Commodity Systems Challenges

Moving Sustainability into the Mainstream of Natural Resource Economies

A Sustainability Institute Report, April 2003

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1. Recreating Commodity Systems — an Essential Part of Sustainability

Why have we written this paper on sustainability and commodity systems, and why should you read it? To answer that question, right up front, we must first ask you, the reader, questions of our own.

How do commodity systems touch your personal or professional life? When you say the word "commodity" what do you think of?

Perhaps the word commodity makes you think of a specific crop — lobster, or lumber, or corn, or bananas — because you earn your livelihood producing it. In that case, if you are like the producers we have gotten to know during the course of our research, you don't need a paper to tell you the importance of understanding and managing a commodity system. You feel pressures on your community. You wonder if your children will be able to stay in your community. You wonder if you and your fellow farmers will be able to afford schooling for your children. You wonder if there will be enough fish in the sea to sustain your fishing fleet in five years' time. You wonder how low the price for your commodity will fall before it is done falling. You wonder if it will ever be done falling.

So for you — producers trying to survive in the main market or diversify into niche markets — we have written this paper with the hope that stepping back to see the systemic reasons for the behavior of commodity economies will help you and your fellow producers take concrete action. We hope examples of what has worked to transform other commodity systems will give you inspiration. And we hope that by being frank about the vulnerabilities of solutions, we will help you refine your strategies.

Perhaps, when you hear the word commodity, you think of a place you love that is threatened by the way a commodity is grown or harvested. Maybe you think of a waterway choked of oxygen by fertilizer run-off or a forest in your view that is destined to be clear-cut. If you see commodities from the point of view of damage done to the environment, we hope this paper helps you understand the causes of fertilizer run-off or massive clear cuts or over-fishing. We hope you will see how good people do bad things for good reasons or because they see no alternative. We hope such an analysis helps you see new options for protecting the forests, oceans, rivers, and soils that you love. We hope this way of looking at commodity systems helps you see opportunities for new partnerships and new actions.

Perhaps the word commodity leads you quickly to concerns for social justice. You are outraged that only a tiny sliver of the consumer dollar makes it back to the majority of the men and women who harvest fish, grain, cocoa beans or tea. You desire a landscape of small farms and prosperous fishing villages and despair at the growth of industrial monocultures. For you, concerned with a commodity economy that can erode social resources as surely as it can erode environmental ones, we offer this paper as a way of understanding the structural forces making commodity systems so potentially destructive of social capital. We hope the examples in this paper convince you that destruction is not inevitable and give you inspiration about the concrete mechanisms that can keep commodity systems and their harvesting communities healthy for the long term.

Maybe you manage a large company dependant on commodity streams for profitability and survival. Perhaps you are searching for the means to do your job and fulfill your company's mission in ways that support social and environmental resources. Quite likely you know that the success of your enterprise depends upon the long-term sustainability of the resource and its harvesters. We hope this paper provides you with fresh insight about the opportunities for commodity buyers to participate in solutions.

Perhaps, when you think of the word commodity, you see yourself at the grocery store or the furniture shop puzzling out your choices, trying to do the right thing. If that is the case, we offer this paper in the hopes that you see specific ways to support sustainable, equitable rules for the commodity systems sustaining you.

We have then, several answers about why we have written this paper. Each answer is sincere, but each is only partial. Take them all together and you have our best answer.

So much that is vital, from the sustenance of our material needs to the beauty of our landscape and equity among people, is influenced by the way our commodity systems behave. If we are going to move toward the world we want, our commodity systems are going to need to change. That can happen most effectively if all those involved, from small producers to large corporations, from social justice advocates to environmental reformers to consumers, believe that these systems can improve and come together to make that happen.

We offer this look at the structure of commodity systems, their traps, and alternative structures, in the hopes that it will facilitate such a coming together.

Where Human Economy Meets the Earth

Commodities that come directly from the earth – grain, meat, cotton, sugar, lumber, fish – are the raw materials at the foundation of every economy. They are the basis of subsistence and material comfort. The natural resource economies that have grown up to harvest, produce, process, refine, transport, and market these commodities exist at the intersection of human systems and the Earth's systems. These commodity economies are where business policies intersect with food webs, where trade rules meet nutrient cycles, where cultural assumptions must mesh with water flows and weather patterns.

The rules and incentives guiding daily decision-making within these dynamic and complex systems determine not only the amount and quality of goods produced but also the condition of ecosystems and human communities. Do the fish, trees, or soils at the heart of a commodity system regenerate faster than they are depleted? Can healthy profit margins exist within a system that is sensitive to regeneration rates? Do the harvesters earn a livable wage? Do the waterways run pure or become filled with sediments or pollutants?

As the scale of commodity production increases, the potential for commodity systems to exceed the capacity of human communities and ecosystems to support them also increases. Commodity systems can overshoot the sustainable harvest of the resources they depend on, as in the collapse of a fishery. They can produce more wastes than ecosystems can absorb, as in pollution from agriculture. They can push so far towards "efficiency" that communities of producers are pushed to the edge of economic survival.

In response to this growing challenge, people around the world are developing policies and practices to manage natural resource economies. People monitor resources and agree on production limits to avoid over-harvesting. Countries and regions tax pollutants and reward good stewardship. Commodity processors form partnerships with producers to use best practices. Local food system projects are emerging.

Unfortunately, these good news stories tend to end in the phrase, "successful, but…" The solutions are helpful to a point, but they also are vulnerable to other pressures. Sometimes they seem promising at the local level, but cannot be increased to a larger scale. Or they cannot be sustained without constant injections of outside money and energy. Or they are blocked by international trade rules. Or they just cannot compete with other regions that have not adopted similar practices.

While the techniques of careful commodity system management currently seem workable within small, geographically constrained experiments, we know that isolated experiments are not enough. If the Gulf of Mexico is impacted by nutrient runoff from all the thousands of acres of row crops in the Mississippi River watershed, then solutions leading to a few percent of these acres converting to organic practices won't significantly improve the health of the Gulf. Careful management of a single fishery cannot be maintained if similar fish from other waters are sold into the market at a lower price. In a globally traded commodity, the commitment of a single player, no matter how large and powerful, cannot ensure the long-term sustainability of a resource.

What will it take to implement locally effective solutions at a scale that is meaningful for the Gulf of Mexico or for the global market for groundfish? How do we keep the benefits of commodity systems while changing them enough to reduce problems?

In trying to answer such questions, we are guided by a tenet of systems analysis — structure gives rise to behavior. Even though each crop and each raw material has its own path from harvest, through processing, to final use, we focus on the patterns of behavior common to these diverse systems. We look for the rules, incentives, and decision making processes that produce those behaviors. We examine why these systems tend to expand beyond the capacity of society or the environment to support them. Finally, we examined the collection of rules and incentives with an eye towards those places to intervene that can be used to keep the productive capacity of commodity systems in balance with ecological and community resources. The conclusion examines opportunities to learn from attempted solutions and to expand their range and effectiveness.

Our Background with Commodities Systems

The insights about the behavior of commodity systems described in this paper are based on Sustainability Institute action-research projects within two U.S. natural resource economies — forestry in New England and corn production in the Midwest — along with preliminary modeling of the shrimp system and years of participating in the international conversation on sustainable agriculture.

Our focus on commodity systems was inspired by our founder, Donella Meadows. She wanted to understand why, systemically, places with rich natural resources are so often on both the ecological and economic edge of survival, and how commodity systems can be transformed so they are stable, sustainable, and equitable. Our goal in these projects was more than understanding – we wanted to build that understanding with and for the stakeholders in commodity systems, so they would understand where leverage points for change may be, and so they could summon the political will to make those changes.

We have worked for four years in the Northern Forest of New England with loggers, mill owners, foresters, and landowners, and in the Midwest with corn farmers, extension agents, elevator operators, and processors. With these stakeholders we built computer simulation models of production and distribution systems. The models are neutral, exploratory tools, easy to understand, and fascinating to use. They incorporate knowledge and assumptions of the system's participants and help spell out logical – but often surprising – conclusions.

Since building these models, we have used them in many workshops to frame discussions about choices and constraints to achieving a sustainable future. The usefulness of this approach in those settings has encouraged us to offer this perspective to a wider audience. At the same time, the corn and forest work have led us on a search through many other commodity systems as we look for real world examples of "system redesign" to share with our growing network of agriculture and forestry colleagues.

2. Behavior of Commodity Systems

Commodity Systems Aim to Produce Standardized Raw Materials for the Lowest Possible Cost

Over the last few hundred years the production of raw materials for human consumption has shifted from local, small-scale, diverse producers to a system of larger-scale, specialized producers selling commodities over long distances through a highly sophisticated distribution and processing infrastructure. Within these commodity systems materials move in one direction — from production to consumption — and money flows back the other direction.

Commodity systems require mechanisms for transport, storage, processing and packaging. They require the gathering of information, the raising of capital, and the exchanging of currencies. The ability of these systems to extract materials, sort, process, and allocate them to a multitude of final demands is not only extraordinarily complex but also life-maintaining for billions of people.

Two basic rules allow commodity systems to accomplish extraction and distribution of raw materials on such a vast scale. First, commodity systems standardize the characteristics of the raw commodity. A ton of Number Two Dent corn from Iowa is indistinguishable from a ton of Number Two Dent from Argentina. A pound of shrimp from Louisiana is identical to a pound of shrimp from Ecuador.

This standardization streamlines the flow of the commodity. Only certain characteristics — those that matter to the next buyer in the chain — are recorded and tracked. As the wheat pours out of tractor-trailer trucks and into grain elevators or as the shrimp from many nets co-mingle in frozen blocks on a transport ship, the history of production is lost. The only information tracked for each product grade is the price and the volume, in metric tons, or bushels, or board feet. This allows traders and buyers to move the commodity as an undifferentiated stream of goods rather than as the identified product of a specific producer.

> ***From the outside, a modern grain elevator looks like a simple enough concrete structure, but inside it is a labyrinth of pipes, ducts, ventilators, belts, and shovel lifts, all controlled from a command room complete with console and flashing, colored buttons. From there it is possible to "blend" grain from different silos so that the foreign customer gets no more than the minimum quality ordered — no more, but no less either, of permitted broken kernels, pieces of weeds, insects, bits of straw, wild garlic, and wild onions. Once the grain is blended, it rockets out along the belts that run as far as a quarter of a mile to reach a waiting ship.***
>
> — Dan Morgan, ***Merchants of Grain,*** 1979[1]

Standardization and substitutability have allowed commodity systems to be extraordinarily streamlined and productive. But as knowledge of the ecological and social context of the commodity is removed, producers are left with very few grounds upon which to compete. If buyers no longer know where or how a commodity was produced, it is impossible to reward producers for stewardship or good community-citizenship.

This leads to a second rule of commodity systems: the producer with lowest prices makes the sale. Producing the most undifferentiated product for the least cost is the secret to survival at the beginning of the commodity chain. Because the production methods, ecological impacts, and contributions to local communities are not associated with a particular truckload of corn or pallet of lumber, competitive advantage for producers in commodity systems comes only from being able to produce a grade of product for the least cost.

FIGURE 2-1 Total U.S. Production Increases Across Many Commodities.

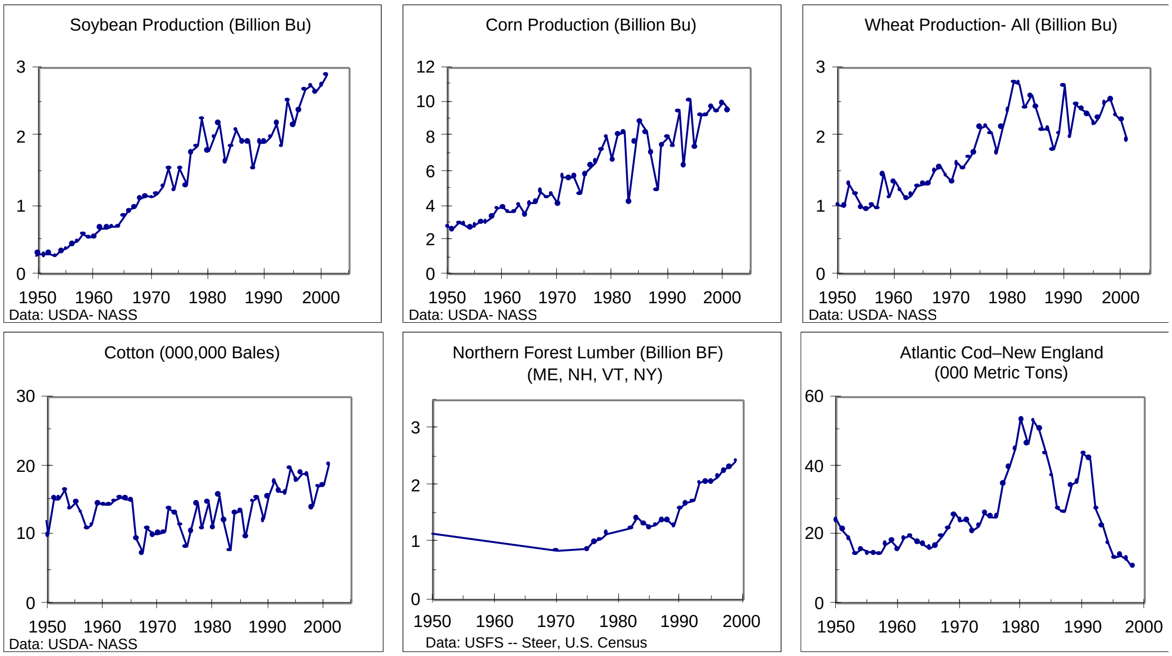
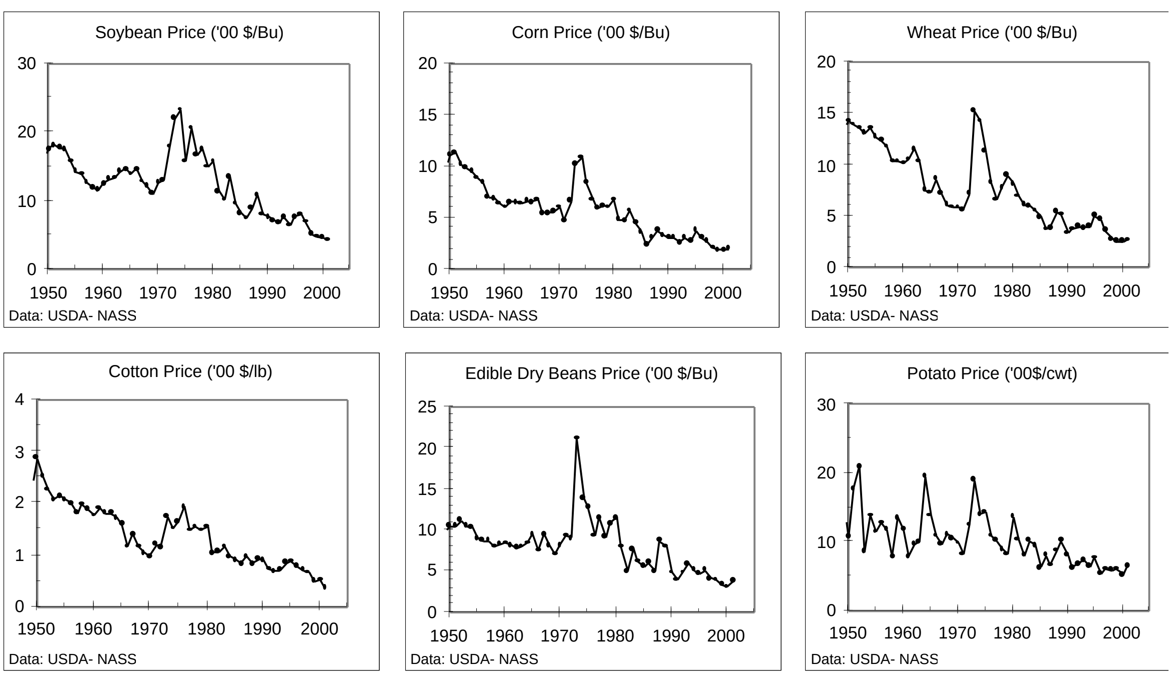
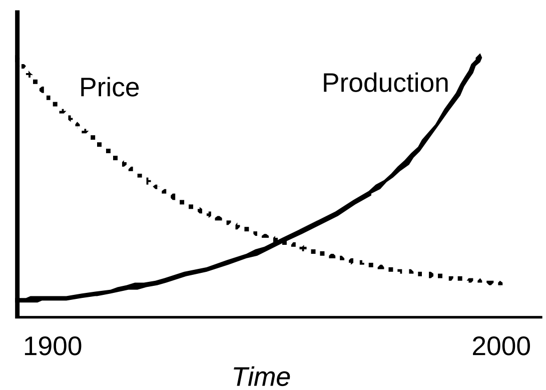


FIGURE 2-2 Falling U.S. Prices Across Many Commodities



Standardization and low price make commodities dependable, accessible and affordable. Processors can depend upon and plan for a specific grade of raw material — from Brazil one month, Iowa the next, Canada the next. Commodities are produced wherever it can be done for lowest costs, thereby increasing economic efficiency. More products become more available for less money.

FIGURE 2-3 Generic Commodity Behavior



All of these useful, desirable features have fueled the success of commodity systems, and commodity systems have grown accordingly. From grains, to lumber, to fish, the amount of commodity harvested or produced has increased over time (Figure 2-1). As commodity production volume increases prices (in constant dollar terms) decline (Figure 2-2). Taken together, these two trends — more and more production and lower and lower prices — are the representative behaviors of commodity systems (Figure 2-3).

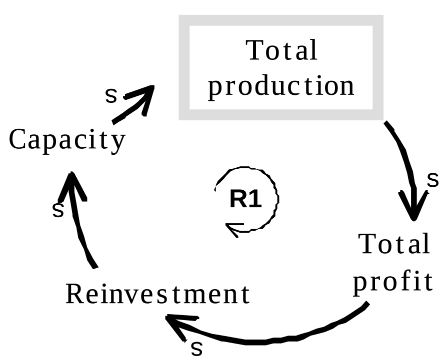
Driving Forces

Reinvestment, Efficiency Increases, and Demand Increases Drive the Growth of Production

The trend toward higher and higher production and the trend toward lower and lower prices per unit of commodity are not merely coincidental. These two behaviors of commodity systems are linked together in a network of mutual cause and effect made up of three feedback loops, each of which causes growth in commodity production.

The first feedback loop, shown in Figure 2-4, is the process by which productive capacity leads to the creation of more productive capacity. This Capital Growth Loop is the core driving force of industrial expansion. Production creates profits, some of which are reinvested in new capital

FIGURE 2-4 Capital Growth Loop



Loop R1: As *Total production* rises, *Total profits* rise too. *Reinvestment* in productive *Capacity* follows, boosting *Total production* yet again. The "R" stands for a "reinforcing" loop.

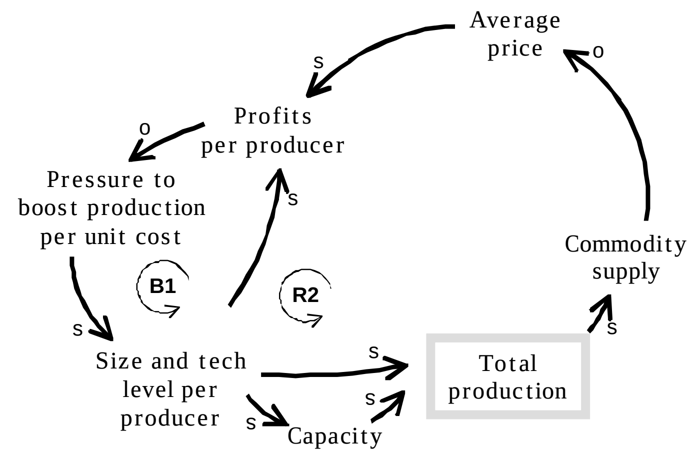
READING A CAUSAL LOOP DIAGRAM

Figure 2-4 is the first of many "causal diagrams" in this paper. In such diagrams, each of the arrows represents a causal connection. Increasing total production, everything else being constant in the system, will lead to an increase in total profit. The "s" at the arrow indicates that the change in total production is in the "same" direction as the change in total profit. More production, more profit. (In later diagrams, an "o" at the arrow will indicate change in the "opposite" direction.) More profits typically lead to more reinvestment in the system, leading to higher total production. This creates a cycle of growth called a reinforcing loop.

equipment —sawmills, tractors, fishing boats — which is then used to increase total production. In this growth process production leads to more capacity for production.

Rising industry-wide production means that the commodity supply available on the market can exceed demand and push the average price down (right hand side of Figure 2-5). Falling prices mean lower profits per producer, all else being equal. In times of falling profits, the two options available to individual producers trying to maintain profits are to reduce costs and to expand production volume (loop B1 in Figure 2-5). Often, the route to cutting costs on a per unit basis is to expand the size of the operation so that the costs of a tractor, a fishing boat, the farm family's time, or the mill's labor are spread across a greater volume of commodity production. While expanding size does cut costs for individual producers, thus compensating for falling profits (loop B1), it also increases overall production (via loop R2). This increase in total production creates a vicious cycle that further decreases prices and profits. The resulting perverse cycle means that producers feel they must "grow or die." The net result is more industry production, ever-lower prices and continuing pressure to reduce costs. These two practices – increasing efficiency and expansion – create the second driver of growth in commodity production, the Efficiency Boosting Loop.

FIGURE 2-5 Efficiency Boosting Loop



Loops R2 and B1: As *Total Production* rises and *Average price* falls, *Profits per producer* fall as well, creating more *Pressure to boost production per unit costs*. This increases the *Size and technology level per producer*, which is intended to increase and restore the *Profits per producer*, via loop B1. (The "B" stands for a "balancing" loop, a feedback loop that seeks stability rather than growth.) However, increasing *Size and technology level per producer* also boosts the *Total production* via loop R2, which puts downward pressure on price and profits and creates a vicious cycle of rising production and falling prices.

In agriculture, this dynamic of increasing production and falling prices has been described as a "treadmill" where individual farmers must produce more and more just to stay in business.

The pressure to increase production and decrease costs has been a feature of commodity systems for as long as they have existed.

> ***We entered an immense low-ceilinged room and followed a vista of dead swine, upon their backs, their paws stretching mutely toward heaven. Walking down to the vanishing point, we found there a sort of human chopping machine where the hogs were converted into commercial pork. A plank table, two men to lift and turn, two to wield the cleavers, were its component parts. No iron cog-wheels could work with more regular motion. Plump falls the hog upon the table, chop, chop; chop, chop; chop, chop fall the cleavers. All is over. But, before you can say so, plump, chop, chop; chop, chop; chop, chop, sounds again… Amazed beyond all expectation at the celerity, we took out our watches***

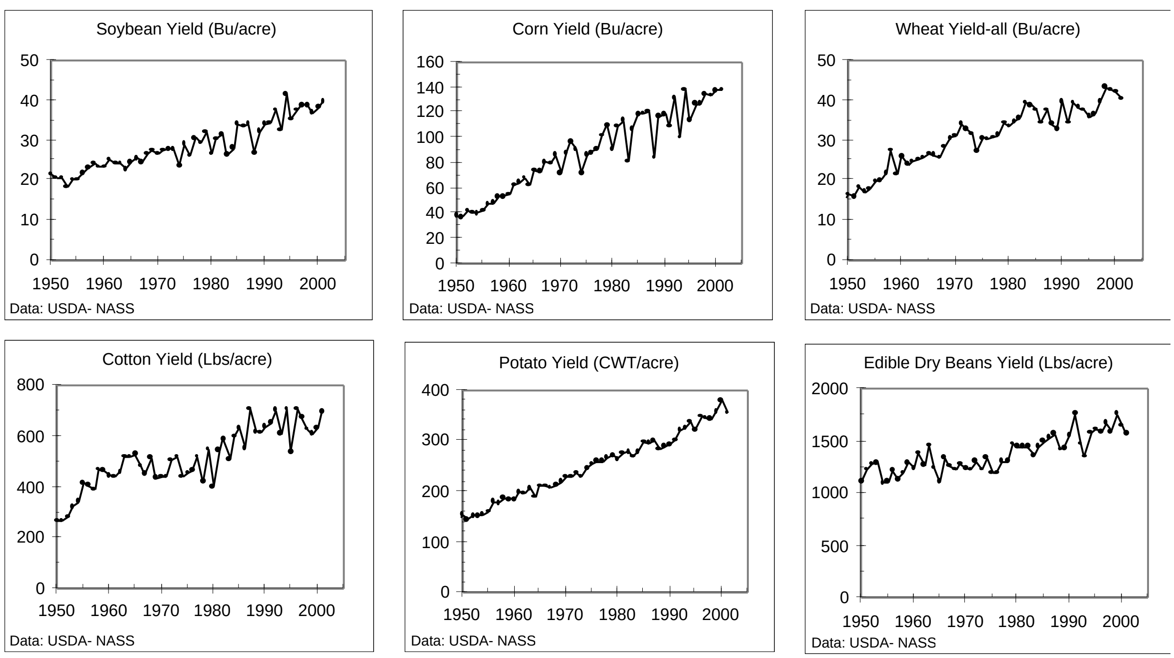
> ***and counted thirty-five seconds, from the moment when one hog touched the table until the next occupied its place.***
>
> — Fredrick Law Olmstead, 1857[2]

And the same pressures exist all over the world, wherever commodity systems develop.

> ***In Brazil, for example, government constraints on tree density and planting techniques have been lifted. Tree-planting has become far denser, increasing from the traditional 900-1,200 coffee trees per hectare to 5,000-8,000.***
>
> — ***Mugged: Poverty in Your Coffee Cup,*** 2002[3]

In many commodity systems, entire industry and government research programs spring up in response to the constant pressure to cut costs and increase production. In agriculture, the delivery of chemical inputs, plant breeding, and, increasingly, genetic modification of seed stock, all result in climbing yields per acre for most agricultural commodities (Figure 2-6). In fisheries, larger boats, bigger nets with a deeper reach, and new technologies for searching out schools of fish increase the catch per year. In forestry sawmills install new equipment for milling smaller and smaller logs — typically processing more wood per day than the old equipment.

FIGURE 2-6 Increasing U.S. Yield per Acre

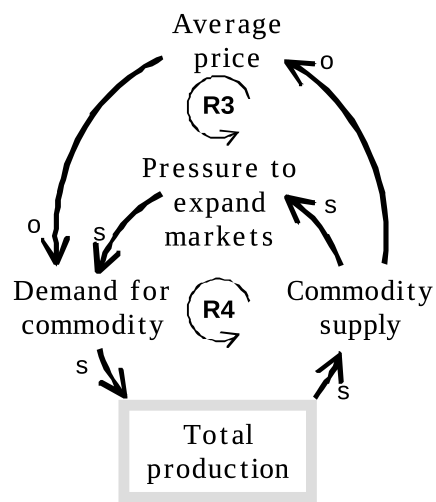


The two reinforcing feedback loops of Figures 2-4 and 2-5 mean that whether profits are high or low, production will rise. Under conditions of high profits, reinvestment leads to increased production. Under conditions of low or falling profits, efficiency measures and expansion lead to increased production. The net result is that whether profits are rising or falling, the typical commodity producer expands production volume year after year.

As production levels rise and prices fall, demand for the product tends to rise as more people can afford it. For example, with commodification, bananas changed from a "specialty" or premium item to an everyday food. Climbing demand gives producers the confidence to invest in increasing production, pushing up supply, pushing down prices, boosting demand, and creating the third driver — the Demand Growth Loop (Figure 2-7). In addition, as commodity supplies build up, commodity producers or their government representatives put effort into creating new uses, for example ethanol from corn, or new markets such as exports. This is shown in loop R4 of Figure 2-7.

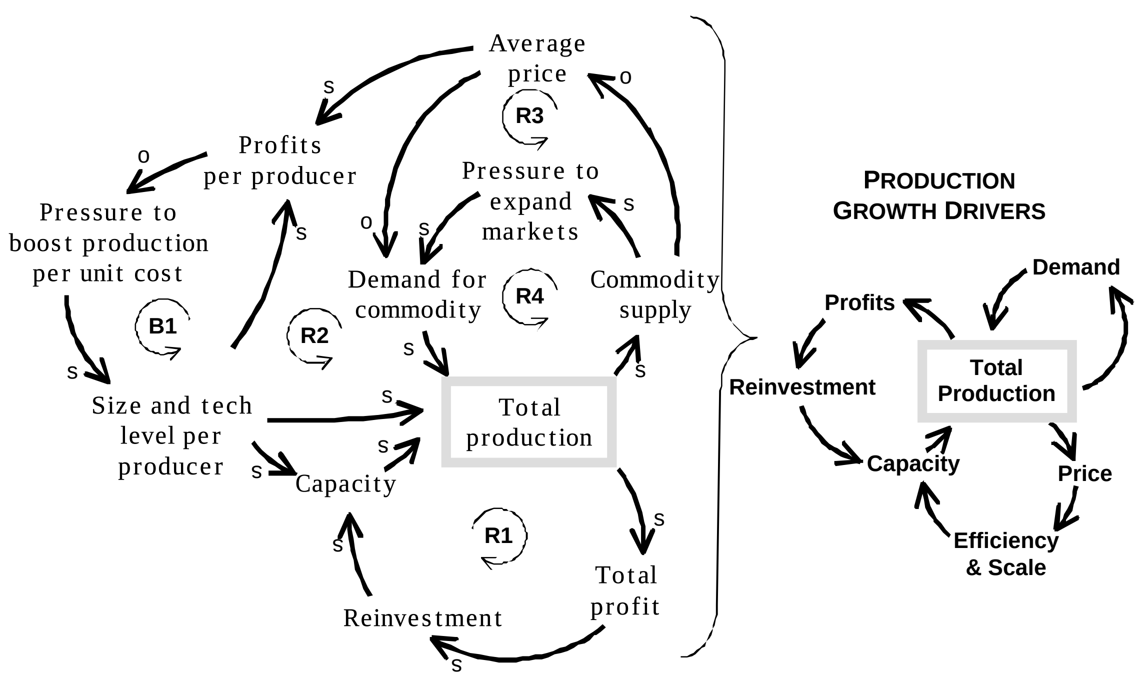
Figure 2-8 places all three of these driving feedback loops into a single diagram centered on total production. The inset of this figure shows a simplified representation of the three types of driving feedback loop. We will rely on this simplified figure for the remainder of the paper.

FIGURE 2-7 Demand Growth Loops



Loops R3 and R4: As *Total production* rises, the *Commodity supply* on the market rises. More supply leads *Average price* to fall, increasing the *Demand for commodity* and supporting and boosting *Total production* (R3). More supply also increases the *Pressure to expand markets,* increasing *Demand for commodity* (R4).

FIGURE 2-8 Combined Production Growth Drivers



The left-hand side of the diagram combines the feedback loops for Reinvestment, Demand Growth, and Efficiency Boosting in one causal loop diagram. In future diagrams, these production growth drivers will be represented by the simplified diagram shown at the right.

Why Supply is Often Out of Balance with Demand

One might expect that in the face of falling prices and rising total production, individual producers would leave the commodity system. While it is true that over time the number of producers in most commodity economies tends to decline, several factors minimize this as a balancing force. As a commodity-producing sector begins to struggle, governments — especially in the richer countries — offer subsidies to boost the income of producers, and keep production levels high. Such programs can also take the form of subsidized research and development, spurring the Efficiency Boosting Loop or the Demand Growth Loop.

Subsidies in commodity systems ripple through the global economy. In rich countries, subsidies allow commodities to enter global markets at artificially low prices, placing enormous economic hardship on producers in parts of the world that do not subsidize their natural resource economies.

> ***Yes [European] milk powder is cheaper than our local milk. But what you must realize is that imports of milk powder have export subsidies on them. The Jamaican farmer has no subsidies whatsoever. Our production figures are true cost.***
>
> — Aubrey Taylor, president of St. Elizabeth Dairy Co-operative, Jamaica, 2002[4]

In addition to government subsidies, many commodity producers will take on outside jobs to keep their farms or their fishing businesses alive. The producers are, in effect, subsidizing the costs of commodity production with their own labor and keeping production levels high even when prices are low.

Commodity producers often feel very little flexibility. Those who use specialized equipment or who have no marketing infrastructure to sell other crops will have little ability to switch commodities in response to falling prices. Commodity production will remain high, even in the face of low prices, if producers have no alternative commodity to produce with their land or equipment.

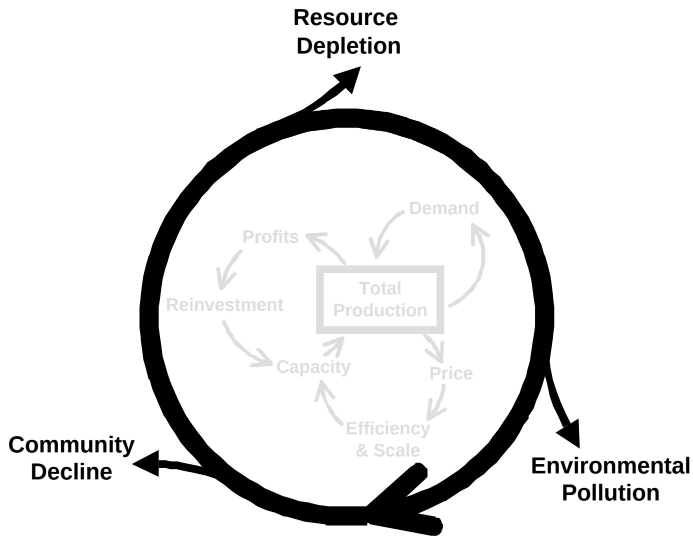
All three of these factors — subsidies, supplemental employment, and lack of production alternatives — add to the tendencies of commodity systems to overproduce relative to demand.

One might also expect that increases in demand would result in higher prices, bringing the system into balance. However, the Reinvestment and Efficiency Boosting Loops are increasing new supplies, driving down price, generally outpacing the rising demand.

The Three Traps of Commodity Systems

The three feedback loops described above — Reinvestment, Efficiency Boosting, and Demand Growth — help explain the rise in production levels and the decline in price seen in most commodity systems. But the benefits to consumers of ever-rising production levels are only one side of the behavior of commodity systems. Commodity systems have another side that is documented daily in newspapers and reports around the world — that of environmental and social crises. Although these problems — from fishery depletion to hypoxia in the Gulf of Mexico to the poor standard of living of cocoa bean harvesters — are usually described and addressed in isolation from one another, they all emerge from the three driving feedback loops we have been examining. Rising up out of the same dynamics that have made commodity systems so productive are mounting pressures on the people and the resource base that make commodity production possible in the first place (Figure 2-9).

FIGURE 2-9 Three Commodity System Traps



The production growth drivers create high levels of production and keep costs of commodities low, but these same growth drivers can also contribute to resource depletion, pollution and community decline.

Increasing productivity and scale within commodity systems increases the scope of the unintended impacts on environment and community. At the same time the constant pressures to lower costs reduces the ability of individuals in commodity systems to address these problems. The social benefit to more affordable and accessible basic commodities is clear. But what of society's goals for our communities and our ecosystems? In general society wants healthy farming, fishing, and logging communities. We want the resource to be well stewarded and able to provide for people on into the future. We want to make sure that natural habitats and ecosystems are not damaged by the processes of commodity extraction and production.

In our research and in many case studies about commodity economies we find that the structure of commodity systems has the potential to push them into three traps of counter-productive behavior. While different commodities may be struggling with different challenges, they all have the potential to experience each of these traps. Avoiding one trap might simply set the stage for encountering another. These traps are tendency of commodity systems to exceed the productive capacity of their natural resource base (Depletion), exceed the ability of the environment to absorb wastes (Pollution), and undermine producer income and communities (Decline).

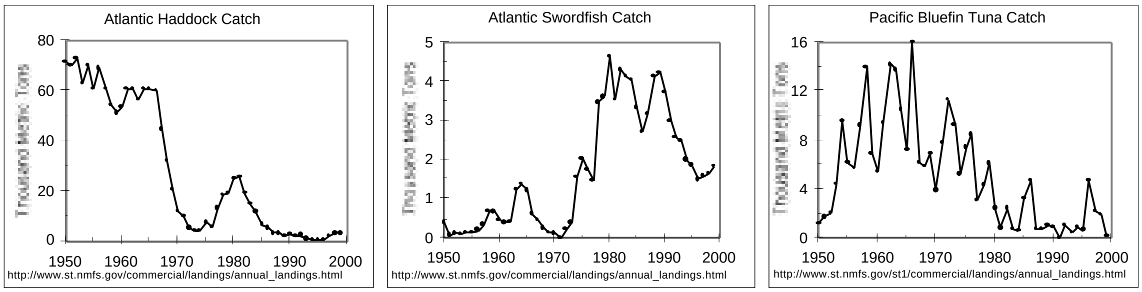
We call these traps because of the built-in structural tendency for commodity systems to "trip" into these modes of behavior and because of the difficulty of getting out once in. The following sections examine the dynamics behind each of these pressures and explore approaches for managing these dynamics.

Trap # 1 Resource Depletion: Harvest rates exceeding natural resource regeneration rates

> ***Commercial fishermen on the West Coast who harvest groundfish from the Pacific Ocean are bracing for more waves as the federal government looks for ways to recover dwindling fish populations. The latest plan calls for pushing half of the groundfish fleet out of the business in Oregon, Washington and California. Remaining fishermen will be faced with additional cutbacks on the number of fish they can catch.***
>
> — CNN Internet news report. 17 Oct 2000 [5]

From the 1890s to the turn of the 21st century, from the virgin pine stands of Michigan to the Pacific groundfish industry, commodity systems display a tendency to grow beyond the capacity of the resource base they are harvesting. Sometimes, as in the conversion of forests to open land in the area surrounding Chicago in the late 1800s, the resource never regenerates. Sometimes, as in the case of fisheries (Figure 2-10), the resource declines precipitously with the prospects for recovery uncertain. The tendency for collapse of the resource results from the interaction between the commodity system's driving feedback loops and the biophysical dynamics of the natural resource at the heart of the system. When the production growth drivers are not responsive to the resource dynamics, the harvesting capacity can easily increase beyond the capacity of the resource.

FIGURE 2-10 U.S. Fish Catch



The depletion trap is most obvious in fisheries and forestry. But it is also present wherever agricultural activities draw down aquifers or reduce soil fertility. Commodity systems whose product comes directly from a renewable resource such as forests and fisheries are easily identified as vulnerable, but commodities systems that are based on crops or animals also depend on the renewable health of soils and rangelands to support the raising of their product.

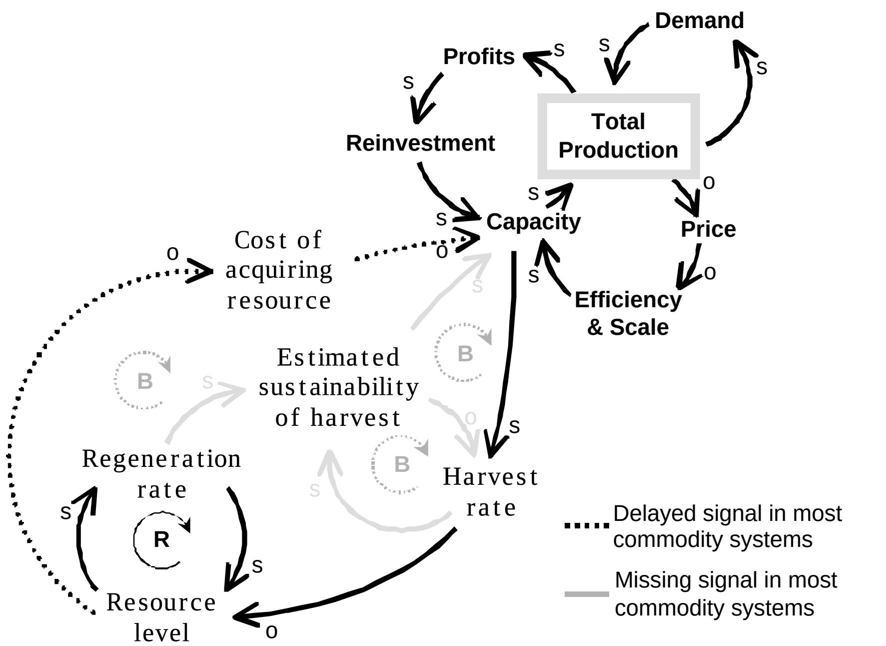
Fisheries illustrate the challenge of balancing growth in commodity production with resource regeneration and show the difficulty of developing market and regulation mechanisms that will ensure sustainability of the resource. At present, the U.N. Food and Agriculture Organization reports that 47 to 50 percent of the world's major marine fisheries are fully exploited and another 15 to 18 percent are over-exploited[6]. Regional studies report similar trends. According to the European Environment Agency, "most fish stocks of commercial importance in European waters appear to be outside safe biological limits."[7]

Early in the development of a fishing industry, the production growth drivers push up the productive capacity — the size and efficiency of the fishing fleet — and thus the harvest rate (Figure 2-11). Prices fall over time and demand grows as processors find new uses for the fish. Harvesting technologies improve — in the form of better nets, sonar, and bigger boats — so that harvests grow and per-unit costs fall. Fishing companies make profits and reinvest in new boats.

> ***The canneries were so efficient at processing the lobsters that they were soon forced to work with smaller lobsters. In 1860, James P. Baxter recalled that four to five pound lobsters were considered small and the two pound lobsters were being discarded as not worth the effort to pick the meat for canning. Only twenty years later, the canneries were stuffing meat from half-pound lobsters into the tins for processing.***
>
> — Gulf Of Maine Aquarium [8]

At some point in this story — often before most players note signs of scarcity — the fishing fleets begin harvesting mature fish faster then the young ones are becoming mature. Some time later, the annual harvest crashes. Regulators often put into place restrictions that allow recovery of the fishery. But just as often, the regulations are too little too late. Sometimes, the viability of

FIGURE 2-11 Resource Depletion Trap



The *Production Growth Drivers* lead to increases in *Harvest rate*. If *Harvest rate* is higher than *Regeneration rate*, then *Resource level* will decline. Although many people expect the *Cost of acquiring the resource* to limit *Total production*, this signal is often too weak or too delayed to do so.

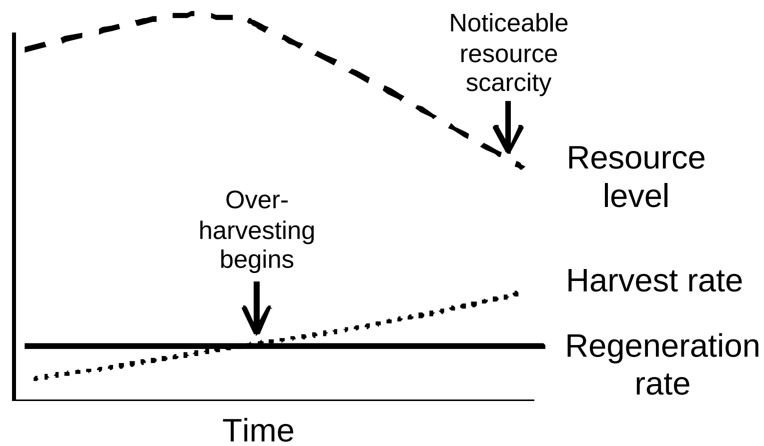
the fishery returns. More often, however, the catch does not return after a respite, as seems to be happening with Pacific Bluefin Tuna, Atlantic Cod, Atlantic Haddock, and Atlantic Swordfish (shown in Figures 2-1 and 2-10).

If a resource is not already regulated (which is the case in most natural resource systems that have not yet been through a cycle of overshoot), then typically the production capacity expands as long as demand for the product is present. This continues until either raw material costs or absolute scarcity prevent additional production. At that point the cost per fish caught overwhelms the benefits from selling the fish. Declining profits slow investment in capacity, eventually slowing the growth in the harvest rate. Declining profits can also encourage producers to leave the commodity system, further reducing production capacity. If these signals happen in time, and capacity is reduced quickly enough, harvest rates decline and the resource can recover.

But the experience in many fisheries, forests, and other renewable resource industries shows that these signals are only rarely timely enough and strong enough to keep harvesting capacity within the limits of the resource. Much more typically the harvest rate "overshoots" the sustainable yield of the resource, eventually leading to a crash of the harvest rate. The result is the "boom and bust" fisheries depicted in the data shown in Figure 2-10.

Market signals do a poor job of preventing overshoot. The cost of acquiring the resource is a weak signal of resource level because the Efficiency Boosting Loop continues, for a time, to drive the harvesting cost down even as the fish are becoming more scarce. The resource must already be well into decline before it becomes significantly more costly to harvest. By the time the ever more efficient boats are pulling up fewer fish, the harvesting capacity of the entire fishery can have grown well beyond the sustainable yield of the resource. Corrections in harvesting capacity happen very slowly. Even if profits are falling, fishing boats continue to be used to bring in as much return on investment as possible. Therefore, capacity only truly begins to decline after the harvesting capacity wears out and is retired, a process that may take many years.

FIGURE 2-12 Resource Level Responds to Harvest Rate and Regeneration Rate



It is important to note that over-harvesting begins as soon as the harvest rate exceeds the growth rate (shown in Figure 2-12). **Thus, the resource can be over-harvested even at a time when the supply of trees or fish appears to be plentiful.** Because the signal of scarcity typically comes long after the capacity to harvest the resource has exceeded the productive capacity of the resource, the harvest rate does not just need to be capped at current levels, it needs to be **reduced** to match the regeneration rate. Reducing harvests, of course, has significant economic impact on jobs and communities, leading discussions about regulation to stretch out over years, and pressuring participants to set harvest limits as high as possible.

Compounding these problems, market signals can accelerate the decline of a resource base. As a commodity product gets scarce it may become more desirable to consumers because of its rarity, making the market price rise and creating an even stronger incentive for the commodity producers to harvest beyond the sustainable yield. As an extreme example, in Tokyo in 1998 a single scarce Bluefin Tuna sold for $83,500.[9]

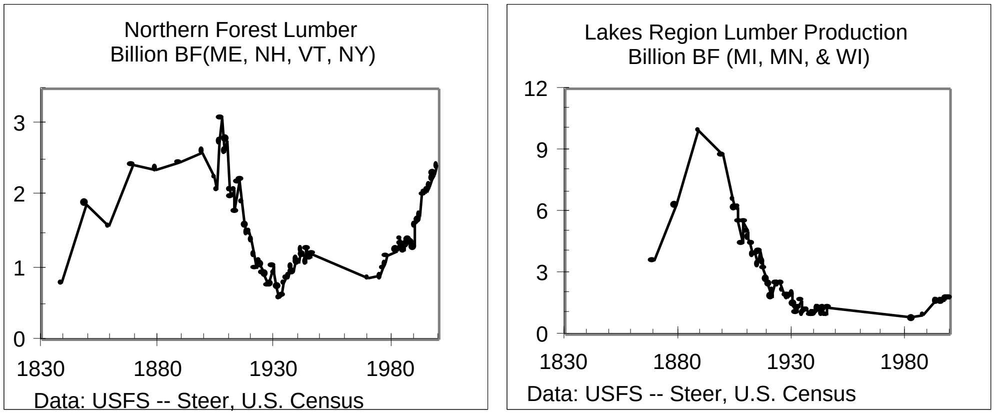
One of the reasons that fishery systems have difficulty matching harvest capacity to sustainable harvest rates is that fish populations are so difficult to estimate. Perhaps, then, if one could physically see the resource level, commodity producers would not harvest above the sustainable yield. And, yet, in the world of forestry, where foresters inventory the trees in a region, the same over-harvest relative to a resource limit trap still occurs.

Many regions in the United States experienced a "boom and bust" in timber harvesting around the early 1900s as sawmills moved across the country from East to West, with harvest rates, exceeding the sustainable yield of the forest, running low on trees, and moving further West.

For example, as shown in Figure 2-13, the forest-based lumber industry of the Northeast boomed in the late 1800s, busted in the early 1900s and was booming again in the late 1900s after forty years of tree growth. In other instances the timber industry did not return. In the Great Lakes region of the U.S., once the industry collapsed the first time, other uses for the land took over and forestry has not returned.

Why does the over-harvesting trap exist even when producers ought to be able to track the growth rate and total size of the resource? Wouldn't the market signals work better at keeping the harvest rate within the sustainable yield of the resource?

FIGURE 2-13 U.S. Regional Lumber Production



This happens because, in forest economies that are based on privately owned forestland, most landowners are willing to harvest and sell timber faster than it grows when the number of trees is high. They often have nothing else to sell. Because of this willingness to sell, timber is harvested faster than its growth rate without the price of the timber increasing significantly. Prices only increase when the landowners feel that the total inventory of desirable species and qualities is low. In other words, when making harvest decisions, landowners tend to look at the supply of timber rather than at the growth rate of the timber. As in fisheries, price is a delayed and weak signal of scarcity. So, lumber producers frequently end up "overshooting" the resource regeneration limit.[10] As in fisheries, when price finally does begin to rise, it becomes even more attractive for landowners to sell their timber, pushing down price and delaying any signal of scarcity to the mills.

The technology adoption dynamics outlined in Figure 2-5 compound the problem. A decision by a sawmill owner to expand the mill’s capacity and, therefore, its harvest demand, has less to do with a clear assessment of the health and regeneration rate of the timber resource and more to do with ensuring survival in a competitive market. Sawmills that survive have the latest technologies. And sawmills with the latest technologies generally are higher capacity. Increasing capacity lowers per-unit costs. As one New England sawmill operator said in an interview with us, "Good market or bad market, it is always a good time to increase production."

After growing strongly over the past thirty years, New England sawmills may be feeling the effects of the raw material limit. Price has been rising for the sawlogs they cut and several species are now quite scarce. Faced with falling profits, some mills have closed, but many more have modernized their mills with technologies that reduce waste using thinner sawblades, cut labor costs with computerized scanners and sorters, and allow the mills to cut a curved log into a straight board. All these technologies reduce costs and keep the mills alive; however they also increase the overall timber appetite of the milling industry. In short, mills may be reacting to scarcity with **increased** demand for timber.

Many operators share the ethic we heard expressed often. "If we run low on timber and mills have to close, my mill is going to be the lowest cost mill and be the last one standing." As this system is currently structured, the competitive pressures to increase production and cut costs lead mill owners to conclude that it is impossible to make decisions based on the sustainable harvest rate of the forests in their region. They believe — probably accurately — that if they were to try, they would be put out of business by global competitors with lower costs of production. Because of looming competition from foreign producers, solving the problem of over-capacity relative to the resource base involves decision making that takes the dynamics of the resource into account. And it requires decision-makers with enough insulation from global pressures to even imagine such decision making.

Escape from the Depletion Trap requires linking the health of the resource with the rate of capacity growth in the industry (the dotted lines in Figure 2-11). Doing this requires both **knowing** the harvest rate and the resource regeneration rate and **controlling** total harvesting capacity so that the harvest rate plus the natural death rate does not exceed the regeneration rate.

In the third chapter we will examine concrete examples of actions, policies, and agreements aimed at matching harvest capacity with the sustainable yield of the resource.

TRAP # 1 RESOURCE DEPLETION

The harvesting capacity of commodity systems tends to grow past the sustainable yield of the resource. Market signals of resource scarcity (in the form of higher costs of harvesting as the resource becomes scarce) are too weak and too delayed to slow the growth of harvesting capacity as the resource begins to be over-harvested. In some cases, the market signals encourage the growth of excess harvesting capacity by encouraging investments in technologies that increase the efficiency of harvesting and boost the harvest rate even as the resource becomes depleted. ***Over the long term, all players in commodity systems—from industry to government to those advocating for the environment and communities—would benefit from actions that ensure that the rate of harvesting not exceed the sustainable yield.*** And because of the delays in the system, such actions need to be taken well in advance of the system running over-capacity.

Trap #2 Environmental Pollution: Waste generation rates exceeding natural waste absorption or purification rates

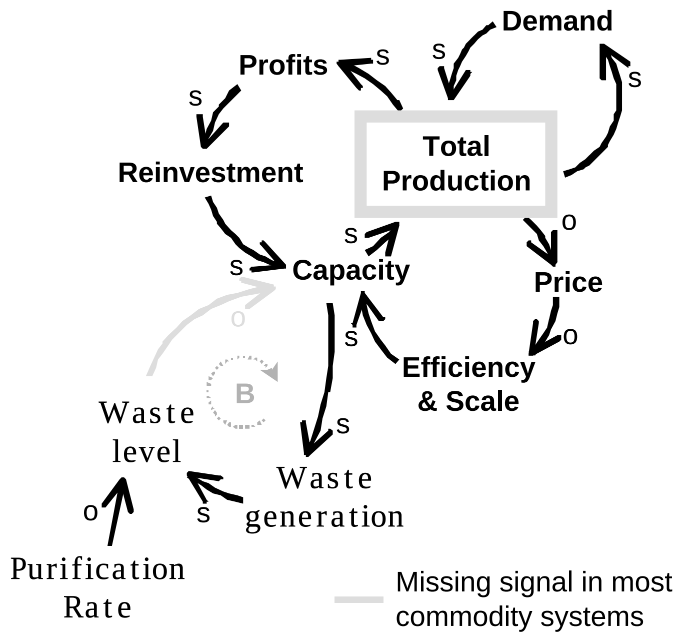
> ***Excavated in the Rockies for more than a century, cadmium is a silver-white metal used in rechargeable batteries, alloys and galvanized chrome on auto parts and appliances. Cadmium usually finds its way into the environment through ore tailings at abandoned mine sites. In the white-tailed ptarmigan, a member of the grouse family, cadmium was found to cause kidney damage, which reduces the bird's ability to process calcium. Forty-six percent of the adult birds surveyed in the 10,000-square-kilometer area were found with alarmingly high cadmium accumulation in their kidneys. "Birds in the winter get really hammered," said James Larison, an alpine ecologist at Oregon State University and lead author of the study, which appears in today's issue of Nature. "Their bones fracture easily so they die at a younger age and they don't have enough calcium to build normal egg shells."***
>
> — CNN Internet News report, 2000[11]

> ***It can stretch for 7,000 square miles off the coast of Louisiana, a vast expanse of ocean devoid of the region's usual rich bounty of fish and shrimp, its bottom littered with the remains of crabs and worms unable to flee its suffocating grasp. This is the Gulf of Mexico's "dead zone," which last summer reached the size of the state of New Jersey.... The trouble with the dead zone is that it lacks oxygen, scientists say, apparently because of pollution in the form of excess nutrients flowing into the gulf from the Mississippi River.***
>
> — New York Times, 1998[12]

Commodity systems produce waste — byproducts of growing, harvesting, or extracting raw materials from the earth. Many such wastes are biodegradable if they are produced at levels that are within the capacity of the environment to absorb or breakdown. Some are long lived toxins that need to be carefully managed, such as some mine tailings. If the production of wastes grows beyond the capacity of surrounding ecosystems to absorb and purify them, then waste products accumulate, often with severe consequences for human and ecosystem health.

Like the Depletion Trap, the Pollution Trap arises from the fact that the Production Growth Drivers of commodity systems are only weakly (if at all) restrained by feedback about the state of the ecosystem receiving the waste (Figure 2-14). Just as a commodity system may already be over-capacity relative to the resource even while the fish or trees appear plentiful, the system may already be over-capacity relative to its waste absorption capacity before signs of pollution or ecological degradation are noticed. As soon as wastes are produced at a rate faster than existing natural or man-made systems can absorb or detoxify them, the commodity systems has over-grown its sustainable capacity. But most often, pressure to address wastes only comes when the wastes have accumulated to the point where they are already damaging humans or ecosystems.

FIGURE 2-14 Environmental Pollution Trap



The *Production growth drivers* push the rate of *Waste generation* upwards. Over time, if the *Waste generation* rate surpasses the *Purification rate*, the *Waste level* builds. However, the connection from the *Waste level* to *Capacity* is weak or missing in most commodity systems.

Managing the pollutants is also complicated by the fact that wastes may accumulate at a point far removed from their origins in commodity production, as when excess nitrogen fertilizer applied in Iowa ends up contributing to algae blooms and lack of oxygen in the fisheries of the Gulf of Mexico.

And, as was the case for the dynamics of resource overshoot, it is the collective action of many individual producers that results in the production and accumulation of wastes. Individual producers are quite limited in their ability to respond if reducing their wastes creates a cost or market disadvantage.

In most commodity systems that run into this trap, production of the waste does not carry a cost for the producer. So, practices that boost production while creating waste products — fertilizing, bleaching, strip mining — can raise the volume of production without raising costs. In these cases, rational producers will be compelled to adopt the practice.

As Figure 2-15 shows, for this trap to be avoided signals about a rising waste level must in some way influence decisions about capacity growth. Many commodity producing systems have grappled with the specific policy measures required to accomplish this. We will discuss some of them in the third chapter.

> TRAP #2 ENVIRONMENTAL POLLUTION
>
> Commodity systems tend to grow to the point where they overload their environment with waste products. Because the costs of pollutant accumulation are rarely felt by the producers who generate the wastes, these systems are not on their own able to avoid overshooting this limit. To avoid this trap, ***as the waste production rate approaches the waste removal rate there must be some mechanism to slow investments in new commodity producing capacity or to increase investments in practices that reduce waste.*** Because of the delays and non-local effects of pollutants in the system, such actions need to be taken well in advance of the system reaching the waste absorption limit.

Trap # 3 Community Decline: Producer incomes falling too low to sustain families and communities

> ***Soon we were in Iowa, headed south on Interstate 35 past the large sign welcoming us to the Heartland. For over a hundred miles we saw nothing but corn, soybeans, and an occasional metal building in which unseen hogs or turkeys lived out their short lives. We saw not one single person working in any of the fields we passed, nor a single farm animal grazing on what had once been a great prairie of grass. Despondent farmers would soon mount $200,000 combines to begin gathering a near-record crop destined for sale at prices that, adjusted for inflation, ranked among the very lowest of the century.***
>
> — Levins, 2000 [13]

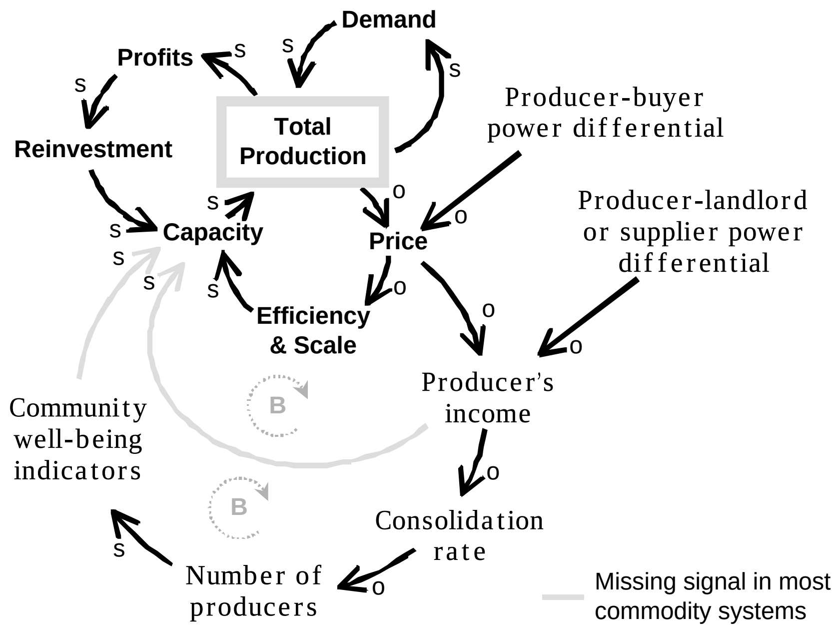
We have already seen that as production rises in commodity systems, prices tend to fall (Figure 2-3). The lower prices result in lower profits, which push some producers out of business. This means that fewer and fewer farmers, fishermen, and sawmills do the work that was once done by many producers. This decline in the number of producers ripples out into communities, impacting schools, churches, and small businesses. As the number of producers declines and the make-up of communities shift, options that were once possible fall away. This trap reduces the choices open to communities.

> ***A dramatic restructuring of the farm sector has been underway since World War II. This restructuring is evident to the most causal observer throughout many parts of the rural Midwest. Abandoned farmsteads, deserted rural schools and churches, and boarded-up businesses tell the story of changes in farming and its effects upon the rural culture. Statistics tell a similar, if not equally compelling story: from 1940 to 1990, the number of farms was reduced by two-thirds and the farm population declined from nearly one-fourth of all Americans to about 2 percent.***
>
> — ***Beyond the Amber Waves of Grain,*** 1995 [14]

Just as commodity systems can grow beyond the sustainable yield of the raw material they harvest or beyond the capacity of the environment to absorb their wastes, they can also consolidate to a point where they put severe pressure on the economic and social life of communities of producers.

Figure 2-15 shows how this plays out. As productive capacity and therefore production levels increase, the unit price of the commodity falls, in the classic behavior mode of commodities. A

FIGURE 2-15 Community Decline Trap



The *Production growth drivers* push down *Price*—and a greater *Producer-buyer power differential* will drive down *Price* all the more. Falling price reduces the *Producer's income* (even more so when the Producer-landlord or supplier power differential is great). Falling income increases the *Consolidation rate* of producers, decreasing the *Number of producers* and lowering *Community well-being* indicators. Feedback is missing, however, that might solve the problem. Neither the falling *Community well-being* nor the falling *Producer's income* affect *Capacity*.

single farmer, coffee picker, or fisherman's income falls unless he can grow, pick, or catch enough additional volume – by using new technology for instance — to survive. What typically happens is that the producers who are least able to increase productivity leave the market. Their land, boats, and equipment are purchased by other producers, so that fewer and fewer producers own more and more production capital. Total production does not fall as these individuals leave the system because their land or boats continue producing under new ownership.

In some commodity systems, especially in poorer countries, the drop in income over time can have devastating impacts on a family's ability to feed, educate, and care for their children. This story — repeated all over the world — can be seen in the words of this Ethiopian farmer who saw his income drop from $320 to $50 over the course of only five years.

> ***Five to seven years ago, I was producing seven sacks of red cherry (unprocessed coffee) and this enough to buy clothes, medicines, services, and to solve so many problems. But now even if I sell four times as much, it is impossible to cover all of my expenses.***
>
> — ***Mugged: Poverty in Your Coffee Cup,*** 2002[15]

The growth processes that bring lower prices and higher production directly cause these unwanted effects — the collapse of farming and fishing communities in the developed nations, and the hunger and deprivation of producers in the poorer parts of the world. No one wants these consequences, they are not the intent of anyone in the system, but still they persist. They persist because commodity systems lack mechanisms to slow the cycle of technical advance, increased production and declining prices. Producers in commodity systems will not have healthy communities and dependable incomes until decisions about capacity growth take into account the impacts of the growth on the incomes and communities of commodity producers.

The tendency of commodity prices to decline over time is exacerbated by the power difference that often develops in commodity systems between the many relatively small producers and the few very large buyers and traders. Producers are often unable to store their commodity to wait for a better price — especially for perishable commodities like milk or fish — while buyers often have huge infrastructures for holding and storing commodities. And, in the era of globalization, buyers are able to buy commodities from wherever in the world the price is the lowest, which effectively increases the number of producers all competing to offer the lowest price.

At the same time, many types of commodity production also require inputs — seeds, fertilizer, equipment — or the rental of land. Here again there is a relationship of many commodity producers with few large input suppliers. Across many commodities it has been well documented that if ever producers' incomes rise, the costs of supplies increases almost in lockstep. This is yet another pressure on the finances of commodity producers.

Agricultural economist Richard Levins describes the situation for U.S. farmers, but the same issues apply to most commodity producers in most parts of the world.

> ***Economic power can be used to manipulate prices, to influence terms of contracts, and to affect the "rules of the game" set by government agencies at all levels. The end result of economic power is that those who have such power are able to earn profits that are not available to those who do not have it. In our present food system, farmers are the ones without economic power.***
>
> ***While the size and monopoly can increase economic power, there is one thing that can certainly reduce it: competition. Of all the economic sectors of our food system, farmers are universally regarded as being the most competitive among themselves. In a world of giants, however, such competition works against farm income. For example why do farmers rush to adopt technology that will benefit a few in the short run, but hurt everyone in the long run? The answer is competition among farmers. Why do farmers constantly strive to produce at levels that keep product prices relatively low? Again competition. And why do farmers have such low economic power that they lose profits to landowners and agribusiness giants? Once more, the answer is competition.***
>
> — Levins, 2001 [16]

> TRAP # 3 COMMUNITY DECLINE
>
> The growth loops that drive rising productivity and falling prices will tend to erode the incomes of commodity producers and the social capital of producing communities. To avoid this trap, ***commodity systems must respond to declines in incomes or quality of life with measures that counteract the trend toward ever-rising production and ever falling prices.***

Is there anything to be done about the trap of low producer incomes and pressures on commodity-producing communities? Just as for the first two traps, the key lies in making sure that decisions about increasing commodity production capacity are informed by an understanding of the effect of that decision on the incomes of commodity producers. It is important to understand that the individually rational decisions of each producer to increase capacity lead to the overproduction and low prices that affect all producers. Because of this, collective agreements by producers to limit the capacity of their system have great potential to solve this problem.

In addressing this trap one must also recognize that whenever there is a power imbalance between the producers and the people they depend upon for supplies or to buy their harvests, the tendency of the system to overproduce for ever lower prices is exacerbated. But while the large processors have the advantage of a direct brand relationship with customers and more ability to push costs down the supply chain, their individual choices are also limited by both consumer choices and competitor actions. Being in a competitive market, they experience the same type of cost reduction and expansion pressures as do producers. Emerging from the Community Decline Trap will require solutions that work for both the producer and processor communities. In the third chapter we consider some promising examples of commodity systems coping with this trap.

Integrating Social and Environmental Goals into Natural Resource Economies

The three production drivers — the Reinvestment, Efficiency Boosting, and Demand Growth Loops — allow commodity systems to serve an important goal, providing plentiful and inexpensive raw materials. But, the uni-polar orientation of commodity systems creates trouble. Recall the two basic rules around which we began our discussion of commodities: commodity systems standardize the characteristics of the raw commodity and the producer with lowest prices makes the sale. By stripping away information about how the commodity was produced, by focusing competition only on the volume and cost of production, commodity systems have served this goal extraordinarily well. But removing this information also prevents the system from responding to signs of pollution, resource depletion, and community decline.

Productivity and efficiency are undeniably important. But the three traps of commodity systems remind us that productivity and efficiency are not the "highest" goals above all others. Creating commodity systems that serve a broader range of goals will require incorporating those other goals into the structure of the rules and incentives that shape the behavior of commodity systems. Sustainable commodity systems will need to be much richer in information, full of the details that have been so intentionally stripped away in the process of commodification.

Historian William Cronin, in his book about the history of the commodities that grew up around the city of Chicago, makes this point well.

> ***Even those of us who will never trade wheat or pork bellies on the Chicago futures markets depend on those markets for our very survival. If we wish to understand the ecological consequences of our own lives — if we wish to take political and moral responsibility for those consequences — we much reconstruct the linkages between the commodities of our economy and the resources of our eco-system.***
>
> — William Cronin, ***Nature's Metropolis,*** 1991[17]

Putting these ideas into practice is a matter of very specific policy decisions and changes in actions. How does one measure the health of the resource and how can that be used to influence the growth of harvesting capacity? What is a fair income for producers? What level of waste is tolerable in any given system? How can costs of production incorporate all the costs to society of particular production practices? Can producers be rewarded for good stewardship?

These are the sorts of questions that can best be examined in the context of real decisions being made on the ground in actual natural resource economies. In the following chapter we will do just that, exploring some of the steps that stakeholders in various commodity systems have taken to address one or more of the traps we have been discussing.

3. Putting Principles into Practice — Examples of Natural Resource Economies That Incorporate Social and Environmental Goals

Systemic Problems Require Structural Fixes

As commodity systems produce an undifferentiated raw material stream, producers compete with one another to produce the greatest volume for the least cost. Competition on these narrow grounds leads commodity systems toward ever higher production levels and ever lower prices. This focus on high production and low costs puts pressure on the ecosystems, families, and communities of commodity producing regions.

Commodity producers are not naïve about these cycles. Living within them day after day, they understand quite clearly the nature of the traps they are caught in — traps that are the sum of individually rational decision-making based on the "rules of the game." But, as any farmer, sawmill owner, or fisherman can tell you, seeing the traps is not enough to avoid them. Such problems cannot be solved at the level of individual producers. Problems arising out of collective behavior will defeat the solutions available to individuals.

A few isolated producers opting out of the efficiency race cannot break the overproduction cycle. In fact as long as most producers increase their productive capacity, anyone who doesn't do so quickly looses customers and looses sales. Harvesters can't afford to incur costs to stay within the sustainable yield of the resource if their competitors invest less in stewardship and offer the same product for a lower price.

Acting as individuals, the only viable option for producers to escape the traps of a commodity economy is to leave the system altogether and focus on a product that can be marketed outside of the structure of that commodity system. This can be accomplished by programs that preserve the history and identity of the product. From wines and cheeses of specific European regions, to high quality lamb delivered directly to restaurants in New York City, to farmers markets and community supported agriculture, there are many examples of producers who have created — or re-created — alternatives to conventional commodities. These examples are very important. They connect people back to the raw materials of consumption, and provide vibrant examples of what healthy food, lumber, and fiber systems look like. By linking consumers directly with the producers of basic raw materials, such initiatives preserve some of the information that is lost in the process of commodification.

While farmers' markets and sheep-milk cheeses deserve all of the attention they receive, we also need to understand other options available for transforming commodity systems. We need to look for solutions that are effective at a larger scale and that are applicable to those raw materials, such as soybeans or paper pulp, that are not well suited to specialty niche markets.

Commodity systems currently dominate world agriculture, fishing and forestry. They affect millions of people and much of the Earth's surface. For the foreseeable future, Iowa will grow more food than can be eaten locally, while New York and Chicago will always need to import food. Landlocked populations will desire fish. Coffee, tea, and cocoa won't be local crops for much of the world's people. The escape of individual producers from these poorly functioning systems — as important as it is — is unlikely to alleviate the pressures that commodities are placing on ecosystems and communities around the world. When a few producers move off into a niche market, they leave the dominant system, with all of its pressures on resources, ecosystems, and communities in place behind them.

For this reason, the following chapter explores how raw materials can be produced in large amounts and traded around the world with rules and incentives that incorporate goals for the long-term sustainability of the resource, ecosystem, and local communities. This would be a new kind of natural resource economy, something in between the niche markets for specialty wines or handcrafted wood products and the industrial monocultures focused solely on low-cost high-volume extraction of materials from the earth.

As far as we can tell, such natural resource economies do not exist anywhere, yet. But across commodities, all over the world, people are experimenting with changes to the structure of commodity systems in order to balance productivity with other goals. Each of these experiments gives us a window into possibilities. By understanding the successes and the vulnerabilities of these experiments, we begin to understand the packages of agreements, policies, monitoring techniques, and regulations that together would characterize a productive, efficient natural resource economy integrated into the ecology and communities of its region.

Following are examples of some of the most promising cases we know about. These are commodity systems that have undergone structural changes — changes in rules, incentives, or penalties — and that have attempted to balance productive capacity with environmental and social goals. The examples are from all over the world, from fisheries, agriculture, and forestry. Some of the changes were accomplished by collective agreement of producers, some were accomplished by demand from consumers, and some were created by the action of governments. But each of these stories also shares with the others common threads.

In each example, people found the will and the power to change "the rules of the game." They reshaped the system they live or work within so that it could respond to goals broader than high production and low costs. Whether it is balancing the harvest rate with lobster reproduction rate, or paying the costs of good stewardship and fair incomes, these programs demonstrate that commodity systems can respond to social and ecological limits.

But, in all of these stories — even the most successful — the restructured commodity system still exists within and responds to a larger economic system. And so, at the same time that they give us hope for a new kind of commodity system, these stories remind us that change is required not just at the level of particular commodity but also in the structures and assumptions of the global economy.

Escaping Commodity Traps Using Collective Agreements

Each of the commodity economy traps arises when the system is structured so that individually rational producer decisions add up to collective behavior that erodes valued environmental or social resources. If producers come together and agree on new rules, they can restructure a system so that individually rational choices are also collectively sustainable. The following examples from fishing and agriculture give a sense of what is possible in the arena of collective agreement on harvest and production levels, and what potential pitfalls should be anticipated.

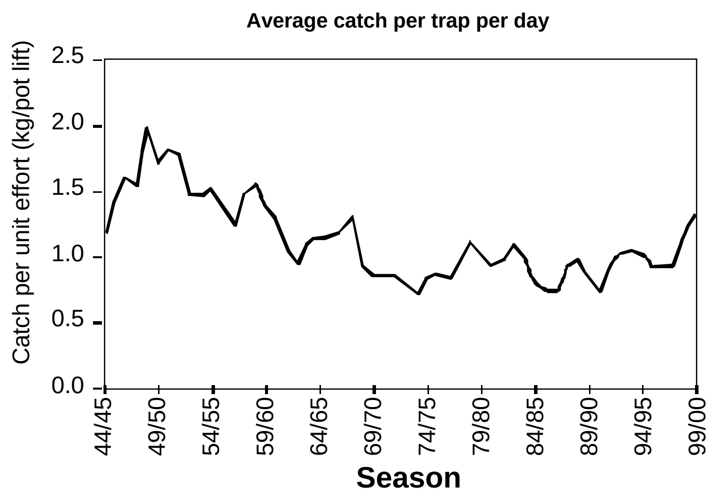
Collective Agreements Limiting Harvesting Capacity – Australian Western Rock Lobster

As we discussed in Chapter Two, commodity systems can quite easily and unintentionally grow to the point where the collective harvest rate is higher than the sustainable yield of the resource. Forest and fishery systems are especially vulnerable to this trap; often the resource limit is the first limit these systems encounter as their productive capacity grows.

In our discussion of the over-harvesting trap in Chapter Two (Figure 2-11) we saw how — without additional system structure — the capacity of the system to harvest a resource tends to ignore imbalances between the harvest rate and the resource regeneration rate.

One of the most successful examples of a collective agreement to balance harvesting with the sustainable yield of the resource is in the Australian fishery for western rock lobster. There, an early response to signs of decline in the fishery resulted in agreements to limit the intensity of harvest. Fishermen, lobster processors, and the government came together in the early 1960s in response to the fact that the average weight of catch per day per lobster pot had been steadily declining since the 1950s (Figure 3-1). The average weight of individual lobsters caught was also declining and more pots were coming up empty. Tracking these indicators gave stakeholders in the rock lobster system information about the sustainability of the harvest. The willingness of stakeholders to respond to this kind of information made way for the changes that have allowed the fishery — headed for depletion in 1960 — to be harvested at a steady rate for the past forty years.

FIGURE 3-1 Australian Western Rock Lobster Fishery Productivity



West Coast Rock Lobster
Annual catch rate (kg/pot lift) for the West Coast Rock Lobster Managed Fishery from 1944/45 to 1999/2000

Source: State of the Fisheries Report 2000/2001[3]

In 1965 the Rock Lobster Industry Advisory Committee was formed as part of the Fish Resources Management Act. The Advisory Committee, made up of fishermen and fisheries managers from the government, helps the Australian government develop management rules. The Western Australia Department of Fisheries is responsible for monitoring lobster populations and enforcing the harvest agreements. Several types of agreements, acting together, help make this a sustainable fishery[18].

Limited number of harvesters: Commercial fishermen must have Managed Fishery Licenses for the western rock lobster fishery. The number of these licenses has been limited since 1963; licenses may be transferred but no new licenses will be issued.

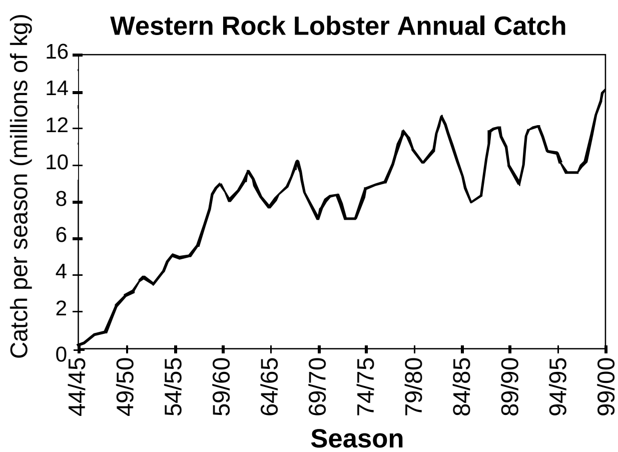
Harvest controls: To ensure that immature lobsters are protected, there are minimum legal sizes for harvested lobsters and a limited season. The pots themselves are configured with holes to allow undersized lobsters to escape. Spawning females are also protected.

Capacity controls: The total number of lobster pots that can be deployed is tightly regulated, with a maximum of 150 pots per license. Because the biology of the lobster has been well studied, fisheries managers are able, by controlling the number of pots in any given year, to regulate the catch in response to the underlying health of the population.

New technology controls: The fishing effort is controlled, rather than setting quotas on the actual harvest. Managers recognize that new technologies, such as underwater video cameras or new pot designs, could lead to over-harvesting even with a regulated number of pots. Therefore, provisions of the rock lobster management plan require assessment and approval of new technologies, all of which are factored into future fishery management decisions.

Together, these regulations have resulted in a stabilizing of the annual western rock lobster catch at levels close to the 1963 level (Figure 3-2)[19]. The approximately 600 boats that are licensed in this fishery earn high seasonal incomes, and licenses and fishing gear have become valuable assets.

FIGURE 3-2 Total Production

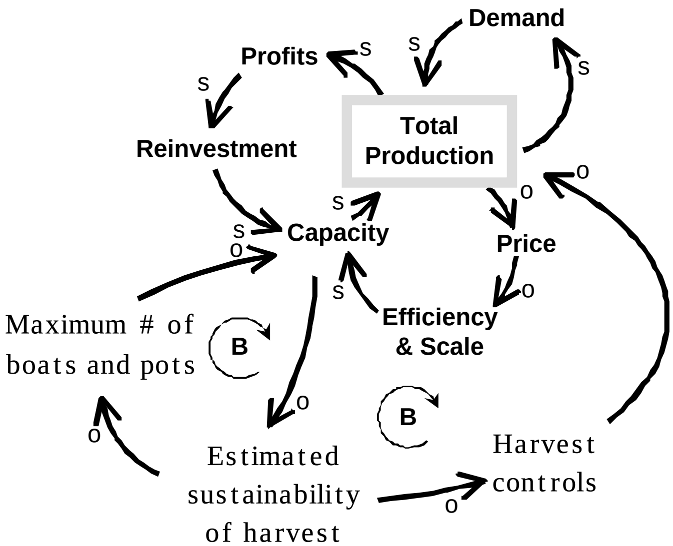


West Coast Rock Lobster
Annual catch (kg) from fishers' compulsory monthly returns for the West Coast Rock Lobster Managed Fishery from 1944/45 to 1999/2000

These agreements introduce new structural elements into the rock lobster system (Figure 3-3). By responding to measures of the sustainability of the harvest, limits on the number of boat licenses and the number of lobster pot per boat accomplish two goals. In the short term the limits regulate current fishing effort, and therefore the current harvest. In the long term, they link investment and boat-buying decisions that affect the future harvesting capacity of the fishing fleet to the underlying health of the resource base.

Other fishery systems (for example, the nearby Australian southern rock lobster fishery) employ quotas that limit the number of fish a producer may market and the number of producers. In such cases the harvest is directly controlled, and technology limits may be less necessary, since producers can only harvest a set amount of fish, no matter what technology they use. This kind of quota system requires more information gathering to make sure that no one is harvesting more than the quota. The southern rock lobster fishery accomplishes this by tracking every lobster from fishing boat to buyer[20]. In either case, the collective agreement has introduced into the system new information pathways and new decision making rules that keep the harvest in balance with the resource.

FIGURE 3-3 Addressing the Resource Depletion Trap with Collective Agreements



This figure builds on Figure 2-8. The *Production growth drivers* need a compelling signal of scarcity because the signal via the *Resource level* and *Cost of acquiring resource* is delayed and, therefore, too late to ensure sustainability. In the rock lobster case the *Estimated sustainability of harvest* successfully limits the *Maximum # of boats and pots,* and the *Harvest controls* limit total production. Together these changes keep the commodity system within the sustainable yield of the resource.

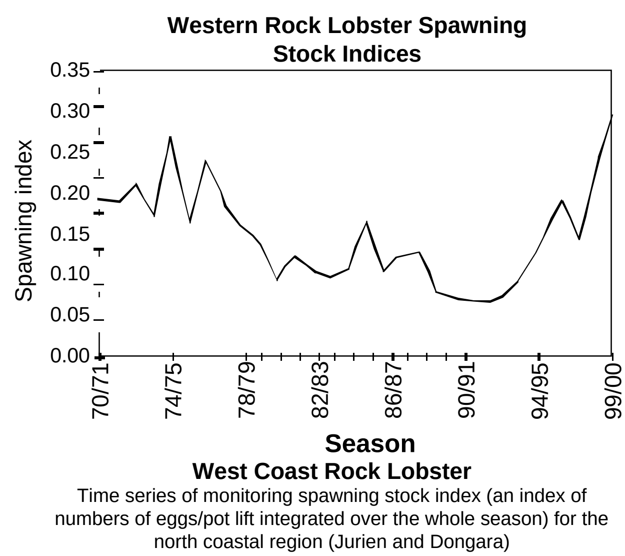
Although the Australian western rock lobster fishery had been carefully managed for decades, in the early 1990s biologists warned that egg production had dropped dangerously low — to 15 to 20 percent of the pre-commercial fishing levels. In response pot numbers per license were temporarily decreased by 18% starting in the 1993/94 fishing season, an action designed to leave an extra 1,000 tons of lobster in the ocean each year. As can be seen in Figure 3-4, spawning stock — a measure of egg production — rose in response to this adjustment.

Having accurate and timely information about the health of the resource base, and the ability to quickly change the harvesting effort if the resource shows signs of depletion, are crucial to keeping the system within sustainable bounds. Natural systems like fisheries are complex and changing, and controls on the harvesting capacity need to be equally dynamic.

Another key to the success of these collective agreements is the partnership between the fishermen and the state government. Together they collect data and then determine annual catch rates and daily pot numbers based on scientists' best predictions about the health of the resource.

The agreements also include a number of provisions for enforcement by the Ministry of Fisheries, including on-boat inspections for legal lobster, pot counts at sea, boat and pot checks during closures, and daily catch weighing and reporting. These enforcement provisions are an important part of the agreements and

FIGURE 3-4 Indicator of Resource Health



source: State of the Fisheries Report 2000/2001[3] highlight the fact that although co-operation is required to construct a collective agreement and set annual provisions of the agreement, good will alone is insufficient.

In 2000, the western rock lobster fishery was the first fishery to be certified as being fished sustainably by the Marine Stewardship Council, a designation that reflects the effectiveness of the work that began in 1963.

The Australian rock lobster example makes quite clear that the adoption of harvest limits is an effective tool to keep fishing capacity within the carrying capacity of a fishery, avoiding the Depletion Trap. This, in turn, can keep prices at a high level and provide good producer incomes, addressing part of Trap #3: socio-economic decline in producer communities.

In the rock lobster fishery, pot entitlements can be bought and sold allowing consolidation as more successful fishermen buy out the less successful ones. This sort of consolidation can contribute to the Community Decline Trap discussed earlier. So far, the Western rock lobster fishery the rate of consolidation has been relatively small. But in other fisheries where quotas can be bought and sold, the trend toward consolidation can be dramatic. In Iceland, for instance, consolidation has been quite problematic.

> ***Concentration of quota shares with fewer and bigger companies has lately been accelerating. Along with a general liberalisation of the economic policy in Iceland, there seems to be an ongoing ideological shift within the industry, leaving behind the idea that fisheries and fish processing should be locally embedded in fisheries communities. Many fisheries companies have joined the Icelandic stock market, and ownership is in many cases not linked to any particular community. Direct transfers of quota shares have become less common, small quota owners are now more likely to 'merge' with bigger companies and receive company shares in exchange for their quota shares. The vulnerability of fishing communities, especially small communities with poor employment alternatives, has become more visible, as there have been several cases of communities left with practically no quota as local quota owners have left or sold out their quota shares.***
>
> ***— Einar Eythorsson, 2000[21.]***

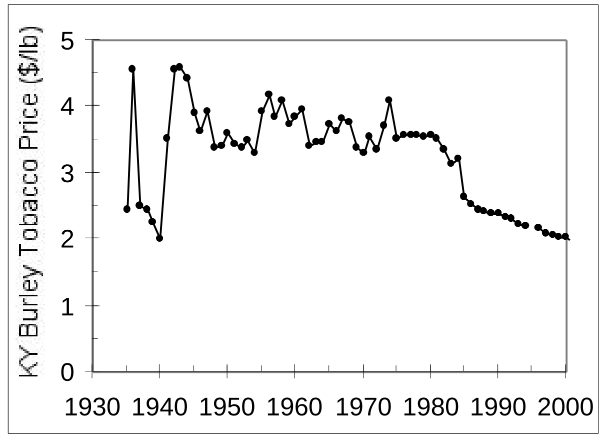
The potential for the concentration of fishing rights can be guarded against by specific provisions in the quota management plan. For example, rules that require the quota holder be present on the fishing boat remove the incentives for a fisherman to buy up his neighbor's boats. Collective agreements do not, automatically, prevent consolidation. If consolidation is a concern in a commodity system, such provisions must be written into the structure of the agreement.

Price Supports and Supply Control Agreements — US Burley Tobacco

In 1998 US Secretary of Agriculture Dan Glickman spoke to an audience of Kentucky tobacco growers.

> ***I just came back from a week doing a farm tour around the country. Fascinating. The only place in America where there has not been a major diminution in the number of family farmers is in tobacco country. The numbers in dairy, wheat, corn, soybeans, rice, cotton, even livestock show over a period of years a rapid reduction in numbers. A lot of it has to do because individual farmers don't have the clout to bargain or to negotiate with the people that they sell to like you have here.***
>
> — US Secretary of Agriculture Dan Glickman, 1998[22]

FIGURE 3-5 Tobacco Price



Secretary Glickman's observation about small farms is backed up by the numbers. In contrast to so many other commodities where the product is sold at or near the cost of production, tobacco plots can return high incomes[23]. In contrast to the trends of declining price and rising production seen in most commodities (recall the generic pattern in Figure 2-3), tobacco price has known long periods of stability (Figure 3-5).

What is it that makes the tobacco story so different from that of most commodities? The Burley Tobacco Growers' Cooperative Association gives the answer in a single sentence. "It was and is simply a matter of price supports in exchange for production controls."[24]

The production controls arise out of a collective agreement that has its roots as far back as the 1920s when tobacco growers experimented with a number of ways of organizing themselves for bargaining with tobacco buyers. Lessons from those early experiments were incorporated into the current tobacco program which, although it has been changed slightly over the years, still exists essentially as conceived in the 1930s[25].

The collective agreement, honored by all producers and enforced with penalties, incorporates several key elements[26].

> **Production quotas:** In the original formulation of the program production quotas were based on acreage. Each tobacco quota-holder could grow tobacco on a pre-determined number of acres. In the early 1970s the quota was changed to a "poundage" system in which producers were allowed to sell only so many pounds of tobacco each season. Quotas are adjusted each year, taking into account expected demand and existing stocks.

> **Quotas tied to land:** Tobacco quotas cannot be sold separately from the land they are associated with. Leasing quotas is also limited, with geographic restrictions (quotas can't be leased across county lines) and restrictions on the total amount of quota that may be leased by any one farmer.

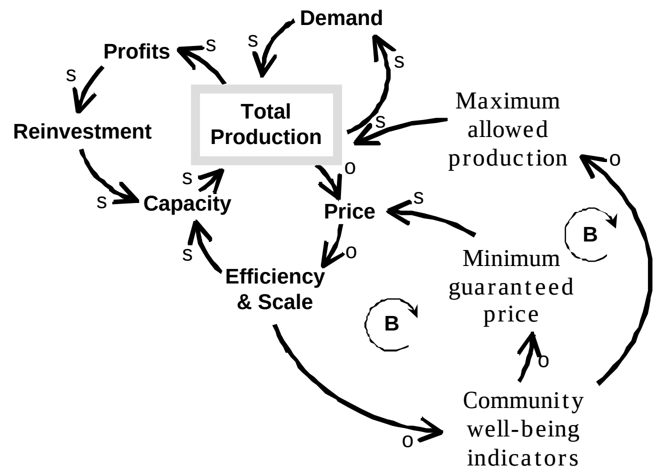
> **Price floor:** The tobacco program guarantees growers a minimum price for their tobacco. Under various phases of the tobacco program this has been determined differently, but the price floor for the first forty years linked the tobacco minimum price with the costs of maintaining a family farm and producing a crop.

Farmer cooperatives take loans from the federal Commodity Credit Corporation to buy any tobacco that has not been sold at a price higher than the minimum price. The cooperatives store and age the tobacco, selling it the following growing season, paying back the government loan — with interest — at this time. This price floor, in contrast to other agricultural programs, is not a cash subsidy. It is a legal mechanism by which companies must pay a minimum amount for U.S. tobacco. Cooperative members themselves cover the management costs of the program.

The trap of eroding incomes leading to economic decline in producer communities is broken by interventions that the tobacco program has employed. As with the Australian rock lobster example, the interventions of the tobacco program bring balance between a goal of the system (in this case decent incomes for growers) and the core driving loops that push capacity upward and prices downward. The production quotas provide an antidote to the Reinvestment Loop. Investments in new capacity are not sensible since each farmer is only able to market a certain amount of tobacco.

The price floor helps to counteract the downward pressure on price that would otherwise result from the imbalance of power between many small producers and few large buyers. In addition, the price floor plus the limit on consolidation of quotas weakens the power of the Efficiency Boosting Loop, reducing the trend toward few large-scale farm operations. In keeping farms small and prosperous, rural populations remain high enough to support schools, churches, and other civic organizations. These changes to the typical commodity system are shown in causal loop form in Figure 3-6.

FIGURE 3-6 Addressing the Community Decline Trap with Collective Agreements



This diagram is adapted from Figure 2-15. The *Production growth drivers* push *Community well-being indicators* down. Several interventions help. *Minimum guaranteed price* boosts *Price*. Support for collective agreements decreases the *Maximum allowed production*, and slows the production growth drivers.

> ***We are made up of a lot of little people. It [the collective agreements of the tobacco program] gives us political clout. And I don't know what we would ever do without price support for the thousands of little people. Because without price protection, the growers have no power whatsoever to protect themselves.***
>
> ***— Joe McDaniel, past president of the Burley Co-op. 1992***[27]

The tobacco collective agreements have also contributed to the environmental health of tobacco-producing regions by limiting erosion.

> ***For a sloping, easily eroded countryside such as I live in, and such as comprises much of the "tobacco belt", tobacco has been an ideal crop, because it has permitted significant incomes to be realized from small acreages, thereby sparing us the inevitable damage of extensive plowing, and because it conforms well to the pattern of livestock farming. If tobacco farmers had attempted to realize an equivalent income from corn, neither they nor their fields would have lasted long.***
>
> — Wendell Berry, 1993[28]

That a program with social goals produces environmental benefits is not surprising, given the structure of commodity systems. Interventions that bring forward goals beyond high productivity will tend to restrain the Production Growth Drivers and thus help to promote the health of environmental and social aspects of the system. Recall that in the Australian rock lobster case, the actions taken to preserve the health of the fishery similarly limited total production and slowed capacity growth in a way that benefited incomes.

The Importance of Enforcement

The tobacco program had a progenitor program, a cooperative action among producers known as the "Old Pool." Many of the rules of the Old Pool are reflected in the present-day tobacco program. Like the current program, the Old Pool was organized so that producers could hold tobacco off the market if buyers offered a price that was too low. But, unlike the current tobacco program, participating in the pool was voluntary. Although joint action was in everyone's best interest, the Old Pool was plagued by "dumping and contract breaching, often through devious methods."[29]

Such cheating highlights an important feature of collective agreements, one also observed in the rock lobster fishery. Collective agreements need not depend solely on good will, trust, or even enlightened self-interest. Although all of these may be required to create collective agreements, careful design of rules, laws, and enforceable penalties can keep the collective agreement strong over the long term. The existence of a legal framework to make the tobacco program work, however, should not be taken to mean that such programs are best imposed by governments on unwilling growers. In the tobacco program farmers vote every four years on whether to continue participation in the program.

In the work that led up to this paper, we found ourselves often in conversations with commodity producers who worried about relying solely on voluntary action when the participation of all producers was required for success. The rock lobster and tobacco programs remind us that collective management of a commodity system can be based on more than just trust and good will. With enforcement built in, producers don't have to depend upon "trust alone."

Commodities Offer Multiple Opportunities for Intervention

In addition to the changes in system structure we have been discussing, there are two special features of Burley tobacco that have probably contributed to the success of the tobacco program. First, in contrast to many agricultural crops, tobacco is not a crop that is easily mechanized.

> ***Tobacco production looks much the same today as it did 70 or more years ago, right down to hand-hoeing out weeds, and hand-picking off bugs in some small plots. Producing an acre of tobacco can require up to 300 hours of land labor, compared to about 1-2 hours for corn or soybeans.***
>
> — Daryll Ray, 2002[30]

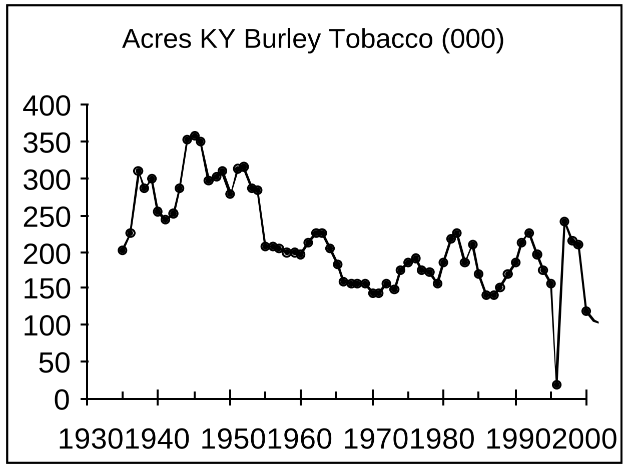
It may be that the lack of opportunities for mechanization of this crop has provided some opportunity to restrain the Efficiency Boosting Loop that is common to most commodities. This implies that the tobacco program has been balancing a weaker driving loop than many commodity systems must contend with.

A second feature also makes the tobacco system different from many other commodities. Aged, cured tobacco is more valuable than fresh tobacco. This is very different from fish or milk or green beans, all of which must be quickly transported and processed or consumed fresh. The aging process of tobacco means that some of the costs of storage and handling can be recouped when the pooled tobacco is sold at the end of storage. This feature of tobacco is not related to the core driving loops, but it shows that storage qualities of commodities can add opportunities for actions such as holding the commodity to support its price.

What Kind of Quota?

When the U.S. Burley Tobacco program was first implemented, quotas were based on acreage, and total production was controlled by adjusting acreage from year to year. Figure 3-7 shows a pattern of decline in the number of acres planted in Burley tobacco in Kentucky from 1950 to 1970. This decline represents the efforts of the managers of the system to keep production constant in the face of yields that doubled during that period (Figure 3-8). In 1971, the quota system was modified so that each quota represented the right to sell a certain poundage of tobacco rather than the right to grow as much as possible on a certain number of acres.

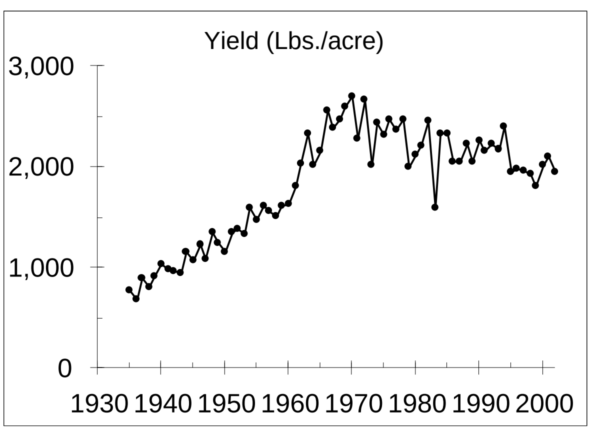
FIGURE 3-7 Decline in Tobacco Acres



Data from USDA-NASS http://jan.mannlib.cornell.edu/data-sets/specialty/94012/1/TAB088.WK1

The distinction between an acreage quota and a poundage quota mirrors the difference between the two kinds of quotas found in western and southern rock lobster. One type of quota limits the capacity that can be used to harvest or produce the resource. We might call this an indirect quota. In farming such a quota limits the number of acres that may be farmed, in fishing it limits the number of boats, nets, or pots. The amount that is produced or harvested is targeted by setting the acreage allowances or pot numbers, and the actual harvest is not specifically controlled.

FIGURE 3-8 Increase in Tobacco Yields



Data from USDA-NASS http://jan.mannlib.cornell.edu/data-sets/specialty/94012/1/TAB088.WK1

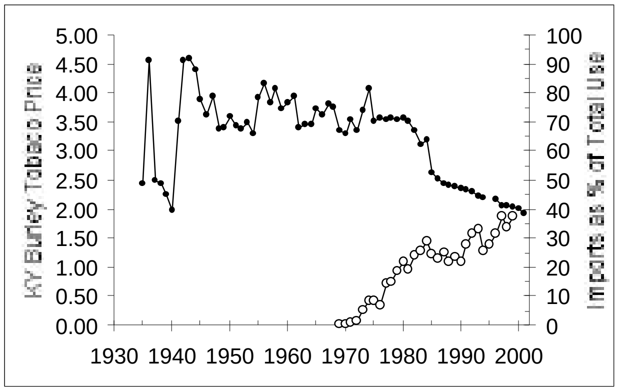
The other type of quota focuses on the quantity of the commodity itself. For this type of quota a producer is allowed to sell a certain amount of fish or a certain number of pounds of tobacco. We might call this a direct quota. When anything other than the amount one can sell is being limited, producers still have an incentive to invest in producing more, using the boats or acres that they are allowed. So if underwater cameras can allow the same number of pots to be placed more strategically, or if new varieties of tobacco seed will produce more pounds of leaves per acre, rational producers will adopt these new technologies. This, of course, activates the very Production Growth Drivers that such quota systems are meant to restrain.

The western Australian lobster system uses indirect quotas, but reduces the power of the Efficiency Boosting Loop by dictating that managers of the resource (the government and the fishermen's organization) review all new technical innovations. The southern rock lobster fishery avoids the problems of the Efficiency Boosting Loop altogether by using direct quotas that place controls on the amount of lobster that may be harvested. And in the 1971 switch from acreage-based to poundage-based quota system, the tobacco program also avoids the problems of the Efficiency Boosting Loop. Figure 3-8 shows that after the switch — with the incentive to boost yields removed — tobacco yields have been quite stable. With this stabilization the number of acres in tobacco has still fluctuated, but the pattern of constant decline disappeared.

Recent History — Impacts of an Increasingly Global Market

A look back at Figure 3-5 shows that the tobacco program's success at holding the producer price steady (in constant dollar terms) began to erode in the late 1980's. What happened to this program which Secretary Glickman saw as essential to the survival of small farms in Kentucky, Tennessee, and North Carolina?

FIGURE 3-9 Tobacco Price Decline and Import Rise



source: USDA ERS (#TBS-247)

Figure 3-9 shows part of the reason. Since the 1970s the fraction of imported tobacco used by the U.S. cigarette industry has risen from close to zero to more than one-third. Tobacco grown outside of the United States is not a part of the U.S. Burley Tobacco program. No price floors or production limits exist in the global tobacco market. In the global market, the three core driving loops remain unrestrained. U.S. cigarette makers, trying to limit their own expenses and raise profits, turned to the imported tobacco. More imported tobacco put pressure on the tobacco cooperatives which had to either limit quotas or hold more and more tobacco each year[31].

In 1993 the U.S. tried to address the problem by passing a law setting a minimum domestic content for cigarettes manufactured in the United States. The law appears to have had the desired effect, for imports fell for several years after this ruling (Figure 3-9). However, in 1995 the GATT dispute resolution process determined that the law was a protectionist violation of free trade, and the law was invalidated. It was replaced by a system of tariffs and quotas on imported tobacco that was in accord with GATT rules, and tobacco imports resumed their upward trajectory in 1996. Trying harder and harder to compete for the domestic tobacco market has forced grower cooperatives to lower their minimum price levels. The power of the cooperatives spoken about so eloquently by Joe McDaniel in 1992 has not been enough to keep prices steady in the face of global competition.

For U.S. tobacco the boundaries of the collective agreement to limit production and support prices have stayed the same for seventy years — about the same number of growers, in the same southeastern states. But over that same time period, the size of the international tobacco growing pool has increased dramatically. Tobacco is grown in South and Central America and in parts of Africa. It is grown in places where land and labor costs are much lower and environmental regulation is less stringent. And those producers, not united in a cooperative with U.S. growers, sell to the very same large buyers as the U.S. tobacco cooperatives. So far, U.S. growers do not see any ways to salvage their commodity program.

Today there is not much optimism among tobacco farmers. The program that took years to establish and fine-tune, the program that was so successful at pulling this commodity out of the typical commodity traps, is now failing to achieve those goals under the impact of a global market. All collective agreements share this vulnerability. The U.S. program for peanuts, the Canadian poultry program, and dairy programs in both Canada and Europe are all under challenge from global competition and trade rules that enforce the "deregulation" of commodity production.

Collective agreements can only work if all of the commodity production for sale is governed by the rules of the agreement. The more "global" a commodity, the wider the group of producers that must come together in order to form an effective collective agreement. There are few examples of collective agreements to regulate commodity production that span national boundaries.

Coffee was one example for a brief time. Until 1989 the supply of coffee was controlled under collective agreements managed by the International Coffee Organization, which set quotas for production and determined the distribution of the quotas between coffee producing nations. Producing and consuming countries were members of this organization. The breakdown of that agreement launched the coffee system into its present mode of overproduction and producer impoverishment.

FOR MORE INFORMATION ON THE TOBACCO PROGRAM

Burley Tobacco Growers Cooperative Association
http://www.Burleytobacco.com/website/default.asp

Collective Agreements — Summary

The cases of the Australian Western Rock Lobster Fishery and the US Burley tobacco program illustrate that collective agreements are powerful tools, particularly useful when dealing with commodity systems that are stuck in traps of over-harvesting or eroding producer incomes.

1. RESOURCE DEPLETION OR PERSISTENT LOW INCOMES ARE NOT INEVITABLE IN COMMODITY SYSTEMS.
   Producers can organize themselves through collective agreements to regulate the productive capacity of the commodity in the form of harvesting, production, or marketing agreements.
2. BALANCING THE HARVEST RATE WITH THE REGENERATION RATE IS ESSENTIAL TO SUSTAINABLE COMMODITY SYSTEMS, EVEN WHEN THE STOCK LEVEL IS HIGH.
   The Australian Western Rock Lobster fishery shows that, in matching resource sustainability with harvesting capacity, it is important to respond to the **relative** rates of harvest and regeneration. The absolute level of the resource stock does not signal the health or sustainability of the commodity system. Rather, it is the decline of the stock, resulting from a harvest rate that is higher than the regeneration rate, which signals imbalance.
3. MULTIPLE GOALS MAY REQUIRE MULTIPLE INTERVENTION POINTS.
   Both rock lobster and Burley tobacco show that keeping commodity harvesting in balance with the regeneration of the resource may require intervention at more than one point in the system. Production limits, price supports, consolidation limits, and technology policies may all be required to keep the multiple goals of a commodity system balanced.
4. CONTINUED MONITORING AND RESPONSIVENESS ARE NEEDED.
   Even when harvest limits are in place, careful monitoring and even occasional corrections to the system are required to keep harvesting capacity in balance with the resource. A changing biological system can only be managed sustainably by an adaptable management system that has the means to collect new information.
5. COLLECTIVE AGREEMENTS DO NOT NEED TO DEPEND ONLY UPON TRUST OR "GOOD-WILL".
   Both rock lobster and Burley tobacco show that collective agreements depend upon the ability to ensure that no players skirt the rules. Legally binding enforcement provisions can be built into collective agreements. In designing such measures it is important to provide the resources for enforcement.
6. INTERVENTIONS IN THE PRODUCTION GROWTH DRIVERS CAN PRODUCE MULTIPLE BENEFITS.
   Interventions that affect the Production Growth Drivers of a commodity system may have multiple benefits. The case of Burley tobacco shows that actions taken in response to social symptoms can also produce environmental benefits. The converse is also true — interventions taken to preserve a resource may increase the economic health of families or communities.
7. QUOTAS THAT LIMIT THE ABILITY TO HARVEST RATHER THAN THE AMOUNT HARVESTED ARE VULNERABLE TO BEING UNDERMINED BY NEW TECHNOLOGIES.
   Such quotas should have some technology-limiting provisions associated with them.
8. THE BOUNDARIES OF A COLLECTIVE AGREEMENT MUST INCLUDE ALL OF THE PRODUCERS SELLING INTO THE MARKET FOR THE COMMODITY.
   Collective agreements can only be successful over the long term when the commodity producers acting together represent most of the commodity production available to a set of buyers. If buyers have the ability to meet their needs for raw materials elsewhere, their own competitive pressures will lead them to do so, leaving the producers with a collective agreement but no market.
9. AS THE MARKETS FOR MOST COMMODITIES BECOME MORE AND MORE GLOBAL, THE REQUIRED BREADTH OF COLLECTIVE AGREEMENTS ALSO EXPANDS.

Escaping Commodity System Traps Using Certification

The strength of collective agreements is that they allow producers to make decisions about multiple goals for their system and take action to balance capacity growth with those other goals. But arriving at collective agreements can be difficult. A successful collective agreement requires that virtually all producers share the intent of the agreement. Enough cooperation to institute a collective agreement may not exist in many natural resource economies. Because of this, it is worth looking at other strategies that allow for even a minority of producers to incorporate environmental or social goals into the way they work.

Certification, for either environmental practices, fair treatment of producers, or regional identity provides one mechanism to incorporate environmental or social goals into a commodity system. Collective agreements require finding sufficient political will among producers to work together to set limits on practices or production levels. In contrast, certification strategies get their momentum from the willingness of consumers to pay more for products produced in accord with their values.

From dolphin-safe tuna to fair-trade coffee to sustainably harvested lumber, certified products are grown or harvested according to higher-than-typical social or environmental standards. Certification involves creation of new minimum standards. A government or non-profit certifying agency monitors production to ensure compliance with the standard.

Organic Certification in Agriculture — Soybeans and Milk

Organic agriculture is a fast growing sector of the agricultural economy in many parts of the world. According to the USDA, the number of certified poultry in the United States has grown from 60,000 in 1992 to 5,000,000 in 2001. Sales of organic milk have risen from 16 million dollars in 1996 to 104 million dollars in 2001[32].

While much organic production happens on small farms and is sold directly to consumers, organic practices are beginning to be seen as an option for traditional commodity growers, as well.

> ***David Petritz, assistant director of the Purdue University Cooperative Extension Service, says the acceptance of organic farming is a dramatic change in agriculture. "Traditional producers now have more than a passing interest in organic farming," he says. "This isn't something they scoff at any longer. Every day, more and more traditional farmers are looking into whether they should convert part of their operation to certified organic.***
>
> ***— Purdue News,*** 1998[33]

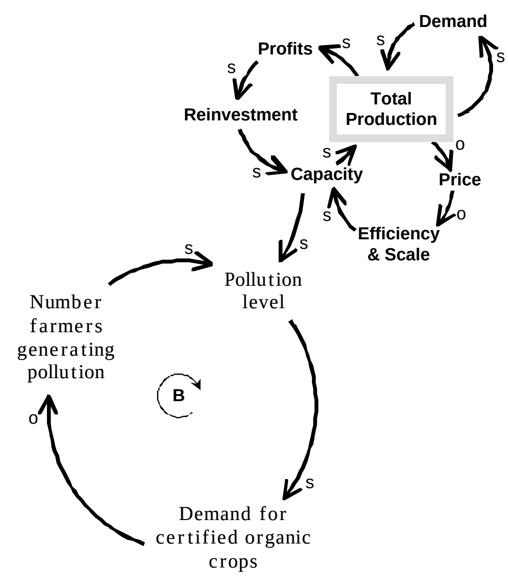
The production of certified organic crops is an attempt to address the first two commodity system traps. Growers of traditional agricultural commodities can reduce their costs by using practices that have downstream impacts — externalizing their costs onto the environment. However, the standards of organic production place constraints on this pattern of behavior. The competition to offer a low price still exists, but now the minimum acceptable practices are much healthier for the farm family, the soil, and the water. In this sense, organic certification limits the erosion of a natural resource (the soil) and the accumulation of wastes (herbicides and pesticides) that characterize so many agricultural commodity systems.

Figure 3-10 shows, in systems terms, how the certification route helps counteract the waste generation trap of commodity systems. As waste levels grow the demand for certified organic products rises out of health and environmental concerns. Producers respond to the demand by changing growing techniques, and the total level of waste generated is reduced.

The enforcement of the certification requirements is a key aspect of this strategy. Since producers are not rewarded for using standards that are higher than the certified standards, there is no incentive for better performance. There may even be incentives for the most powerful producers to attempt to dilute the standards.

> ***"The current trend," says Robert Simmons, international team leader for the private certifying agency, Farm Verified Organic, "seems to be a race to the bottom for standards." Last month, for example, Fieldale Farms, a Georgia chicken processor that slaughters several hundred thousand organic chickens a month, sought a waiver from USDA regulations requiring organically grown chickens be fed 100 percent organically grown feed. Not enough organic feed was available to meet company demands, a Fieldale spokesperson told The Atlanta Journal Constitution***
>
> — Linda Baker, 2002[34]

FIGURE 3-10 Addressing the Pollution Trap with Certification Program



This diagram is adapted from Figure 2-8. The *Production growth drivers* lead to more *Pollution level*, but that level doesn't affect the *Production growth drivers.* It can, however, increase the level of health concerns and, thus, the *Demand for certified organic crop*. More demand means a greater *Number of farmers growing organic crops* and also less *Waste generation.*

High hopes have also been pinned on organic certification as a mechanism to avoid the third trap of commodity systems, their tendency to erode incomes of producers and to consolidate production in fewer and fewer hands. It may be too soon to know for sure if organic certification can really help with this trap, but there are many signs which suggest that certification based on production methods alone is not a dependable remedy for the trap of consolidation in the face of falling incomes.

> ***In California, five giant farms control half of the state's $400 million organic produce market. Horizon Organic, a publicly traded Colorado-based company, controls more than 70 percent of the nation's organic milk market. More than 30 percent of its milk is produced at two industrial-size dairies, one of which milks close to 5,000 cows. Corporate food giant General Mills now owns leading organic manufacturer Cascadia Farms, Kraft Foods owns Boca Burgers, and Heinz, reported the Wall Street Journal this June, is seeking to develop an organic ketchup to sell at Whole Foods and Wild Oats, the nation's biggest natural foods supermarkets.***
>
> — Linda Baker, 2002[35]

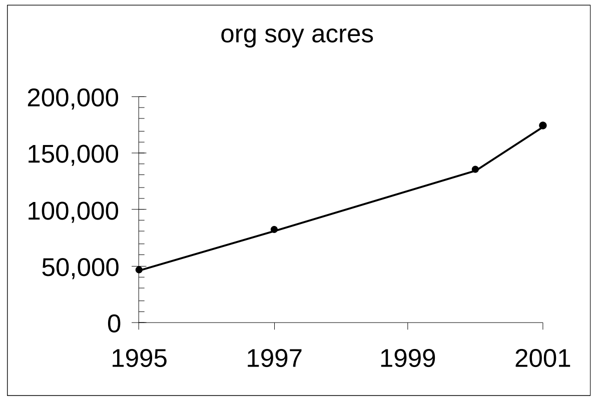
Statistics like these hint that organic certification alone is an incomplete solution, one that addresses ecological concerns but may not be so effective for social concerns. Could additional levels of structural change be added on to the certification route? To consider this question we turn first to the production of organic soybeans.

Organic Soybeans

Soybeans have shared in the recent rapid growth of organic agriculture. Figure 3-11 shows the increase in the number of acres of organic soybeans over the past seven years, although despite such rapid growth, organic soybeans are still a small fraction of the total commodity stream, making up less than one percent of the total US soybean production. [36]

These soybeans are sold primarily into the Japanese market for organic tofu. The rising demand for organic meat is also increasing the demand for organic soy to feed to livestock.

FIGURE 3-11 U.S. Organic Soy Production

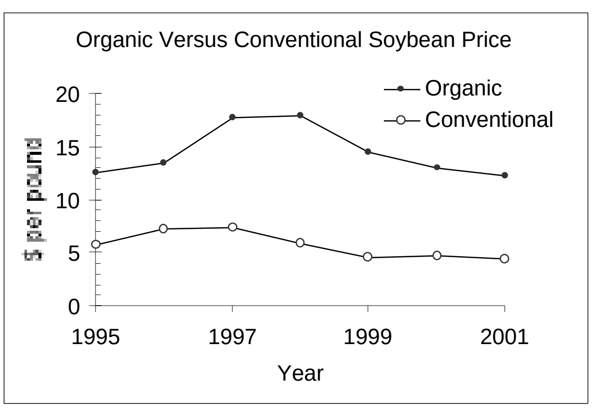


Source USDA-ERS

It is clear that the production practices required for organic certification could go a long way towards pulling the soybean system out of the resource and waste traps of commodity systems. If substantial acres became devoted to organic production it would indeed have a strong impact on the health of the Mississippi River watershed.

To date, US growers of organic soybeans have received significant price premiums compared to growers of conventional soybeans (Figure 3-12). The existence of higher prices for organic soybeans is, at first glance, a very hopeful sign.

FIGURE 3-12 Certified Organic and Conventional Soybean Prices in the U.S.



Bertramsen and Dobbs. Economics Commentator #426. South Dakota State University 2002

It is too early in the growth of the organic soybean industry to know for sure if going organic is a solution to falling incomes and consolidation. But, the currently available data and anecdotes suggest that if the system is to avoid this trap, it will be because additional changes in system structure — beyond organic certification — will have been implemented.

1997 and 1998 saw the highest prices for organic soybeans. Such high prices brought other growers into organic production, spurring the growth in organic soy acres we saw in Figure 3-11. Although organic soybean prices are still high relative to conventional prices, price declines have accompanied increases in production over the past several years. In this way organic soybeans behave just like any other non-certified commodity — as production rises, prices fall.

So far, growth in demand for organic soybeans has been able to absorb much of the growth in production, but the declining price trend over time stands as a warning signal. Certification only brings a price premium when supply is matched with demand for the certified product. In addition, the issue of power differences between the many relatively small producers and the few larger buyers can put pressure on the price of certified commodities just as it does for standard commodities.

There are signs that organic soybean growers recognize these two points, and are organizing themselves to deal with these issues. Organic soybean grower cooperatives are now beginning to work with each other to market their beans to large soybean processors. For instance, in 2000 several organic producer groups united to form OFARM, The Organic Farmers Agency for Relationship Marketing. [37]

> ***OFARM benefits include sharing price information with other OFARM producer groups, developing reliable inventory information, keeping up with markets and market trends, eliminating one-on-one negotiations with buyers, developing and monitoring producer-friendly contracts, developing and monitoring a list of credit-worthy buyers for members and enhancing opportunities to add new crops and agronomic practices to farm rotations.***
>
> ***— The New Ulm Journal,*** 2002[38]

While not as formalized as the collective agreements in rock lobster or tobacco, the collective action taken by groups like OFARM does give producers a way to address the power differential between themselves and large buyers.

In addition, as of early 2002, newspaper accounts of OFARM's activities indicate that the group is "talking about supply control so that we don't all plant the same thing." [39]

It is too soon to be sure that organic soybean growers will be able to come to collective agreements that allow them to manage their commodity's productive capacity. Still, these growers' first steps toward organizing for collective actions show that it is possible to link control of supply with demand for certified commodities.

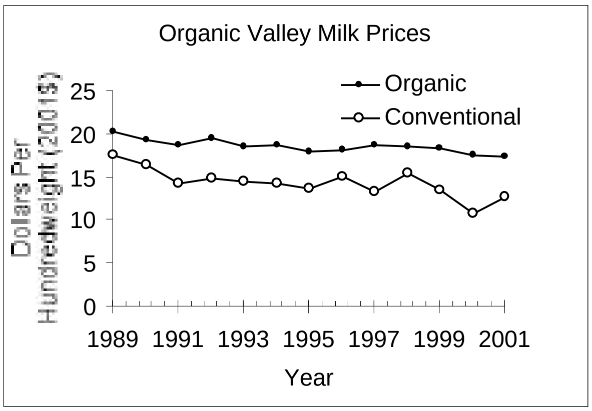
Unfortunately, even as these hopeful signs emerge, there are also signs that the same issues that undermined the fifty-year old Burley tobacco program make the US organic soybean growers vulnerable. Organic soybeans are sold into an international market, and growers in other countries, especially China and Brazil, sell into the same pool as US organic soy producers.

> ***Robert Carlson, president of the North Dakota Farmers Union and a member of the Agriculture Trade Advisory Committee to the USDA in a tele-conference October 25 from Jamestown, North Dakota, said one of the things they learned was that the Chinese government has set aside an area in central China that they claim is not subject to pollution. The purpose of setting aside the 250,000 acres was to use this land strictly for organic production. With the output from this region, they hope to capture "a big chunk" of the organic food market in Japan, Carlson said.***
>
> ***— Resource News International,*** 2000 [40]

Since current US organic soybean acreage is less than 200,000 (Figure 25), the entry of 250,000 Chinese acres into the same market will limit the ability of agreements among US soybean producers to keep overall production in line with demand. Perhaps rising demand — maybe in the form of demand for organic animal feed — can absorb the production not only of increasing numbers of US acres, but also of growing organic soybean harvests from China and Brazil. If not, organic certification and supply control within national boundaries seem unlikely to be enough to keep organic soybean producer incomes stable and high. The lessons of other commodities suggest that if demand for organic soybeans stops growing, only a collective agreement to limit production at the level of all of the producers who sell into the international market for organic soybeans will hold prices at their currently high level.

Organic Valley Milk Cooperative

FIGURE 3-13 Certified Organic and Conventional Milk Prices in the U.S.



source: Organic Valley Milk

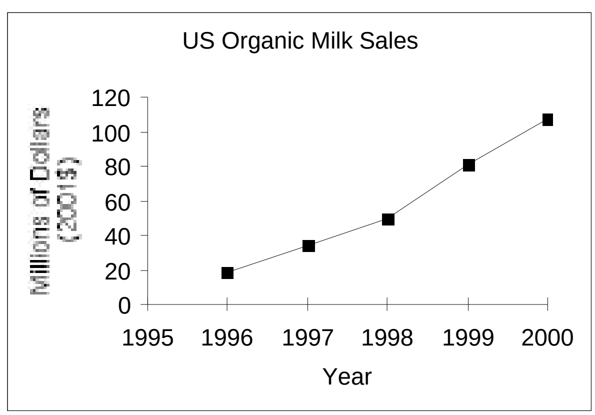
Figure 3-13 shows data collected over more than ten years from the Organic Valley Corporation, the processing arm of the CROPP cooperative, a national cooperative of organic dairy (and other) producers. It shows that, in constant dollar terms, organic producers have received a price premium relative to conventional milk producers.

Such stable prices to producers over the past ten years clearly contradict the pattern of falling prices seen across most commodity systems. Organic milk consumption has been growing strongly (Figure 3-14), absorbing the tendency towards increased production seen in other commodity systems. Such growing demand has moderated the overproduction/falling prices trap that will reassert itself if demand lags behind supply.

Even at this time of rising demand, the members of Organic Valley have developed agreements to keep production matched to demand. Most importantly, they will not accept new members unless there are indications of adequate demand for the milk of the new producers.

> ***CROPP membership is dependent on a number of considerations. Location and our needs for supply are the first considerations. To keep our pay prices high to our farmers, we must carefully match supply with sales.***
>
> — Organic Valley website, 2002[41]

FIGURE 3-14 Organic Milk Production



USDA-ERS

In the Organic Valley organization, all decisions (including the annual setting of prices) are made democratically through the farmer-members and their elected board of directors. Each farmer member has the same voting power, regardless of size of operation, and there is no minimum herd size for entry into the cooperative.[42] Thus, in terms of issues of governance and participation, the trends towards consolidation are moderated. This fact may be responsible for the relatively small herd sizes of Organic Valley members — an average herd of forty-five cows. On the other hand, there are not explicit measures in the cooperative to limit consolidation or growth in scale.

In this example, just as is beginning to happen in organic soybeans, the tool of organic certification has been combined with other tools that address the economic and social aspects of the system. It is limits on production (via limits on new members of the cooperative) and the cooperative structure of the organization that lessen the power imbalance between a small number of large processors and large number of small producers typically seen in commodity systems.

FOR MORE INFORMATION ON ORGANIC CERTIFICATION

US Department of Agriculture

http://www.ers.usda.gov/Briefing/Organic/

International Federation of Organic Agriculture Movements
http://www.organicts.com/organic_info/index.html

Organic Valley Milk

http://www.organicvalley.com

Fair Trade Certification — Coffee

Just as a commodity can be certified for its practices relative to ecological limits, certification programs also exist for social characteristics. These labels provide consumers with assurances that the producers of specific commodities work in decent conditions and earn a fair wage.

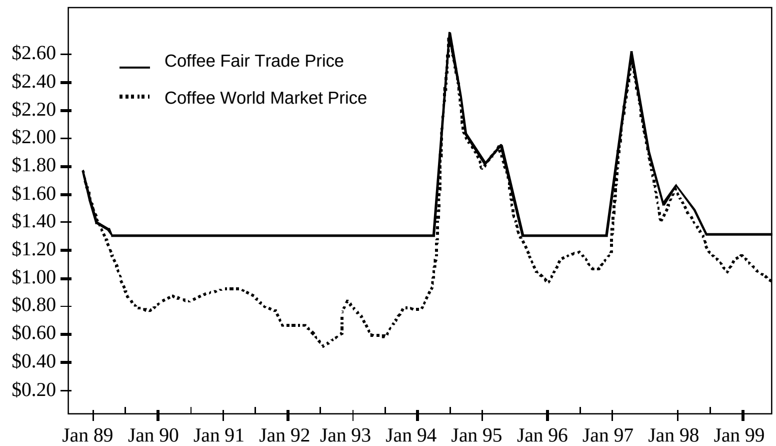
While organic standards have recently been formalized into a single set of regulations in the United States, fair trade certification can mean slightly different things depending upon which body is doing the certifying. Still, the basic intent is the same across many programs. The Fair Trade Labeling Organization's certification conditions are a good example of what is typical.[43]

- price covers the cost of production
- social premium for development purposes
- partial payment in advance to avoid small producer organizations falling into debt
- contracts that allow long term production planning and sustainable production practices
- farmer cooperatives that use a democratic structure
- plantations and factory workers receive decent wages, good housing, minimum health and safety standards, rights to unionize, no child or forced labor;
- minimum environmental requirements.

As with organic products, the demand for Fair Trade Products is increasing — by about 40 percent in 2001. [44] Bearing a "Fair Trade" label, products such as tea, cocoa, coffee, and bananas can be found in more and more mainstream retail outlets and grocery stores.

The impact on the producers who supply these products is large. Take for example coffee. The coffee commodity system has all of the elements of the classic commodity traps we have explored in this paper: many small producers scattered over fifty countries, four large multinational buyers, and a long chain of middlemen between the two[45] . The past few years have seen overproduction and prices below the cost of production. In the midst of this system growers who produce for Fair Trade groups like Equal Exchange have received steady prices that are higher than conventional prices (Figure 3-15).

FIGURE 3-15 World Coffee Prices



Source: Equal Exchange 2001 Ann. Report
http://www.equalexchange.org/downloads/Annual%20Report%202001.pdf

Ongoing challenges in Fair Trade certification:

Although Fair Trade certification attempts to pull producers out of all three traps of commodity systems, each program still exists within the context of the Production Growth Drivers.

For instance, as we saw in the forestry case in Chapter Two, rising profits often are reinvested in productive capacity. Anecdotes such as the following suggest that tropical coffee farmers operate according to the same logic as northern mill owners.

> ***Santiago Paz, General Manager of CEPICAFE, a small farmer cooperative in Peru, explains, "The above-market premiums earned from fair trade have enabled our members to invest in improving their farms and acquiring small machinery, all of which helps to improve coffee quality. In addition, this added income allows us to fix up our homes, cover medical expenses, and provide an education for our children."***
>
> — Equal Exchange, 2002[46]

Clearly such programs can lead to direct increases in the living standards of coffee growers, but in this story one can see potential investments that could boost the quantity of production as well as the quality. It is worth noting that rising production is the main reason for falling incomes in the first place, so it will be important for the Fair Trade movement to avoid this trap by finding ways to match production with the demand for the certified product.

Finally, like organic certification, Fair Trade products today represent only a tiny fraction of total global commodity flows. Keeping our attention on all of the producers suffering under the weight of rock-bottom coffee prices, we can see that Fair Trade is a part of a solution. But, without very substantial increases in demand for these products, it remains an incomplete one.

> ***Not all poor producers can move into the premium market of specialty arabica coffees. If too many producers try to move into this segment of the market, it would cease to be a niche capable of commanding high prices. Simply supporting producers in the specialty market cannot be a solution to the systemic problems affecting millions of farmers.***

— ***Mugged: Poverty in Your Coffee Cup,*** 2002 [47]

Although certified products are differentiated and retain some of their history of production, many of the same pressures that have historically pushed conventional products toward commodification still exist, and there is a danger that certified raw materials might avoid one trap of a commodity system only to capitulate to another.

With some certification schemes the incentives to grow larger and produce more still exist. Within this context certification changes the rules, limiting the social and environmental impacts of commodity production by allowing only certain practices.

Some certification requirements do interrupt the core driving dynamics of commodity systems. For instance, the Marine Stewardship Council certification of fisheries as sustainable requires that producers have implemented plans to keep catch rates below the sustainable harvest rate. As we saw in the previous section, this is a step that intervenes to limit the role of the Production Growth Drivers, and a step that usually requires collective agreement to implement. Other certification rules, for instance the prohibition on chemical fertilizers in organic farming, simply alter practices, not the core, driving dynamics.

FOR MORE INFORMATION ON FAIR TRADE

Equal Exchange
http://www.equalexchange.org
Fair Trade Labelling Organization International
http://www.fairtrade.net/
Oxfam's Fair Trade Campaign
http://www.maketradefair.com/

Certification — Summary

From Organic soybeans and milk to Fair Trade coffee, several themes have developed as we look at programs to certify social and environmental attributes of commodity production.

1. CERTIFICATION IS AN IMPORTANT STEP IN BRINGING MULTIPLE GOALS INTO COMMODITY SYSTEMS.

   Certification allows at least some producers to survive economically while stewarding a resource or earning a fair wage.

2. CERTIFICATION CHANGES THE RANGE OF ALLOWED PRACTICES, BUT IT DOES NOT NECESSARILY INTERRUPT THE PRODUCTION GROWTH DRIVERS

   Whether it is requirements about particular farming and fishing techniques or designations of social practices, certification rules change the context within which producers attempt to produce more with lower costs. But, certified systems can be pulled into one or more of the traps of commodity systems. If environmental practices are certified but attention is not also directed toward balancing production with demand, the system can fall into the trap of overproduction and declining incomes. If, in a global market, environmental goals are specified but not labor practices, the environmentally friendly commodity will eventually be produced wherever labor is the least expensive.

3. CERTIFICATION PROGRAMS NEED TO BUILD IN ALL THE GOALS THAT ARE HELD FOR A SYSTEMS – SOCIAL, ECONOMIC AND ENVIRONMENTAL

   The Production Growth Drivers put pressure on resources, environment and communities. If only some of these pressures are addressed in certification programs, the others may grow into problems themselves. Don't expect that organic products will always bring a price premium or always be associated with good working conditions. Don't assume that Fair Trade products will always be good for the environment. Far-sighted certification programs will make sure to build in all the goals they have for a commodity into the certification conditions.

4. THE HIGHER EARNINGS ASSOCIATED WITH CERTIFICATION MAY BE REINVESTED IN PRODUCTIVE CAPACITY, THEREBY RAISING THE HARVEST AND PRODUCTION RATES.

   Certification programs need to anticipate consequences of rising incomes, and producers groups might want to consider agreements that either channel such resources into practices that improve operations without boosting production or ensure that any increase in production is matched to demand and is first allocated to smaller producers.

5. NOT ALL GOALS NEED TO BE SERVED BY CERTIFICATION.

   Certification programs often work well as one aspect of "system redesign", but they need not be the only aspect. For instance certification might work well in one region for improving environmental performance, but cooperative organization or collective agreements may be required to address the imbalance of power between producers and buyers or to control the tendency toward overproduction. Be open to other mechanisms to work alongside the certification program

6. VOLUNTARY CONSUMER BEHAVIOR IS THE POWER BEHIND AND THE LIMIT OF CERTIFICATION SCHEMES.

   Certification schemes connect innovative producers with dedicated consumers. Because of this, certification schemes begin to build awareness of sustainable production methods and a base of informed consumers. But certification schemes' dependence on consumer demand also seems (at least today) to limit the applicability of this category of solution to the majority of producers, farmland, fisheries and forests that are struggling with the traps of commodity systems. By proving that it is possible to produce and trade commodities in a way that incorporates multiple goals, these systems are hugely valuable. But without major transformation in consumer attitude, certification schemes on their own seem unlikely to absorb anything close to the bulk of current commodity flows.

   While education and communication efforts can be expected to boost consumer willingness to pay higher prices for certified products, the problems of commodity economies can not be solved by certification at a rate faster than this new demand can be created.

7. CELEBRATE CERTIFICATION SCHEMES FOR THE LOCAL DIFFERENCES THEY MAKE AND THE IMPORTANT ROLE THEY HAVE IN AWARENESS BUILDING, BUT DO NOT COUNT ON THEM TO CHANGE THE BULK OF COMMODITY FLOWS IN THE NEAR FUTURE.

Escaping Traps Using Government Taxes and Payments

Thus far we have looked at two quite different mechanisms for keeping the productive capacity of a commodity system in balance with the ecological and social resources of that system. Via collective agreements, producers can take cooperative action to maintain balance between productivity and social and environmental goals. Certification schemes provide a way to link up the producers who are serving environmental and social goals with the consumers who care about those goals.

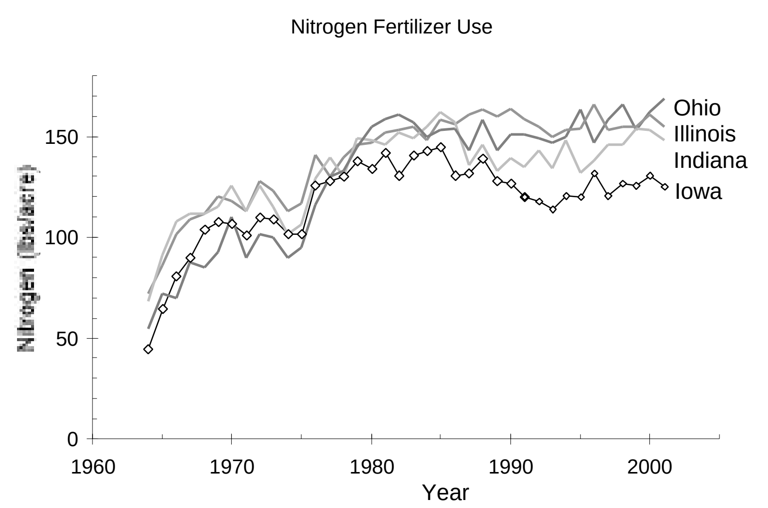
A third approach to incorporating social and environmental goals and avoiding the traps of commodity systems relies on the unique powers of governments to shape incentives and rules. Using the tools of taxes and incentives, governments can interject new goals in commodity systems, so that producing the most for the least cost is no longer the only strategy of the commodity system.

In this section, we consider three examples of such policies. One case — a program to tax the use of nitrogen fertilizer in Iowa — is a government effort to put an often-externalized cost back into a commodity system. Another case — a program funded by New York City residents to improve land management practices in upstate New York — uses the power of governments to pay for good stewardship of land. The third case examines Switzerland's reform of agricultural subsidies by paying farmers for serving that society's goals for clean water, biodiversity, and healthy rural communities. All of these cases remind us that it is entirely possible to re-shape commodity systems to serve goals that stretch far beyond productivity.

Incorporating Environmental Costs — Iowa Groundwater Protection Act

In the Corn Belt region of the United States commodity agriculture pushes up against the limits of ecosystems to absorb agricultural chemicals. This is seen, in particular, in the pollution of groundwater with nitrates and herbicides and in the pollution of the Mississippi River and Gulf of Mexico with fertilizer run-off.

FIGURE 3-16 Midwestern U.S. Fertilizer Use



USDA - NASS

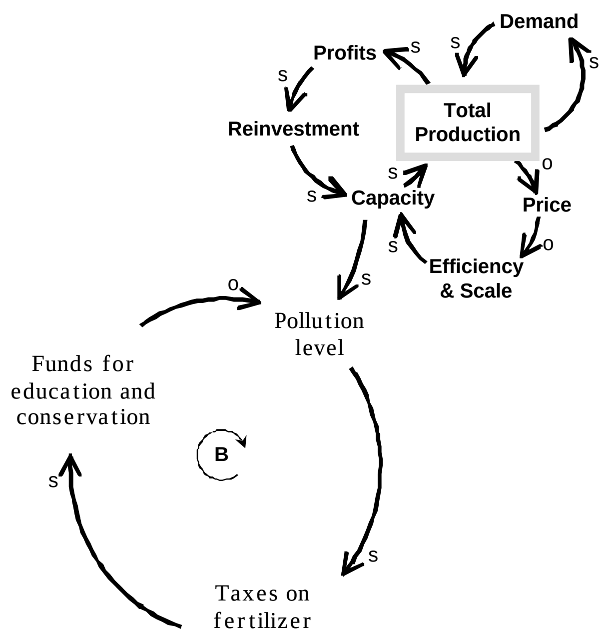
In 1987 the state of Iowa responded to this situation with the passage of the Groundwater Protection Act. This legislation established fees that are paid by pesticide manufacturers who wish to register products for use in Iowa and dealers who wish to sell in Iowa. In addition, taxes are charged on fertilizer use — per ton of nitrogen, for example. This fertilizer tax is one kind of direct feedback to the farmer — the more nitrogen is used, the more tax is paid. [48]

As shown in Figure 3-16 the amount of nitrogen fertilizer used per acre in Iowa has dropped compared to the period just before the passage of the legislation, and is lower than nearby states in the Corn Belt.

The nitrogen tax itself is relatively small — around seventy-five cents per ton of nitrogen fertilizer.[49] But, because the funds raised are applied to training, research, and technical assistance to reduce fertilizer use, the program does seem to have helped counteract the tendency of commodity systems continually increase the use of productivity boosting inputs.

Figure 3-17 shows a systems diagram of the waste generation trap of commodity systems, modified with a program like the Iowa Groundwater Protection Act. With this modification to the system, the core driver that would tend to over-produce wastes is counterbalanced by the tax and associated education and technical assistance programs aimed at reducing fertilizer use.

FIGURE 3-17 Addressing the Pollution Trap with Taxes



This diagram is adapted from Figure 2-8. The *Production growth drivers* lead to more *Pollution level*, but that level doesn't affect the *Production growth drivers.* It can spark *Taxes on fertilizer* and generate *Funds for education and conservation programs*, thus decreasing *Pollution level*

Figure 3-17 shows that the Iowa nitrogen tax program does not change the structure of the core driver itself. The underlying incentives to maximize production and minimize costs are still present. With fertilizer prices of close to two-hundred dollars per ton, a seventy-five cents per ton tax is unlikely to change many decisions based on profit, making the tax a weak balancing tool. The program is pushing against the momentum of the system primarily through education, rather than economics.

Water Quality Stewardship Payments — New York City and The Catskills

The pollution generated by commodity systems that have grown beyond the capacity of their environment to absorb wastes can impact populations far beyond the producing area. Water pollution, as it flows downstream, can affect many people and many ecosystems. Those affected often feel powerless to change upstream behavior. But, the mere fact that there are so many downstream recipients of pollution has the potential for collective coordinated action.

That was the case when New York City needed to ensure a clean drinking water supply. The event that triggered action was when an outside authority (the EPA), wielding a very big stick (the Surface Water Treatment Rule), threatened to make the city build expensive drinking water filtration plants. The goal was to filter out pollution generated by farming activities upstream of the city's reservoirs. However, the filtration plants would have had very large on-going operations and maintenance costs.

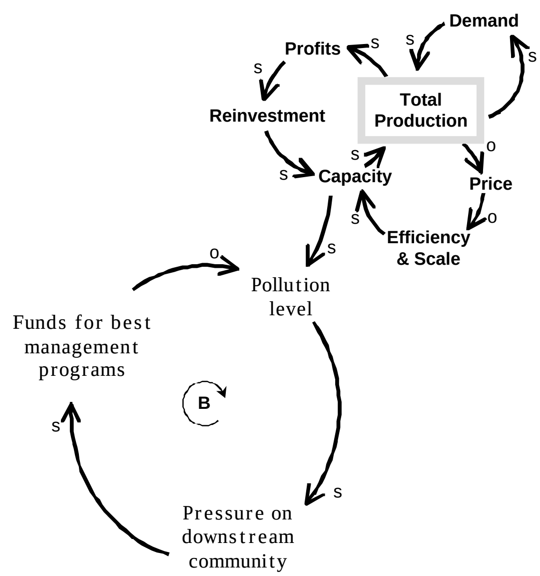
Rather than solve the problem with downstream filtration technology, New York City decided in 1990 to try influencing upstream behavior. After a long period of negotiations (150 sessions over one and a half years) the Environmental Protection Agency, the state, the city, the upstate communities, and environmental groups agreed upon a plan to protect the entire watershed.[50]

> ***The lesson here is to invite everyone to the table — and keep everyone at the table, which was no easy task. In a sense, we were lucky. With a $4 to $6 billion filtration-plant pricetag hanging over the city's head, there was a great incentive to tough out the negotiations. The difficult lesson for all the parties has been learning to live with compromises. It's a lesson we are still learning***
>
> — EPA Assistant Regional Administrator William J. Muszyski, 2000.[51]

The Watershed Agricultural Council is the non-profit organization (funded primarily by the New York City Department of Environmental Protection) that develops the policies and procedures that protect the watershed from agricultural pollutants. Through the Council, New York City pays the full costs of changes made by farmers who adopt Best Management Practices. In exchange, farmers sign Whole Farm Plan contracts guaranteeing they will stick with the management practices. The program is designed to do no harm to farming in upstate New York.

> ***It is the Task Force's and New York City's intention that not one farm will be put out of business by this program. While actively participating in the development and implementation of their Whole Farm Plans, farmers will not have to pay for the planning, implementation, maintenance or operation of Best Management Practices recommended to meet the water quality objectives of New York City's outlined in the Whole Farm Plan***
>
> ***— The Brown Book,*** December 1991[52]

FIGURE 3-18 Addressing the Pollution Trap with Best Management Practices



Similar to previous diagrams, the *Pollution level* can build *Pressure on the downstream community* and *Funds for best management programs,* which can reduce *Pollution level.*

More than ninety percent of the farms in the target watersheds participate in the program[53], ensuring high water quality for the residents of New York City. This creative solution was less expensive for the taxpayers of New York City than construction and maintenance of water filtration facilities.

In this example the citizens of the New York City (via the city government) pay the upstate farmers for careful stewardship of the watershed. The arrangement recognizes that water flowing into New York City is as much a product of upstate agriculture as grain and milk. The Watershed Agricultural Council program changes the incentives experienced by farmers in the region, counteracting the pressures that would ordinarily have them spend as little as possible on management practices in order to minimize costs and maximize yields.

Figure 3-18 shows that, from a systems perspective, this approach is fairly similar to the Iowa groundwater example. As wastes from commodity production begin to affect surrounding communities, resources are allocated towards better management practices. This can be a better solution for all concerned, since the downstream communities solve the problem for less cost, and the commodity producers are able to afford producing their crops in a more sustainable fashion.

FOR MORE INFORMATION ABOUT THE PARTNERSHIP BETWEEN UPSTATE AGRICULTURE AND THE NEW YORK CITY

Watershed Agricultural Council
http://www.nycwatershed.org/

Direct Payments for Social and Environmental Benefits — Swiss Agricultural Policy

The Iowa groundwater program and the New York City watershed program both compensate for the fact that the incentives in commodity production lead producers to put pressure on ecosystems in order to lower costs and raise production. Through taxes, training, or payments to offset the costs of better production techniques, governments can help shift commodity systems to less damaging methods of production.

This approach can be taken one step further — beyond offsetting the costs of better practices, citizens and their governments can pay producers for environmental and social benefits. Given that, in many countries, agricultural production is already heavily subsidized, this is often a matter of shifting public investment in natural resource producing communities from commodity production to stewardship.

One country that has made such a switch is Switzerland. In 1993, economic support of agriculture was reallocated so that "the state remunerates the provision of public good for which there is social demand but no market and special ecological services with direct payments." [54] The payments are given to farmers contingent on compliance with ecological requirements, including nutrient management, diversified crop rotations, a share of land in ecological compensation areas (semi-natural zones such as meadows and hedges), and ground cover in winter. [55] As a result in 1998 about 88% of Swiss agricultural land was farmed according to these requirements.

By linking economic support to sustainable practices, the government is able to interject additional goals into the commodity systems. On the farms supported by these programs, producing the most for the least cost is only one of several goals. Good land stewardship becomes an additional goal.

Subsidy reforms were initially made when Swiss agriculture was protected from the pressure of global markets. However, as Europe becomes more unified and as the pace of globalization increases, this level of protection has begun to change.

> ***After agriculture was made much more ecological in a first reform phase (1993-1998), the emphasis now is on increasing competitivity. Today agriculture still enjoys certain protective measures imposed at the Swiss borders, including the EU countries. With increasing mobility and in view of international agreements, this protection will be eroded. Under these circumstances prices and costs must be reduced if market shares are going to be maintained.***
>
> — Eduard Hofer, 2000[56]

In 1999, Swiss agricultural policy began to focus on abolishing all price and market guarantees. And so, with less protection from low-priced agricultural commodities from other regions and with less support of prices, Swiss agriculture seems poised to enter into the typical commodity dynamics of overproduction and falling prices.

Since direct payments for ecological practices do not interfere with the core drivers that create increasing production and falling prices, it seems quite likely that farm incomes in Switzerland will begin to erode, requiring more and more support to keep farmers on the land.

As was the case of for some of the examples of certification, direct payments alone may not be enough for a successful escape from all of the traps of commodity systems. Without measures to keep production within the limits of demand, the spiral of falling incomes seems all-too-likely to undermine the very innovative government investment in public goals.

FOR MORE INFORMATION ABOUT REFORMS IN SWISS AGRICULTURE

Swiss Federal Office for Agriculture
http://www.blw.admin.ch/e/index.htm

Government Mediated Interventions — Summary

From taxing pollutants to rewarding good stewardship government programs can influence commodity systems.

1. CITIZENS CAN USE THE POWER OF GOVERNMENT TO TAX AND REWARD SPECIFIC PRACTICES THAT REFLECT MULTIPLE GOALS FOR COMMODITY SYSTEMS.

   Governments can reshape commodity systems by taxing practices that place burdens on communities or ecosystems and by paying commodity producers for the ecosystem and social benefits of particular production practices.

   By paying for what it values — clean water, biodiversity, small farms — society can shift the goals of commodity systems to include more than just high productivity and low costs.

2. TAXING INPUTS TO A COMMODITY SYSTEM CAN SUPPORT WASTE AND POLLUTION REDUCTION PROGRAMS.

   Investments in education and assistance can be supported by taxes on the polluting substances and can help moderate the traps of commodity systems. However, the impact may be limited if Production Growth Drivers are still in place.

3. EVEN AS GOVERNMENTS INTRODUCE PAYMENTS FOR "SOCIAL GOODS" AND TAXES ON "BADS", PRODUCTION GROWTH DRIVERS OF COMMODITY SYSTEM BEHAVIOR CAN REMAIN IN PLACE.

   Paying farmers for good practices without any mechanism for the control of production runs the risk that prices and incomes will fall lower and lower, and farmers will require more and more government payments to maintain the same income level. If maintaining producer incomes is an explicit goal of such programs, measures to limit supply and break the over-production cycle will be needed.

   Paying for good stewardship while leaving the Production Growth Drivers unrestrained is unlikely to be a long-term solution. While it will quite likely establish better environmental practices, pressures from the influx of cheaper commodities produced where standards are not as high will probably put pressure on prices and thus incomes. If the society also has the goal of maintaining many small producers, some system to restrain overproduction and competition from global markets will be required.

Strategic Thinking About the Redesign of Commodity Systems

Stakeholders in commodity systems have a range of tools available to them for balancing the productive capacity of the system with the limits of the natural and social systems supporting that productivity. What, of all the options available, will be the most effective tools to bring balance to a particular commodity system? The answer, of course, depends on the details of that system. Does it produce a crop that could be marketed directly, like vegetables or meat or cheese? Does it produce a very undifferentiated raw material, like soybeans or pine boards? Can the commodity be produced anywhere in the world or only in particular locations? How well organized are the producers of the commodity? Do they have a mechanism for making and enforcing agreements or would that organization need to be created? The answers to such questions will point to the most sensible options for "redesign" of each commodity system in question.

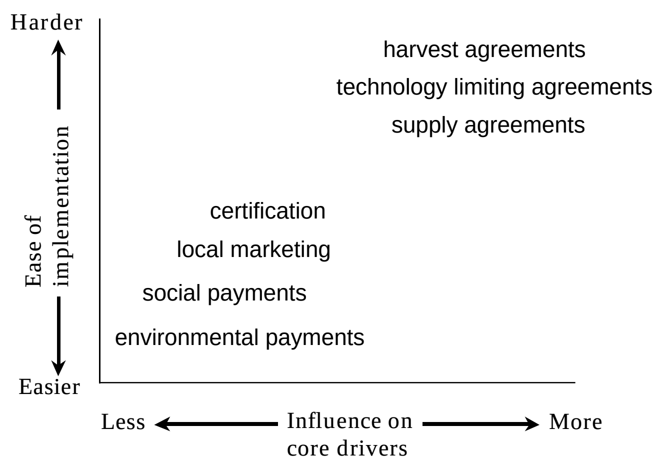
In our models and in the examples we have considered in this chapter, the interventions that put limits on how far commodity producing capacity can grow are the interventions that are most likely to bring long term stability to natural resource economies. In general, these interventions are policies that allow producers to agree on how much to harvest, what level of technology to use, or how much commodity to market.

While collective agreements are the most effective interventions, they are the most difficult to implement. They require producers to move from competition to cooperation and often push against the short-term interests of buyers further along the commodity chain. These buyers feel pressured more by the need for cheap, plentiful raw materials than by the need for a sustainable and equitable system for producing those materials.

Other tools, like certification programs or government payments for social and ecological best practices, can certainly help commodity systems, even if they do not intervene in the core dynamics. They help because they draw better boundaries around social and environmental resources, limiting the inadvertent damage that the core drivers can do to communities and ecosystems. Because such schemes are often voluntary, and because they don't interfere with the politically difficult issues associated with changes in the Production Growth Drivers, they may be easier to begin.

Figure 3-19 provides one way to think about these different interventions. The solutions with more influence on the Production Growth Drivers tend to be also be the more difficult to implement. They require more actors. And sometimes they are more threatening to established interests in the system. These more difficult — but more transformative — solutions cluster in the upper right hand corner of the figure. At the lower left are those interventions that work at the periphery of the Production Growth Drivers.

FIGURE 3-19 Intervention Strategies



It is not the case that interfering with the core dynamics is good, and more peripheral interventions are bad. Both are needed. The peripheral interventions, because they are easier to implement, can limit damage and build commitment to even more far-reaching change, buying all of us more time to build the knowledge and partnerships that will be need to institute changes closer to the core of commodity systems.

The challenge we face lies not in deciding which of these approaches is right and which is wrong. The challenge is implementing what can be accomplished now, with the resources and coalitions that already exist ***and*** beginning to build the level of understanding and cooperation that will be needed to intervene in the Production Growth Drivers of these systems.

4. Recreating Natural Resource Economies

At Sustainability Institute we are not only researchers. We also bring our simulation models and systems-thinking framework to groups trying to understand and shift the behavior of particular commodity economies. We work with state foresters, sustainable agriculture activists, policy institute analysts, government agency heads, senior managers at companies, and program directors of private foundations.

Although these leaders come from different worlds, they all tell versions of the same story. When local projects — even the most inspiring ones — are considered in the context of broader economic trends, these sustainable agriculture, forestry, and fishing initiatives feel inadequate to the challenges they face. The loss of productive farmland, the degradation of water and soil resources, the continual drop in numbers of farmers and fishermen, the decline of forests and fisheries — all these indicators make leaders in many systems wonder if they are doing too little too late.

In the race to save forests, ecosystems, waterways, and rural communities, many of us find ourselves working in emergency mode, pushing as energetically as we can in whatever direction we sense opportunity. With so much at stake, the sense of urgency is completely understandable. It is an urgency all of us who have written this paper share.

At the same time, our analysis of commodity systems has convinced us that even as we act out of urgency, we must also be deliberate in our response. At least some of our collective energy must be focused on the core systemic drivers that produce the alarming trends in the first place. We will not be successful if we spend all of our energy trying to repair the damage they do. We must also reshape commodity systems from their core. We must attend to the Production Growth Drivers.

All of our analysis tells us that this is completely possible. Intellectually, the problem is not that complex. There are tools — many of which have been described in this paper — that are right at hand. What we need — what we must create — is the kind of shared understanding that will allow new partnerships to take hold.

Commodity systems are not going to shift easily. We will need the concerted efforts of producers, governments, commodity buyers, and international organizations. We hope the ideas and framing presented here will contribute to the creation of some of these partnerships and inspire those who are ready to address the traps of commodity systems at their core.

Elements of a Solution

New System Structures for Responding to Social and Environmental Indicators

The art of keeping commodity production within the capacity of the resource to regenerate, within the capacity of the environment to assimilate wastes, and within the capacity of producing communities to sustain themselves simplifies to a single principle**.**

Feedback (information, incentives, regulations) about the state of resources, the surrounding environments, and producing communities MUST be strong enough to counterbalance the inherent pressure to increase efficiency, scale, and level of production.

Whatever the exact nature of the solution, it must adjust the growth of commodity-producing capacity in response to environmental or quality of life indicators in an accurate and timely fashion.

Designing Interventions

The kinds of interventions that can help bring balance to commodity systems — collective agreements, certification, and government-mediated taxes and payments — do so by connecting the decision to increase or decrease harvest capacity, harvest rate, and harvest practices with information about the state of social or environmental resources. Several rules of thumb are helpful when thinking about how each of these interventions modifies commodity systems.

FEEDBACK NEEDED FOR AVOIDING COMMODITY SYSTEM TRAPS

Trap # 1: Resource Depletion
To avoid the over-harvesting trap, the harvest rate must be held under the resource growth rate. This cannot be accomplished by relying on market signals of scarcity, such as a rising price. The market price for a raw material will signal scarcity only *after* the harvest is well above the production rate. By then, the health of the resource base may be severely damaged and producers or harvesters may be so far over-capacity that coming into balance is politically and economically very difficult.

Trap #2: Pollution
To avoid the waste accumulation trap, as the waste production rate approaches the waste removal rate there must be some mechanism to slow investments in new commodity producing capacity or to increase investments in practices that reduce waste.

Trap # 3: Community Decline
To avoid the trap of stressing producer communities, commodity systems must respond to declines in producer incomes, producer numbers, and the quality of life in producing communities with measures which counteract the trend toward ever-rising production and ever-falling prices.

First, the more effectively an intervention deals with the core growth drivers of a system, the more likely it is that the intervention will "spring" multiple traps. The interventions that put limits on the growth of commodity harvesting or producing capacity are the most likely to bring long-term stability to natural resource economies. In general these policies allow producers to agree on limits to how much to harvest, what level of technology to use, or how much commodity to market. Because these interventions tend to limit capacity growth in general, an intervention designed to protect a resource (say a harvest limit) might also protect producer incomes by slowing the push toward overproduction.

Second, it is VITAL that the boundaries of the solution match the boundaries within which the commodity is produced and sold. Harvest limits, technology limits, and supply control agreements only work if all of the producers selling into a given market are a part of the agreement. If fishermen along one section of coast agree to harvest limits, they can survive on lower harvest rates because the price of fish will rise to reflect the lower supply. But, if fishermen just down the coast harvest the same species without limits and sell into the same market, the "sustainable" producers will not be able to compete. If U.S. corn growers set production limits but sell into the same market as Argentinean farmers who do not have production limits, the U.S. agreements will not be able to prevent overproduction and falling prices.

There are two ways to address this relationship of solution scale and market scale. The first is to narrow the market, to protect in some way a small group of producers from the rest of the commodity stream. The second approach is to scale the solution to the global market, making it as multi-national as the commodity market.

Local Product — Narrowing the Boundaries of the Market

One of the most successful innovations in sustainable agriculture has been the establishment of locally branded products. Local products create a smaller and more manageable community of producers, a smaller group to come to agreements, making the decisions to control supply or use sustainable practices easier to manage. The "going local" solution works best when the product has (or can create) distinctive local characteristics or quality that differentiates that product from broader commodity flows.

But creating a local brand is not a long-term solution in and of itself. The principles of sustainable management for this smaller set of producers are *the same as for a larger commodity system.* Production needs to be balanced with the capacity of the resource to regenerate, the ability of the environment to absorb wastes, and the demand for the product. Individual investments need to be balanced with market level production goals. Single processors must not be allowed to control the market unless primary producers have adequate negotiating clout.

Local product successes in many parts of the world show that smaller groups of producers can integrate multiple goals into the management of a natural resource economy. Local successes rely both on continued management discipline and on consumers' loyalty to these locally branded products.

Although not constrained to one locality, products certified as organic, sustainable, or fair trade also reduce the scale of the market to protect the new economy from the drivers of the wider commodity system. In this case, it is not the loyalty of consumers to the locale that makes the solution work, but the loyalty of consumers who desire a particular kind of production method.

All of these scaled-down approaches share a vulnerability. All of them, if they are successful, can grow to recapitulate the problems of larger commodity systems. People investing their energy into such programs will benefit from looking at the mainstream commodity economy and asking:

> When my local, green, product becomes successful will it be produced in other regions and compete in my market?
> Will any of us in this market turn toward consolidation to improve productivity?

Going local or certified is not guaranteed protection against these possibilities.

Global Agreement — Increasing the Boundary of the Solution to All the Players

For the many commodities that don't go directly to a consumer or that serve as raw materials for other products, it is very difficult to create a meaningful local identity. For such products the appropriate boundary of the solution includes all the producer communities that compete within the same market.

As markets globalize and producers from nations with differing environmental and social standards compete to sell to the same buyers, competition tends to reward those places with the least costly standards. The ability that nations once had to interject goals other than the pursuit of economic efficiency into natural resource systems is fading, and new international structures have yet to become effective.

The challenges at this level of coordination are great. Integrating social and environmental goals into the market system at the global level involves agreement across cultures and nations. But once implemented, these agreements have the potential to create a level playing field and would be the hardest to undermine.

There are signs that this is possible. At different times in history commodity producers from many nations have organized themselves to control their productive capacity. The International Coffee Agreement was one example of this. The OPEC oil cartel is another. Solutions at this global level will also require new multi-national bodies. Organizations like the WTO and Codex show us that such cooperation is possible.

Global cooperation is a huge challenge, but we can at least imagine a few first steps. Commodity producers can reach out to each other across national boundaries, forming associations to create enforceable production agreements. Governments can work together to come to agreements on global environmental and social standards so that the multinational reach of commodity buyers is balanced by multinational protection of social and environmental resources.

Economists and policy makers know how to do these things, experimentally at least. What is needed is the clear political will to produce our global sustenance in a way that ensures that future generations will be able to sustain themselves.

New Thinking — What Kind of Efficiency are We Pursuing Anyway?

This paper has described the core drivers of commodity systems. The harvests of many producers are combined and distributed through a supply chain to an often-global network of consumers. Commodity producers, processors and traders along the commodity chain continually reduce costs by increasing scale and by investing in more efficient technologies and practices. As multiple producers are able to reduce costs and increase production, prices tend to fall, pressuring the remaining producers to follow suit in order to compete. Such competition yields losers, company bankruptcies and farm losses. And it generates winners, most often those who can produce more volume for less cost.

And isn’t this how it ought to be? Isn’t this simply our economic system finding the most efficient ways to meet human needs?

The answer to that depends on what the word "efficient" means to you. If "efficient" means producing the most materials for the least cost of labor, materials, and capital then commodity systems continue to grow more and more efficient.

But the stories and examples in this paper demonstrate that striving to make commodity production more "efficient" in this narrow financial sense can cause the erosion of natural and community resources. The pollution of the Gulf of Mexico, the impoverishment of coffee growers, the crashing of fisheries — all of these unwanted consequences emerge from the pursuit of one kind of efficiency.

In the preceding chapters we have outlined structural changes to commodity systems. From supply limits to harvest limits to certification for best practices to tax and payments based on stewardship, these system-fixes are ways of expanding the goals of our natural resource economies to encompass more than the standard definition of efficiency.

Limiting supply to keep incomes stable, limiting harvests to protect the future supply of fish or trees, limiting technology to serve both of these goals — these are not efficient steps, at least not as efficiency is generally defined within economic systems. Instead, these are steps that declare that other goals, particularly sustainability and equity, are equally valid and equally urgent priorities of people at the beginning of the 21st century.

Supply control, technology limits, and harvest agreements are difficult to implement not only because they require broad stakeholder agreement, but also because such measures pull commodity systems towards a new kind of efficiency.

Does this mean that the pursuit of efficient use of labor materials and capital is wrong? Of course not. Adding new goals to a system does not mean throwing our old goals away. But it does meaning balancing goals against one another. There will be times when the best thing for nature will increase costs, or when relieving strain on a community lowers the amount of commodity produced. In sustainable commodity systems there will be gray areas. People will need to make value judgements and balance a range of priorities.

What kind of efficiency do we want? What goals do we want our natural resource systems to serve now and into the future? These are not always going to be easy or comfortable questions. Still, we must face the fact that changing commodity systems, as with all of the elements of the transition to sustainability, isn't just about new policies or new best practices. In the end it is also about changing the way we think.

The need to change the thinking of an entire industrial culture feels daunting of course, especially when time seems short and natural resource systems are in such peril.

On the other hand, the idea that human beings have broader goals than the narrow kind of efficiency now guiding most commodity systems, makes such basic sense that we may be surprised by its ability to penetrate into even the most stuck places within commodity systems. Perhaps it is an idea whose time has finally come.

The only way to find out is to experiment with this frame of reference in our efforts to revitalize commodity systems. This understanding, embedded in the right places, could move ideas like harvest limits and supply control from the radical fringe into the mainstream.

Creating truly sustainable flows of raw materials will require working together across lines that have rarely been crossed. Producers, buyers, traders, and consumers, from rich nations and poor ones — all of us will need to ask each other hard questions and listen to the answers.

> With what do we want our commodity systems to be efficient?
> And what do we want our commodity systems to produce efficiently?

These are not questions about system structure, certification protocols, tax policy or quota levels, although society's answers to these questions give shape to tax policy, certification protocols, and quota levels.

These are questions about values, meaning, purpose and responsibility.

Producers don't tend to ask these questions of traders or policy makers or consumers. Consumers don't tend to ask them of producers or commodity buyers or policy makers.

If we did ask such questions of one another, we might learn that everyone from commodity producers to buyers to consumers wants these systems to be efficient with land, water and soil as well as with labor and capital. We might see that all of us hope these systems could produce vibrant communities, biodiversity, clean water, and beautiful countryside as well as plentiful raw materials.

Once we reach such a shared and broadened definition of the efficiency of natural resource economies, we will find that the policies, agreements, and programs to create sustainable commodity systems have been in plain sight all along.

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