

# Breaking Commons Cartels

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## Abstract

Scholars and others concerned with resource management typically celebrate pathways to stability and cooperation in the commons. Within in this celebratory literature, Elinor Ostrom's principles of long-enduring institutions have become recognized as a landmark achievement. This article reexamines stable commons institutions generally and Ostrom's principles specifically. While these principles undoubtedly have helped identify ways to build stable institutions, they have an unexplored downside. Specifically, when our values change, stable institutions can thwart new values from making headway in the commons. A number of scholars have used game theory to explain the power of institutions to resolve problems plaguing the commons. However, the game theory used thus far does not take into account that how we value the commons is subject to change. Using conventional game theory to describe the power of institutions to govern the commons, the article extends that theory and highlights a dark side of institutions.

*Key Words: Changing values, rival uses of commons, principles of long enduring institutions, and change in the commons*

## I. Introduction

Garrett Hardin (1968) introduced an environmental fable about a tribe of herdsmen who faced what seemed an extricable dilemma. The herdsmen grazed their cows on an open field. Because each herdsman took each cow he grazed home for the slaughter and because the entire tribe shared in deterioration of the commons, it paid every herdsman to graze as many cows as possible. This was true even if all the while every herdsman resented others for doing the same. According to Hardin's recounting, the incentives did not change even when overgrazing threatened to destroy the field and the herdsmen's livelihood. This was "the tragedy of the commons."

A rich literature has arisen that challenges one of Hardin's (1968) core assumptions—that without outside intervention, commons users could not free themselves from their tragic circumstances (Ostrom 1990; Rose 1994; Hardin 1982). This scholarship has relied mostly on empirical case studies and to a lesser extent game theory and has illustrated many situations where commons users can free themselves from the tragedy of the commons by building institutions. The power of these institutions is that they can restrict access to the commons.

Roughly two decades after Hardin recounted the fictionalized tragedy facing the herdsmen, Elinor Ostrom (1990 at 88-102) combed through the empirical evidence and

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identified unifying principles that characterized those cases where commons users overcame the tragedy of the commons. She referred to these as “design principles of long-enduring institutions.” Inasmuch as Hardin’s tragedy of commons serves as the first chapter of the rich commons literature, Ostrom’s principles are probably the centerpiece of the second chapter. They are much admired and employed by managers of various common-pool resources world over (Ostrom 1992). While certainly less well known, a number of other scholars (Wade 1988; Baland and Platteau 1996; McKean 1992; Agrawal 2002) have reexamined, extended, and added to Ostrom’s principles.

In previous work, I have emphasized the importance of pushing the commons scholarship to examine not only the benefits of commons institutions (i.e., stability) but also their costs (i.e., rigidity) (Daniels 2007). We see the costs of stable institutions most clearly when the way that society values the commons changes. Building off of Hardin’s (1968) parable of the herdsmen, imagine the herdsmen used institutions to fight back the tragedy of the commons and succeeded in doing so over the long term. While many commons scholars would not find it surprising that the herdsmen settled on a sustainable method of providing forage for their cows, this does not mean that this fable ends with “And they lived happily ever after.” What if the way society values that open field changes? What if the field the herdsmen called “pasture” eventually seen as an important water shed, a place for recreation, or a habitat for animals that do not easily co-exist with cows? Protecting any of these rival values would require removing the herdsmen and their cows. This fictional example makes a simple point that plays out again and again in a wide array of common-pool resources: stable governance of a commons can thwart society’s emerging values. Stable institutions allow a particular group—a commons cartel—to hold a commons hostage, and often to the detriment to competing visions of the commons.

The concern that institutions may stand in the way of change is in no way a new one. In fact, at the inception of the United States, Thomas Jefferson observed,

I am certainly not an advocate for frequent and untried changes in laws and constitutions.... But ... I know also, that laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths disclosed, and manners and opinions change with the change of circumstances, institutions must advance also, and keep pace with the times. We might as well require a man to wear still the same coat which fitted him when a boy, as civilized society to remain ever under the regimen of their barbarous ancestors (Jefferson 1816).

More recently, Douglass North won a Nobel Prize in large part for his pioneering work that documented how the staying power of institutions can bind us to decisions and values of the past (North 1990). Within the context of natural resources—many of which are classic commons—Charles Wilkinson has famously asserted that “natural resource policy is dominated by the lords of yesterday,” by which he meant institutions designed during a different time and under different circumstances (Wilkinson 1992, 17).

This raises a fundamental question, why has the commons scholarship largely ignored the costs of rigidity that go arm-and-arm with the benefits of stable institutions? First, the simple answer: scholars have ignored institutional rigidity because of the enormity of the challenge of creating and sustaining institutions sufficient to stave off the tragedy of the commons. Second, a more subtle one: because the focus of the commons scholarship has generally focused on the fate of a set of commons users, we have taken for granted something quite fundamental. Namely, what a “commons” is depends on the values and preferences of particular commons users. A tribe of herdsman are like to see a field differently than a clan of hunters or a team of soccer players. So, given this challenge and this lens, it is not surprising that the view of what a commons is, most often is static. This is particularly the case, if we are defining success in terms of long-enduring institutions.

A number of scholars have used game theory to show how institutions can help resolve problems in the commons (Ostrom, et al 1994; Hardin 1982; Runge 1984). This article extends that foundational game theoretical work by taking into account the costs of removing institutions when the way we value the commons changes. Part II discusses the design principles that lead to stability in the commons. In doing so, it emphasizes the role of practical effect of these principles in providing for credible threats and commitment and reducing collective action costs. These three challenges are often thought to be necessary to overcome the tragedy of the commons. Part III summarizes how game theory has shown that institutions can help commons users overcome constant “temptations to free-ride and shirk” (Ostrom 1990, 15). Part IV extends this foundational game theory to take into the dark side of stable institutions, particularly when society changes the way it values the commons. Simply put, this game theory illustrates something typical commons game theory has ignored: when the way that society values the commons changes, stability—often pitched as the key to solve the tragedy of the commons—transforms into rigidity.

## **II. Design Principles of Stable Commons Institutions**

The literature on the commons has worked to ferret out a road map of how to create and sustain robust institutions in the commons. This is often seen as the key to undoing the tragedy of the commons. The output of this rich scholarship is in significant part captured in several compilations of design principles that promote institutional stability put forward by Ostrom (1990) and others (Wade 1988; Baland and Platteau 1996; McKean 1992; Agrawal 2002). While some have argued that due to a myriad of complicating factors it is impossible to really settle on such principles in an empirically satisfying way (Agrawal 2001, 2002), these principles arguably make up the most noteworthy summary of the commons literature compiled to date.

One may find it problematic that these principles differ from scholar to scholar and perhaps from commons to commons. Yet, there are threads that bind all this scholarship together. I identify three in particular.

First, institutions provide a credible commitment to commons users that if they cut back then they will reap the benefit of their own sacrifice (Ostrom, 1990 at 43-45; Kreps, 1990; North and Weingast, 1989; Williamson, 1983). It is not easy to convince commons users to cut back because in the commons “temptations to free-ride and shirk” are ever present (Ostrom, 1990 at 15). A credible commitment provides commons users assurance that they specifically will benefit in the future for the sacrifices they make today. Examples of design principles that give commons users such an assurance include determining ahead of time who has rights to use the commons and to what extent (Ostrom 1990, 91-92), empowering commons users to manage the commons (Ostrom 1990, 93-94), and predetermining conflict-resolutions procedures (Ostrom 1990, 100-101). A more detailed examination of those design principles that help provide credible commitments is found in Table 1.

Second, institutions can close off open access resources and keep out those excluded under the institutional arrangement. In other words, they provide a credible threat for those tempted to circumvent the rules of the game (Shelling 1960). Design principles that prevent cheating that which is owed to privileged commons users include monitoring (Ostrom 1990, 94) and graduated sanctions (Ostrom 1990, 94-100) are a couple of examples of institutional design principles that work to create credible threats. Again, Table 1 highlights other design principles that have the effect of providing credible threats in the commons.

The third thread is that institutions can help us overcome the challenge of coordinating collective action (Olson 1965). Examples of principles that do just this include allowing commons users the right to organize themselves (Ostrom 1990, 101) and to interact within nested enterprises (Ostrom 1990, 101-102). Again, Table 1 below summarizes those design principles put forward by various scholars and illustrates how each of these help address one or more of these challenges.

While one may take a more nuanced view of these principles, as the many design principles put forward by scholars illustrate, but as categories, credible commitments, credible threats, and coordinating collective action encapsulate all of the principles. Credible commitments and threats help commons users meet the challenges posed by the tragedy of the commons. Coordination of collective action helps promote cooperation in a circumstance where many would be tempted to free-ride. Rooting the myriad of factors into three helps simplify and also seems to answer a need identified by Agrawal to reduce the number of causal variables (Agrawal 2001, 2002).

	Credible Commitment	Credible Threats	Reduce Costs of Collective Action
Clear Commons Boundaries (O, W, BP, A, M) <sup>+</sup>	x	x	X
Clearly Defined Users of Commons (O, M)	x	x	
Users Influence Rules Governing Commons (O, BP, A, M)	x		X
Robust/Ease of Monitoring (O, W, BP, M)	x	x	X
Graduated Sanctions (O, W, A, M)	x	x	

Predefined Conflict-resolution Mechanism (O, A)	x	x	x
Rights of Users to Organize (O, M)	x		x
Nested Enterprises (O, A)	x		x
Small Group Size (W, BP,A)		x	x
Users Live Near Commons (W, BP, A)	x	x	x
Tight-Knit Community (W, BP, A)	x	x	x
Users Financially Dependent on Commons (W, BP)	x		x
Support of Government/ No Interference (W, BP, A, M)	x	x	x
Simple Rules (W, BP, A, M)	x	x	x
Small Commons (BP)		x	x
Resource Easy to Store (A)	x		x
Resource Predictable (A)	x	x	x
Demand on Resource Predictable/Low (A)		x	
+ Sources O=Ostrom (1990); W=Wade (1988); BP= Baland and Platteau (1996); M=McKean (1992); A= Agrawal (2002).			

Documentation of these principles is an important achievement. In fact, Douglass North has gone so far as to insist that we call Ostrom's principles of long-enduring institutions specifically, commandments rather than principles (North 1999, 10). Yet, as discussed more below, all three of the categories of design principles for the commons—those that focus on credible commitments, those that provide credible threats, and those that facilitate collective action—all have an oft ignored dark side, and likewise, so do the celebrated design principles for long-enduring institutions.

### III. Game Theory and the Role of Stable Institutions

Using game theory, scholars generally characterized problems facing the commons with two games—particularly the prisoners' dilemma and chicken.<sup>1</sup> Game theory can also illustrate the power of institutions to alter the way commons users act and react to each other. The thrust of much of this literature is that institutions can resolve the challenges posed by the prisoners' dilemma and chicken. Institutional stability can transform interactions within the commons from these games into games of assurance. For the sake of clarity, this is worth revisiting a bit more detail.

The prisoners' dilemma has been used to illustrate why it is so difficult to close off open-access common (Ostrom, Gardner, and Walker 1994; R. Hardin 1982). Securing cooperation among commons users is difficult, particularly when restraint of use or consumption of the commons is required. The prisoners' dilemma plays out by the two defining traits of a commons—rivalry and the difficulty to exclude others (Ostrom 1990, 30; Tietenberg, 2000, 598)—leading to a free-for-all among commons users. Under the

<sup>1</sup> As typically defined, a "game" includes a set a players, a set of possible strategies (or moves) available to each player, and specified payoffs that correspond to the combination of strategies available to each player. Expressed more formally, a normal form game consists of three variables (N, S,  $\pi$ ). N is the set of players of the game, {1, ..., n}. S is the strategy set for each player,  $S=S_1 \times \dots \times S_n$  with strategy profile  $s=(s_1, \dots, s_n)$ . The function  $\pi$  defines the payoffs,  $\pi :S \rightarrow R^n$ . (von Neumann and Morgenstern 1944).

prisoners' dilemma, conservation of the commons makes no sense—it only leaves more for others to consume. Other versions of this game play out by commons users taking advantage of the resource's traits to cheat the rules of the game and to take more than allotted them. So, the prisoners' dilemma game results a dominant strategy for each player (a pure Nash Equilibrium) that leads to a collective suboptimal outcome: each player consuming as much as possible without regard to the health of the commons or the collective plight of the resource users. (Hardin 1968). This leads to an environment that is difficult to build or sustain institutions. This dynamic is shown in Figure 1.

**Prisoners' Dilemma/Tragedy of the Commons Game  
Figure 1**

		Player 2	
		Reduce Consumption	Sustain Consumption
Player 1	Reduce Consumption	B <sub>1</sub> , B	A <sub>1</sub> , D
	Sustain Consumption	D <sub>1</sub> , A	C <sub>1</sub> , C*

Where  $A > B > C > D$  and \* signifies a Nash Equilibrium

Chicken is the second game frequently used to describe another subset of problems facing the commons (Taylor and Ward 1982; Runge 1948; Ward 1993). Chicken illustrates why we see freeriders when it comes to investing in the commons. Again, this is an example of the defining characteristics of the commons working against the health of the commons. Because it is difficult to exclude potential users, some users of the commons may assume that it is in their best interest to sit on the sidelines and enjoy the benefits of the sacrifices of others. However, those tempted to freeride may change their opinion once it becomes clear that those initially willing to invest will refrain from contributing if freeriding is prevalent. So, in chicken, two alternatives emerge, both of which are difficult to alter once they appear (both are Nash equilibria): robust investment (winning over freeriders) or scant investment (joining them). This strategic interaction is depicted below in Figure 2.

**Chicken Game  
Figure 2**

		Player 2	
		Invest	Freeride
Player 1	Invest	A <sub>1</sub> , B <sub>2</sub> *	C <sub>1</sub> , D <sub>2</sub>
	Freeride	D <sub>1</sub> , C <sub>2</sub>	B <sub>1</sub> , A <sub>2</sub> *

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Where  $A > B > C > D$  and \* signifies a Nash Equilibrium

The major thrust behind the institutional approach to these commons problems is that “rules can change the games that appropriators play” (Ostrom, Gardner, and Walker 1994, at 293). Indeed, this is a foundational theme of the scholarship on the commons that has followed Hardin’s (1968) explanation of the tragedy of the commons. The past four decades of work within this body of scholarship emphatically shows that due to institutions, commons are not necessarily tragic.

From a game theoretic perspective, the institutional story explains how rules and organizations have changed the payoffs available to users of the commons. Institutions can induce commons users to act differently by altering the perceived payoffs available to those willing to over consume, freeride, or cheat the rules of the game. Again, the way this occurs is that institutions can offer credible commitments increase the payoffs for certain strategies, credible threats decrease payoffs, and reducing the costs of collective action decreases the transaction costs of other strategies.

By tinkering with the institutional constraints, we often see a game called assurance take the place of the prisoners’ dilemma or chicken. For illustrative purposes, consider the prisoners’ dilemma game introduced in Figure 1. While the nuances of institutional design are generally much more complicated than this, assume that an institution is in place that punishes those unwilling to cut back their consumption of the commons. Assume that the letters (A, B, C, and D) used in Figure 1 represent the preferences of the players of the game. The threat of punishment ( $p_i$ ) that applies only to those who sustain their consumption of the commons must be taken into account. The value of ( $p_i$ ) is dependant on the severity of the punishment and the perceived likelihood that it will actually occur.<sup>2</sup> This is reflected in Figure 3a.

**Prisoners’ Dilemma with Punishment**  
**Figure 3a**

		Player 2	
		Reduce Consumption	Sustain Consumption
Player 1	Reduce Consumption	B <sub>1</sub> , B <sub>2</sub>	A <sub>1</sub> - p <sub>i</sub> , D <sub>2</sub>
	Sustain Consumption	D <sub>1</sub> , A <sub>2</sub> - p <sub>i</sub>	C <sub>1</sub> , C <sub>2</sub>

Where  $A > B > C > D$

<sup>2</sup> This framework is a variation of Plott’s Equation— Preferences × Institutions = Outcomes (Plott 1991).

This simple interaction between players' preferences and institutional constraints, assuming that the threat of punishment is sufficient and credible, may adjust the preferences of the players of the game. If it does so, and all players prefer reducing their consumption—given the punishment—it can change the prisoners' dilemma game into a game of assurance. This will mean that all players will have a dominant strategy to reduce consumption, creating a new Nash Equilibrium. This is illustrated in Figure 3b.

**Assurance Game  
Figure 3b**

		Player 2	
		Reduce Consumption	Sustain Consumption
Player 1	Reduce Consumption	A <sub>1</sub> , A <sub>2</sub> *	B <sub>1</sub> , C <sub>2</sub>
	Sustain Consumption	C <sub>1</sub> , B <sub>2</sub>	D <sub>1</sub> , D <sub>2</sub>

Where  $A > B > C > D$  and \* signifies a Nash Equilibrium

Of course, this illustrative example is not confined to the prisoners' dilemma game. Chicken may also become a game of assurance as well. This occurs for the same reason discussed above: institutions have the power to adjust the players' expected payoffs and change the way the game.

#### **IV. A Dark Side of Stable Institutions**

Stable institutions, while the key ingredient that promotes cooperation and even sustainability in the commons, often prove problematic when preferences change (Daniels 2007). Stability can become rigidity when the way we value the commons changes. Because so many commons—particularly among those that are natural resources—have almost an infinite set of uses, our values are bound to change over time.

Whereas the commons literature and game theory applications within this literature have made great strides in evaluating the difficulties presented by competing users who value the commons in a similar way, the same cannot be said when it comes to evaluating competition among multiple values of the commons.

Values often collide in the commons. Should we protect owl habitat or employ local loggers to cut down trees? Do we keep our rivers free flowing or dam them for drinking water, to produce electricity, or for recreation? What should be done with the Arctic National Wildlife Refuge? The number of competing pressures vying for the commons within our forests, cityscapes, radio spectrum, and even global atmosphere highlight such tensions.

When institutions give a particular vision of the commons a privileged place, we may later come to regret it because our institutions lag behind our changing values, and sometimes painfully so. Stable institutions thwart emerging values in the commons by allowing a particular group with a particular vision of why a commons has value to hold it hostage to the detriment of other groups with competing visions of the commons. When values change, commons users seem more like commons cartels, and stable institutions look more and more like tragic institutions—an institution that systematically undermines rival values (Daniels 2007).

The commons literature has not grappled sufficiently with the importance of changing values. Too often the scholarship views the commons through the eyes of a particular set of commons users. To more fully understand the dynamic in the commons we either need to take more of a societal view (a macro analysis instead of a micro analysis) or do as Aldo Leopold suggested sometime ago, we need to “think like a mountain,” meaning evaluate the stakes from the prospective of the commons itself instead of the commons user (Leopold 1966).

Extending traditional commons game theory highlights the power of institutions in the commons. Absent institutions, we might imagine a commons with an incumbent user and an emerging rival. Where possible, they may prefer a case where neither of them has to accommodate the other. However, this is not always possible because values conflict. Put in more concrete terms, we may find that we cannot have a mountain for hiking and mining, a wetland drained for development and used for flood control, or a field for cows and picnicking. The more one competing user has to make way for the other, and the less this is reciprocated, the more we can imagine those committed to a competing use to dislike the outcome. In simple terms, this is set forth in Figure 4 below.

**Incumbent and Rival Preferences**  
**Figure 4**

		Player 2	
		Accommodate New Use	Do Not Accommodate New Use
Player 1	Concede to Incumbent Use	C <sub>1</sub> , C <sub>2</sub>	A <sub>1</sub> , D <sub>2</sub>
	Do not Concede to Incumbent Use	D <sub>1</sub> , A <sub>2</sub>	B <sub>1</sub> , B <sub>2</sub>

Where  $A > B > C > D$

Rival uses may have greater social value than incumbent uses. Yet, these resources are more typically “dominated by the lords of yesterday” (Wilkinson 1992, 17) to the detriment of the larger society. Why?

The very institutions that provided a cure to the tragedy of the commons intentionally favors one commons use. Given what we know about the principles of long-enduring institutions, they work to provide one set of commons users a privileged place at the table: this is merely credible commitments living up to their name. They punish those who challenge the values of incumbent users: credible threats prove credible, and incumbents use them to thrash rivals. Institutions promote cooperation among incumbents: collective action is cheaper for incumbents, and incumbents economize in working together to shore up their holdings and to fend off rivals.

In game theory, this plays out by institutions adjusting the payoffs for incumbents and rivals. Institutions enhance the value incumbents see in the commons. They erode the temptation of rivals to attempt to steal away a commons for an alternate value. Institutions make it more difficult for rivals to capture the commons and to compete with incumbents. This is represented in Figure 5a.

**Incumbent and Rival Preferences**  
Figure 5a

		Player 2	
		Accommodate New Use	Do Not Accommodate New Use
Player 1	Concede to Incumbent Use	$C_1, C_2$	$A_1 + i, D_2$
	Do not Concede to Incumbent Use	$D_1, A_2 - i$	$B_1 + i, B_2 - i,$

Where  $A > B > C > D$  and  $i$  represents the power of institutions

The power of institutions may be enough to alter the payoffs of the parties. When institutions are strong, rivals will take that into account, and we might rivals adjust their preferences and prefer to concede to incumbents rather than grappling with the power institutions vest in incumbents. When this occurs, a Nash Equilibrium emerges that allows the incumbent to entrench its advantage over the incumbent. This would create a payoff matrix that looks something like Figure 5b.

**Institutional Adjustments to Incumbent  
and Rival Preferences**  
Figure 5a

		Player 2	
		Accommodate New Use	Do Not Accommodate New Use
Player 1	Concede to Incumbent Use	$C_1, A_2$	$A_1, B_2^*$
	Do not Concede to	$D_1, C_2$	$B_1, D_2$

Incumbent Use



Where  $A > B > C > D$  and \* represents a Nash Equilibrium

This sort of strategic interaction helps explain why we often see incumbents exact deference from rivals. We often find examples within the commons where rivals can only access the commons to the extent that rivals are not harmed. For example, prior appropriations water law allows for change to the extent that more senior users are not hurt. The slow progress of reforming the radio spectrum is largely explained by the fact that change has only been possible to the extent that incumbent users were not harmed. It is why we see “grandfathering” incorporated in our urban landscapes through land use. Rivals often find that it makes great sense not to wake sleeping dragons.

Furthermore, the power of institutions in aiding incumbent values helps explain why rivals often do not bother reforming existing institutions but rather build new ones to challenge the institutions protecting incumbents. Proliferation of institutions has become a hallmark of the commons in the developed world. As rivals experience political losses within one level of government, they often shop their wares with another. We see departments within a single government pitted against each other. This tug-of-war of interests generally does not lead to one set of users overcoming another. Rather, what we see is a little give here and a little take there. No wonder the change that comes is almost always incremental in the commons. Of course, as institutional arrangements change so too does the payoff structure of the players of the games. Because of this, a Nash Equilibrium working toward the incumbents’ advantage may not be so difficult to negotiate as it might seem at first blush. Rather than changing the rules of the game, losers are much more likely to find a different venue and try their hand at an entirely new game altogether. While those seeking change have not altered prior appropriations water law, rivals have sought and used federal law to address reallocation of water rights. This can be seen in rivals using the Clean Water Act or Endangered Species Act to increase the amount of water left in rivers and streams. Within the context of the radio spectrum, we find rival users of the bandwidth (e.g., wireless Internet providers and cell phone companies) have sought not only to change FCC oversight of the spectrum but also have wooed Presidents and the Congress by highlighting how changing the method of allocating the spectrum from permit to auction could fill the Federal coffers. Lastly, while it is not uncommon to hear that land use is inherently local, it is also not uncommon to find rivals trying to use state and federal law to attempt to undercut local land use decisions.

This layering of institutions is a rational reaction of those committed to one particular view of the commons trying to escape the power of existing institution by changing forum and trying to build allies among those that have not already picked sides. This is merely a reflection of those pushing rival values attempting to minimize the transaction costs of securing change.

## V. Conclusion

Stable institutions have a downside when the way we value a commons changes. Game theory, within the commons literature, has paid too little attention to how we value commons that is liable to change. The value of the commons is contextual. A tribe of herdsman may see an open field and say “pasture.” A city planner may see the same field as a park. Al Gore may see it as a potential candidate for afforestation. Because the way we value the commons changes over time, we need to begin to grapple with that point if we are going to better understand the challenges faced in the commons.

Over the past forty years, the commons literature has explored the tragedy of the commons and the ways to resolve it. This paper challenges those invested in that literature to embrace the complexity of the commons. Resolving the tragedy of the commons often creates a problem. Institutions can do wonders in providing credible commitments, credible threats, and reducing collective action costs. However, institutions can also provide stability, indeed rigidity, in the face of societal demand for changing the way we value and manage the commons. To fully understand the tradeoffs of different commons uses, we need to understand that a commons has many potential uses, some that cut across different scales, some that harmonize or conflict with other uses of the commons, and some that serve potential users of the commons while excluding others. Ignoring this complexity may lead us to mistake rigidity for stability and cooperation for a commons cartel.

The challenge of providing sufficient stability to stave off the tragedy of the commons but enough flexibility to overcome institutional inertia is a formidable challenge. The principles of long-enduring institutions may provide a cure to the tragedy of the commons. Application of game theory to commons management has illustrated the importance of institutions. We need to realize, however, as with many medications there are unintended side effects. In the commons literature, minimizing the side effects of institutions is something often neglected. Our patients deserve better.

## **References to Consult**

Agrawal, A. 2002. Common Resources and Institutional Stability. In *The Drama of the Commons* eds. Elinor Ostrom, et al.

Agrawal, A. 2001. Common Property Institutions and Sustainable Governance of Resources. *World Development* 29(10): 1649-72.

Axelrod, RM.. 1984. *The Evolution of Cooperation*.

Baland, JM and JP Platteau. 1996. *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?*

Daniels, B. 2007. Emerging Commons and Tragic Institutions. *Environmental Law* 37: 517.

- Hardin, G. 1968. The Tragedy of the Commons. *Science* 162: 1243.
- Hardin, R. 1982. *Collective Action*.
- Jefferson, T. Letter to Samuel Kercheval on the Virginia Constitution (July 12, 1816), reprinted in HS Randall, *The Life of Thomas Jefferson* (1858).
- Kahneman, D, JL Knetsch and R Thaler. 1991. Anomalies: The Endowment Effect, Loss Aversion and Status Quo Bias, *Journal of Economic Perspectives* 5: 193.
- Kahneman, D and A Tversky. 1984. Choices, Values and Frames. *American Psychologist* 39: 341.
- Kahneman, D and A Tversky. 1979. Prospect Theory: An Analysis of Decision Under Risk. *Econometrica* 47: 263.
- Kreps, DM. 1990. Corporate Culture and Economic Theory. In *Perspective on Positive Political Economy*. JE Alt & KA Shepsle eds.
- Leopold, A. 1966. *A Sand County Almanac*.
- McKean, MA. 2000. Common Property. In *People and Forests: Communities, Institutions and Governance*. CC Gibson et al. eds.
- McKean, MA. 1992. Success on the Commons: A Comparative Examination of Institutions for Common Property Resource Management. *Journal of Theoretical Politics* 4:247.
- Nash, JF 1950. Equilibrium Points in n-Person Games. *Proceedings of the National Academy of Sciences* 36:48-49.
- North, DC. 1999. Dealing with a Non-Ergodic World: Institutional Economics, Property Rights and the Global Environment. *Duke Environmental Law and Policy Forum* 10:1.
- North, DC. 1990. *Institutions, Institutional Change, and Economic Performance*.
- North, DC and B Weingast. 1989. Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth Century England. *Journal of Economic History* 49:1.
- Olson, M. 1965. *The Logic of Collective Action*.
- Ostrom, E. 1992. Rudiments of a Theory of Common-Property Institutions. In *Making the Commons Work: Theory, Practice, and Policy*. DW Bromley ed.

- Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*.
- Ostrom, E. 1992. *Crafting Institutions for Self-Governing Irrigation Systems*.
- Ostrom, E. 2001. Reformulating the Commons. In *Protecting the Commons: A Framework for Resource Management in the Americas*. J Burger, et al. eds.
- Ostrom, E, R Gardner, and J Walker. 1994. *Rules, Games, and Common-Pool Resources*.
- Plott, CR. 1991. Will Economics Become an Experimental Science? *Southern Economics Journal* 57:901
- Runge, CF. 1992. Common Property and Collective Action in Economic Development. In *Making the Commons Work: Theory, Practice, and Policy*. DW Bromley ed.
- Runge, CF. 1984. Institutions and the free rider: The assurance problem in collective action. *Journal of Politics* 46:154-81.
- Schelling, TC. 1960. *The Strategy of Conflict*.
- Taylor, M., and H. Ward. 1982. Chickens, whales, and lumpy goods: Alternative models of public goods provision. *Political Studies* 30:350-70.
- Thompson, Jr, BH. 2000. Tragically Difficult: The Obstacles to Governing the Commons. *Environmental Law* 30:241.
- Tietenberg, T. 2000. *Environmental and Natural Resource Economics*. 5<sup>th</sup> ed.
- Tversky, A, and D Kahneman. 1981. The Framing of Decisions and the Psychology of Choice. *Science* 211:453.
- von Neumann, J, and O Morgenstern. 1944. *Theory of Games and Economic Behavior*.
- Wade, R. 1988. *Village Republics: Economic Conditions for Collective Action in South India*.
- Ward, H. 1993. Game Theory and the Politics of the Global Commons. *The Journal of Conflict Resolution*, 37:203-235.
- Weingast, BR. 1997. Political Foundations of Democracy and the Rule of Law. *American Political Science Review* 91: 245.
- Wilkinson, CF. 1992. *Crossing the Next Meridian: Land, Water, and the Future of the West*.

Williamson, OE. 1983. Credible Commitments: Using Hostages to Support Exchange. *American Economic Review* 73: 519.