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Replacing Spectrum Auctions with a Spectrum Commons

STUART BUCK

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I. INTRODUCTION

¶1 Imagine the following scenario:

> You are at a crowded party. As is typical of parties, many people are carrying on conversations at once, and the air is full of noise. In fact, you are having trouble hearing what other people are saying due to the din. Suddenly, the door opens, and several federal agents appear, badges in hand. "Your attention please," their leader says sternly. "Because so many people are talking too loud, causing others to have trouble hearing their own conversations, the newly-established Federal Speech Commission will now exercise its plenary authority to regulate conversations. Since some of you are having trouble hearing each other, we decree that in order for anyone to have a conversation for the rest of the night, you must first get our permission--and we will base our permission on whether you can convince us that your planned conversational topic is indeed worthy of discussion (after all, sound waves are scarce, and we wouldn't want anyone wasting perfectly good sound waves on chit-chat). Furthermore, we will not allow any improper language, and we would appreciate your efforts to talk about serious subjects such as philosophy, politics or foreign affairs. Thank you for your attention, and you can begin lining up to get permission to talk."
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> As time went on, everyone got accustomed to the Federal Speech Commission, and its officious regulation of any and all party conversations. Before long, however, a few people had a bright idea. Instead of having the FSC representatives decide on who got to speak and when, why not allow the people themselves to decide as long as they bought the right to do so? That is, let the FSC sell off the right to speak at parties, and whoever wanted most to speak could simply bid the highest. It would make money for the government, and would encourage economic efficiency. It also seemed like a step towards personal freedom.
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> Of course, since sound waves were scarce, and since the FSC still had authority to regulate and allocate the right to talk, it would be necessary to have restrictions on the subjects that could be discussed, or the language that could be used, or on the number of talkers allowed at any one time.

Law Clerk, Judge Stephen F. Williams, D.C. Circuit Court of Appeals, 2001-02; former law clerk, Judge David A. Nelson, United States Court of Appeals for the Sixth Circuit, 2000-01; J.D., Harvard Law School, 2000. Thanks to Lawrence Lessig and Yochai Benkler for their inspiration and advice, and to Thomas Hazlett and Douglas Lichtman for their helpful comments.

> And despite the FSC's admirable purpose, something seemed faintly amiss about the government *selling* the right to speak, whether at parties or elsewhere. No one ever seemed to consider how it was that the government could claim the right to sell speakers' licenses in the first place. Nevertheless, the auction idea took off, and the FSC busied itself with raising exorbitant amounts of money thereby.

¶2 Now, the obvious problem with this imaginary scenario is that it just seems far too intrusive and overweening. In order to promote lively and entertaining party conversations that do not drown everyone else out, it is simply not necessary to license the speakers individually, or to sell the right to speak. The goal of promoting easy listening at parties could be attained by the straightforward measure of asking everyone to lower their voices, in other words, by a sort of power restriction. Moreover, it is not necessary that the federal government does the asking--each party host can take it upon himself to ask the party guests to speak more softly. If the party as a whole disturbs the peace, the local police are perfectly capable of handling the situation by requesting the partiers to quiet down. In short, even though it can be difficult to converse at a loud party, we leave the decisions on how to regulate sound waves with individual speakers themselves, and with local authorities as a last resort. Never does the federal government concern itself with localized problems of sound wave interference.

¶3 Though there exists no Federal Speech Commission (not yet anyway), this fable of mine is not as far from reality as it might seem. For the past several decades, the Federal Communications Commission has regulated who can speak using the electromagnetic spectrum, and when, where, how much, for what purposes, and even at times on what subjects. The rationale for the FCC's regulatory regime has traditionally been the "scarcity" of the spectrum. Yet, even though this rationale has been debunked many times, the FCC continues its regulatory mission unabated.

¶4 Many commentators and scholars, most famously Ronald Coase,[1] have advocated that the solution to this over-regulation is that government should *sell* the rights to the spectrum, rather than issue licenses by bureaucratic fiat. Since the FCC began spectrum auctions in 1993, following the mandate of the Balanced Budget Act of 1993, those same commentators have applauded as the spectrum has been auctioned off, bit by bit, to the highest bidder. Our society's attachment to spectrum auctions developed so quickly that storms of protest arose when the government decided not to auction, but to give away, the spectrum for digital television broadcasts.[2]

¶5 But the auction "solution" only masks an underlying problem, which is that spectrum is misconceived in the first instance as a form of property that necessarily requires individualized allocation. The spectrum auction regime retains the government in its traditional role of providing centralized allocation and bureaucratic enforcement of monopoly rights to the spectrum. This regime functions as a barrier to entry for those mid-level companies that might have the most innovative ideas about spectrum usage. Additionally, by requiring that all spectrum users buy access to the spectrum, either from the FCC or from middlemen, the auction regime makes it more expensive for rural and poorer users to participate in modern media, for example, accessing the Internet via wireless radios.[3] Land-line access is often quite expensive, and even though wireless access

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[1] Ronald Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1 (1959).

[2] *See, e.g.*, William Safire, *Stop the Giveaway*, N.Y. TIMES, Sept. 4, 1996, at A21.

[3] A comparison of cost proposals for Internet access to a Colorado Springs school district is enlightening. The bid offered by US West, a land-line telephone company, asked that the school district pay initial installation

is usually cheaper, expanding the availability of wireless access with a spectrum commons would make it far cheaper yet.

¶6 To make matters worse, the federal government seems to be proceeding on outdated assumptions about technology. It assumes that interference is a problem that requires individual allocation, whereas new technological developments, such as spread spectrum and ultra-wideband radio, make it possible for many users to use the same broad swath of spectrum simultaneously without interference. In the provocative words of George Gilder: "At a time when the world is about to take to information superhighways in the sky--plied by low-powered, pollution-free computer phones--the FCC is in danger of building a legal infrastructure and protectionist program for information smokestacks and gas guzzlers."[4]

¶7 Even if the FCC had never attempted to regulate speech content directly, it would still inhibit speech by the very fact that we have a centralized allocation system in which only a few select people or organizations gain access to government-sponsored monopolies over the airwaves. As former FCC chairman Charles Ferris noted, "By allocating spectrum, the FCC necessarily makes decisions about the content of the information disseminated over the airwaves."[5] He explains further:

> Consideration by the FCC of information content is inherent in the entire system of frequency allocation.□□□ When it allocates spectrum to cellular radio, land mobile service, direct broadcast satellite, or public safety use, the Commission inevitably decides among competing uses of those frequencies and determines the "content" of the information to be carried on the airwaves.[6]

¶8 Thus, the auction solution to the problem of FCC regulation may be no better than the previous system of license allocation. Just as it would seem problematic for the government to *sell* the right to have party conversations, it should seem equally problematic for the government to *sell* the right to use communications equipment. It is troubling for the government to be involved *at all* in deciding who gets to speak, when, and where, and for what purposes, as is still the case under the FCC auction system. If a local school, for example, wishes to use wireless radios in an unused portion of the broadcast spectrum to connect to the Internet, the FCC can invade the school and seize its transmitters, even if the transmitters are discrete and sophisticated enough that they avoid any actual interference with broadcasters. This sort of government control would be unthinkable in the context of sound waves, e.g., the Federal Speech Commission crashing in and demanding that everyone get its permission to speak. Rather than treating electromagnetic waves and sound waves as functionally equivalent--which they certainly are--we use vastly different systems of regulation for the two types of waves.

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costs of $1.5 million, and monthly access charges of $12,000 for a T-1 line with bandwidth of 1.54 megabytes per second. In sharp contrast, a bid from OMC for *wireless* access asked for an installation charge of $601,000, with *no* monthly access charges thereafter, for a total bandwidth of 12 megabytes per second. One Economic Comparison, School Dist. 20, Colo. Spgs., *available at*. The reason for this cost difference is simple--wireless radio access does not require the same continuing service that a physical phone line would.

[4] George Gilder, *Auctioning the Airwaves*, FORBES ASAP, April 11, 1994, *available at http*://www.seas.upenn.edu:8080/~gaj1/auctngg.html.

[5] Charles D. Ferris & Terrence J. Leahy, *Red Lions, Tigers and Bears: Broadcast Content Regulation and the First Amendment*, 38 CATH. U. L. REV. 299, 303 (1989).

[6] *Id.* at 312.

¶9 This disparity in regulation is nonsensical.[7] Following the visionary lead of Lawrence Lessig and Yochai Benkler,[8] I argue that the spectrum might be best governed, at least in part, as a commons. There is good reason to fear that the spectrum may soon be irrevocably privatized,[9] and thus indefinitely subject to the heavy hand of centralized regulation, unless we take seriously the arguments for regulating the spectrum as a commons.

¶10 How would such a regime operate? Expanding on Benkler's and Lessig's work, I suggest that we examine the burgeoning literature on how successful commons are managed and created. Numerous studies and books have described common-pool systems for allocating land and other resources.[10] Despite the usual concerns about the "tragedy of the commons,"[11] the world offers many examples of non-tragic commons that have been employed successfully for centuries.[12] Analyzing how successful commons develop and operate should offer fruitful insights as to how a commons in the electromagnetic spectrum could work.

¶11 A commons in the spectrum could offer several benefits, including greater freedom to experiment with local variations on spectrum usage, a greater incentive to develop technologies for spectrum sharing (such as spread spectrum radios or ultra-wide-band technology), and a greater harnessing of widely-dispersed information about spectrum usage. Additionally, regulating the spectrum as a commons might facilitate efficient transactions among competing users, and make economies of scale feasible for cross-boundary uses. The potential benefits are great enough to justify serious consideration of the commons as a regulatory possibility.

¶12 Now for a short outline of the article: In Part II of this piece, I briefly describe the genesis and current status of spectrum auctions in the United States. Following that, I propose a system of regulating the spectrum as a Common Property Regime (CPR), based on scholarship that investigates the conditions for creating successful

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[7] As Krattenmaker and Powe say, "Suppose that the government now decides to add to its ownership of the airwaves the ownership of the air as well. If it were to do so, then the government could demand that all outdoor speech conform to rules regulating the use of the public's air because, of course, speech travels through the air. Absurd? We think so." THOMAS G. KRATTENMAKER & LUCAS A. POWE, JR., REGULATING BROADCAST PROGRAMMING 228 (1994) (citation omitted).

[8] *See* Yochai Benkler, *Overcoming Agoraphobia: Building the Commons of the Digitally Networked Environment*, 11 HARV. J.L. & TECH. 287, 394 (1998); Yochai Benkler & Lawrence Lessig, *Net Gains*, THE NEW REPUBLIC, Dec. 14, 1998, *available at* http://www.thenewrepublic.com/archive/1298/121498/benklerlessig121498.html (last visited Aug. 14, 2001); Lawrence Lessig, *Symposium: Commons and Code*, 9 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 405 (1999).

[9] As Yochai Benkler puts it, "Exhaustive privatization□□□ would privatize the entire usable spectrum, thereby effectively eliminating the possibility that a spectrum commons will develop." Benkler, *supra* note 8, at 293.

[10] *See generally* THE POLITICAL ECONOMY OF CUSTOMS AND CULTURE: INFORMAL SOLUTIONS TO THE COMMONS PROBLEM (Terry L. Anderson & Randy T. Simmons eds., 1993); COMMON PROPERTY RESOURCES: ECOLOGY AND COMMUNITY-BASED SUSTAINABLE DEVELOPMENT (Fikret Berkes ed., 1989); MAKING THE COMMONS WORK: THEORY, PRACTICE, AND POLICY (Daniel W. Bromley ed., 1992); THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES (Bonnie J. McCay & James M. Acheson eds., 1987); DAVID RALPH MATTHEWS, CONTROLLING COMMON PROPERTY: REGULATING CANADA'S EAST COAST FISHERY (1993); ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990); GLENN G. STEVENSON, COMMON PROPERTY ECONOMICS: A GENERAL THEORY AND LAND USE APPLICATIONS (1991); F. Berkes et al., *The Benefits of the Commons*, 340 NATURE 91 (1999).

[11] Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968). Hardin's description of the over-exploitation of English common fields has been challenged as historically inaccurate. Susan Jane Buck Cox, *No Tragedy on the Commons*, 7 ENVTL. ETHICS 49 (1985).

[12] Worth noting is that Garrett Hardin himself later said, "The title of my 1968 paper should been 'The Tragedy of the *Unmanaged* Commons.'" Garrett Hardin, *The Tragedy of the* Unmanaged *Commons: Population and the Disguises of Providence*, *in* COMMONS WITHOUT TRAGEDY: PROTECTING THE ENVIRONMENT FROM OVERPOPULATION–A NEW APPROACH 162, 178 (Robert V. Andelson ed., 1991).

CPRs in physical resources. In a short Conclusion, I sum up the case for the spectrum commons.

II. THE HISTORY OF SPECTRUM AUCTIONS

¶13 The history of spectrum auctions is not a promising story for visionary legal scholars who hope to influence public policy. Selling the rights to broadcast spectrum was first proposed by a Chicago law student named Leo Herzel in 1951.[13] Ronald Coase then advocated the auctioning of spectrum in his famous 1959 article on the FCC.[14] And through the years, other scholars occasionally proposed market-based mechanisms for allotting spectrum.[15] It was not until 1993, however, that Congress finally decided to follow the advice of these scholars and auction the spectrum.

¶14 The Omnibus Budget Reconciliation Act of 1993,[16] which added Section 309(j) to the Communications Act of 1934,[17] authorized the FCC to sell monopoly rights to radio spectrum via competitive bidding. Congress directed the FCC to award spectrum licenses by the auctioning process, in order to "protect the public interest," and to promote other objectives, including the "speedy development and deployment of new technology and services to benefit the public, including rural areas; economic development and competition through broad distribution of licenses and diversity among license holders; recovery for the public of some of the commercial value of the spectrum and avoidance of unjust enrichment; and efficient and intensive spectrum usage."[18]

¶15 Pursuant to this congressional mandate, the FCC created the Wireless Telecommunications Bureau (WTB) on December 1, 1994,[19] which in running the spectrum auctions has become the busiest division of the FCC. As of March 5, 2002, the WTB had conducted 45 separate spectrum auctions with a total of 21,853 licenses awarded and governmental receipts of nearly $42 billion.[20]

¶16 Based on its expanded auction authority granted by the Balanced Budget Act of 1997,[21] the FCC plans to eventually auction the spectrum for "all full power

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[13] Leo Herzel, Comment, *"Public Interest" and the Market in Color Television Regulation*, 18 U. CHI. L. REV. 802 (1951).

[14] Coase, *supra* note 1.

[15] *See, e.g.*, Arthur S. De Vany et al., *A Property System for Market Allocation of the Electromagnetic Spectrum: A Legal-Economic-Engineering Study*, 21 STAN. L. REV. 1499 (1969); Mark S. Fowler & Daniel L. Brenner, *A Marketplace Approach to Broadcast Regulation*, 60 TEX. L. REV. 207 (1982); ITHIEL DE SOLA POOL, TECHNOLOGIES OF FREEDOM 128-38 (1983); Thomas W. Hazlett, *Assigning Property Rights to Radio Spectrum Users: Why Did FCC License Auctions Take 67 Years?*, 41 J.L. & ECON. 529, 534 (1998) (providing a table of unsuccessful proposals to sell spectrum access).

[16] Omnibus Budget Reconciliation Act, Pub. L. No. 103-66 (1993) (relevant sections codified at 47 U.S.C. §§ 309(i) and (j) (1998)).

[17] 48 Stat. 1064, 47 U.S.C. § 151 et seq. (1934).

[18] 47 U.S.C. § 309(j)(1998).

[19] The WTB was created by a merger of three FCC divisions: the Private Radio Bureau, the Spectrum Auctions Task Force, and the Mobile Services Division of the Common Carrier Bureau.

[20] Current auction data are available athttp://wireless.fcc.gov/auctions/summary.html. It is worth noting that many of the auction licensees are paying off their bids over a 10-year period. *The FCC Report to Congress on Spectrum Auctions*, WT Docket No. 97-150, FCC 97-353, at 1 n.2 (rel. Oct. 9, 1997) [hereinafter "FCC Report"], *available at* http://wireless.fcc.gov/auctions/data/papersAndStudies/fc970353.pdf.

[21] Pub. L. No. 105-33, 111 Stat. 251 (1997) (relevant sections codified at 47 U.S.C. §§ 309(i) and (j) (1998)). As amended, Section 309(j) now provides that, with a few exceptions for certain public safety noncommercial services and noncommercial public broadcast stations, the "Commission shall grant the license or permit to a qualified applicant through a system of competitive bidding" if mutually exclusive applications are received for any initial license or construction permit.

commercial radio and analog television stations."[22] Scheduled auctions for the near future include spectrum in the 218–219 MHz range, as well as certain FM and AM broadcast radio frequencies.[23] The FCC also plans to reallocate 60 MHz of spectrum that was formerly allocated to broadcast television channels 60 through 69,[24] although that reallocation has been highly contentious. [25] For a 6 MHz area of spectrum adjoining public safety spectrum, the FCC has announced a new class of commercial licenses: the Guard Band Manager License.[26] Guard Band Managers will "be engaged in the business of subdividing the spectrum they acquire at auction and leasing it for value to third parties, including both commercial service providers and private wireless users."[27] They will be held to "strict frequency coordination and interference rules," but may otherwise subdivide their spectrum in any manner that they choose.[28] With only one dissenter, [29] the FCC claims that this "innovative spectrum management approach" will allow people "to more readily acquire spectrum for varied uses" and will result in a "more efficient use of this limited resource."[30] The guard band auction, completed in September of 2000, raised nearly $520 million, selling 96 licenses to nine winning bidders.[31] Eight guard band licenses left unsold were auctioned in February 2001, and raised another $21 million.[32]

¶17 Many other countries, inspired by the United States' example, plan to auction spectrum. According to an FCC Report, Mexico has licensed the FCC's auction system, and the FCC has demonstrated the system to representatives of Argentina, Australia, Brazil, Canada, Hungary, Peru, Russia, South Africa, and Vietnam.[33]

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[22] FCC First Report and Order, In the Matter of Implementation of Section 309(j) of the Communications Act--Competitive Bidding for Commercial Broadcast and Instructional Television Fixed Service Licenses, FCC 98-194, 13 FCC Reg. 15920 at ¶ 9 (1998). The FCC also intends to auction all pending mutually exclusive applications for any secondary broadcast services. *Id.*

[23] *See* http://wireless.fcc.gov/auctions/summary.html#scheduled.

[24] *See* 47 U.S.C. § 337(a), amended by the Balanced Budget Act of 1997, Pub. L. No. 105-33, 111 Stat. 251, § 3004 (1997) (directing that 24 MHz of spectrum be reallocated for public safety use and 36 MHz be reallocated for commercial use).

[25] *See, e.g.*, Stephen Labaton, *The Battle of the Bandwidths*, N.Y. TIMES (Aug. 11, 2000), *available at*http://www.nytimes.com/library/tech/00/08/biztech/articles/11spectrum.html; Heather Forsgren Weaver, *CTIA to Sue if Private Wireless Gets Spectrum*, 18 RCR RADIO COMM. REPORT, Dec. 20, 1999.

[26] FCC Adopts Rules for Guard Band Manager Auction, Mar. 9, 2000, *at* http://ftp.fcc.gov/Bureaus/Wireless/News_Releases/2000/nrwl0009.html. For a more complete description of the Guard Band auction, *see* Auction of Licenses for the 700 MHz Guard Bands Scheduled for June 14, 2000, *available at* http://www.fcc.gov/Bureaus/Wireless/Public_Notices/2000/da000559.txt.

[27] FCC Adopts Rules for Guard Band Manager Auction, Mar. 9, 2000, *at* http://ftp.fcc.gov/Bureaus/Wireless/News_Releases/2000/nrwl0009.html.

[28] *Id.*; *see also* Stephen Labaton, *F.C.C. to Promote a Trading System to Sell Airwaves*, N.Y. TIMES ON THE WEB, Mar. 13, 2000, *available at* http://partners.nytimes.com/library/tech/00/03/biztech/articles/13spec.html (noting that FCC's rules "would create a trading system in which telecommunications companies of all kinds□□□ could bid for underused slivers of the spectrum that are already under the control of other companies").

[29] FCC Commissioner Harold Furchtgott-Roth dissented from the restrictions barring cellular usage in the "guard bands" and the restriction of sale to "guard band managers." Commissioner Harold Furchtgott-Roth Argues for Greater Flexibility in Guard Bands, Mar. 9, 2000, *available at* http://ftp.fcc.gov/Speeches/Furchtgott_Roth/Statements/2000/sthfr013.html. Furchtgott-Roth argues that he would rather have allowed any "technically-compliant applicant to bid on the guard bands, rather than limiting eligibility to 'guard band managers,'" and that the FCC's "market" solution actually "blocks innovation and invites government micro-management." *Id.* Despite Furchtgott-Roth's dissent, however, allowing spectrum users to reallocate their piece of the spectrum would be a step forward from the current situation in which the FCC involves itself in approving every license transfer. *See, e.g.*, *Wireless Telecommunications Bureau Grants Consent to Assign C and F Block Broadband PCS Licenses*, Sept. 19, 2000, *available at* http://www.fcc.gov/Bureaus/Wireless/Public_Notices/2000/da002137.txt.

[30] Furchtgott-Roth, *supra* note 29.

[31] George Leopold, *Presidential Election Puts FCC at a Crossroads*, ELEC. ENG'G TIMES, Oct. 2, 2000.

[32] *Second 700 MHz Guard Band Spectrum Auction Closes*, FCC News Release, Feb. 22, 2001, *available at*http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-210396A1.pdf.

[33] FCC Report, *supra* note 20, at 19.

¶18 Spectrum auctioning has also received vast support by academics. Numerous scholars and policy analysts advocate auctioning and private ownership as the most efficient method of spectrum allocation.[34] The FCC has looked to many of those same scholars for help in designing the auctioning process so as to raise the maximum possible revenue.[35] One scholar noted that the first FCC auction in 1994 was "the biggest use of economic theorists as consultants" since the 1984 breakup of AT&T.[36] Those few academics who criticize our current auction policy tend to do so on the basis that the FCC retains too much control over the usage requirements, and propose that we should let the auction winners re-allocate their piece of the spectrum as they choose.[37] Professor Robinson, for example, argues that "subsequent transferability" is necessary to allow spectrum usage to "adapt to changing economic and technological circumstances."[38] In a recent filing with the FCC, no fewer than 37 of the most prominent economists who have studied the spectrum (including the eminent Ronald Coase) urged that the FCC drop its restrictions on spectrum usage by current licensees and allow secondary markets to emerge.[39]

¶19 In short, the practice of auctioning spectrum seems almost inevitable at this point. Yet it was not that long ago that abandoning the FCC's comparative licensing process in order to auction spectrum would have been inconceivable. The arguments against auctioning must be considered, whatever their chances of political approval might seem at the moment.

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[34] *See, e.g.*, PETER HUBER, LAW AND DISORDER IN CYBERSPACE (1997); Evan R. Kwerel and John R. Williams, *Moving Toward a Market for Spectrum, available at*http://www.cato.org/pubs/regulation/reg16n2e.html; John McMillan, *Why Auction the Spectrum* 6 (1994), *available at* http://www.market-design.com/files/mcmillan-why-auction-the-spectrum.pdf; Gregory L. Rosston & Jeffrey S. Steinberg, *Using Market-Based Spectrum Policy to Promote the Public Interest*, 50 FED. COMM. L.J. 87 (1997); Adam D. Thierer, *A Policy Maker's Guide to Deregulating Telecommunications Part 6: A Free-Market Future for Spectrum*, *in* TALKING POINTS No. 11 (Heritage Foundation, 1996), *available at* http://www.heritage.org/library/categories/regulation/tp11.html; Brian C. Fritts, Note, *Private Property, Economic Efficiency, and Spectrum Policy in the Wake of the C Block Auction*, 51 FED. COMM. L.J. 849 (1999).

[35] One economist, for example, served as an auction advisor to the FCC *and* to several communications firms, including PageNet, MCI, Pocket Communications, and CD Radio. Peter Cramton, *The Efficiency of the FCC Spectrum Auctions*, 41 J.L. & ECON. 727, 727 (1998).

[36] John McMillan, *Selling Spectrum Rights*, 8 J. ECON. PERSPECTIVES 145, 146 (1994).

[37] *See, e.g.*, Arthur De Vany, *Implementing a Market-Based Spectrum Policy*, 41 J.L. & ECON. 627, 628 (1998) ("Only when we have unbundled spectrum and broadcasting assets to create deep and liquid markets in spectrum bandwidth and its derivatives will we capture the full promise of spectrum markets that Herzel and Coase contemplated."); Howard A Shelanski, *The Bending Line Between Conventional "Broadcast" and Wireless "Carriage,"* 97 COLUM. L. REV. 1048, 1079 (1997) (proposing that the "fundamental rule should be to de-zone spectrum usage where possible"); Pablo T. Spiller & Carlo Cardilli, *Towards a Property Rights Approach to Communications Spectrum,* 16 YALE J. ON REG. 53, 82 (1999) (suggesting that the FCC should "publicly auction fully transferable warrants, each enabling an existing specific operating license to be converted to a full property right"); Lawrence J. White, *"Propertyzing" the Electromagnetic Spectrum: Why It's Important, and How to Begin*, 9 MEDIA L. & POL'Y 19, 20-21 (2000); Fritts, *supra* note 34, at 884 (arguing that the FCC should grant full property rights in spectrum).

One prominent auction critic, Eli Noam, has proposed a new system involving an instantaneous "spot market" in spectrum, in which spectrum users would buy access codes in real time from a central clearinghouse. Eli Noam, *Spectrum Auctions: Yesterday's Heresy, Today's Orthodoxy, Tomorrow's Anachronism – Taking the Next Step to Open Spectrum Access*, 41 J.L. & ECON. 765, 777 (1998). Noam's proposal has been criticized, however, as merely replicating a system of auctions on a much grander scale. Thomas W. Hazlett, *Spectrum Flash Dance: Eli Noam's Proposal for "Open Access" to Radio Waves*, 41 J.L. & ECON. 805, 814 (1998); Timothy J. Brennan, *The Spectrum as Commons: Tomorrow's Vision, not Today's Prescription*, 41 J.L. & ECON. 791, 799–800 (1998).

[38] Glen O. Robinson, *Spectrum Property Law 101*, 41 J.L. & ECON. 609, 619–20 (1998).

[39] Comments of 37 Concerned Economists, *In the Matter of Promoting Efficient use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets* (Feb. 7, 2001), *available at* http://www.aei.brookings.org/publications/related/fcc.pdf.

III. A COMMONS REGULATORY REGIME?

A. Why a Commons?

¶20 Why might one prefer a common property regime over strictly individual private property? McKean and Ostrom offer several factors that can make a CPR the preferable system.[40] In this article, however, I focus on the benefits of CPRs that could reasonably be applied to the spectrum.

1. Indivisibility

¶21 If a resource is difficult to divide, such as the ocean or the atmosphere, then managing it as a CPR may be the best possibility.[41] For many years, the spectrum has been seen as "scarce," and thus as requiring division into individual slices allocated to specific companies.[42] (Somewhat disturbingly, the notion of scarcity was often used to justify both content regulation[43] and government allocation, neither of which were ever necessary.[44])

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[40] Margaret McKean & Elinor Ostrom, *Common Property Regimes in the Forest: Just a Relic from the Past?*, 180 UNASYLVA 3, 6-7 (1995). There are other reasons to prefer common property, such as the following:

1. The need to overcome high geographic variability in environmental characteristics such as rainfall or incidence of pests and diseases. *See* Gary D. Thompson & Paul N. Wilson, *Common Property as an Institutional Response to Environmental Variability*, 12 CONTEMP. ECON. POL'Y 10 (1994); Gary D. Thompson & Paul N. Wilson, *Ejido Reforms in Mexico: Conceptual Issues and Potential Outcomes*, 70 LAND ECON. 448, 454 (1994). As Thompson and Wilson note, common property enables farmers and herders to "diversify" their holdings, much as investors in the stock market do. *Id.*

2. High costs of public land registration and policing land boundaries. *See* Brent M. Swallow & Daniel W. Bromley, *Co-management or No Management: The Prospects for Internal Governance of Common Property Regimes through Dynamic Contracts*, 22 OXFORD AGRARIAN STUD. 3, 4 (1994).

[41] McKean & Ostrom, *supra* note 40, at 6-7; *see also* STEVENSON, *supra* note 10, at 76 (arguing that common property is preferable when "the resource is unamenable to being split into individually controlled units").

[42] In the famous *Red Lion* decision, the Supreme Court held:

> [I]t is idle to posit an unabridgeable First Amendment right to broadcast comparable to the right of every individual to speak, write, or publish. If 100 persons want broadcast licenses but there are only 10 frequencies to allocate, all of them may have the same 'right' to a license; but if there is to be any effective communication by radio, only a few can be licensed and the rest must be barred from the airwaves.

Red Lion Broadcasting Co. v. Federal Communications Commission, 395 U.S. 367, 388-89 (1969). To this day, the Court has never renounced the scarcity rationale. *See, e.g.*, Columbia Broadcasting System, Inc. v. Democratic National Committee, 412 U.S. 94, 101 (1973) ("Broadcast frequencies are a scarce resource [that] must be portioned out among applicants."); FCC v. League of Women Voters of California, 468 U.S. 364, 376 (1984) ("[W]e have long recognized that Congress□□□ has power to regulate the use of this scarce and valuable national resource."). It did, however, suggest in *FCC v. League of Women Voters* that it might be prepared to reconsider the doctrine based on new technological developments. *Id.* at 376 n.11 ("The prevailing rationale for broadcast regulation based on spectrum scarcity has come under increasing criticism in recent years.□□□ We are not prepared, however, to reconsider our longstanding approach without some signal from Congress or the FCC that technological developments have advanced so far that some revision of broadcast regulation may be required.").

[43] *See* Nat'l Broad. Co. v. United States, 319 U.S. 190, 226-227 (1943) ("Freedom of utterance is abridged to many who wish to use the limited facilities of radio. Unlike other modes of expression, radio inherently is not available to all."). *See generally* Jonathan W. Emord, *The First Amendment Invalidity of FCC Ownership Regulations*, 38 CATH. U. L. REV. 401 (1989) (describing the many ways in which the scarcity rationale has been used to justify broadcast regulation).

[44] The scarcity metaphor, even if correct, would not require that the government allocate spectrum licenses. As Judge Bork pointed out, "All economic goods are scarce, not least the newsprint, ink, delivery trucks, computers, and other resources that go into the production and dissemination of print journalism." Telecommunication Research & Action Ctr. v. FCC, 801 F.2d 501, 508 (D.C. Cir. 1986). In other words, scarcity is hardly unique to the spectrum--it is a condition common to all resources to some extent (that is, no resource is infinite). Yet it has never been thought necessary for the government to allocate and license the use of wood, steel, or paper.

¶22 Cutting-edge technology, however, promises to make it possible for multiple users to share the same spread of frequencies without interference.[45] This would make the notion of divisibility obsolete. For example, ultra-wideband (UWB) technology might enable cellular phone networks to share spectrum space with other traditional uses, by using nanosecond pulses at extremely low power (i.e., in the millionths of a watt) spread out over an extremely wide spectrum band. The receiving devices would know how to decode the transmission, which would appear as background noise to traditional receivers.[46]

¶23 The possibilities raised by new technologies are described aptly by telecommunications activist Dave Hughes:

> First of all, using digital signal processors, a radio can be made to disassemble a stream of data fed into it from a source. It can be made to do this right down to the sub-byte level – bundle it into tiny packets of data, and transmit those packets in short bursts in random ways over a wide range of frequencies.□□□ This can be done at low levels of power, while a corresponding radio at the other end, using the same proprietary algorithms used by the first radio, can capture and analyze those packets, re-assemble them perfectly, and feed them into a receiving system or network.
>
> Secondly, error-correcting techniques possible for digital signaling can even deal robustly with the interference that does occur. If a great deal of interference occurs, the usual effect is the slowing down (from retrying to get the signal through perfectly) of the rate of data exchange, not its complete failure.
>
> .□□□
>
> In other words, spread spectrum, using frequency hopping techniques can co-exist with other radios using the same frequencies or bands. In fact there can be 'spectrum sharing' to such a degree that it is no longer necessary for the FCC to award licenses to just one transmitting entity operating in an area. There still have to be rules, of course, but very different rules, for this new era of digital radio.[47]

¶24 Another means of avoiding spectrum interference among cellular phone and wireless Internet users would involve such products as Adaptive Broadband's AB-Access. This product scans available frequencies to find which of ten available channels has the best signal from a base station. "If several devices or the base station itself subsequently detects 'noise' in the channel, the base station controller intelligently moves the entire group of affected subscribers to another channel to avoid the interference."[48] Thus, by using devices that are "smart" enough to seek

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[45] For a good overview of new technologies, *see* Leander Kahney, *The Third-Generation Gap*, SCI. AM., Oct. 2000, *available at* http://www.sciam.com/article.cfm?articleID=00031A96-ADF7-1C73-9B81809EC588EF21&..

[46] UWB technology is being developed by such companies as Time Domain of Huntsville, Alabama. Avery Comarow, *Larry Fullerton: Seeing Through Walls, Tracking Down Your Car*, U.S. NEWS & WORLD REPORT, Jan. 10, 2000, at 64. According to Tim Shepard of the MIT Laboratory for Computer Science, UWB could make centralized allocation and regulation of the radio spectrum unnecessary in the future. Tim Shepard, *Getting the Most Value Out of the Radio Spectrum*, Talk presented at the Ultra Wide Band Conference at 6, Washington, D.C., Sept. 29, 1999.

[47] David R. Hughes, *The Case for Shared Wireless Public Spectrum*, The Cook Report on Internet, *available at* http://wireless.oldcolo.com/course/case2.txt.

[48] Daniel L. Scharre, Bill Anderton, & Robert Campbell, *Don't fear the U-NII*, TELEPHONY, Sept. 20, 1999, *available at* http://industryclick.com/magazinearticle.asp?releaseid=2843&magazinearticleid=15734&siteid=3&magazineid=7.

clear channels before transmitting or receiving, spectrum interference can be avoided.[49]

¶25 As Timothy Shepard has demonstrated, multihop packet radio network technology may make it possible for millions or billions of network users in a single metropolitan area to communicate effectively without interfering with each other.[50] Even with "completely decentralized control,"[51] the "performance of such a system could rival that of traditional metropolitan area telephone systems."[52] "Decentralized control" might be a misnomer, as there would obviously need to be some means, governmental or otherwise, of assuring that the communications equipment in use is compatible spread spectrum technology instead of conventional, powerful transmitters that would cause too much interference. What Shepard means by decentralization, however, is that "no system-wide coordination is needed to manage the use of the channel."[53] In other words, no central authority would have to allocate any specific channels or pieces of spectrum to particular users or companies.[54]

¶26 Because these newer technologies are by definition used over a broad range of spectrum, the concept of divisibility and individual allocation becomes meaningless. If such technologies are the best and most efficient way to use the spectrum for some applications, then the spectrum should be seen as an indivisible resource as to those applications. This in turns implies that some sort of common pool regime might be the best way of governing at least some areas of the spectrum.

2. "Productive efficiency through the internalization of externalities"[55]

¶27 In many situations, the use of one tract of land may affect the use of other land. For example, changing the forestation pattern on a hill may affect the water supply for downhill fields. If all such land is owned in relatively small parcels by different individuals, they will have to engage in Coasian bargaining in order to reach the efficient result--and high transaction costs may make such bargaining infeasible. Creating a common property regime can enable the collective group to take those externalities into account, thus acting as a single owner would.[56] Similarly, the productivity of one parcel of land may be greater if adjacent land can be put to a complementary use. Collective management helps to overcome the transaction costs that inhibit people from making the many individualized deals that would be

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[49] In the words of George Gilder:

> [I]nnovations from such companies as Steinbrecher and Qualcomm Inc. of San Diego overthrow this [scarcity] paradigm. Not only can numerous radios operate at non-interfering levels in the same frequency band, they can also *see* other users' signals and move to avoid them. In baseball jargon, the new radios can hit 'em where they ain't; in football idiom, they run for daylight. If appropriately handled, these technologies can render spectrum not scarce but abundant.

Gilder, *supra* note 4.

[50] Timothy J. Shepard, *A Channel Access Scheme for Large Dense Packet Radio Networks* 10, Proceedings of ACM SIGCOMM, Stanford University, Cal. (1996).

[51] *Id.* at 10.

[52] *Id.* at 11.

[53] *Id.* at 6.

[54] Shepard was presaged in Pool's famous 1983 book on broadcast regulation, which stated that "new multiplexing approaches in which signals are separated from each other by means other than frequency bands may make obsolete the notion of defining rights to use the spectrum primarily by frequency assignments." ITHIEL DE SOLA POOL, TECHNOLOGIES OF FREEDOM 147 (1983).

[55] Shepard, *supra* note 50, at 7.

[56] For an example of the interactions between small parcels of land and the need to promote efficient interactive policies, *see* T.A. White & C.F. Runge, *Cooperative Watershed Management in Haiti: Common Property and Collective Action*, 46 UNASYLVA 50 (1995).

necessary to ensure complementary usage.[57] One might amplify this point by analogizing to Coase's famous paper on the nature of firms,[58] in which he showed that transaction costs can be avoided by using collective institutions such as firms to structure ongoing business relationships. "[L]ike the Coasian firm," says one scholar, CPRs can enable people to avoid "the prohibitively high transactions costs associated with a system of private contractual arrangements."[59]

3. Economies of scale

¶28 An additional benefit of CPRs might be economies of scale. As Maurizio Merlo notes in his discussion of the Italian *regole* (community forest management):

> The extent of the land base on which communal forestry is practiced (thousands of hectares) allows economies of scale not only for sustained timber production□□□ but also for effective sustainable multipurpose management; these economies of scale are often not possible in individually owned private forest estates, which are generally rather small in Italy.[60]

¶29 Or as Eggertsson notes in discussing Icelandic common pastures, "The use of vast, unfenced mountain pastures suggests important economies of scale in driving the animals up to the mountains in early summer and in searching the afrettir and driving the flocks down again in the fall, but to realize these gains collective action is required."[61]

4. Mobility and range of services

¶30 With the rise of wireless devices as communications tools, it is becoming necessary that users have the ability to travel and move about without losing service. Under the current auction system, individual companies have to compete to acquire aggregated licenses across geographical areas. As John McMillan notes, such aggregation provides the following benefits: 1) a company can "spread [its] fixed costs of technology acquisition and customer-base development"; 2) it can reduce any problems of interference at boundary areas by owning adjacent areas; and 3) it can offer better "roaming" capabilities, enabling customers to travel with less likelihood of interruption in service.[62] But a common pool regime would more effectively produce these same benefits, without the costs of both buying licenses across wide territories (even where the prospects of interference are minimal) and of designing a plan for strategic bidding.

¶31 Similarly, Jon Peha observes that the use of wireless devices to create a "smart environment"[63] actually "requires *open access* to spectrum, i.e., it must be possible to

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[57] McKean & Ostrom, *supra* note 41, at 8.

[58] Ronald Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (Nov. 1937).

[59] Robert A. Blewett, *Property Rights as a Cause of the Tragedy of the Commons: Institutional Change and the Pastoral Maasai of Kenya*, 21 E. ECON. J. 477, 478 (1995).

[60] M. Merlo, *Common Property Forest Management in Northern Italy: A Historical and Socio-economic Profile*, 46 UNASYLVA 58, 62 (1995); *see also* STEVENSON, *supra* note 10, at 76 (arguing that common property is the preferred solution when the technological characteristics of production (*e.g.*, economies of scale) favor it over private property).

[61] Thráinn Eggertsson, *Analyzing Institutional Successes and Failures: A Millennium of Common Mountain Pastures in Iceland*, *in* THE POLITICAL ECONOMY OF CUSTOMS AND CULTURE: INFORMAL SOLUTIONS TO THE COMMONS PROBLEM, *supra* note 61, at 109, 119.

[62] John McMillan, *Selling Spectrum Rights*, 8 J. ECON. PERSPECTIVES 145, 150 (1994); *see also* Lawrence M. Ausubel et al., *Synergies in Wireless Telephony: Evidence from the Broadband PCS Auctions*, 6 J. ECON. & MGMT. STRATEGY 497 (1997) (describing the synergies that are possible when an auction winner is able to obtain licenses in adjacent territories).

[63] For example, an environment wherein various electronic devices can communicate with each other, such as a portable phone communicating with a Palm Pilot, with a desktop computer, etc.

begin transmissions in a particular location without prior consent or licensing procedures."[64] Because some wireless devices will be mobile, it would be exceedingly cumbersome to have to obtain licenses granting "exclusive rights to spectrum at every location where the device might ever reside."[65] So, for certain applications, an unlicensed commons (assuming certain operating protocols) may be the most efficient way to use the spectrum.

B. Tragedy of the Commons?

¶32 In the legal literature on spectrum usage, the word "commons" traditionally occurs only in the phrase "tragedy of the commons." As Arthur De Vany argues, in a wholly typical passage, "Pervasive interference externalities destroy the ability of markets to work efficiently and may prevent them from working at all if the spectrum becomes a commons."[66] In this view, the spectrum if left unregulated would fall victim to over-congestion and chaos, similar to the overgrazing described in Garrett Hardin's famous article.[67] As Thomas Hazlett has said:

> While many□□□ are impressed by the technical agility of "spread spectrum" and other techniques to squeeze much more electronic communications out of any given bandwidth, it is simply not true that the tragedy of the commons has been solved by science. It is, was, and will continue to be solved by rules.□□□ Without an owner to establish primacy (so users may know who, precisely, is colliding with whom), we anticipate a costly race to establish rights.[68]

¶33 The theory that complete privatization or complete governmental control (as in socialism) are the only solutions to the tragedy of the commons is simply not empirically accurate. The past decades have seen literally thousands of studies that demonstrate the existence and viability of commons regimes.[69] Theorists have shown that "no specific property regime can be expected *a priori* to provide the solution to the tragedy of resource degradation."[70] It is simply naive to persist in the blind invocations of the tragedy of the commons that characterize discussions of

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[64] Jon M. Peha, *Wireless Communications and Coexistence for Smart Environments*, *available at*http://www.ece.cmu.edu/~peha/smart.pdf.

[65] *Id.*

[66] Arthur De Vany, *Implementing a Market-Based Spectrum Policy*, 41 J.L. & ECON. 627, 637 (1998).

[67] *See* Hardin, *supra* note 11. Again, note that Hardin's description of the history of the commons has been challenged as inaccurate. *See* Cox, *supra* note 11.

[68] Thomas W. Hazlett, *Spectrum Flash Dance: Eli Noam's Proposal for "Open Access" to Radio Waves*, 41 J.L. & ECON. 805, 815 (1998).

[69] For a staggering collection of research on commons property regimes, *see* the website for the International Association for the Study of Common Property, *at* http://www.indiana.edu/~iascp. For just a smattering of the possible citations, *see* ROBERT NETTING, BALANCING ON AN ALP (1981); ROBERT Y. SIY, JR., COMMUNITY RESOURCE MANAGEMENT: LESSONS FROM THE ZANJERA (1982); Pranab Bardhan, *Symposium on Management of Local Commons*, 7 J. ECON. PERSPECTIVES 87 (1993); L. Carlsson, *Still Going Strong, Community Forests in Sweden*, 72 FORESTRY 11 (1999); Michael J. Casimir & Aparna Rao, *Sustainable Herd Management and the Tragedy of No-Man's Land: An Analysis of West Himalayan Pastures Using Remote Sensing Techniques*, 26 HUM. ECOLOGY 113 (1998); Mark Schoonmaker Freudenberger et al., *Resiliency and Change in Common Property Regimes in West Africa: The Case of the Tongo in the Gambia, Guinea, and Sierra Leone*, 10 SOC'Y & NAT. RESOURCES 383 (1997); Donald R. Leal, *Community-Run Fisheries: Avoiding the "Tragedy of the Commons,"* 19 POP. & ENVT. 225 (1998); Merlo, *supra* note 60; Mark Somma, *Institutions, Ideology, and the Tragedy of the Commons: West Texas Groundwater Policy*, 27 PUBLIUS 1 (1997); Allan H. Smith & Fikret Berkes, *Solutions to the 'Tragedy of the Commons': Sea-urchin Management in St. Lucia, West Indies*, 18 ENVTL. CONSERVATION 131 (1991), *available at* http://home.cc.umanitoba.ca/~berkes/smith_1991.pdf; J.T. Thomson & C. Coulibaly, *Common Property Forest Management Systems in Mali: Resistance and Vitality Under Pressure*, 46 UNASYLVA 16 (1995); David Ward et al., *Land Degradation Is Not a Necessary Outcome of Communal Pastoralism in Arid Namibia*, 40 J. OF ARID ENVIRONMENTS 357 (1998).

[70] Bruce A. Larson & Daniel W. Bromley, *Property Rights, Externalities, and Resource Degradation*, 33 J. DEV. ECON. 235, 255 (1990).

the spectrum, especially considering that the spectrum (unlike other properties) is non-depletable and may soon approach non-rivalrousness with certain new technologies.[71]

¶34 One cause of the conceptual confusion surrounding the "tragedy of the commons" is the misconception that property has to fall within one of three categories: Total privatization (a la Blackstone), total governmental control, or totally open to all to use without constraints.[72] In fact, however, making distinct classifications among systems of property is at times difficult. At the edges, the various types of property systems blend into each other.[73] The real world offers an astounding variety of property systems that resemble private property in some respects, while retaining features that resemble open access. Some aboriginal tribes, for example, have private household property in land in the winter, but collective property in land in the summer, due to the relative advantages of collective hunting during the summer.[74] For another example, in the Salish tribe of the Pacific Northwest, river sites for the construction of fishing weirs were privately owned, but the weirs were village property, while the platforms on top of the weirs were private property.[75] In a village of Borneo, dry land is exclusively private property, except during the wet season, when it becomes open access property.[76] Our classificatory systems should not be so stringent that we miss the intermediate bundles of property rights that may work most efficiently for certain resources and situations.[77]

¶35 Another common misconception is the definition of "common property" as property that is open to anyone to use. Such a definition is misleading. A system which is open to all to use should be called an 'open access system,' while the term 'common property' should be reserved for those arrangements in which "a particular group of individuals share rights to a resource."[78] An open access system,

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[71] *See supra* notes 45-53 and accompanying text.

[72] STEVENSON, *supra* note 10, at 2-4; Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 720 (1986).

[73] Gary D. Thompson & Paul N. Wilson, *Common Property as an Institutional Response to Environmental Variability*, 12 CONTEMP. ECON. POL'Y 10, 10 (1994).

[74] Martin J. Bailey, *Approximate Optimality of Aboriginal Property Rights*, 35 J.L. & ECON. 183, 189-91 (1992). Additionally, Bailey states that it is "not unusual for families to have private property in land with recognized boundaries for one food resource but not another." *Id.* at 195. For another example of seasonal variation in property rights, *see* Freudenberger et al., *supra* note 69. Freudenberger et al. say that in many parts of the Sudano-Sahelian zone, land usage rights actually shift seasonally from one ethnic group to another--pastoral groups have rights during the dry season, and farmers have rights during the wet season. This system is complementary and synergistic, in that the cattle manure left by the pastoralists' herds fertilizes the ground, while the trees raised by the farmers provide shade and fodder for the herds. *Id.* at 395.

[75] Sara Singleton, *Commons Problems, Collective Action and Efficiency: Past and Present Institutions of Governance in Pacific Northwest Salmon Fisheries*, 11 J. THEORETICAL POL. 367, 374-75 (1999). The reason for this division of property rights was due to the incentives created--for each site where a weir was to be constructed (a large project requiring many laborers or the entire village), the fact that a single individual owned the site made it easier to coordinate the construction. Once the weir was built, however, all the villagers had the right to use it, from individual platforms that they personally owned. *Id.*

[76] Patricia J. Vondal, *The Common Swamplands of Southeastern Borneo: Multiple Use, Management, and Conflict*, *in* THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES, *supra* note 10, at 231, 234-35.

[77] *See* Berkes et al., *supra* note 10 ("[S]uccessful approaches to the commons dilemma are found in complementary and compatible relationships between the resource, the technology for its exploitation, the property-rights regime and the larger set of institutional arrangements.").

[78] McKean & Ostrom, *supra* note 40, at 6; *accord* James A. Swaney, *Common Property, Reciprocity, and Community*, 24 J. ECON. ISSUES 451, 452 (1990) ("Common property is not open access, as is commonly assumed in the property rights school of economics, and the absence of an explicit set of restrictions on use does not mean the resource is open access."). The distinction between common property and open access has been made since Ciriacy-Wantrup's and Bishop's oft-cited 1975 article. S.V. Ciriacy-Wantrup & R. Bishop, *"Common Property" as a Concept in Natural Resource Policy*, 15 NAT. RESOURCE J. 713 (1975).

or what Garrett Hardin later called the "*unmanaged* commons,"[79] is indeed subject to free rider problems and over-exploitation.[80] But true common property systems--in which distinct groups of individuals hold property rights to a resource--are closer to individual private property rights, and hence are far less likely to fall prey to the same problems as an open access system.[81] The crucial thing to remember is that "the definition of private property rights has to do with the rights not the nature of the entity that holds them. The private nature of private property rights does not require that they be held by individual persons; they may also be vested in groups of individuals."[82]

¶36 The rampant confusion attached to the term "commons" has led to perverse results in many cases in which reformers privatize land, replacing CPRs in the hopes of increasing efficiency.[83] In many such instances, as McKean and Ostrom note, the "transfer of property rights from traditional user groups to others eliminates the incentives for monitoring and restrained use, converts owner-protectors into poachers and exacerbates the resource depletion it was intended to prevent."[84] Another scholar notes that privatization efforts in African pastoral lands has "met with almost uniform failure, and have in many instances contributed to increased human suffering and the further degradation of the land."[85] Another example is the pastures of central Asia--studies of satellite imagery have shown that both the Russian pastures (which are ruled by state-owned agricultural collectives) and the Chinese pastures (which have been privatized) experience many times *more* degradation than the nearby Mongolian pastures (which are still governed by traditional pastoral commons).[86]

C. Designing Meta-Rules for a Spectrum Commons

¶37 Yochai Benkler argues that we have too long neglected the commons as an institutional approach,[87] and that our legislative and administrative policy should strive "towards the creation of a well regulated commons in our information

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[79] Garrett Hardin, *supra* note 11.

[80] *See, e.g.*, Casimir & Rao, *supra* note 69, at 132 (noting that among Himalayan pastures, those that are privately owned and those that are managed as a commons are not overexploited, while open access areas are).

[81] *See* Blewett, *supra* note 59, at 477 ("Economists should now realize that commons problems are necessarily associated with only CPR's with no restrictions in access.").

[82] McKean & Ostrom, *supra* note 40, at 6.

[83] *See* SIY, *supra* note 69 (describing how modern planners who dismantle commons systems of water management in the Philippines have often "unwittingly brought about the destruction of the very institutions and organizational resources that are critical to the successful operation of irrigation systems"); *see also* Bonnie J. McCay & James M. Acheson, *Human Ecology of the Commons*, *in* THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES, *supra* note 10, at 1, 9 (noting the "faulty assumption" that "private property protects resources from abuse and waste, and common property does not").

[84] McKean & Ostrom, *supra* note 40, at 5; *see also* Blewett, *supra* note 59, at 488 ("Private property encouraged and allowed the destruction of the pastoral commons."); Dean Lueck, *Contracting Into the Commons*, *in* THE POLITICAL ECONOMY OF CUSTOMS AND CULTURE: INFORMAL SOLUTIONS TO THE COMMONS PROBLEM, *supra* note 61, at 43, 54 (discussing the detrimental effects of nationalization of communal forests in India, Nepal, Niger, and Thailand); David Ward et al., *supra* note 69, at 358 (noting that in non-equilibrial pastoral systems, interventions aimed at achieving stability "are likely to be irrelevant at best, or disruptive and destructive at worst").

[85] J. Terrence McCabe, *Turkana Pastoralism: A Case Against the Tragedy of the Commons*, 18 HUM. ECOLOGY 81, 83 (1990).

[86] Elinor Ostrom et al., *Revisiting the Commons: Local Lessons, Global Challenges*, 284 SCIENCE 278, 278 (April 9, 1999); *see also* Barton H. Thompson, Jr., *Tragically Difficult: The Obstacles to Governing the Commons*, 30 ENVTL. L. 241, 257 (2000).

[87] Yochai Benkler, The Commons as a Neglected Factor of Information Policy, (unpublished manuscript), *available at* http://www.law.nyu.edu/benklery/commons.pdf. *See generally* Yochai Benkler, *From Consumers to Users: Shifting the Deeper Structures of Regulation Toward Sustainable Commons and User Access*, 52 FED. COMM. L.J. 561 (2000).

infrastructure."[88] Benkler's answer to the alleged tragedy of the commons is first to note that the spectrum is a perfectly renewable and non-exhaustible resource. The spectrum does not require maintenance any more than gravity does. Thus, the only characteristic of the spectrum that could conceivably lead to a tragedy of the commons is the "potential for interference, or conflicting uses."[89] Each individual user of the spectrum has an incentive to use more and more power or bandwidth, because he or she will receive all the benefits, while bearing few of the costs.

¶38 Benkler proposes, therefore, that "rules concerning power limits□□□ in combination with transmission protocols□□□ can operate to prevent interference and avoid congestion."[90] Thus, the FCC should develop rules for the use of unlicensed equipment under which "the access a device may gain to the unlicensed spectrum" is tied to the "efficiency of that device's use of the spectrum."[91] In such a regulatory scheme, the manufacturers of equipment would now have an incentive to create devices that would maximize efficient use of the spectrum while minimizing potential interference with other usages. Benkler's conclusion: "Assuming the development of appropriate spectrum-sharing rules and protocols, and in the presence of an equipment market to reward investment in more efficient devices, the absence of a property system in spectrum should not result in a tragedy of the commons."[92]

¶39 Benkler's prescription of creating a commons in the spectrum is not described in any great detail. Who would do the regulating in his system is left undetermined, as well as who would monitor behavior, administer penalties, and make decisions about localized exceptions to any regulation.

¶40 What I envision for the electromagnetic spectrum is something akin to a "co-management" system, defined by Swallow and Bromley as follows:

> A state government assigns and protects group rights, enforces restrictions on group membership, and protects boundaries from incursions by outsiders. That is, the state governs relationships between common property regimes, provides external legitimacy for the group of resource users within regimes, but does not support any particular form of governance within regimes. At the community level, the users having exclusive rights to the resource may develop any type of resource management institution that they identify as being appropriate.[93]

¶41 Thus, the FCC (and, as appropriate, the ITU) would concern itself with drawing minimal boundaries as to spectrum allocation, formulating principles for inclusion and exclusion in localized spectrum management groups, and guiding the process of bargaining and discussion among such groups.[94] For most spectrum uses (i.e., all

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[88] Benkler, *supra* note 8, at 394. Lawrence Lessig has also suggested that the spectrum should be seen as a commons. Lessig, *supra* note 8.

[89] Benkler, *supra* note 8, at 359.

[90] *Id.* at 360.

[91] *Id.*

[92] *Id.* at 362.

[93] Swallow & Bromley, *supra* note 40, at 5. For good discussions of co-management theory, *see* Hans-Kristian Hernes & Håkan T. Sandersen, *Institutional Design of Fisheries Co-management: The Problem of Democracy and Representation* (paper presented at 1998 Conference of the International Association for the Study of Common Property), *available at* http://www.indiana.edu/~iascp/Plenary/hernes.pdf; E. Pinkerton, *Factors in Overcoming Barriers to Implementing Co-Management in British Columbia Salmon Fisheries*, 3 CONSERVATION ECOLOGY 2 (1999), *available at* http://www.consecol.org/vol3/iss2/art2.

[94] Elinor Ostrom et al., *supra* note 86, at 281 (noting that government can "facilitate the assembly of users of a CPR in organizational meetings, provide information that helps identify the problem and possible solutions, and legitimize and help enforce agreements reached by local users"); *see also* Nathalie A. Steins & Victoria M. Edwards, *Platforms for Collective Action in Multiple-Use Common Pool Resources*, 16 AGRIC. & HUMAN VALUES 241 (1999) (describing how the government can facilitate common pool governance); Gary D. Thompson & Paul N.

those frequencies which are not capable of long distance transmission), the local spectrum management group would be the primary source of authority and governance.[95] The FCC would establish regulations that govern membership in local groups--for example, cellular phone companies, land mobile radio services, paging companies, satellite companies, broadcast television and radio companies, etc., would all be eligible for membership. The FCC could also serve the role of providing information about regulatory possibilities, institutional arrangements, and technical standards, as well as providing some enforcement authority for violations of regulations in a way that affects large geographic areas.[96] At the level of the local group, though, the spectrum should be governed according to principles of successful CPR management.

¶42 Naturally, these are highly abstract and generalized suggestions. I mean to flesh them out in the following discussion, in which I draw upon the path-breaking work of Elinor Ostrom in analyzing successful CPRs.[97] Based primarily (although not solely) on her work, I will attempt to sketch a commons-based regulatory scheme for the spectrum that would hopefully achieve a solution to the tragedy of the commons, while precluding as far as possible any insurgence of the FCC's centralized bureaucratic rulemaking. One thing to keep in mind, however, is that I will not identify any specific spectrum allocations that might result; the whole point of the meta-rules that I propose is that they leave specific decisions in the hands of the actual spectrum users.

¶43 Ostrom has identified eight general principles that typically characterize successful CPR management wherever it is found, in such varied situations as Philippine irrigation systems and Alpine mountain forests.[98] Here are the principles and Ostrom's discussions thereof, along with my own suggestions as to how they could be fruitfully applied to spectrum management.

1. Clearly defined boundaries – Individuals or households who have the right to withdraw resource units from the commons must be clearly defined, as must the boundaries of the commons itself.[99]

¶44 This principle is what Ostrom calls the "first step in organizing for collective action,"[100] and might be applied to the spectrum as follows:

Wilson, *Ejido Reforms in Mexico: Conceptual Issues and Potential Outcomes*, 70 LAND ECON. 448, 461-62 (1994) (arguing that the government can reduce transaction costs by sponsoring organizational forums and educating citizens about common property management techniques).

[95] This role would be similar to that of the Philippine *zanjera*s, that is, local water-management groups. As Robert Siy points out, the "local-level organization" can "serve as a body where … problems can be discussed among water users and, if possible, remedied," and can be the key to "more efficient water allocation practices." SIY, *supra* note 69, at 10.

[96] *See, e.g.*, Edella Schlager et al., *Mobile Flows, Storage, and Self-Organized Institutions for Governing Common-Pool Resources*, 70 LAND ECON. 294, 310 (1994) (describing the role government can play in facilitating common pool governance by local users); Shashi Kolavilli & Jeffrey D. Brewer, *Assessing Common Property Institutions*, at *10-12 (paper presented at 1998 Conference of the International Association for the Study of Common Property) (describing the role of external agents in providing support to local commons organizations), *available at* http://www.indiana.edu/~iascp/Drafts/kolaval.pdf.

[97] OSTROM, *supra* note 10.

[98] *Id.* at 90.

[99] *Id.* at 91.

[100] *Id.* Worth noting is that even the condition of clear boundaries is not absolutely necessary in every circumstance. Robert Blewett recounts that among the Maasai of Kenya, territorial boundaries were "flexible, if not ambiguous," and often "overlapped." Robert A. Blewett, *supra* note 59, at 480. For the Maasai, "the 'vagueness' of both territory and ethnicity were additional ways of coping with the uncertainties of the pastoral economy." *Id.* at 481.

a) Clearly defined boundaries

¶45 Strict boundaries are perhaps less important for spectrum regulation than for traditional commons involving non-renewable resources.[101] If the users of a common forest are not able to set clear boundaries regarding geography and people, their common effort would be in jeopardy from free-riding non-contributors.[102] In contrast, the spectrum's perfectly renewable nature means that the users do not have to "invest" in maintaining the spectrum or in keeping it from depletion.[103]

¶46 Boundaries are, however, necessary to some extent, not to prevent free-riding, but to prevent rivalrous uses from interference. If the spectrum were completely unregulated at any level, one would expect spectrum users to employ ever-increasing power levels in an attempt to drown out potential interferers. One might also see an undue amount of interference with air traffic control signals, or police and fire signals, or military signals, etc. Thus, some boundary-drawing is necessary to set various conflicting uses apart.

¶47 This principle implies that the FCC should maintain a role in dividing up the spectrum in broad, general lines, while allowing for local exceptions where the spectrum users so determine. For example, it might be best for the broadcast television frequencies allocated to Channel 2 to remain the same across the country; likewise, it might be best for the range of frequencies in which cellular phone service takes place to be generally the same nationwide. This is because people often travel or move across the country, and would benefit from being able to use the same devices in each particular locality. But, in each case, the FCC should do no more than laying down the outer boundaries, while allowing generous exceptions. Thus, if a particular geographic area lacked any television broadcaster who wished to use the frequency allocated to Channel 67 elsewhere in the country, the users of that area would be free to allocate that channel to other, more efficient uses.

¶48 Because lower frequencies are capable of reaching around the world, some form of international line-drawing will have to continue into the foreseeable future. As an amateur radio operator, for example, I have used frequencies in the 14 MHz range to contact other amateurs as far away as Australia, despite using only 150 watts of power and a simple dipole antenna made of a long piece of wire across a rooftop. In contrast, even a 100,000-watt FM radio station with a 300-foot tower broadcasting at 90 MHz is not able to reach more than roughly a 30-mile radius--which is why your favorite radio station quickly fades when you drive out of town. Thus, for those lower frequencies at which international interference is a physical possibility, the International Telecommunications Union and the FCC will have to retain a role in creating boundaries and promulgating standards for usage. At higher frequencies, however, it is not necessary that the FCC do much more than set boundaries drawing the lines between usage areas (such as government, military, police and safety, broadcast, cellular phones, etc.). Within the broad ranges of spectrum identified for any one particular use, the local users would be free to decide among themselves how best to allocate and regulate usage, including technical modifications that would improve efficient sharing.

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101 *See, e.g.*, Elinor Ostrom, *Institutional Arrangements for Resolving the Commons Dilemma: Some Contending Approaches*, *in* THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES, *supra* note 10, at 250, 258 (noting the carefully defined boundaries and users of commons areas in Japanese villages).

102 *See, e.g.*, McCabe, *supra* note 85, at 88-91 (describing the territorial boundaries used by East African tribes).

103 Additionally, as noted above, technological developments may make the spectrum not only non-exhaustible, but also to some extent non-rivalrous.

b) Clearly defined users

¶49 The various users who are allowed to partake in a commons need to be defined and limited, in order to avoid the problems of open access.[104] Of all Ostrom's principles, this one is perhaps the most problematic in its application to the spectrum. Defining the relevant users, and deciding how to allow entrance into their midst, is a thorny issue. In the lobster fisheries of Maine, for example, people are restricted from fishing at all unless they are members of a harbor gang,[105] while each harbor gang has its own territory.[106] In the Swiss alpine common pastures, entry is usually restricted by community residency or by family lineage.[107] Unlike the lobster fishermen of Maine or the farmers of Switzerland, however, spectrum users can cause interference outside of their local geographic community. Thus, the community of spectrum users will likely be more spread out and less homogeneous than the Maine lobster fishermen, who fish in small groups that often share a bond of kinship.[108]

¶50 The heterogeneity of spectrum users and their ability to cause interference outside local communities might be seen as a serious problem for the feasibility of a CPR. After all, various studies have found that the strength of community ties often enables groups to overcome the selfish incentives that might otherwise cause a tragedy of the commons.[109] However, some evidence suggests that tight-knit kinship relations are not always necessary in order for a community to form successful commons management. In a study that compared three tribal villages in the Maya Lowlands of Guatemala, for example, the researchers found that the "Itzaj community is the most socially atomized but the one whose individuals most clearly learn to act to maintain the common environment," while the Q'eqchi' tribe is "the most socially interconnected and ceremoniously institutionalized but is least likely to preserve the resource base."[110] Although strong community bonds are beneficial in forming commons regulatory regimes, such bonds are not a *sine qua non*.

¶51 The best solution might be to define the users as any parties who are interested in how the spectrum is used. Thus, the body of users who could participate in local decisions would include cellular phone companies, radio and television broadcasters, equipment manufacturers, satellite services, consumers' groups, and others. As I discuss below, such companies have already formed a variety of associations dedicated to finding common agreement on technical standards for wireless interchanges.[111] By forming such groups, widely dispersed people are able to form "communities" that strive towards the same end--effective wireless interactivity. In so doing, they have displayed the characteristics that enable communities to find

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104 For an example of the problems that arise when communities are unable to define and limit users, *see* E. N. Anderson, Jr., *A Malaysian Tragedy of the Commons*, *in* THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES, *supra* note 10, at 327, 330.

105 JAMES M. ACHESON, THE LOBSTER GANGS OF MAINE 48 (1988); *see also* James M. Acheson, *The Lobster Fiefs Revisited: Economic and Ecological Effects of Territoriality in the Maine Lobster Industry*, *in* THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES, *supra* note 10, at 37. Schlager and Ostrom also report that most successful commons fisheries have residency requirements. Edella Schlager & Elinor Ostrom, *Property-Rights Regimes and Coastal Fisheries: An Empirical Analysis*, *in* THE POLITICAL ECONOMY OF CUSTOMS AND CULTURE: INFORMAL SOLUTIONS TO THE COMMONS PROBLEM, *supra* note 61, at 13, 29.

106 ACHESON, *supra* note 105, at 71-83 (discussing the type of territories available to lobster fishermen).

107 STEVENSON, *supra* note 10, at 218.

108 ACHESON, *supra* note 105, at 48-49.

109 *See, e.g.*, MATTHEWS, *supra* note 10, at 89-91; Michael Taylor & Sara Singleton, *The Communal Resource: Transaction Costs and the Solution of Collective Action Problems*, 21 POL. & SOC'Y 195, 198-202 (1993).

110 Scott Atran et al., *Folkecology and Commons Management in the Maya Lowlands*, 96 PROC. NAT'L ACAD. SCIENCE U.S. 7598, 7603 (1999).

111 *See infra* notes 221-253 and accompanying text.

collective solutions to commons dilemmas, such as relationships that are stable, varied, and direct.[112]

2. Congruence between appropriation and provision rules and local conditions – Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions and to provision rules requiring labor, material, and/or money.[113]

¶52 This principle recognizes the fact that local conditions should often determine the content and extent of regulations.[114] Ostrom points to Spanish irrigation systems as a prime example. The rules for such systems include water auctions, generous rations, or time-controlled rations, as well as slightly different fee payment schemes--all depending on the water storage facilities available in the particular locale.[115] In a related article, Ostrom points to polycentricity--systems involving "multiple governing authorities at differing scales"--as achieving "the advantages of utilizing local knowledge as well as the redundancy and rapidity of a trial-and-error learning process."[116]

¶53 This principle is especially apt to my thesis--the FCC cannot possibly make itself aware of all the infinitely diverse possibilities that could affect the appropriate spectrum regulations for every particular locality.[117] Its regulations, despite their seemingly exhaustive detail, are nonetheless broad, general, and aimed at the lowest common denominator. For example, the FCC's equipment regulations for the Unlicensed National Information Infrastructure[118] specify that all transmissions in the 5.15–5.25 GHz band must have a peak power spectral density of less than 2.5 mW/MHz,[119] that any emissions in the adjoining bands must be attenuated by at least 27 decibels,[120] and so on ad nauseam. Despite the detail of these regulations, they are uniform and general, applying to any transmissions in that particular band, anywhere in the country. A wise spectrum policy, on the other hand, would allow

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112 *See* Taylor & Singleton, *supra* note 109, at 199 (describing conditions for finding solutions to collective action problems). As Taylor and Singleton observe, these conditions are often absent in "communities" that consist of capitalist firms, for reasons that include the lack of face-to-face relations between managers of different firms and the heterogeneity of various industries. *Id.* at 208-09. As discussed below, however, wireless companies have already formed several associations to set interoperability standards, thus providing forums for face-to-face interactions. *See infra* notes 221-253 and accompanying text.

113 OSTROM, *supra* note 10, at 92.

114 For an example of a tragedy of the commons where this principle was not observed, *see* Anderson, *supra* note 104, at 332.

115 *Id*; *see also* Douglas S. Noonan, *International Fisheries Management Institutions: Europe and the South Pacific*, *in* MANAGING THE COMMONS 165, 173 (John A. Baden & Douglas S. Noonan eds., 2d ed. 1998) ("For any institution to manage successfully in the long term requires that the policies are appropriate to the local conditions□□□."); Edella Schlager et al., *Mobile Flows, Storage, and Self-Organized Institutions for Governing Common-Pool Resources*, 70 LAND ECON. 294, 294 (1994) (pointing out that users design different institutional arrangements according to the characteristics of the resource).

116 Elinor Ostrom, *Polycentricity, Complexity, and the Commons*, 9 GOOD SOC'Y 37, 39 (1999). By contrast, the current system involves the FCC in deciding which technology is truly superior and which deserves to be promoted. *See, e.g.*, Patrick Mannion, *FCC Redraws Battle Lines for Wireless LANs*, ELEC. ENG'G TIMES, Sept. 4, 2000 (discussing decisions that the FCC is probably less well-equipped to make than would be a collective association of spectrum users themselves).

117 *Cf.* F.A. HAYEK, THE ROAD TO SERFDOM 55 (1944) ("There would be no difficulty about efficient control or planning were conditions so simple that a single person or board could effectively survey all the relevant facts. It is only as the factors which have to be taken into account become so numerous that it is impossible to gain a synoptic view of them that decentralization becomes imperative."); DIETRICH DORNER, THE LOGIC OF FAILURE (Rita Kimber & Robert Kimber trans., 1996) (reporting on people's incapacity to engage in successful central planning).

118 FCC Unlicensed Nat'l Information Infrastructure Devices, 47 C.F.R. §§ 15.401 *et seq.* (2000).

119 *Id.* § 15.407(a)(1).

120 *Id.* § 15.407(b)(1).

for local variations, so as to harness the information available only to those users or companies who are familiar with the local conditions.[121] As one scholar observes, the "FCC's national allocation patterns of spectrum for mobile radio uses have meant, for example, that forestry communications allocations have lain idle in New York City, while its allocations of spectrum for taxicab communications have been idle in Idaho."[122] Or take power restrictions: It is inconceivable that power limitations should be the same in Colby, Kansas and in San Francisco. A more effective spectrum policy would allow higher power outputs in those areas where spectrum usage is lower, and conversely would restrict power output further in crowded urban areas.

¶54 A sub-principle related to appropriation is the use of a *lottery* to distribute the rights to use or draw from a CPR. For example, the fishermen off the coast of Alanya, Turkey, came up with the following system: After drawing up a list of eligible fishers for the common waters, the fishers draw lots for the initial assignment on the first day of the fishing season. "Every day thereafter, each fisher moves east to the next site until the end of January. After January, each fisher reverses course and moves west to the next site. This gives everyone about the same opportunity to reach the stocks of fish□□□ ."[123] Similarly, the Japanese village of Hirano used a lottery to distribute its winter fodder for several hundred years.[124] The fodder was gathered from communal land, cut, dried, bundled, and then distributed by lottery to the village's families.[125] In an article providing the game-theoretic analysis of the lottery approach, Rob Moir lists several reasons why this system worked in Hirano:

i) It prevents *competitive* cutting, thereby removing the problem of 'rule by capture'.

ii) It assures relatively equal amounts of fodder per household.

iii) Because the fodder varied in quality,

  a) it avoided bad feelings in the village, and

  b) it avoided *competitive* bundling.

iv) In a repeated game framework.

  a) it creates an incentive to conform to the norms of the community because of the equalizing properties of the mechanism, and

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[121] As Ostrom notes in a discussion of a common-pool-resource system devised by Turkish fishermen, "Central-government officials could not have crafted such a set of rules without assigning a full-time staff to work (actually fish) in the area for an extended period." Elinor Ostrom, *Reflections on the Commons*, *in* MANAGING THE COMMONS, *supra* note 115, at 111. Ostrom has also been quoted as saying that it is doubtful that "any national agency has the extensive time-and-place information needed to tailor a set of rules to the particulars of local situations." MATTHEWS, *supra* note 10, at 87; *see also* White, *supra* note 37, at 26.

[122] White, *supra* note 37, at 25-26.

[123] *See* Leal, *supra* note 69, at 232 (citing F. Berkes, *Marine Inshore Fishery Management in Turkey*, *in* PROCEEDINGS OF THE CONFERENCE ON COMMON PROP. RES. MANAGEMENT 63 (National Research Council 1986)). For a more thorough examination of fisheries around the world, *see* Martin S. Weinstein, *Pieces of the Puzzle: Solutions for Community-Based Fisheries Management from Native Canadians, Japanese Cooperatives, and Common Property Researchers*, 12 GEO. INT'L ENVTL. L. REV. 375 (2000).

[124] *See* Margaret A. McKean, *Management of Traditional Common Lands (Iriaichi) in Japan*, *in* MAKING THE COMMONS WORK: THEORY, PRACTICE, AND POLICY 63, 66 (Daniel W. Bromley ed., 1992).

[125] *Id.* at 78-79.

b) it creates an immediate version of the tit-for-tat strategy because one may be punished with one's own small low-quality bundle, or may not be rewarded with one's own large high-quality bundle.[126]

¶55 Moir compares the lottery system to the Rawlsian veil of ignorance that is so famous in political philosophy.[127] Because the various appropriators from the CPR do not know which of the bundles they will ultimately receive, they no longer gain from cheating. The dangers of the lottery approach, on the other hand, include the possibility of overuse (if the lottery mechanism is used to distribute not the actual product but the right to produce[128]), and the possibility of shirking and free-riding as the number of users increases.[129]

¶56 A principle similar to a lottery is that of *rotation*. A typical problem for irrigation systems dependent on rivers, canals, and the like, is that the farmers at the head end of the system have too much incentive to draw water, while farmers at the tail end have too little incentive to invest in the maintenance of the system.[130] Some groups of farmers in Nepal found a unique solution to this incentive asymmetry--rotate access to water rights. Two types of rotation are found; in the first, farmers rotate water rights by season (the crops planted are seasonal), and in the second, they rotate rights on a daily basis.[131] In an even more creative solution to this problem, the Philippine *zanjeras* have used a system in which individual farmers belonging to a collective group divide their land into strips, so that each individual farmer has a set of land strips scattered along the river--thus eliminating any incentive that a given farmer on an upstream piece of land would have to overdraw water.[132] Ostrom and Gardner report that farmer-managed irrigation systems, with their creative array of solutions, produce a greater level of equality between head- and tail-end users as compared to government-managed systems.[133] This is not surprising, they say, since government systems can rely on forced taxation to survive, whereas farmers who run their own systems face competitive pressure to find efficient solutions.[134]

3. Collective-choice arrangements – Most individuals affected by the operational rules can participate in modifying the rules.[135]

¶57 Ostrom states the rationale behind this principle as follows: "[I]nstitutions that use this principle are better able to tailor their rules to local circumstances, because the individuals who directly interact with one another and with the physical world

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126 Rob Moir, When Incentive Compatibility Backfires: Individual Analysis of the Lottery Mechanism 2 (working paper), *available at* ftp://fundy.csd.unbsj.ca/pub/rmoir/lotteryind.pdf.

127 *Id.* at 3.

128 *Id.* at 5.

129 *Id.*

130 *See* Elinor Ostrom & Roy Gardner, *Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work*, 7 J. ECON. PERSP. 93, 96-97 (1993).

131 *Id.* at 99-100.

132 For each individual farmer, to overdraw from an upstream strip of land would hurt his own usage on his downstream strips. This system of rights is described and diagrammed in SIY, *supra* note 69, at 39–40. This arrangement of property rights can lead to problems if one farmer wishes to sell part of his land, as the new owner of a single strip of land would not have the same set of incentives as the other farmers in the *zanjera*. The farmers presumably take this potential problem into account when entering into this arrangement, however.

133 Ostrom & Gardner, *supra* note 130, at 102-03.

134 *Id.* at 109 n. 15.

135 OSTROM, *supra* note 10, at 93.

can modify the rules over time so as to better fit them to the specific characteristics of their setting."[136]

¶58 Thus, in managing the common pastures of the Swiss Alps, the members of the commons will vote to adjust grazing rights if it becomes apparent that the carrying capacity of the pasture has changed.[137] For most purposes, the Swiss farmers are able to vote on how the commons is to be regulated, whether by a one-person-one-vote system or by a vote system weighted according to the grazing rights owned by each person.[138] In fact, "the users not only participate, but they have complete control over decisions regarding the corporately managed resource."[139] Of course, the number of relevant users has an effect on the possibilities for direct commons governance or representative governance. In the smaller irrigation systems of the Philippine *zanjera* (water management groups), the "decision-makers, implementers and beneficiaries may be the same persons,"[140] while in the larger systems, a more complex division of responsibilities, coordination processes, and feedback mechanisms becomes necessary.[141]

¶59 The FCC, like most federal administrative agencies, follows a minimal version of this principle in the notice-and-comment rulemaking procedure.[142] The origin of the Unlicensed National Information Infrastructure provides an example--Apple Computer petitioned the FCC in 1995 to allocate a 300 MHz swath of spectrum for use by unlicensed devices. The FCC adopted a Notice of Proposed Rule Making, soliciting comments regarding the regulation of such devices.[143] When the FCC finally created the Unlicensed National Information Infrastructure (the name for the 300 MHz area of unlicensed spectrum) in 1997,[144] it had considered fifty-two comments and twenty-six reply comments,[145] including comments from industry representatives, schools,[146] and public interest groups.[147]

¶60 This is not to say that notice-and-comment rulemaking approaches the participatory nature of successful commons. The difference is, of course, where the final authority is vested. The FCC currently has the ultimate authority to issue rules governing spectrum, whether or not the rules frustrate the wishes of any particular user(s). In successful commons, on the other hand, the end-users do not merely comment on a proposed rule; they make the rule themselves, based on the knowledge that they have gained through their experience with local conditions.[148]

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136 *Id.*

137 STEVENSON, *supra* note 10, at 103.

138 *Id.* at 132.

139 *Id.* at 221.

140 SIY, *supra* note 69, at 9.

141 *Id.*

142 Indeed, administrative agencies are often criticized for this very fact. *See, e.g.*, DAVID SCHOENBROD, POWER WITHOUT RESPONSIBILITY: HOW CONGRESS ABUSES THE PEOPLE THROUGH DELEGATION 109 (1993) (arguing that because in "many rulemakings, the regulated industry is the only private participant," the legislative process is subject to "balkanization").

143 Amendment of the Commission's Rules to Provide for Unlicensed NII/SUPERNet Operations in the 5 GHz Frequency Range, ET Docket No. 96-102, 11 F.C.C.R. 7205 (1996) (Notice of Proposed Rulemaking).

144 In the Matter of Amendment of the Commission's Rules to Provide for Operation of Unlicensed NII Devices in the 5 GHz Frequency Range, 12 F.C.C.R. 1576 (1997) (amending 47 C.F.R. pts. 1, 2, & 15), *available at* http://www.fcc.gov/Bureaus/Engineering_Technology/Orders/1997/fcc97005.pdf.

145 *Id.* at ¶ 3.

146 *Id.* at ¶ 10.

147 *In the Matter of Allocation of Spectrum in the 5 GHz Band to Establish a Wireless Component of the National Information Infrastructure*, Comments of the Center for Democracy and Technology, *available at* http://www.warpspeed.com/cdt.html.

148 In Alert Bay, an Indian fishing community on the coast of Vancouver Island, the Department of Fisheries managers rely heavily on the information and wisdom provided to them by the Indian "elders and

This places substantial responsibility on the local users to cooperate and work together in establishing the boundaries and penalties for spectrum usage.

¶61 This condition is especially important because it is unlikely that a given institution will settle on the optimal set of rules on the first try, nor that the optimal rule set will remain the same over time. As McGinnis and Ostrom note, successful CPRs are characterized by the fact that the participants "modified the rules-in-use over time in light of past experience according to their own collective choice and constitutional rules."[149] Again, it is essential for efficient spectrum usage that we harness the superior information that only local users possess.[150]

¶62 This condition would thus provide one of the most attractive benefits of regulating the spectrum as a commons. Because the FCC can't possibly know all the local conditions that would justify variations, it puts users into a straitjacket of bureaucratic regulation, which can be escaped only at the enormous transaction cost of petitioning the FCC for an exception. If such issues were decided at a local spectrum forum, however, local users would be able to use their superior information about local conditions to come to an agreement--at far less cost--that would enable efficient spectrum usage. In the words of one scholar, "A malfunctioning approximation to a formalized system of state control or private property rights, based on a distant authority only dimly aware of local conditions, may be worse in terms of resource management than a strategy which aims to improve, or at least not impair, local systems of rules."[151]

4. Monitoring – Monitors, who actively audit the commons conditions and the behavior of the users, are accountable to the users or are users themselves.[152]

¶63 According to Ostrom, it is a "surprising" fact that in "robust" commons, the "monitoring and sanctioning are undertaken not by external authorities but by the participants themselves."[153] This is surprising because, as Ostrom notes, "the normal presumption has been that participants themselves will not undertake mutual monitoring and enforcement because such actions involve relatively high personal costs and produce public goods available to everyone."[154] Thus, it is usually assumed that punishment systems have to be established by a centralized authority in order to overcome the collective action problem. However, given the empirical evidence that individuals in commons systems *do* engage in monitoring

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fishermen." This reliance on local knowledge, however, is informal and is "limited by the personality and intentions of the local manager," which means that it is less successful in managing the commons than if the users made the decisions themselves. Evelyn Pinkerton, *Intercepting the State: Dramatic Processes in the Assertion of Local Comanagement Rights*, *in* THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES, *supra* note 10, at 344, 366.

149 Michael McGinnis & Elinor Ostrom, *Design Principles for Local and Global Commons*, *in* 2 THE INTERNATIONAL POLITICAL ECONOMY AND INTERNATIONAL INSTITUTIONS 464, 468 (Oran R. Young ed., 1996).

150 *See, e.g.*, D.M. Warren & B. Rajasekaran, *Putting Local Knowledge to Good Use*, 13 INT'L AGRIC. DEV. 8 (1993) (arguing that policymakers should rely more heavily on local knowledge possessed by indigenous peoples).

151 Robert Wade, *The Management of Common Property Resources: Collective Action as an Alternative to Privatization or State Regulation*, 11 CAMBRIDGE J. ECON. 95, 105 (1987).

152 OSTROM, *supra* note 10, at 94.

153 *Id.* For example, the tribes of Mali regulated their common forests by having young men periodically patrolling village lands, "under the control of senior villagers." Thomson & Coulibaly, *supra* note 69, at 19; *see also* SIY, *supra* note 69, at 122 (describing self-monitoring efforts by the Philippine *zanjeras*); Singleton, *supra* note 75, at 389 (reporting that Salish fishermen carry out monitoring themselves).

154 OSTROM, *supra* note 10, at 95.

and punishment schemes, the "relative costs and benefits must have a different configuration" than that usually assumed.[155]

¶64 First, Ostrom notes that in many commons systems, the rules in force make monitoring costs low, often by placing "the two actors most concerned with cheating in direct contact with one another."[156] Thus, in irrigation rotation systems, an irrigator who nears the end of his turn will be deterred from over-collecting water by the presence of the next irrigator in line, who will himself be deterred from starting early by the presence of the first irrigator.[157] Thus, mutual monitoring can be accomplished by structuring the rules such that the individuals can monitor as a "by-product" of their normal activities, without incurring any additional monitoring costs.[158] This points to an additional benefit of Principle 3--individuals who design their own rules and enforce them are forced to take monitoring costs into account, and thus they "can learn from experience to craft enforceable rather than unenforceable rules."[159]

¶65 At this point, an objector might argue that a CPR would probably have higher enforcement and monitoring costs than would a system of private property. As Stevenson points out, however, both private and common property rights are susceptible to invasion--private property can be invaded by trespass or theft, and common property can be invaded by overuse or violating local regulations.[160] Similarly, both systems incur enforcement costs--private property is protected by fences, locks, guards, trespass suits, etc., while the police may be called in if private protection fails.[161] "Criticism of common property for its need to incur enforcement costs□□□ is unbalanced if it takes no account of the investment that society and individuals make in protecting private property."[162] Moreover, common property regimes are often able (contrary to the classical predictions of rational choice theory) to develop social norms that aid in the enforcement of the local regulations.[163]

5. Graduated Sanctions – Users who violate operational rules are likely to be assessed graduated sanctions, depending on the seriousness and context of the offense, by other users, by officials accountable to these users, or by both.[164]

¶66 Sanctions are necessary to enforce the conditions and terms of any common property regime.[165] Examples of this principle in operation are numerous. [166]

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155 *Id.*

156 *Id.*

157 *Id.*

158 *Id.* Ostrom also notes that individuals who are successful monitors (i.e., they catch rule-violators) often are rewarded by gaining personal status and prestige for their efforts. *Id.* at 96.

159 *Id.*□at 96.

160 STEVENSON, *supra* note 10, at 73.

161 *Id.*

162 *Id.*; *cf.* NEIL K. KOMESAR, IMPERFECT ALTERNATIVES: CHOOSING INSTITUTIONS IN LAW, ECONOMICS, AND PUBLIC POLICY (1994) (arguing that institutional analysis is incomplete unless comparisons are made between competing institutions).

163 For a game-theoretic account of why this is so, *see* Rajiv Sethi & E. Somanathan, *The Evolution of Social Norms in Common Property Resource Use*, 86 AM. ECON. REV. 766 (1996); *see also* Paul Seabright, *Managing Local Commons: Theoretical Issues in Incentive Design*, 7 J. ECON. PERSPECTIVES 113, 117-24 (1993).

164 Sethi & Somanathan, *supra* note 163.

165 In fact, in an example of second-best theory, if the participants are unable to sanction, they shouldn't monitor either. R.G. Lipset & K. Lancaster, *The Economic Theory of Second Best*, 24 REV. OF ECON. STUD. 133 (1957-58). Game-theoretic experiments have shown that the ability to monitor leads to inefficiently high levels of appropriation unless it is accompanied by an ability to sanction as well. Rob Moir, *Spies and Swords: Behaviour*

Among Maine's lobster fishermen, for example, those who fish outside their territory are punished by "surreptitious molestation of lobstering gear."[167] Among the Barabaig of Tanzania, fines payable in honey beer are assessed for minor offences, payments of cattle are required for more serious offences, and exclusion may be imposed for someone who abuses a water source.[168] For Swiss farmers, those who allow too many animals to graze on the common pastures are assessed graduated fines.[169]

¶67 Penalties can be harsh at times. One study reports that in the Foni Jarrol District of Gambia, if a child picks a protected fruit out of season, the "parents must buy a goat and a couple of liters of oil, butcher the goat, cook the meat, and distribute it to the village. In addition, they are fined 100 dalasis (roughly U.S.$13) to the village treasury. After the feast, the offending youth is taken into the bush by his or her peers and soundly thrashed."[170]

¶68 In small, tight-knit communities, however, penalties sometimes take the form of social pressure rather than monetary fines or jail time. For example, in the local groundwater districts that manage West Texas water reserves, the district staff "have little regulatory authority and have almost no sanctioning power," relying instead on "persuasion, incentives, education, and their ability to alter social expectations about groundwater use."[171] Another example is the Pacific Northwest fisheries of the Salish tribe, which enforces fishing regulations by "name-calling via the short-wave radio as well as other forms of gossip."[172] And of course, some communities use a combination of social sanction along with monetary or penal sanctions. In the Moyamba District of Sierra Leone, for example, someone who fishes from the common pond during the dry season "is subject to public humiliation and is required to dance before the public as well as pay a monetary fine."[173]

¶69 As for the spectrum, effective penalties could be administered in two disparate ways. First, people or companies who violate any particular local spectrum code could be brought to court on a nuisance charge, and their penalty could vary according to the nature of the interference and any previous offences. Social sanctions might be effective in small towns where the number of relevant users is fairly low, but in large urban areas the law would probably have to provide a range of possible remedies.

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in Environments with Costly Monitoring and Sanctioning 25-26 (July 29, 1999) (working paper), *available at* ftp://fundy.csd.unbsj.ca/pub/rmoir/sancmon.pdf. This is because when the participants can *see* others over-appropriating but are unable to punish that behavior, they fall into a race to the bottom, as they compete to draw as much as possible before the other participants deplete the resource. *Id.*

166 *See, e.g.*, Patricia J. Vondal, *The Common Swamplands of Southeastern Borneo: Multiple Use, Management, and Conflict*, *in* THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES, *supra* note 10, at 231, 241-42 (noting the graduated processes available to resolve disputes in the use of swampland in Borneo).

167 ACHESON, *supra* note 105, at 74 (describing the monitoring and privately administered punishment meted out on those who violate fishing boundaries); *see also* Thomson & Coulibaly, *supra* note 69, at 19 ("Infractions were sanctioned in the light of their seriousness as well as the willingness of the accused to admit guilt and submit to penalties.").

168 Swallow & Bromley, *supra* note 40, at 6. Swallow and Bromley also recount that the Rhiraya tribe in the Moroccan mountains calls upon supernatural spirits to punish unrepentant offenders. *Id.*

169 STEVENSON, *supra* note 10, at 92, 127-29.

170 Freudenberger et al., *supra* note 69, at 390. This study also quotes an unpublished treatise from 1592, which reports that tribal members who picked a fruit out of season would be sold into slavery. *Id.* at 386.

171 Somma, *supra* note 69, at 6.

172 Singleton, *supra* note 75, at 389. Singleton reports that "[g]iven the importance of reputation and mutual aid in what are generally small, fairly close-knit communities, these measures seem to be fairly effective." *Id.*

173 Freudenberger et al., *supra* note 69, at 393.

¶70 The second type of penalty would be those that are literally incorporated into electronic devices themselves. In a fascinating paper on this subject, Satapathy and Peha consider the possibilities for structuring electronic devices such that they would have internal "penalties" (i.e., unavoidable periods of waiting before resuming transmission) that would be imposed automatically if the device was "greedy" with its use of the spectrum. [174] Such penalties would suffice to "avoid a tragedy of the commons."[175] Analogously, McKean and Ostrom note that if one wishes to prevent over-exploitation of a common forest, regulating forestry equipment, such as the size of a saw, can "be just as effective in restraining harvesting and may also be simpler to enforce."[176]

¶71 Moreover, Satapathy and Peha note that these electronic "penalties" could differ according to the use and location: an absence of penalties would be the best option if "isolated operation is guaranteed," while another type of penalty would be best for "indoor applications, and for frequency bands that severely limit propagation distance."[177] Thus, their evidence suggests that localized determinations of the appropriate equipment protocols would likely result in the most efficient use of any spectrum commons.

¶72 It might be argued that regulating the spectrum as a CPR would require higher (and more inefficient) technical standards than would be necessary under a individualized property regime. This argument would be analogous to Dnes's claim that in commons fisheries, fishermen incur deadweight costs in that they have to "adopt more *technically* efficient equipment" than would otherwise be necessary.[178] Unlike fisheries, however, the non-depletable and renewable nature of the spectrum makes this argument less persuasive. Spectrum users are not competing for a finite resource--their very efforts to find more technically efficient equipment actually expand the available spectrum.[179]

6. Conflict-resolution mechanisms – users and their officials have rapid access to low-cost local arenas to resolve conflicts among users or between users and officials.[180]

¶73 As would seem obvious, effective rule-enforcement requires the availability of at least some "conflict-resolution mechanisms."[181] Having access to relatively cheap and effective dispute-resolving mechanisms is essential to the success of any CPR. As Douglas Noonan notes in an example of fisheries management, the presence of such mechanisms largely explains the success of the South Pacific Forum Fisheries Agency as opposed to the failure of the European Union's Common Fisheries Policy, despite the generally greater wealth and knowledge of Europe vis-à-vis the

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174 Durga P. Satapathy & Jon M. Peha, *Etiquette Modification for Unlicensed Spectrum: Approach and Impact*, 1 PROC. OF THE IEEE VEHICULAR TECH. CONFERENCE 272 (1998), *available at* http://www.contrib.andrew.cmu.edu/usr/dsaq/vtc_conf.pdf.

175 *Id.* at 275.

176 McKean & Ostrom, *supra* note 40, at 12.

177 Satapathy & Peha, *supra* note 174, at 276; *see also* Durga P. Satapathy & Jon M. Peha, *Spectrum Sharing Without Licenses: Opportunities and Dangers*, PROC. OF THE TELECOMMS. POLICY RESEARCH CONFERENCE 15 (1996), *available at* http://www.ece.cmu.edu/~peha/TPRC96.pdf.

178 Antony W. Dnes, *Rent Seeking Behaviour and Open Access Fishing*, 32 SCOTTISH J. POL. ECON. 159, 160 (1985).

179 *See* IRA BRODSKY, WIRELESS: THE REVOLUTION IN PERSONAL TELECOMMUNICATIONS 17-18 (1995) (noting that although 2 MHz was thought to be the highest usable frequency in 1925, technical advances have made it possible to use frequencies up to about 40 GHz--an increase of more than 20,000-fold).

180 OSTROM, *supra* note 10, at 100.

181 *Id.*

South Pacific.[182] As Siy notes, "One capability which each group of water users cannot do without is the ability to manage conflict[...]."[183]

¶74 These mechanisms need not be formal court systems, and in fact can be "quite informal."[184] Court systems have, however, been used with success. This is another choice that might be most effectively made by the local bodies of spectrum users. Likely, some form of arbitration might be required in any spectrum dispute, with possible appeal to a state district court. As the next principle recognizes, however, the resolution mechanism should strictly enforce those rules that are chosen by the local users, without succumbing to the temptation to overrule such rules on policy or constitutional grounds.

7. Minimal recognition of rights to organize – The rights of users to devise their own institutions are not challenged by external governmental authorities.[185]

¶75 This principle might seem counterintuitive, especially to those steeped in the American legal system's recurrent assumption that justice can be served only if rules are subject to judicial review. In judicial review, however, would lay disaster for successful commons systems. As Ostrom notes, "if external governmental officials presume that only they have the authority to set the rules, then it will be very difficult for local appropriators to sustain a rule-governed CPR [common pool resource] over the long run."[186] Matthews notes that in a Canadian fishing community, the willingness of courts to intervene in determinations of fishing rights caused community residents to lose confidence both in the community committee and its regulations.[187] Even more threatening are federal attempts to ban community resource management by enforcing antitrust laws against such efforts.[188]

¶76 What role, then, should the federal government play in spectrum regulation? I would envision the FCC's role as a facilitator of localized commons systems. The FCC would provide guidance for interested parties about how best to construct a local spectrum management associations based on the commons principles outlined above. It would certify such local groups and provide remedies for spectrum usage by people or corporations that disobey or refuse to participate in such associations. The FCC would also be able to set default boundaries for spectrum usages. The ultimate decisions about how to use the spectrum (excepting, of course, military and public safety uses) would be left to the local spectrum management associations. In other words, I envision a role for the FCC similar to that of the Scottish and Norwegian governments in facilitating and delegating responsibility to local fishery management associations.[189]

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182 *See generally* Noonan, *supra* note 115, at 165.

183 SIY, *supra* note 69.

184 OSTROM, *supra* note 10, at 101. For example, in the Douentza district of Mali, "until the end of the colonial era appeals of village-level decisions were brought before canton chiefs whose decisions were usually final. In the Bankass region, the Dogon multivillage *alamodiou* associations (charged with maintaining social peace and furnishing social security as well as managing renewable resources) provided for an internal form of appeal, from the decisions of community *alamodiou* leaders (*soraman*) to the paramount head (*seri*)." Thomson & Coulibaly, *supra* note 69, at 20.

185 OSTROM, *supra* note 10, at 101.

186 *Id.*

187 MATTHEWS, *supra* note 10, at 174.

188 *See, e.g.*, Leal, *supra* note 69, at 232–233 (describing the federal government's antitrust lawsuit against Gulf Coast shrimp fishing associations).

189 *See id.* at 233-36.

8. For Commons that are parts of larger systems: Nested enterprises – Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.[190]

¶77 This condition simply refers to the different possible levels of government regulation--a local commons for spectrum might be co-managed by a state regulatory authority, which in turn would be co-managed by the FCC and by international bodies (which would by necessity have a say in governing those frequencies that are capable of international transmission).

D. Evidence that a Commons Would Work

¶78 All this talk of the spectrum as a commons might seem like armchair speculation. After all, it has never been done before. Or has it? As recounted in a 1910 article, the Chicago Wireless Club, comprised of 100 amateur radio operators, was able to negotiate a successful spectrum sharing agreement with commercial radio stations in Chicago.[191] Under the agreement, all radio amateurs with over 500 watts of power were restricted to special times for transmitting, during which commercial stations and low-powered amateur operators were not allowed to transmit. Thus, private spectrum users were able to create an effective spectrum-sharing plan based on time and power limitations, despite a lack of governmental oversight or allocation.

¶79 In his classic history of amateur radio's early years, Clinton DeSoto confirmed the ability of amateur radio operators to govern themselves: "Ever since 1912, and especially in the post-war years, amateurs had been without actual governmental supervision; yet they had built up a tradition the moral effect of which kept them within their self-created bonds."[192] "Through the exercise of mutual cooperation, some ten thousand stations operated together without ruinous interference, under plans worked out by clubs and executive councils which, in the larger metropolitan areas (the Chicago Plan was the notable forerunner), assigned times of operation to different classes of stations, so that all could work successfully."[193]

¶80 DeSoto also recounts that amateur radio operators followed Ostrom's principle of self-monitoring.[194] Because governmental regulation was inadequate to prevent interference, "amateurs were eventually forced to adopt self–policing tactics when their internal organization achieved sufficient strength."[195] "Amateurs with sufficient vision to recognize that amateur radio must keep its house in order if it were to continue to exist, took it upon themselves to reprove and assist offenders."[196]

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190 OSTROM, *supra* note 10, at 101.

191 *The "Wireless" Devotees of Chicago*, 56 ELECTRICAL WORLD 139 (1910). What might be more rare, however, is a switch from a private property system to a common property system. The transition usually happens the other way around. However, an example of private-to-common transitioning is the alpine pastures of the Swiss canton of Glarus, which were privately owned until the seventeenth and eighteenth centuries, at which point the private owners sold the pastures to local communities in order to obtain investment capital. STEVENSON, *supra* note 10, at 113 n.19.

192 CLINTON B. DESOTO, 200 METERS & DOWN: THE STORY OF AMATEUR RADIO 132 (1936).

193 *Id.* at 75.

194 *See supra* notes 152-63 and accompanying text.

195 DESOTO, *supra* note 192, at 34.

196 *Id.* at 68.

¶81 But what does this modest example prove? As a skeptic might argue, the Chicago Wireless Club's spectrum sharing plan was successful only because of the extremely limited number of users (probably under 150).[197] In a large metropolitan area today, the number of spectrum users would be in the millions (counting cellular phones, radio and television broadcasters, wireless Internet access, etc.), and private agreements on sharing the spectrum would be impossible to create given the large transaction costs.

¶82 In response, I would make two arguments. First, despite the vastly greater number of spectrum users today, the relevant users who would participate in forming a local spectrum sharing agreement would be relatively small.[198] For example, it would not be necessary for each individual cellular phone user to participate in negotiations about how to use the local spectrum, as the 100 members of the Chicago Wireless Club likely had to do back in 1910. Rather, the cellular phone companies and manufacturers would be the relevant parties to the local negotiations. And the number of such companies in a given region will by necessity be far smaller than the number of end-users in that region. Thus, effective negotiations would likely be as feasible now as they were in 1910 Chicago plan.

¶83 Second, there is no reason to think that the transaction costs associated with commons-management will be any greater than they currently are under the auction regime. With auctioning, companies have had to hire expensive auction theorists as consultants,[199] and more importantly, have had to pay money to the government for the privilege of using the spectrum--some $42 billion in all so far.[200] Surely a set of local and national commons-management groups could be set up for less than $42 billion. Moreover, as Edwards and Steins note, "users might derive transaction *benefits* from participation in resource allocation and management decision-making arenas," including the benefits of "social interaction," and "a sense of increased self-worth."[201]

¶84 One prominent scholar has argued a commons in the spectrum will not work, pointing for evidence to the modest success (or lack thereof) of the FCC's experiment with the Unlicensed National Information Infrastructure (U-NII).[202] This imposing title is the FCC's term for a band of spectrum in the 5 GHz range for which no license is required. The FCC issued an order in 1997 establishing the U-

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197 As James Buchanan has suggested, incentives that are present in small group interactions are not necessarily available when the groups are larger:

> Volunteer fire departments arise in villages, not in metropolitan centers. Crime rates increase consistently with city size. Africans behave differently in tribal culture than in industrialized urban settings. There is honor among thieves. The Mafia has its own standards. Time-tested honor systems in universities and colleges collapse when enrollments exceed critical size limits. Litter is more likely to be found on heavily traveled routes than on residential streets. Even the old adage, Never trust a stranger, reflects the recognition of this elemental truth, along with, of course, additional ethical predictions. Successful politicians organize grassroots support at the precinct level.

JAMES M. BUCHANAN, FREEDOM IN CONSTITUTIONAL CONTRACT 162 (1977).

198 As some commentators have suggested, a relatively small population (under 150 people) might be the optimal group size (in terms of minimizing supervision costs, exclusion costs, and shirking). Thus, the Hutterite colonies of South Dakota tend to split in two once the population reaches 130-150. Lueck, *supra* note 84, at 50.

199 John McMillan, *Selling Spectrum Rights*, 8 J. ECON. PERSPECTIVES 145, 146 (1994).

200 *See* http://wireless.fcc.gov/auctions.

201 Victoria M. Edwards & Nathalie A. Steins, *Developing an Analytical Framework for Multiple-Use Commons*, 10 J. THEORETICAL POL. 347, 377 n.22 (1998).

202 THOMAS W. HAZLETT, THE WIRELESS CRAZE, THE UNLIMITED BANDWIDTH MYTH, THE SPECTRUM AUCTION FAUX PAS, AND THE PUNCHLINE TO RONALD COASE'S "BIG JOKE": AN ESSAY ON AIRWAVE ALLOCATION POLICY (AEI-Brookings Joint Center for Regulatory Studies, Working Paper 01-02, January 2001), *available at* http://www.aei.brookings.org/publications/working/working_01_02.pdf. The U-NII is not the only band allocated for unlicensed use, *see id.* at 139; 47 C.F.R. § 15.301 (setting standards for unlicensed PCS devices), but it is probably the most well-known.

NII at the urging of Apple Computer,[203] Microsoft, Compaq, and other major corporations.[204] In addition to the equipment manufacturers interested in unlicensed spectrum, other interest groups supported the idea. A group of educators, including California State University, the South Carolina Educational Television Commission, and the Education Network of Maine, argued that unlicensed spectrum would be the most affordable and convenient way to provide "last-mile" services to classrooms, especially compared to the costs of maintaining land-based T-1 lines to individual rooms.[205] The FCC spoke approvingly of such uses, as well as the potential for unlicensed wireless networks to "improve the quality and reduce the cost of medical care" by allowing medical personnel to exchange electronic information quickly.[206]

¶85 The resulting U-NII regulations look like this: There are very specific power limitations for each of the U-NII bands (5.15–5.25 GHz, 5.25–5.35 GHz, and 5.725–5.825 GHz),[207] as well as limitations on emissions outside the frequency bands.[208] U- NII devices are required to automatically discontinue transmission if they have no information to transmit.[209] Practically any device that meets the technical standards prescribed can transmit at any time, and no one has any right to complain about any interference within the band that might result.[210]

¶86 The advantages of unlicensed spectrum can include the following: First, services may be cheaper and more easily installed. A Cisco Systems white paper observes (perhaps self-servingly) that a fiber optic network can cost $300,000 to $500,000 to install in a typical office building, compared to less than $200,000 for a multipoint broadband wireless system using U-NII frequencies.[211] Second, companies can reach under-served markets, such as rural areas, more easily without having to install wire-bound networks.[212] Third, the wireless services are not restricted by having to work with incumbent local exchange carriers.[213] Fourth, the fact that an FCC license is not required means that there will be fewer delays in service and that the provider does not have to spend millions just to gain access to

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[203] *See* Apple Computer, Inc., Petition for Rulemaking; "NII BAND," Allocation of Spectrum in the 5 GHz Band to Establish a Wireless Component of the National Information Infrastructure, RM-8653 (May 24, 1995), *available at* http://www.warpspeed.com/lovette1.html.

[204] Amendment of the Commission's Rules to Provide for Operation of Unlicensed NII Devices in the 5 GHz Frequency Range, 12 F.C.C.R. 1576 (1997) (Report & Order) (amending 47 C.F.R. pts. 1, 2 & 15) [hereinafter U-NII order], *available at* http://www.fcc.gov/Bureaus/Engineering_Technology/Orders/1997/fcc97005.pdf.

For a fuller description of the genesis of the U-NII Order, *see* Benkler, *supra* note 8, at 331-40. According to the FCC, the National Information Infrastructure is a term that includes all information networks in the United States (including those not built yet), such as telecommunications, radio, television, and the Internet. U-NII Order, *supra* note 204, at n.2.

[205] U-NII Order, *supra* note 204, at n.17.

[206] *Id.* at n.37 and accompanying text.

[207] 47 C.F.R. § 15.407(a)(1), (2), (3).

[208] 47 C.F.R. § 15.407(b).

[209] 47 C.F.R. § 15.407(c).

[210] For further discussion of the technical requirements imposed by the FCC on unlicensed spectrum, *see* S. Michael Yang et al., *On the Use of Unlicensed Frequency Spectrum, Use Rule Evolution, and Interference Mitigation* (Jan. 18, 2001), *available at* http://www.jacksons.net/~tac/First%20Term/On%20the%20use%20of%20unlicesed%20frequency%20spectrum%20research%20paper4.pdf.

[211] Cisco Systems White Paper, *Building New World Networks with Unlicensed Wireless Spectrum: Using U-NII Spectrum to Penetrate the Broadband Market* (2000).

[212] *Id.*

[213] *Id.*

the spectrum.[214] Yet another advantage, according to the CEO of wireless service provider airBand, is that unlicensed spectrum allows companies to deploy "new services and technologies with fewer approvals needed from the FCC and other regulators."[215]

¶87 How has the U-NII worked in practice? Thomas Hazlett argues that the results are disheartening for commons proponents. He says that unlicensed entry causes over-crowding,[216] and points out that "financial markets have yet to embrace unlicensed service providers," thus indicating that unlicensed uses are not seen as viable investments.[217] His evidence on the latter point (the sum total of market valuations for licensed vs. unlicensed providers) is of questionable import. Because the spectrum devoted to licensed uses is much more suitable for phone networks than is the U-NII range (which requires an "absolutely clear line of sight"[218]), it is only natural that the companies using unlicensed spectrum would be smaller and fewer in number. More importantly, though, the U-NII, as pointed out above, is essentially an open access system. As one company insider observed, "Using unlicensed frequencies is a limited market. A carrier cannot deploy a nationwide network with unlicensed frequency because it is on a first come, first served basis, and a single carrier likely couldn't secure the spectrum on a nationwide basis."[219] But a first come, first served system is not a common pool regime; it is a squatter's regime. Even if the U-NII is a blazing failure, that has no implications for the viability of a true common pool regime. Precisely because the U-NII is unlicensed and is open to all, usage standards are like a public good, and hence will be under-produced.[220] This would not be true, however, of a common property regime, wherein the local users would better internalize the benefits of an efficient co-usage standard.

¶88 Indeed, perhaps the best evidence that a common pool regime could work for the spectrum consists of all the associations that technology companies have already formed to set interconnectivity standards. Without any government-facilitated spectrum CPRs in place, large technology manufacturers have come together to negotiate standards for wireless interchanges between different makes of computerized products. The WAP Forum,[221] started in 1997 by Nokia and Motorola and a few other companies, has gotten some 200 manufacturers of computer handsets to agree on a wireless application protocol (WAP).[222] WAP uses a new mark-up language called WML (Wireless Mark-up Language--to be contrasted with HTML, or Hyper-Text Mark-up Language) that is specifically designed to allow quick display of information such as stock quotes or bank accounts--just the type of information that mobile phone users typically need.[223] Using this protocol, [224]

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214 *Id.* Similarly, one wireless provider's CEO observes that without having to spend money on the spectrum, "We are using that to fund our deployment and to pass the savings on to our customers." *airBand Launches Plan to Lead Broadband Market*, CT WIRELESS, Nov. 30, 2000.

215 *airBand Launches Plan to Lead Broadband Market*, *supra* note 214.

216 HAZLETT, *supra* note 202, at 142.

217 *Id.* at 143-44.

218 Gerry Blackwell, *Another Kind of Unlicensed RF*, ISP-PLANET, Aug. 21, 2000, *available at* http://www.isp-planet.com/fixed_wireless/technology/5.8ghz.html.

219 Kelly Carroll, *Come On, Take a Free Ride*, TELEPHONY, July 24, 2000 (quoting Arnon Kohavi, senior vice president of Vyyo).

220 HAZLETT, *supra* note 202, at 147.

221 *See generally* http://www.wapforum.org.

222 William J. Holstein, *Moving Beyond the PC*, U.S. NEWS & WORLD REPORT, Dec. 13, 1999, at 54.

223 *2000 Style: Wireless Application Protocol for Mobile Phones*, COMPUTER WEEKLY, April 22, 1999.

handheld phones will have a universal language by which such information can be displayed. According to the WAP webpage, "WAP Forum members represent over 95% of the global handset market, carriers with more than 100 million subscribers, leading infrastructure providers, software developers and other organizations providing solutions to the wireless industry."[225]

¶89 Another example is the Bluetooth standard.[226] Named after King Harald Bluetooth of Denmark, who ruled from A.D. 940 to 985 and unified that country,[227] Bluetooth will provide a universal standard for wireless communication between electronic devices that are in the same room, such as computers, wireless phones, handheld organizers, and others.[228] This will mean that "an electronic organizer in your pocket could transmit a phone number to the cell phone in your briefcase and initiate a phone call," or that "your digital camera could send a photo straight to your printer," or that "seconds after you snapped a photo from a ski lift, the digital camera could send the image to the cell phone in your pocket, which could then send the photo as an e-mail attachment to friends back home."[229] Bluetooth accomplishes this inter-device communication by using spread-spectrum technology[230] in the 2.4 GHz frequency range (the same range as microwave ovens and cordless phones).[231] Moreover, the expected speed for data exchange is 720 kilobits per second, or some thirteen times faster than the typical Internet connection today.[232] At a recent electronics convention, the Blueooth pavilion included "demonstrations of ISDN-to-Bluetooth, DSL-to-Bluetooth, USB-to-Bluetooth, and automobile-to-Bluetooth devices, to name a few of the many."[233] This means that Bluetooth could become a universal standard for interconnectivity between highly disparate devices.

¶90 The movement to create Bluetooth is currently led by nine companies called the Bluetooth Promoter Group, including 3Com Corporation, Ericsson, IBM, Intel, Lucent Technologies, Microsoft, Motorola, Nokia, and Toshiba.[234] In addition, more than 1,200 other companies have signed on to the effort.[235] As recently reported, "These standards□□□ together mean that a sizable percentage of manufacturers now agree on how to make many wireless devices and get them to

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224 For a general technical description of WAP, *see* Brent Dorshkind, *WAP Untethers the Web*, 17 UNIX REVIEW'S PERFORMANCE COMPUTING 59 (1999); *see also* Karen J. Bannan, *The Promise and Perils of WAP*, SCI. AM., October 2000, *available at*

225 WAP FAQ's, http://www.wapforum.org/faqs/index.htm.

226 *See generally* www.bluetooth.com. *See also* Lisa Guernsey, *Preparing for a Collision of Wireless Services*, N.Y. TIMES, Apr. 27, 2000, *available at*http://www.nytimes.com/library/tech/00/04/circuits/articles/27next.html.

227 *High-tech Devices Linked by Bluetooth*, MINNEAPOLIS-ST. PAUL STAR-TRIBUNE, Oct. 8, 1999.

228 Holstein, *supra* note 222, at 56. Eventually, the distance at which Bluetooth devices can communicate may reach 100 meters. Denise Romberg, *Bluetooth Reborn as Network Connectivity Tool*, COMPUTING CANADA, June 4, 1999.

229 *High-tech Devices Linked by Bluetooth*, *supra* note 227; *see also Bringing Up Bluetooth*, CHIEF EXECUTIVE, Aug. 1, 2000, at 68.

230 *See supra* notes 45-54 and accompanying text.

231 *High-tech Devices Linked by Bluetooth*, *supra* note 227.

232 Bill Machrone, *A Wireless Entanglement*, PC MAGAZINE, Mar. 9, 1999.

233 Frank J. Derfler, Jr., *Cross Signals: 802.11b, Bluetooth, and HomeRF: Technology Information*, PC MAGAZINE, April 18, 2000, at 226.

234 Mary Lisbeth D'Amico, *Industry Leaders Join Bluetooth Wireless Effort*, INFOWORLD DAILY NEWS, Dec. 1, 1999.

235 *Id.*

function together."[236] As a result of their efforts, some have estimated that there will be over one billion Bluetooth-enabled devices in the world by 2005.[237]

¶91 Another example of collective industry cooperation is the Wireless Ethernet Compatibility Alliance,[238] founded in August 1999 by companies including 3Com, Lucent, and Nokia. In the words of one of its founders, WECA's mission is to "certify cross-vendor interoperability and compatibility of IEEE 802.11b wireless networking products and to promote that standard for the enterprise, the small business, and the home."[239] That is, WECA will certify interoperability standards for products used by Local Area Networks (LANs).[240] WECA's efforts are distinguished from Bluetooth's in that Bluetooth will apply to home consumer products such as Palm Pilots and PCs, while WECA's standard is for all LANs, including large and small businesses.[241]

¶92 Finally, the most recent example may be the Broadband Wireless Internet Forum,[242] a program of the IEEE Industry Standards and Technology Organization wherein some thirty-eight companies (as of January 2001) have joined together to promote broadband wireless systems based on a technology called Vector Orthogonal Frequency Division Multiplexing.[243] The companies include Agilent, Cisco Systems, Texas Instruments, Toshiba, and others.[244] The stated goal is to "establish product roadmaps that lower product costs, simplify deployment of advanced services, and ensure the availability of interoperable solutions."[245]

¶93 The advent of the WAP Forum, the Bluetooth project, WECA , and BWIF shows that large corporations in the wireless business are indeed capable of bargaining with each other and coming to a rational solution to the problems of wireless interconnectivity. These arrangements come about because companies are interdependent to some extent; that is, they depend for their individual success on the willingness of others to cooperate in creating interoperability standards.[246] It does no good for only two or three companies to agree on a standard--for a standard to be successful, it has to be used by many different companies, so that individual consumers can buy the varied products that they want without having to worry about interconnectivity.

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[236] *Id.* at 56. For a good background on the technical side of Bluetooth, *see* Graham Prophet, *Living in a Wireless Wonderland*, EDN MAG., June 5, 2000, at 79.

[237] *Bringing Up Bluetooth*, CHIEF EXECUTIVE, Aug. 1, 2000, at 68.

[238] *See generally* http://www.wirelessethernet.org.

[239] *IEEE 802.11b Wireless LANs*, Apr. 25, 2000, at 2 (3Com Technical Paper), *available at*http://www.3com.com/other/pdfs/*infra*/corpinfo/en_US/50307201.pdf.

[240] WECA FAQs, http://www.wirelessethernet.org/faqs.asp. WECA has not created its own interoperability standard, but rather uses the IEEE 802.11b High Rate standard, which it calls "Wi-Fi." *Id.* This standard is in competition with the HomeRF Consortium's Shared Wireless Access Protocol, under which standard Compaq, Intel, and Proxim plan to offer products. Derfler, *supra* note 233, at 226.

[241] WECA FAQs, http://www.wirelessethernet.org/faqs.asp; *see also* Scott Jones, *Wireless Networking: WLANs Bring Connections Without Cords To Home & Office*, 11 SMART COMPUTING 85, 85 (2000), *available at*http://www.wirelessethernet.org/articles/Smart%20_Computing_Editorial.htm; *Wireless LANs: Added Width for New Wireless Age*, COMPUTING, Sept. 21, 2000, at 53 (comparing Bluetooth to WECA).

[242] *See generally* http://www.bwif.org.

[243] Press release, BWIF (Jan. 17, 2001), *available at* http://www.bwif.org/011701_bwif.html.

[244] *Id.*

[245] BWIF FAQs, http://www.bwif.org/faqs3.html.

[246] Interdependence has been identified as an enabling condition for creating a successful commons. Singleton, *supra* note 75, at 370 (noting that social institutions which make people's long term interests interdependent can provide a check on shirking and opportunism); Swaney, *supra* note 78, at 455 ("Interdependence in providing an important good or in managing a key resource is usually the principal thread holding common property together.").

¶94 This kind of cooperative behavior would also likely be possible for spectrum usage in general. Companies that make communications equipment or broadcast equipment, companies that offer such products to end users (such as cellular phone companies), and companies that use such products themselves (such as broadcasters) would come together in face-to-face negotiations[247] just as they already have with the above-mentioned projects. They would then set universal standards, perhaps along the lines of the designs articulated by Jon Peha and Timothy Shepard,[248] to govern their uses of the spectrum. Because the companies would be unable simply to purchase individualized allocation and ownership giving themselves monopoly over a spectrum block, they would be forced to engage both in technological innovation (to improve spectrum-sharing) and in cooperative bargaining (to reduce any potential reciprocal externalities). These cooperative bargaining relationships would in turn create social pressures to conform to the agreed-upon wireless standards.[249] The fact that companies would anticipate the need for ongoing relationships would inhibit any temptation they might feel to behave opportunistically.[250] Moreover, the ability of companies to communicate with each other effectively (as already demonstrated in the above initiatives) makes it much more likely that they will be able to develop "credible *ex ante* commitments without relying on external authorities."[251] As one scholar reports, the "presence of a prior history of cooperative institutions in the communities concerned was a positive predictor of cooperative society success," at least in part because pre-existing institutions give people a chance to "establish a reputation for cooperation that will serve them well in the future."[252] The associations just described give good reason to think that the wireless industry in general may have the communitarian characteristics that enable lowered transaction costs and thus enable solutions to commons dilemmas.[253]

¶95 One might object that there just isn't room in the spectrum to allow such experimentation with a new commons regime. After all, isn't the spectrum "scarce," that is, crowded with users on every possible frequency? The answer to this question is No.[254] As Paul Baran, one of the architects of the Internet, pointed out in a 1995 speech:

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247 Face-to-face interaction has proven important in enabling groups to overcome the problems of collective action. *See, e.g.*, Elinor Ostrom, *A Behavioral Approach to the Rational-Choice Theory of Collective Action*, 92 AMER. POL. SCIENCE REV. 1, 1 (1998), *available at*http://www.indiana.edu/~workshop/publications/elinor_ostroms_address.html.

248 *See supra* notes 46-54, 63-65 and accompanying text.

249 As Mark Somma says, "[L]ocal networks that use education, persuasion, incentives, and changing social expectations" are the most effective means of managing groundwater resources, in comparison to command-and-control bureaucracy and the market system. Somma, *supra* note 69, at 13; *cf.* SIY, *supra* note 69, at 102 (describing the way that social events involving food, drinking, and gossip encourage continued participation in commons management).

250 Singleton, *supra* note 75, at 374-75 (noting that because community members expected to continue interacting over time, their transaction costs of cooperating were lowered).

251 Elinor Ostrom et al., *Covenants With and Without a Sword: Self-Governance is Possible*, *in* THE POLITICAL ECONOMY OF CUSTOMS AND CULTURE: INFORMAL SOLUTIONS TO THE COMMONS PROBLEM, *supra* note 61, at 127, 129 (employing a game-theoretic analysis to demonstrate that individuals can solve social dilemmas when they have the ability to communicate with each other).

252 Paul Seabright, *Managing Local Commons: Theoretical Issues in Incentive Design*, 7 J. ECON. PERSPECTIVES 113, 122 (1993).

253 *See* Taylor & Singleton, *supra* note 109, at 200-01.

254 *See, e.g.*, THOMAS G. KRATTENMAKER & LUCAS A. POWE, JR., REGULATING BROADCAST PROGRAMMING 204-19 (1994); Emord, *supra* note 43 at 441-48; Charles W. Logan, Jr., *Getting Beyond Scarcity: A New Paradigm for Assessing the Constitutionality of Broadcast Regulation*, 85 CAL. L. REV. 1687, 1697 (1997); Matthew L. Spitzer, *The Constitutionality of Licensing Broadcasters*, 64 N.Y.U. L. REV. 990, 1007-20 (1989).

This is not to suggest that the FCC has admitted the impotence of the scarcity doctrine. As recently as 1996, the then-chairman of the FCC claimed that "it is simply not possible for more than a handful of

> Tune a spectrum analyzer across a band of UHF frequencies and you encounter a few strong signals. Most of the band at any instant is primarily silence, or a background of weaker signals. The spectrum analyzer connected to an antenna reveals that much of the radio band is empty much of the time.[255]

¶96 As Baran points out, "In part, the frequency shortage is caused by thinking solely in terms of dumb transmitters and dumb receivers."[256] Or, in the words of Ira Brodsky, president of Datacomm Research Company, "[T]he spectrum shortage is a manufactured problem. For example, the UHF-TV band comprises 336 MHz of bandwidth. Few cities have more than a half dozen active UHF-TV stations (each occupying just 6 MHz). The rest of the UHF-TV band has been sitting around for years collecting electromagnetic dust."[257] Brodsky goes on to say:

> History suggests a combination of technology and entrepreneurial activity will conquer almost any shortage. Over the last two decades, we have witnessed impressive growth in spectrum capacity. First trunking and then space-division multiplexing (cellular) arrived to boost the capacity of narrowband radio systems. Now digital radio techniques like time-division multiplexing and code-division multiplexing promise even more capacity. We have just begun to explore the possibilities of micro- and picocellular radio networks. *For the near term, we face not so much the threat of a spectrum shortage, but a spectrum glut.*[258]

IV. ANSWERING THE ARGUMENTS FOR AUCTIONS

A. Efficiency?

¶97 One of the most common arguments in favor of spectrum auctions is that they lead to the greatest economic efficiency by putting "spectrum into the hands of those who□□□ value it most highly."[259] According to this rationale, the "social value of a license□□□ is equal to the most efficient firm's valuation of it."[260] Thus, as Peter

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broadcasters to use the spectrum in any geographic area"--a claim that is demonstrably false. Reed E. Hundt, *A New Paradigm for Broadcast Regulation*, 15 J.L. & COMM. 527, 542 (1996). Given the incentives created by the auction regime, however, the FCC will likely never admit that spectrum is not scarce (in the sense of being overcrowded). *Cf.* Milton M.R. Freeman, *Graphs and Gaffs: A Cautionary Tale in the Common-Property Resources Debate*, *in* COMMON PROPERTY RESOURCES: ECOLOGY AND COMMUNITY-BASED SUSTAINABLE DEVELOPMENT, *supra* note 10, at 92, 100-01 (noting that Canadian bureaucrats in charge of wildlife management misrepresented data, being motivated by competition for budgetary resources).

255 Paul Baran, Is the UHF Frequency Shortage a Self Made Problem, Address at the Marconi Centennial Symposium (June 23, 1995), *available at* http://www.interesting-people.org/archives/interesting-people/199507/msg00023.html; *see also* Paul Baran, Visions of the 21st Century Communications: Is the Shortage of Radio Spectrum for Broadband Networks of the Future a Self Made Problem, Keynote speech at the 8th Annual Conference on Next Generation Networks (Nov. 9, 1994) ("[L]et's start by reviewing this presumption of a permanent shortage. Let's consider how, with an application of already known technology, we could create even a surplus of frequencies."), *available at* http://wireless.oldcolo.com/course/baran1.txt.

256 Baran, Address at the Marconi Centennial Symposium, *supra* note 255.

257 BRODSKY, *supra* note 179, at 17; *see also* W. Curtiss Priest & Kenneth Komoski, *Wireless: to Achieve Universal Service* (Oct. 30, 1995), (stating that out of the 376 MHz of spectrum devoted to UHF television, 240 MHz is typically unoccupied in most major cities), *at* http://www.eff.org/pub/Groups/CITS/Reports/volksmodem_wireless_com.proposal.

258 BRODSKY, *supra* note 179, at 18.

259 Rosston & Steinberg, *supra* note 34, at 107; *see also* Testimony of Larry Irving on Management of the Radio Spectrum before the House Committee on Commerce, Subcommittee on Telecommunications, Trade and Consumer Protection (Feb. 12, 1997) (arguing that auctions "are more likely to award licenses to the parties that value them most and therefore can result in the most economically efficient license distribution"). According to one economic analyst, the substantial level of auction revenue received so far is a prima facie sign of efficiency. Cramton, *supra* note 35, at 730.

260 John McMillan, *Why Auction the Spectrum?*, 19 TELECOMMUNICATIONS POLICY 191, (1995), *available at* http://www.market-design.com/files/mcmillan-why-auction-the-spectrum.pdf; *see also* Adam D. Thierer, *A Policy Maker's Guide to Deregulating Telecommunications Part 6: A Free-Market Future for Spectrum*, in TALKING POINTS

Huber put it, selling spectrum allows the buyers to "get on with putting spectrum to the best possible use."[261] Or, to quote a report from the President, "Auctions can help promote economic efficiency, by ensuring that spectrum is deployed in the highest-return uses□□□."[262]

¶98 The first problem with the efficiency argument is that it seems difficult to verify empirically. As the FCC Report admits, "Determining the value of spectrum in advance of an auction is very difficult."[263] If the value of the spectrum cannot be measured *ex ante*, then there seems to be no basis for saying that the final winners in a particular auction are necessarily those who valued the spectrum most highly. One suspects that the definition of "value" being used here is circular--the highest-value-user is defined as whoever happens to win a particular auction, and then the auction is praised for its power of discovering the highest-value-user. But if one does not accept as self-evident the efficiency of auctions,[264] the "highest value user" argument won't hold much sway.

¶99 Moreover, there might be any number of uses or combinations of users that would produce an ultimately greater social value from a piece of the spectrum, but that will not come out on top in a particular auction because of the restrictions placed on licenses. For example, the FCC might auction off a certain area of the spectrum for PCS (personal communication services) in a given city. The winner might pay, say, $1 a pop, that is, $1 per capita. But without an *a priori* valuation of the spectrum at that level, how are we to know that $1 a pop for PCS service reflects the highest social value? Perhaps the highest value use would be for another TV station to open up on those frequencies.[265] Or perhaps the highest value use would be for wireless Internet access systems. There might be a million possible combinations of various uses for that spectrum that would have a higher value than $1 a pop. But because of the FCC's artificial rules constraining the use of the spectrum to one type of service, those other possibilities are off-limits from the start. Thus, there is no guarantee that the outcome is necessarily the most efficient.

¶100 To take a concrete example, the FCC has announced plans to auction 36 megahertz of spectrum formerly allocated to UHF TV channels 60 through 69.[266] Initially, the FCC proposed that 6 megahertz be designated as "guard bands," in which stricter rules would apply to prevent interference with nearby spectrum, and which would be restricted to private-radio networks.[267] As one report noted, however, some would-be bidders protested: "One company, Silicon Valley start-up FreeSpace Communications LLC, for example, has said it has developed a new technology that could provide fast and cheap Internet access over a national

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No. 11 (Heritage Foundation, 1996), *available at* http://www.heritage.org/library/categories/regulation/tp11.html (arguing that auctioning will "guarantee more rapid deployment of the spectrum to new users who value it most highly").

261 PETER HUBER, LAW AND DISORDER IN CYBERSPACE 73 (1997).

262 *Promoting Competition in Traditionally Regulated Industries,* ECONOMIC REPORT OF THE PRESIDENT 155, 160 (1996).

263 FCC Report, *supra* note 20, at 32.

264 Indeed, it may be that even costless privatization can lead to a Pareto deterioration. *See* Eirik G. Furubotn, Comment, *Privatizing the Commons*, 54 SOUTHERN ECON. J. 219, 220 (1987).

265 This is not likely, however. As Kwerel and Williams showed in their 1992 analysis, preventing UHF broadcasters in Los Angeles alone from reallocating their spectrum to cellular phone usage would cause net social losses of between $660 million and $783 million (in 1991 dollars) for the years 1992-2000. Evan Kwerel & John R. Williams, *Changing Channels: Voluntary Reallocation of UHF Television Spectrum* 2 (Office of Plans and Policy Working Paper No. 27, FCC, November 1992).

266 *See supra* notes 24-25 and accompanying text.

267 *See supra* note 26 and accompanying text.

network that wouldn't result in frequency interference."[268] Mike Farmwald, the founder of FreeSpace, was pessimistic after petitioning the FCC to reconsider its allocational rules: "As a naive semiconductor guy, I don't get it.□□□ This just seems like the old way: government taking care of industry in a certain way."[269] In another report, Farmwald was quoted as saying, "We think it is a ridiculous notion that valuable spectrum be used by private [wireless entities.] They are wasteful because they don't compress and they have large cell sites."[270] Farmwald of course has an incentive to claim that his proposed use of the spectrum is the most efficient; but the FCC similarly has an incentive to claim that *its* proposed allocation is the most efficient. It is enough for my point that we take the FCC's self-congratulatory proclamations of efficiency with a healthy dose of skepticism.

¶101 One might argue that this problem could be solved by simply removing the restrictions on spectrum usage once it is sold. Thus, Spiller and Cardilli (among others) argue that we should sell the spectrum to the highest bidder, and then let that bidder do whatever it pleases with that spectrum--sell it to someone else, change the type of service offered, etc.[271] If the highest value use for that particular area of spectrum would be for three PCS companies to compete simultaneously using spread spectrum technology, then the winner of an FCC auction would reallocate the spectrum to that use. Or, as Thomas Hazlett puts it, proponents of a spectrum commons have to answer the fundamental question "why, if spectrum sharing is highly efficient, it takes a government policy banning exclusive use to promote it?"[272]

¶102 This, however, is the wrong question. The question is not whether the government should ban exclusive uses, but whether the government should *allow* non-exclusive uses or exclusive uses or any combination thereof, depending on the decisions made by local common property management. In a system (like the one we now have) where the default spectrum license is to an exclusive user, the Coase theorem implies that efficiency could be undermined by high transaction costs. For example, even if the truly optimal use for a piece of spectrum (considering the interests of the consumers) were to have three PCS companies in competition using spread spectrum technology, the sole winning bidder would prefer to retain the monopoly rents, and would be reluctant to stimulate its own competitors by reallocating spectrum to them.[273] Under the current auction system, some companies engage in strategic bidding to stifle competition. To quote an industry magazine:

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[268] Kathy Chen, *FCC Sets Rules for Auction of Spectrum That Could Be Technological Speedway*, WALL ST. J., Jan. 7, 2000, at A6.

[269] *Id.* at B1 (quoting Farmwald). For more information on FreeSpace, *see* Loring Wirbel, *FCC Spectrum Ruling Nudges Wireless to 'Last Mile': Startup Floats Plan to Bring Broadband Home*, ELEC. ENG'G TIMES, Jan. 10, 2000.

[270] Weaver, *supra* note 25.

[271] Spiller & Cardilli, *supra* note 37, at 82; *see also* Glen O. Robinson, *supra* note 38, at 619-20 (arguing that "subsequent transferability" is necessary to allow spectrum usage to "adapt to changing economic and technological circumstances").

[272] HAZLETT, *supra* note 202.

[273] As Eli Noam notes, "Advocates of resale markets need to explain the empirical fact that there was never any meaningful resale of nonadvertising time slots for spectrum access by broadcasters, even in multistation markets (or by cable companies for their bandwidth).□□□ The basic problem is the resistance to provide a competitor with a vital input at a price that permits entry." Noam, *supra* note 37, at 786-87. Noam also points out that the only two bidders that showed up for a particular spectrum auction in New Zealand were the "previous monopolists in telecommunications and broadcasting"--and it is "hard to imagine that their motivation is to encourage usage by competitors." *Id.* at 786.

In a similar vein, Thomas Hazlett observes that if an incumbent license holder could accommodate a competitive entrant with a slight, inexpensive modification, it will not do so. Rather, hoping to keep its profits by deterring entry, it will "maximize profit by withholding information, advancing narrow arguments against entry." HAZLETT, *supra* note 202.

> Some existing regional players may try to buy spectrum in markets where they already operate in hopes of cornering the market. For example, during a previous local multipoint distribution service auction, New York City licenses sold far cheaper than some markets in New Mexico, where existing players were bidding for licenses to keep the competition out[...].[274]

¶103 Because the FCC auctions by definition sell resources to single particular winning bidders, optimal outcomes that involve simultaneous uses (such as spread spectrum or ultra-wideband technologies) will never win in an auction.[275] Moreover, those newer technologies require the use of broader areas of spectrum than the traditional FCC license, as Yochai Benkler has pointed out.[276] This means that someone who wished to provide such services would have to negotiate and bargain with numerous pre-existing license holders in order to consolidate a broad enough area of spectrum. The transaction costs would probably be too high for that to occur.[277] Worse, the holdout problem might arise, as a license holder of a prime area of spectrum could demand too much money for relinquishing his license to the would-be aggregator. Indeed, this very phenomenon has happened recently with the proposal to re-auction broadcast spectrum for so-called 3G (or third generation wireless) uses[278]--incumbent broadcasters have been unwilling to forego their licenses at any price, because under the FCC's "must carry" rules, giving up a broadcast signal means giving up the right to have a channel included in a cable lineup.[279] It seems indisputable that the FCC's initial allocation of spectrum ownership by auction *can* affect the possibility of achieving an efficient outcome.

¶104 Another problem with the efficiency thesis is that the proceeds of the auctions become an effective commons themselves in the hands of the government. Thus, while it may be true that the auction system lessens the rent-dissipating competition for licenses (as compared to the lottery system), it may also be the case that "more rent will be dissipated in the competition over revenue being politically distributed."[280] That is, "Government measures to convert commonly owned resources into privately owned resources are vulnerable to rent seeking behavior that can dissipate a significant portion of the efficiency gained from privatization. And this is true even if the government simply sells the resources with no rent seeking taking place at the time of transfer."[281]

¶105 The FCC has claimed that one indication of auctions' efficiency is that few auctioned licenses have been resold. In 1996, for example, 12 PCS A and B block

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274 Nancy Gohring, *Auction Block Intrigue: 39 GHz Auction May Yield Some Surprises*, TELEPHONY, April 24, 2000.

275 Any attempt to design an auction so as to capture optimal multi-user outcomes would likely fail. One might try to require, for instance, that the individual bidders place multiple simultaneous bids that reflect their valuations on 1) sole ownership of an area of spectrum, 2) dual ownership of that spectrum, 3) three-way ownership, 4) four-way ownership, etc. Nevertheless, if the company expected that sole ownership would likely bring with it the monopoly advantage of capturing consumer surplus, it would undervalue the other multi-owner possibilities, thus failing to take into account the increase in general social value (i.e., from consumer surplus) that might result from multiple uses and competition. Nonetheless, the problem of valuing multi-use items by auction might conceivably be solved someday by auction theorists.

276 *See* Benkler, *supra* note 88, at 363-64.

277 *Id.*

278 For a good explanation of 3G services, *see* Leander Kahney, *The Third-Generation Gap*, SCI. AM., October 2000, *available at* http://www.sciam.com/article.cfm?articleID=00031A96-AatID=2; Ernest Rejman, *3G is Poised to Take Over the Cellular World*, MICROWAVE JOURNAL, Sept. 1, 2000, at 162.

279 *See Battle of the Airwaves*, THE ECONOMIST, July 29, 2000, at 57; *see also* Aaron Pressman, *Digital Squatters Won't Budge From Spectrum*, THE INDUSTRY STANDARD, June 5, 2000.

280 Dwight R. Lee & David Kreutzer, Comment, *Privatizing the Commons*, 50 SOUTHERN ECON. J. 1162, 1163 (1983).

281 *Id.* at 1163-64.

licenses representing 6.5% of total revenue were resold, whereas 75 cellular licenses distributed by lottery were resold in 1991.[282] As the above analysis indicates, however, a low resale rate might simply reflect the inefficiency caused by the fact that auctions necessarily sell spectrum to one particular bidder, while the FCC further restricts spectrum to specific uses. Moreover, the auction price for a certain area of spectrum may be a substantial barrier to entry for a startup company, even if that company could potentially put that spectrum to better use. By selling off spectrum to the highest bidders, who then make even larger investments in infrastructural networks, we may be guaranteeing that fledgling, innovative startups will not be able to pay the incumbent for the use of that spectrum. If that is the case, the low rate of resale may well represent the fact that auctions put up higher barriers to entry for smaller and younger companies.

B. Speedy Implementation?

¶106 The second reason that auctions are praised is for their quick implementation— auctions are able to allocate spectrum more expeditiously than either lotteries or comparative hearings.[283] According to an FCC Report, it took about two years on average to award cellular licenses in comparative hearings and over one year by lotteries.[284] In contrast, FCC auctions have taken as little as two days to run,[285] although it still takes an average of 233 days from the filing of an application to the license grant under the auction system.[286] The problem with this sort of thinking is that the baseline standard is the old system of comparative hearings or lotteries. Judged by this standard, auctions are indeed an improvement in efficient and timely administration.[287] But if one views the appropriate baseline as a laissez-faire system (which would involve *no* governmentally-caused delays in allowing new users to participate in spectrum usage), the auctioning system loses some of its luster. It all depends on your view of the baseline reality.

C. Technological Innovation?

¶107 Third, auctions are supposed to promote technological innovation. In this area, the FCC has historically suffered from a lackluster reputation. Cellular telephony provides an example of the FCC's suspicious attitude towards new technology. As Professor Thomas Hazlett has said:

> Take the case of cellular telephony, first demonstrated as technical reality… in 1946. The FCC leapt into action, designating a bloc of UHF spectrum to be used for the service… in 1968. But, believing it may have acted too hastily, the commission reconsidered. It took until 1984 to begin issuing licenses in earnest; the job wasn't finished until… 1989.[288]

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[282] FCC Report, *supra* note 20, at 23.

[283] *E.g.*, Kwerel & Williams, *supra* note 34 (arguing that auctions would "eliminate the regulatory delay and other costs associated with the administrative allocation and assignment processes").

[284] FCC Report, *supra* note 20, at 7.

[285] The Interactive Video and Data Service auction, conducted on July 28-29, 1994, is an example. FCC Report, *supra* note 20, at 11.

[286] *Id.* at 22.

[287] As Peter Cramton, an academic proponent of auctions, said, "Any auction would look good relative to the FCC's past experience with comparative hearings and lotteries." Cramton, *supra* note 35, at 735; *see also* Rosston & Steinberg, *supra* note 34, at 107 (noting that "auctions vastly reduce the delay involved in… getting licenses into the hands of those who value them most highly, as compared to lotteries or comparative hearings") (emphasis added).

[288] Thomas Hazlett, *Free Markets for Telecom: Spectrum Auctions*, WALL ST. J., Dec. 20, 1994, at A14.

¶108 In contrast, say the proponents of auctions, selling off rights to the spectrum encourages innovation. By forcing firms to "use their own resources to compete for valuable spectrum, auctions encourage firms who value the spectrum the most to use it productively and in innovative ways."[289] Or as one especially enthusiastic supporter put it, "Entire new industries□□□ are thereby allowed to develop and create jobs for thousands of workers."[290] The FCC Report on Spectrum Auctions describes several companies as paragons of the innovation supposedly stimulated by the auctioning system. For example, the Report says:

> Airadigm Communications was the first broadband PCS C block licensee to launch service in Green Bay and Madison, Wisconsin. Airadigm has not only provided services to parts of rural America but it has also reached some of the most underserved Americans by joining into a partnership with the Chillicothe Native American tribe, which plans to provide cutting edge wireless local loop service on the tribe's reservation.[291]

¶109 Unfortunately for the FCC, Airadigm turned out not to be a paradigm of entrepreneurial achievement. A recent report noted that Airadigm and other so-called winners of the 1996 PCS auction "have yet to recover from the high cost of their licenses."[292] As of that report, Airadigm was battling with the FCC in bankruptcy court to lower the amounts due for the spectrum that Airadigm had bought.[293]

¶110 Even if the FCC had been correct in its assessment of Airadigm's potential for innovation, such innovation would be not only possible, but more profitable and widespread, under a common pool system that (in all likelihood) regulated only power and equipment protocols. It is only the FCC's reputation for stifling innovation that makes it possible for the auctioning system to seem innovation-friendly by comparison. One's view of baseline reality is critical. If the baseline state is one of FCC-forbidden access to spectrum, then the auctioning process might be praised for opening up the spectrum to new and valuable industries. But surely the same industries (or who knows how many others) would have developed even more rapidly had the FCC never forbidden access to spectrum in the first place.

¶111 With the proper baseline view in mind, the auctioning process actually functions more as a barrier to entry than as a facilitator of new industry.[294] To quote Dr. David Clark, a senior research scientist at the Advanced Network Architecture Group at MIT:

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[289] FCC Report, *supra* note 20, at 3. To take another example, the FCC Report on Spectrum Auctions made the following claim:

> Aggregation [as allowed by auctions] may also facilitate the adoption of new technologies and services. For example, if a company uses an innovative technical standard for its equipment that is not compatible with other standards, then aggregating licenses in adjacent geographic areas would allow the company to provide seamless service over a large area.

Id. at 14-15.

[290] Testimony of Larry Irving, *supra* note 259. Irving was the Assistant Secretary for Communications and Information at the National Telecommunications and Information Administration.

[291] FCC Report, *supra* note 20, at 23.

[292] Denise Culver, *WinStar's Last License Windfall*, INTERACTIVE WEEK FROM ZDWIRE, Aug. 30, 1999.

[293] *Id.*

[294] *E.g.*, Jeffrey Silva, *FCC to Halt Procedures if TV Channels on Block This Year*, RCR RADIO COMM. REPORT, June 21, 1999 ("In contrast, start-up personal communications services firms are struggling to stay financially afloat. A big auction this year could scare away precious capital, their lifeblood."); Weaver, *supra* note 25 (describing upstart Freespace Communications' fear that it will not be able to compete in an auction against large wireless companies, despite its claimed ability to use that spectrum more efficiently).

> The FCC auctions off spectrum at high prices, necessitating conservative business plans by those who can afford it. By contrast, the whole history of the Internet is one of speculative innovation, of trying something new and seeing if it works. But how can you justify spending $2 billion to $4 billion for a field-of-dreams experiment in wireless? A few big firms with national footprints – the wired phone companies – own large parts of the spectrum. And they conservatively use the same business model they used for voice technology. So we have national companies putting up new antennae on lots of towers, and offering a monthly service contract. This has nothing to do with technology, but rather with business plans.[295]

¶112 By forcing companies to pay large upfront fees for access to the spectrum, auctions may in many cases represent a substantial barrier to innovation and experimentation. Under a common-pool approach to the spectrum, companies would be free to experiment and innovate without being inhibited by the barriers of artificially-created spectrum monopolies.

D. A Source of Federal Funds?

¶113 Fourth, auctions are seen as a source of fodder for the federal budget.[296] The Balanced Budget Act offers examples of the primacy of the budgetary motive. For example, the FCC is instructed to auction spectrum from 2.11 to 2.15 GHz, "unless the Commission determines that auction of other spectrum A) better serves the public interest, convenience, and necessity, and B) *can reasonably be expected to produce greater receipts*."[297] Senator John McCain, who proclaimed himself "one of the principal architects of Title III of the Balanced Budget Act,"[298] said the following of that Act:

> In addition, the bill contains several provisions designed to enhance the revenues spectrum auctions will bring in by improving the auction process itself.□□□ It also requires the FCC to establish reserve prices and minimum bids. Finally, it eliminates the entrepreneurial uncertainty, and consequent lessened auction revenues, that is caused when spectrum is allocated for any and all unspecified uses. It does this by stating certain, limiting conditions and procedures under which the FCC will be permitted to allocate spectrum for flexible use in the future. Collectively these provisions should result in increased revenue from spectrum auctions.[299]

¶114 For another example, in introducing legislation that would require the FCC to set a minimum bid in its auctions, Senator John Kerrey said, "The importance of this legislation is heightened by the increasing congressional reliance on spectrum auctions in telecommunications and budget policy. The President's budget alone relies on $36 billion of revenues from spectrum auctions."[300] Or as a recent news article noted, Congress has already spent some of the revenue expected from the FCC's upcoming auction of the spectrum currently allocated to UHF channels 60

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[295] Betty Spence, *Now and Soon*, CHIEF EXECUTIVE, August 1, 2000, at 51.

[296] Thus, whenever a new auction is announced, the FCC provides an estimate of the revenue it hopes to raise. For example, the FCC announced that it expected to raise $2.6 billion in the May 2000 auction of spectrum in the 700 MHz. range. Jonathan Collins, *FCC Makes Waves – Controversy Once Again Rocks Spectrum Auctions*, TELE.COM, Jan. 24, 2000, at 20. Such valuations are often difficult, however, with the OMB and the CBO competing, as usual, to predict expected revenue. Jeffrey Silva, *Spectrum Valuation Difficult Task for Budget Makers*, RCR RADIO COMM. REPORT, Jan. 10, 2000, at 18.

[297] Balanced Budget Act of 1997, Pub. L. No. 105-33, § 3002(c)(3), 111 Stat. 261 (emphasis added).

[298] 143 CONG. REC. S8493, 8494 (daily ed. July 31, 1997) (statement of Sen. McCain).

[299] *Id.* at S8495.

[300] 143 CONG. REC. S3799 (daily ed. April 29, 1997) (statement of Sen. Kerrey).

through 69.[301] The eagerness to increase auction revenues will only grow greater in light of the recent European auctions that raised $35.5 billion in the UK and a stunning $42 billion in Germany.[302] As one recent article noted, "The Federal Communications Commission (FCC) is starting to get some heat from members of Congress on wireless spectrum issues. With billions of dollars in federal revenue at stake, representatives say wireless spectrum battles are poised to become more public – and more political – in the coming year."[303]

¶115 Not only Congress has its eye on auction money; political lobbyists and special interest groups also perceive in auctions a chance to win revenue for their pet projects.[304] The problem with this view is that it fails to recognize that money does not grow on trees. If telephony providers, for example, have to pay $10 per customer for the monopoly rights to a particular chunk of spectrum, in a long run equilibrium the providers will pass the spectrum costs to their customers via higher rates. If broadcasters have to pay for spectrum, they will have to charge higher advertising rates, which will in turn cause higher prices for goods that are advertised via broadcast technologies. Thus, any price paid into the government treasury for spectrum access will ultimately translate into higher prices for goods and services that the public buys.

¶116 The most serious problem with the budgetary justification for auctions is that auctions tend to create a self-serving arrangement between the large companies and the politicians. Now that politicians have come to depend on auction revenue for balancing the budget,[305] it is in their interest to keep access to the spectrum artificially scarce, and therefore expensive.[306] If spectrum is made too freely available, even via the auction method, revenues will decrease. The WCS auction debacle of 1997 serves as a prime example of what happens when a spectrum auction is hurried for budget purposes--out of the 128 licenses sold, some went for as little as a dollar each.[307] In the future, politicians will be sure not to allow too much spectrum to be sold too quickly. In fact, Rep. Rick Boucher (D., Va) opposed a bill which would have allowed greater spectrum flexibility, on the grounds that it "amounted to a net increase in spectrum supply… and would reduce demand for the FCC auctions, costing the government money."[308] Similarly, it is in the interest of the current incumbents to lobby Congress and the FCC to maintain spectrum

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[301] Kathy Chen, *FCC's Next Airwaves Auction Pits Old Guard vs. Internet Companies*, WALL ST. J., Dec. 20, 1999, at B1.

[302] *See Wireless Carriers Fear High Prices for Capacity*, BALTIMORE BUS. J., Sept. 8, 2000, at 34.

[303] James R. Dukart, *Spectrum Cap Flap–Congress Weighs in on Wireless Auctions*, TELE.COM, Sept. 18, 2000, at 24.

[304] *E.g.*, Common Cause, *How Much Is It Worth?* (1997), *at* http://www.commoncause.org/publications/040297_rpt2b.htm (noting that if HDTV spectrum were auctioned, the revenues would pay for "eight years of subsidized lunches for low-income children" or "the construction of 5,883 new elementary schools").

[305] *E.g.*, Wirbel, *supra* note 269 ("Congress is depending on the application of auction revenues toward the fiscal year 2001 Defense Department budget, meaning that proceeds from the auction must be in the Treasury by Sept. 30.").

[306] Charles L. Jackson et al., *Public Harms Unique to Satellite Spectrum Auctions*, Strategic Policy Research, *available at* http://www.spri.com/pdf/reports/sia/pubharms.pdf ("To increase revenues, individual countries conducting auctions will have an incentive to restrict the supply of satellite spectrum (*e.g.*, warehousing spectrum and orbital resources), implement *a priori* planning and oppose new allocations of satellite spectrum…."); Jon M. Peha, *Spectrum Management Policy Options*, IEEE COMM. SURVEYS, *available at* http://www.comsoc.org/livepubs/surveys/public/4q98issue/peha.html ("The best way to maximize long-term revenues is to inflate the value of licenses by artificially creating scarcity, i.e., not releasing much spectrum.").

[307] Bryan Gruley, *Dollar Days: Sale of FCC Licenses in Several States Nets Budget Pocket Change*, WALL ST. J., June 3, 1997, at A1. A company called McLeodUSA paid one dollar each for four licenses covering four states and 15 million people. A vice-president of this company is quoted as saying, somewhat wryly, "Our CFO guaranteed we could double our money." *Id.*

[308] Hazlett, *supra* note 288, at A14 (quoting Rep. Boucher).

scarcity, because they do not want their potential competitors to gain access at less expensive rates.[309] As former-FCC chairman Ferris notes, "[I]t serves the interests of those who have gained access to a frequency to restrict as much as possible its availability to potential competing users."[310] Similarly, Thomas Hazlett points out that the FCC licensing system has historically served as a "cartel enforcement device" for industries like broadcasting.[311] This collusion between the communications companies and bureaucrats can only create even higher barriers to entry for start-up companies.[312]

E. Transaction Costs?

¶117 Fifth, auctions are seen as preferable to the old systems of lotteries and comparative hearings because of transaction costs--under the former systems, applicants had to expend resources on preparing the "best" application, and the FCC had to administer a costly system of allocation.[313] Now, applicants no longer have to make large expenditures on rent-seeking and pursuing licensure, and governmental administrative expenditures have similarly decreased.[314] Again, though, one's view of baseline reality is what matters. The same sorts of transaction costs might diminish even further under a commons approach to regulating the spectrum. In such a system, companies would no longer have to spend money to keep their competition from winning any particular auction. Instead, they would incur transaction costs only in their efforts to coordinate the implementation of technology that would allow effective spectrum sharing.

F. Assisting Minorities?

¶118 The affirmative action ideals sought by the FCC may be the most problematic element of the auctioning system. Congress has specifically instructed the FCC to take such considerations into account, listing one of the goals of auctioning as follows:

> [P]romoting economic opportunity and competition and ensuring that new and innovative technologies are readily accessible to the American people by avoiding excessive concentration of license and by disseminating licenses among a wide variety of applicants, including small businesses, rural telephone companies, and businesses owned by members of minority groups and women.[315]

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[309] To quote Gruley, "Cellular-phone-service companies that won in prior auctions complain that falling prices have devalued their licenses. They want Congress to have the FCC allot spectrum more slowly." Gruley, *supra* note 307. Gruley also quotes a lobbyist for Motorola as saying, "If you want to create value, you've got to create scarcity." *Id.*

[310] Ferris & Leahy, *supra* note 5, at 322-23.

[311] HAZLETT, *supra* note 202.

[312] *See, e.g.*, *Wireless Carriers Fear High Prices for Capacity*, *supra* note 302, at 34 (noting that smaller carriers "may find they do not have the cash to keep with their larger competitors and may have to find alternatives for increasing their network capacity"); Allyson Vaughan, *Paging Auction Debate Rages*, WIRELESS WEEK, Aug. 7, 2000, at 20 ("Many smaller paging carriers oppose auctions, contending they make it more difficult to acquire spectrum when larger carriers, flush with cash, can outbid them.").

[313] According to one estimate, the cost of an average lottery application was over $3,500 and the cost of a detailed application for a comparative hearing was $130,000. FCC Report, *supra* note 20, at 8 & n.16; *see also id.* at 8 (noting that the "demands associated with comparative hearings and lotteries overburdened the Commission's resources, which were not prepared for the deluge of applications"); *id.* at 22 (noting that FCC administrative costs for running auctions typically average 0.62% of the total auction revenue raised).

[314] Kwerel & Williams, *supra* note 34.

[315] 47 U.S.C. § 309(j)(3)(B) (1998).

¶119 In pursuit of this end, the FCC has used several different means of helping minority- or female-owned businesses win spectrum auctions, including bidding credits, installment plans,[316] and, for the auctions of broadband PCS, and "entrepreneurs' blocks."[317] Following the Supreme Court decision of *Adarand Constructors, Inc. v. Pena*,[318] the FCC modified its approach to affirmative action, choosing to concentrate its efforts on small businesses, which are often owned by minorities and women anyway. In recent auctions, the FCC has offered "new entrant" bidding credits, which would target startup companies or companies with no prior media interests.[319] Because such companies are often small minority- and woman-owned businesses, the FCC believes that "new entrant" credits would satisfy the congressional mandate while keeping within constitutional constraints. In the 1999 auction of PCS licenses,[320] the FCC designated certain licenses as "Entrepreneur's Blocks," which meant that the bidders were required to have had gross revenues under $125 million for the previous two years and total assets not exceeding $500 million.[321] For those bidders that had average gross revenues under $40 million for three years, the FCC awarded a 15% discount, while bidders with revenues under $15 million for three years got a 25% discount.[322]

¶120 The first problem with the bidding credits is that there is no guarantee that they will help the intended beneficiaries in the slightest. As Ayres and Cramton demonstrate in an insightful article,[323] the likely result of bidding preferences for "weak bidders" is that stronger bidders will be forced to bid more aggressively in order to win the auction. They say, "Bidding subsidies for weak bidders--far from being 'giveaways'--can *prevent* giveaways by forcing relatively strong bidders to bid closer to their reservation prices."[324] Their results are fairly easy to demonstrate with a simplified example. Suppose an auction is conducted with only two bidders: a small company ("Small"), whose reservation price for a chunk of spectrum is $2,250,000, and a big company ("Big"), whose reservation price is $3,000,100. If the auction is conducted without any subsidies, Big will bid slightly over $2,250,000, thus winning the auction for much less than its reservation price, decreasing efficiency. If, however, Small is given a 25% subsidy, then Small can effectively bid up to $3,000,000, forcing Big to bid far closer to its actual reservation price, thus increasing efficiency. But if the objective of the bidding credit is to aid Small, the results are ambiguous--either Small loses the auction if Big's reservation price is greater than Small's total bid, or it wins if its total bid, including the credit, is greater than Big's reservation price. But when Small wins, it will likely end up paying the

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316 The FCC used installment plans in six auctions, including regional narrowband PCS, IVDS, MDS, 900 MHz SMR, and the broadband PCS C and F blocks. FCC Report, *supra* note 20, at 28. However, after several of the PCS C-block bidders went bankrupt or had trouble making their payments, in part because their bids had been artificially inflated by the FCC's special programs, the FCC suspended the use of installment programs. *Id.* at 30; *see also* Quentin Hardy & Bryan Gruley, *Best of Intentions: FCC Auction Designed to Favor Little Guys Threatens to Sink Some*, WALL ST. J., Aug. 1, 1997, at A1.

317 FCC Report, *supra* note 20, at 28.

318 515 U.S. 200 (1995).

319 FCC First Report and Order, *supra* note 22, at ¶189.

320 PCS, or personal communication services, is a title that encompasses services such as portable phones or fax machines, as well as paging devices.

321 C, D, E, and F Block Broadband PCS License Auction Fact Sheet, *available at* http://wireless.fcc.gov/auctions/22/factsheet.html. This auction did not, however, allow payment on installment plans.

322 *Id.*

323 Ian Ayres & Peter Cramton, *Deficit Reduction Through Diversity: How Affirmative Action at the FCC Increased Auction Competition*, 48 STAN. L. REV. 761, 766 (1996).

324 *Id.* at 775.

maximum that it can afford, regardless of the bidding credit involved.[325] Thus, bidding credits may maximize revenue for the seller, but do not necessarily lower the barriers to entry for small companies.[326] In fact, it "appears that the private value – to designated entities – of the various subsidies is zero."[327]

¶121 In another possible situation, bidding credits result in inefficiency, according to the FCC's definition of selling the spectrum to whoever values it most. Imagine the following scenario. Small values the spectrum at $2,500,000. Big values the spectrum at $2,700,000. Without subsidies, Big will obviously win, an efficient outcome. With the 25% subsidy, however, Small will be able to bid past Big's reservation price, thus winning the auction for slightly over $2,700,000. But the result here is inefficient--Small won the auction, despite valuing the spectrum less than Big. This potential inefficiency is confirmed by Ayres and Cramton, who say that "subsidies often cause inefficiency whenever the good is actually sold to a weak bidder."[328]

¶122 The only situation in which bidding credits can both be efficient (according to the FCC's definition) *and* help the small company to win is if two conditions are met. First, the small company must have a reservation price that is higher than the big company's. Second, the small company must be unable to obtain the financing needed to actually bid up to its reservation price. Thus, if Small values the spectrum at $3,000,000, but can afford to pay only $2,250,000, and if Bid values the spectrum at $2,500,000, then without bidding credits, Big will win inefficiently, while the 25% bidding credit help the small company obtain the spectrum at an efficient price. Nevertheless, without empirical evidence as to the incidence of such situations, it is intuitively more likely that bidding credits will be either useless (because the small companies lose anyway), or inefficient (because the small companies are able to inflate their bids far past their true value), or harmful (by forcing small companies to bid higher, thus raising the barriers to entry).

¶123 Ira Brodsky points out that bidding credits may inhibit innovation by making it harder for mid-sized companies to compete against the large, well-financed companies and the small companies that have the credits. Mid-sized companies are often more *willing* to design and employ innovative technologies than large companies and more *capable* of doing so than smaller companies. In Brodsky's words:

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[325] According to one economist's analysis of the C-Block PCS auction conducted by the FCC in 1995, "the net, after-discount prices of the licenses targeted for woman- and minority-owned bidders were about the same as the prices for the other licenses." PAUL MILGROM, AUCTION THEORY FOR PRIVATIZATION 27 (1995), *available at* http://www.market-design.com/files/milgrom-auctioning-the-radio-spectrum.pdf. This is confirmed by Hazlett's and Boliek's analysis of both the C-Block PCS auction and the RNPCS auction of 1994--in both auctions, the "winning prices bid by designated entities, net of bidding credits, were at or above the prices paid by nondesignated entity bidders." Thomas W. Hazlett & Babette E.L. Boliek, *Use of Designated Entity Preferences in Assigning Wireless Licenses*, 51 FED. COMM. L.J. 639, 650 (1999), *available at* http://www.aei.org/ra/rahazl9905.pdf.

[326] In fact, the FCC's early experiments with preferential treatment--including low-interest financing and deferred payments on winning bids for the designated companies--may have contributed directly to the C-Block fiasco in 1995, wherein numerous winners overbid and ended up declaring bankruptcy. *See* Congressional Budget Office, *Impending Defaults by Winning Bidders in the FCC's C Block Auction: Issues and Options*, Sept. 1997, *available at* http://www.cbo.gov/showdoc.cfm?index=37&sequence=0&from=1. This is because the government's preferential treatment made possible "opportunistic bids," in which the bidders could overbid because of the decreased risks associated with overbidding. As Hazlett and Boliek note, any "scheme that defers the payment of the license fee shifts downside risk from the bidder to the government, since the bidder can default on its promised payment to the government if license values fall below the net auction price. Thus, it effectively insures the bidder against losses at the government's expense." Hazlett & Boliek, *supra* note 325, at 652.

[327] Hazlett & Boliek, *supra* note 325, at 657.

[328] Ayres & Cramton, *supra* note 323, at 775.

> [T]he FCC's broad-band PCS auctions may have the unintended effect of squeezing out the entrepreneurs who were the most receptive to innovative technologies. It will be difficult for medium-size firms to outbid the interexchange carriers and RBOCs on the one hand, and those receiving preferential treatment in the way of discounts on the other.[329]

¶124 Yet another problem with bidding credits is the opportunity for collusion. In a recent auction of C Block and F Block PCS spectrum, the FCC set aside 170 out of 422 possible licenses to receive a small business credit of 25%.[330] Several huge companies, including AT&T Wireless and Sprint PCS, entered into alliances with much smaller businesses, thus enabling them to take advantage of the FCC's small-business preferences.[331] For example, a man named George Crowley set up a new business called Salmon PCS with $50 million of his own money and $285 million put up by Cingular Wireless (a much larger corporation).[332] Salmon PCS won 79 licenses covering markets with a population of over 70 million.[333] Cingular Wireless, however, planned to provide the financing for the over-$2.3 billion bid by Salmon.[334] The kicker--the bidding credits provided by the government to Salmon were worth more than $550 million.[335] Cingular was thus able to win spectrum licenses on much more favorable terms than would otherwise have been available. A Cingular spokesman admitted as much in an industry article quoted by the *New York Times*: "We are going to be doing all our bidding through our designated entity, Salmon PCS. That will allow us to bid on all eligible licenses, including a number of those set aside just for small businesses."[336] Similarly, a small company named Alaska Native Wireless partnered up with AT&T Wireless to bid $1.48 billion for a license covering New York City.[337] It doesn't take a rocket scientist to know which of those two companies really intends to provide services in New York. All in all, more than 95% of the high bids in that auction came "from the largest companies and their partners."[338]

¶125 An underlying and more fundamental problem with the bidding credit system is that it gives the minority and weaker participants a false sense that they are being done a favor. An analogy might make the point clear. Imagine that the government required everyone to pay a "licensing fee" of $10 every time they spoke out loud. But, in order to help out those who are less well off, the government announced that out of the goodness of its heart it would allow poor people to speak out loud for only $7.50. Most of us would readily recognize that the poor people are not being done any favors here, compared to the current system in which all people can speak out loud for free, as long as they refrain from creating a public nuisance. But if we were caught up in a frame of reference in which the government had the power to put fees on speaking, a lowered price for poor people might indeed seem like a valuable subsidy. Once again, it all comes down to one's view of the baseline reality.

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329 BRODSKY, *supra* note 179, at 47.

330 *A Flawed Wireless Auction*, N.Y. TIMES, Feb. 13, 2001, at 30 (editorial).

331 *See generally* Stephen Labaton & Simon Romero, *Wireless Giants Won F.C.C. Auction Unfairly, Critics Say*, N.Y. TIMES, Feb. 12, 2001.

332 *Id.*

333 *Id.*

334 *Id.*

335 *Id.*

336 *Id.*

337 *Id.*

338 Stephen Labaton, *Big Companies Win Airwave Bids*, N.Y. TIMES, Jan. 25, 2001.

¶126 A commons regime would be much better for the smaller, minority-owned and female-owned businesses that affirmative action programs have tried to help. Rather than having to bid in an auction against the likes of AT&T or CBS,[339] they would be able to participate on equal footing in their local spectrum management group.

G. Fairness?

¶127 As Congressman Edward Markey said in a debate on the fairness doctrine, "It does not seem to me to be an outrageous idea that broadcasters – who are granted, at no cost, the exclusive use of a scarce public resource, the electromagnetic spectrum – be required to inform the public in a responsible manner."[340] Indeed, to the extent that broadcasters or other users are given a government-protected monopoly over a particular range of spectrum, it does seem fair that they have to pay for the privilege.[341] This rationale would disappear, however, insofar as an area of the spectrum is governed as a commons. Just as the users of the atmosphere (that is, everyone who breathes) do not need to pay the government for the privilege, neither should those spectrum users who participate in commons governance.

V. CONCLUSION

¶128 We should reconsider our spectrum regulation from the ground up--for too long we have assumed wrongly that spectrum can be used efficiently only if given or sold to monopolistic individual "owners" to use for predetermined purposes. Rather, the large body of common property literature suggests that it might be possible to regulate the spectrum as a commons. Doing so would allow for more localized determinations of efficient usage, would create incentives for technological innovation, would harness the specialized information collected and known by local users, would facilitate efficient transactions among competing users, and would make economies of scale feasible for cross-boundary uses. These benefits would likely outweigh any transaction costs associated with creating local commons regulatory groups, especially given that spectrum users would no longer have to pay billions to the government for the privilege of using a property of nature. The potential benefits from regulating the spectrum as a commons are great--while the potential costs from continuing to sell spectrum to the highest bidder are also great. In sum, I think that the spectrum commons could be the most efficient way of allocating and regulating our communications systems.

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339 One commentator notes that it can be "tougher for new entrants" to establish themselves in major economic centers, because the big corporations have already bought up all the available spectrum. Gohring, *supra* note 274.

340 Edward J. Markey, *The Fairness Doctrine, Congress, and the FCC*, 6 COMM. LAW 1, 26 (1988).

341 Ferris & Leahy, *supra* note 5, at 304 ("If broadcasters were found to have full first amendment rights, Congress would be justified in expecting compensation for broadcasters' use of the electromagnetic spectrum.").