights and resource domains can and most likely will change over time is also important in the development of policy for common resources, and is critical if agreements and treaties designed to solve commons problems are to be effective in the long run. In fact, change in national borders—and corresponding change in rights domains—has already been cited as a significant factor in interna-

tional disputes over fugitive freshwater resources (see Wolf, Yoffe, and Giordano 2003).

The preceding analysis demonstrated that the existence and nature of commons problems vary according to spatial relationships between resources and resource users, and that those relationships are not constant but vary themselves with temporally dynamic resource and sociopolitical domains. Policies to manage at least some common resources were also shown to have varied based on their geographic nature. While some of the policy differences are due to factors unrelated to commons geography, it seems reasonable to assume that part of the variation exists because different geographic forms of the commons are better governed under some policy regimes than others. A key question for policy and future research is whether a systematic framework can be developed to match particular management rules and principles to common resources by geographic form (open-access, fugitive, or migratory) and sociopolitical scale. Such a framework could serve to refine policy in existing resource-management systems, as well as reduce the probability of confronting newly identified “tragedies of the commons” as management regimes are created for more recently recognized commons, such as the atmosphere, biodiversity, ecosystems, and the Internet.

Conclusion

Perhaps to a greater degree than any other general category of goods, natural resources are subject to unsustainable use rates due to the frequent inadequacy of regimes to manage their “common” nature. While resource study has formed a major theme of the geographic discipline, geographers have rarely applied their methods towards an explanation of the commons phenomenon or its solution. As a first step in remedying this shortfall, this article has proposed a conceptual framework for the analysis of the commons problem using a geographic perspective. It links the role of sociopolitical scale in the commons to a simple set of spatial archetypes to demonstrate fundamental differences in three categories of common resources: open-access, fugitive, and migratory.

The framework presented provides a new perspective from which to examine and consider the problem of the commons and highlights additional issues in resource management deserving further attention. The first of these issues is the definition of resource domains. As has been made evident in the field of water resources through the “watershed versus ecoregion” debate (Omernik and Bailey 1997), the spatial dimension of a given resource

domain is not always self-evident. Furthermore, the definition of what constitutes a single resource—and, therefore, its domain—is problematic. With some biological resources, the issue may revolve around an assessment of when local populations of a given species are independent and when they are interchangeable parts of a larger population structure (Wilson et al. 2001; codified in the U.S. Marine Mammal Protection Act, 16 U.S.C. § 1362(11)). More broadly, all resources may arguably be considered to be part of a single, interconnected earth-resource system definable only at the global scale.

Second, even if resource domains can be clearly defined, the idea—put forward by Powell and others and further emphasized here—that coincidence of resource and rights domains may be beneficial to resource management must be placed in the context of overall system complexity. In other words, the potential advantages of creating new rights domains coincident with a particular resource space must be considered against the costs—in terms of political or administrative complexity—of adding overlapping and spatially inconsistent management layers.

Third, the transferability across scales of resource policy in general and commons policy in particular should be questioned, not merely assumed. Young (1996) has already drawn attention to the danger of assuming transferability of propositions derived from commons-management studies on small societies to the international arena and vice versa. The fact that the very nature of the commons problem may change across scales only heightens the need for a better understanding of cross-scale transferability.

Finally, the temporal dimension of resource systems necessitates an understanding that resource and rights domains may change over time. Anticipation of such change may improve the long-term viability of resource systems in much the same way that the recent trend towards proportional, rather than absolute, allocation of international waters in treaty agreements has lessened water disputes by accounting for adjustments in annual flow variation.

In summary, this article has used concepts of scale and space to recast the commons problem, and has demonstrated the applicability of those concepts through a range of selected examples. Clearly, however, the approach taken was a deductive one. The true test of the fidelity of the concepts presented here for a range of resource types and cultural settings awaits additional work using case studies and other approaches. Whatever the particular outcomes of such work, however, the propositions presented here demonstrate how new insights can be

gained through the application of geographic tools to previously “ungeographic” problems.

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Notes

1. The controversy centers on the confusion of “common” resources with unowned resources (see elsewhere in this article for further discussion) and Hardin’s influential proposal that “common” resources should be socialized or privatized for their protection (Ostrom et al. 1999).
2. Each of the authors just cited studied spatial aspects of the commons as related to water.
3. In addition to providing a useful review of scale concepts in the social sciences, Gibson, Ostrom, and Ahn (2000) refer to sociopolitical scales as “levels of political jurisdiction.”
4. The efficacy of the United States system must be questioned, since the landowner has considerable latitude in controlling the creation or destruction of habitat responsible for the health of wildlife and virtually no ability to effect improvements in mineral resources.
5. In the 1990s, treaty negotiations involving water allocations between Syria and Turkey broke down due to the inclusion by arbitrators of language concerning ownership rights. Negotiations restarted when language was changed to cover only rights to use and distribute, rather than “own,” water (A. Wolf, interviewed by the author, 12 February 2001).
6. In addition, when rights are tradable, users placing the highest value on particular rights to resource use tend to obtain those rights by bidding up the purchase price.
7. A translation by Benjamin Jowell is available at http://www.constitution.org/ari/polit_00.htm (last accessed 16 April 2003).
8. For example, Ostrom (1997) cites numerous examples in which the state nationalized resources but did not then apply the monetary or other means to protect its assets. The result was the conversion of what had been communally owned property into de facto open-access resources, with predictably negative results.
9. This gradation is suggested in the above quotation by Ciriacy-Wantrup and Bishop (1975, 714).
10. It should be noted that, even if followed, the statutory establishment of “optimal” harvest limits does not necessarily result in efficient use of resources. For example, commercial fish harvests in the United States have frequently been designed such that seasons are suspended when quotas are met. This “first come, first served” allocation system encourages overcapitalization in equipment, as fishers compete amongst themselves for the maximum shares of the fixed available harvest.
11. It is also possible that an open-access solution at one scale could be proscribed at another. For example, Columbia River

fishers in the United States were prohibited by U.S. national law from communally managing the salmon fishery (Ostrom 1997) despite work by the U.S. government to address “commons” issues for salmon at an international scale.

12. The example given is for a resource that can be divided relatively easily between users. Analogous solutions can also apply to resources—such as the atmosphere—for which division into discrete units is not possible or is problematic. In the case of the atmosphere, for example, maximum emissions levels could be set and then shares divided between “users.”
13. It should not be inferred from this discussion that resource allocation decisions *should* be made via a top-down political or legal approach rather than through direct cooperation between involved parties. Efficacy of approach is an empirical question and may depend on scale and other factors.

In this example, a neatly nested hierarchy of social and political power existed, in which units at smaller scales were plainly subservient to those at larger scales. While this construct is conceptually useful, it should be recognized that decisions—and the nature of the decision-making process—at one scale can dynamically affect outcomes at other scales (Berkes 2000; Young 2002).

14. They did not, however, define the sociopolitical scale at which the “even” division of output was carried out—the household, or the individual within the household.
15. James’ (1952) analysis divided relationships between spatial phenomena into four categories, correspondence, in-situ correspondence, ex-situ correspondence, and discordant.
16. The domain of a resource is not only the space it currently occupies, but also the space needed to carry out its natural function. In the language of Jones’ (1954) unified field theory, the domain of a resource is the extent of the “field” in which, in the broadest possible sense, it moves. Thus, for example, the domain of a catfish may be just the pond in which it lives, while the domain of migratory gray whales includes the coastal waters of Mexico, the United States, and Canada. It should also be remembered that the “natural” domain of some resources can be modified through human action. For example, the construction of refuges in the United States changes the distributional patterns, and hence the domain, of wintering waterfowl.

It is important to keep in mind the role of individual resources within broader earth systems when attempting to define a resource domain, especially over longer time scales. While it may appear that a forest has a discrete, measurable boundary, a decision to change forest structure—for example, through timber harvest—may also change forest function. As a result, rainfall and run-off levels may be altered, impacting the hydrologic cycle, biotic composition, land use, and so on beyond a narrowly defined forest domain.

17. This is not to imply that other factors for resource misuse might not apply, only that a necessary condition has been met for efficient resource allocation within the context of neoclassical economics.
18. The basis for the outcome can be understood through the economic theory of externalities (Tietenberg 1992) or from a game-theoretic perspective using the “prisoner’s dilemma” (Runge 1983).
19. This is theoretically similar to the classic “negative externalities” problem.

20. The biological definition of migration is “a two-way movement within the area normally occupied by a species population” (Dasmann 1981, 106).
21. An economic analysis of the conditions under which this outcome might occur, as well as an exposé of the conditions under which private negotiation might effectively solve similar problems, can be found in studies of what has come to known as the Coase theorem (Coase 1960).
22. The March 1985 Treaty between the Government of Canada and the Government of the United States of America Concerning Pacific Salmon (1469 U.N.T.S. 357) uses an absolute sovereignty principle reminiscent of the Convention on the Law of the Sea of 10 December 1982 (34 I.L.M. 1542) in which each party “owns” the fish born in its natal waters, regardless of later location. Waterfowl are managed under the 1936 Convention for the Protection of Migratory Birds and Game (39 Stat. 1702) without specific ownership principles having been established. Instead, parties must come to annual agreements on harvest numbers.

References

- Adams, David A. 1993. *Renewable resource policy: The legal-institutional foundations*. Washington, DC: Island Press.
- Allen, Julia C., and Douglas F. Barnes. 1985. The causes of deforestation in developing countries. *Annals of the Association of American Geographers* 75:163–84.
- Aristotle. *Politics*. http://www.constitution.org/ari/polit_00.htm (last accessed 16 April 2003).
- Barrows, Harlan H. 1923. Geography as human ecology. *Annals of the Association of American Geographers* 13:1–14.
- Bassett, Thomas J., and Donald E. Crummey, eds. 1993. *Land in African agrarian systems*. Madison: University of Wisconsin Press.
- Berkes, Fikret. 2000. Cross-scale institutional linkages: Perspectives from the bottom up. Paper presented at Constituting the Commons: Crafting Sustainable Commons in the New Millennium, Indiana University, Bloomington, 31 May–4 June.
- Blomley, Nicholas K. 1994. *Law, space, and the geographies of power*. New York: Guilford Press.
- Bradley, Michael D., and Michael C. Carpenter. 1986. Subsiding land and falling groundwater tables: Public policy, private liability, and legal remedy. *Economic Geography* 62:241–53.
- Ciriacy-Wantrup, S.V., and Richard C. Bishop. 1975. “Common property” as a concept in natural resource policy. *Natural Resources Journal* 15:713–27.
- Clark, Gordon L. 1982. Rights, property, and community. *Economic Geography* 58:120–38.
- Coase, Ronald. 1960. The problem of social cost. *The Journal of Law and Economics* 3:1–44.
- Cohen, Saul. 1991. Global geopolitical change in the post–Cold War era. *Annals of the Association of American Geographers* 81:551–80.
- Comrie, Andrew C. 1994. Tracking ozone: Air-mass trajectories and pollutant source regions influencing ozone in Pennsylvania forests. *Annals of the Association of American Geographers* 84:635–51.
- Dales, J. H. 1968. Land, water, and ownership. *Canadian Journal of Economics* 4:791–803.
- Dasmann, Raymond. 1981. *Wildlife biology*. New York: Wiley.
- Dougill, Andrew S., David S. G. Thomas, and A. Louise Heathwaite. 1999. Environmental change in the Kalahari: Integrated land degradation studies for nonequilibrium dryland environments. *Annals of the Association of American Geographers* 89:420–42.
- Emel, Jacque L., and Elizabeth Brooks. 1988. Changes in form and function of property rights institutions under threatened resource scarcity. *Annals of the Association of American Geographers* 78:241–52.
- Emel, Jacque, and Rebecca Roberts. 1995. Institutional form and its effects on environmental change: The case of groundwater in the Southern High Plains. *Annals of the Association of American Geographers* 85:664–83.
- Furubotn, Eirik G., and Svetozar Pejovich. 1972. Property rights and economic theory: A survey of recent literature. *Journal of Economic Literature* 10:1137–62.
- Gibson, C. C., E. Ostrom, and T. K. Ahn. 2000. The concept of scale and the human dimensions of global change: A survey. *Ecological Economics* 32:217–39.
- Giordano, Mark. 2002. International wildlife law and the geography of the commons. Unpublished doctoral dissertation. Oregon State University.
- Gordon, H. Scott. 1954. The economic theory of a common property resource: The fishery. *The Journal of Political Economy* 62:124–42.
- Hardin, G. 1968. The tragedy of the commons. *Science* 162:1243–48.
- Hartshorne, Richard. 1939. The nature of geography. *Annals of the Association of American Geographers* 29:173–658.
- Harvey, D. 1977. Population, resources, and the ideology of science. In *Radical geography*, ed. R. Peet, 213–42. Chicago: Maaroufa.
- Hosier, Richard H. 1988. The economics of deforestation in Eastern Africa. *Economic Geography* 64:121–33.
- James, P. E. 1952. Toward a further understanding of the regional concept. *Annals of the Association of American Geographers* 42:195–222.
- Jones, Stephan. 1954. A unified field theory of political geography. *Annals of the Association of American Geographers* 49:111–23.
- Kasperson, Jeanne X., Roger E. Kasperson, and B. L. Turner II, eds. 1995. *Regions at risk: Comparisons of threatened environments*. Tokyo: United Nations University Press.
- Kay, Jeanne. 1979. Wisconsin Indian hunting patterns, 1634–1836. *Annals of the Association of American Geographers* 79:402–18.
- Marks, Stewart A. 1984. *The imperial lion: Human dimensions of wildlife management in Central Africa*. Boulder, CO: Westview Press.
- Marsh, George Perkins. [1864] 1965. *Man and nature, or physical geography as modified by human action*, ed. David Lowenthal. Cambridge, MA: Harvard University Press.
- McCay, Bonnie M., and James M. Acheson, eds. 1987. *The question of the commons: The culture and ecology of communal resources*. Tucson: The University of Arizona Press.
- Menzies, Nicholas K. 1994. *Forest and land management in imperial China*. New York: St. Martin’s Press.
- Mitchell, Don. 1995. The end of public space? People’s Park, definitions of the public, and democracy. *Annals of the Association of American Geographers* 85:108–33.
- Netanyahu, Sinaia. 1998. Bilateral water policy coordination under uncertainty. In *Conflict and cooperation on transboundary water resources*, ed. Richard Just and Sinaia Netanyahu, 363–80. Boston: Kluwer Academic Publishers.

- Netting, Robert. 1976. What Alpine peasants have in common: Observations on communal tenure in a Swiss village. *Human Ecology* 4:135–46.
- Omernik, James M. 1987. Ecoregions of the conterminous United States. *Annals of the Association of American Geographers* 77:118–25.
- Omernik, James M., and Robert. Bailey. 1997. Distinguishing between watersheds and ecoregions. *Journal of the American Water Resource Association* 33:935–49.
- Ostrom, Elinor. 1990. *Governing the commons: The evolution of institutions for collective action*. Cambridge, U.K.: Cambridge University Press.
- . 1997. Private and common property rights. *Encyclopedia of Law and Economics*. <http://encyclo.findlaw.com/2000book.pdf> (last accessed 3 February 2003).
- Ostrom, Elinor, Joanna Burger, Christopher B. Field, Richard B. Norgaard, and David Policansky. 1999. Revisiting the commons: Local lessons, global challenges. *Science* 284:279–82.
- Pattison, William D. 1964. The four traditions of geography. *Journal of Geography* 63:211–16.
- Peuquet, Donna J. 1988. Representations of geometric space: Toward a conceptual synthesis. *Annals of the Association of American Geographers* 78:375–94.
- Price, Edward T. 1995. *Dividing the land: Early American beginnings of our private property mosaic*. University of Chicago Research Paper no. 238. Chicago: University of Chicago Press.
- Reed, Maureen G. 1995. Cooperative management of environmental resources: A case study from Northern Ontario, Canada. *Economic Geography* 71:132–49.
- Reiser, Marc. 1986. *Cadillac desert*. New York: Viking Press.
- Richey, Jeffery E. 2000. Spatial techniques for understanding commons issues. In *Protecting the commons: A framework for resource management in the Americas*, ed. Joanna Burger, Elinor Ostrom, Richard B. Norgaard, David Policansky, and Bernard D. Goldstein, 273–92. Washington, DC: Island Press.
- Roberts, Rebecca S., and Jacque Emel. 1992. Uneven development and the tragedy of the commons: Competing images for nature-society analysis. *Economic Geography* 68:249–72.
- Runge, C.Ford. 1983. Common property and collective action in economic development. In *Common property and resource management*, prepared by Panel on Common Property Resource Management Board on Science and Technology for International Development Office of International Affairs National Research Council, 31–60. Washington, DC: National Academy Press.
- Sack, Robert David. 1973. A concept of physical space in geography. *Geographical Analysis* 5:16–34.
- . 1983. Human territoriality: A theory. *Annals of the Association of American Geographers* 73:55–74.
- Saff, Grant. 1996. Claiming a space in a changing South Africa: The “squatters” of Marconi Beam. *Annals of the Association of American Geographers* 86:235–55.
- Sauer, C. O. 1925. The morphology of landscape. In *University of California Publications in Geography*, Vol. 2, 19–53. Berkeley: University of California Press.
- Schaefer, Fred K. 1953. Exceptionalism in geography: A methodological examination. *Annals of the Association of American Geographers* 43:226–49.
- Schlager, Edella, and Elinor Ostrom. 1992. Property rights regimes and natural resources: A conceptual analysis. *Land Economics* 68:249–62.
- Schlager, Edella, and Elinor Ostrom. 1993. Property rights regimes and coastal fisheries: An empirical analysis. In *The political economy of customs and culture*, ed. Terry Anderson and Randy Simmons, 13–41. Lanham, MD: Rowman and Littlefield Publishers.
- Schroeder, Richard A. 1997. “Reclaiming” land in The Gambia: Gendered property rights and environmental intervention. *Annals of the Association of American Geographers* 87:487–508.
- Semple, Ellen Churchill. 1903. *American history and its geographic conditions*. Boston: Houghton and Mifflin.
- Spate, O. H. K. 1960. Quantity and quality in geography. *Annals of the Association of American Geographers* 50:377–94.
- Taaffe, Edward J. 1974. The spatial view in context. *Annals of the Association of American Geographers* 64:1–16.
- Teclaff, Ludwik A. 1996. Evolution of the river basin concept in national and international water law. *Natural Resources Journal* 36:359–91.
- Tietenberg, Tom. 1992. *Environmental and natural resource economics*. New York: HarperCollins Publishers.
- Watts, Michael. 1983. *Silent violence: Food, famine, and peasantry in northern Nigeria*. Berkeley: University of California Press.
- Wilson, James, Robert Costanza, Bobbi S. Low, and Elinor Ostrom. 2001. Scale misperceptions and the spatial dynamics of a social-ecological system. In *Institutions, ecosystems, and sustainability*, ed. Robert Costanza, Bobbi S. Low, Elinor Ostrom, and James Wilson, 59–76. Boca Raton, LA: Lewis Publishers.
- Wolf, A. 1998. Conflict and cooperation along international waterways. *Water Policy* 1:251–65.
- Wolf, Aaron, Shira Yoffe, and Mark Giordano. 2003. Basins at risk: The determinants of conflict and cooperation over international transboundary waters. *Water Policy* 5: 31–62.
- Young, Emily. 2001. State intervention and abuse of the commons: Fisheries development in Baja California Sur, Mexico. *Annals of the Association of American Geographers* 91:283–306.
- Young, Oran. 1996. Rights, rules, and resources in international society. In *Rights to nature: Ecological, economic, cultural, and political principles of institutions for the environment*, ed. Susan S. Hanna, Carl Folke, and Karl-Göran Mäler, 245–64. Washington, DC: Island Press.
- . 2002. Institutional interplay: The environmental consequences of cross-scale interactions. In *The drama of the commons*, ed. Elinor Ostrom, Thomas Dietz, Nives Dolsak, Paul C. Stern, Susan Stonich, and Elke U. Weber, 263–92. Washington, DC: National Academy Press.
- Zimmerman, Erich. 1933. *World resources and industries*. New York: Harper and Brothers.

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