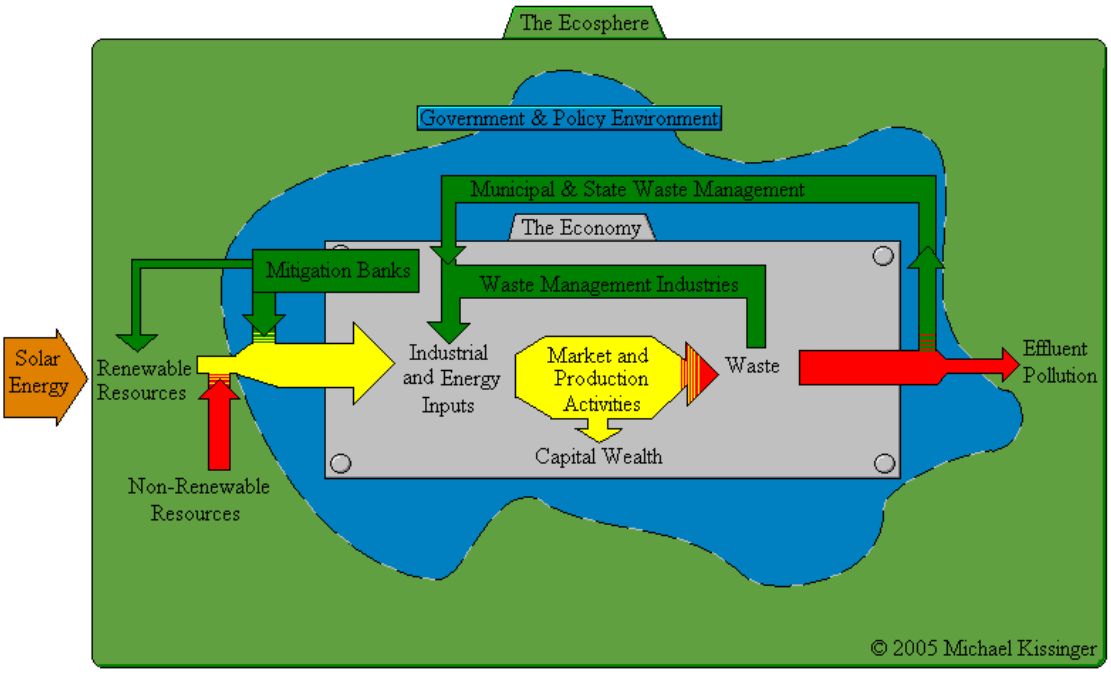
Green Production, Eco-Marketing and Sustainable Policies



By

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Table of Contents

1. Introduction

In the 21st century, there are at least three major resources that threaten to limit human growth. They are petroleum, fresh water, and arable land. While a shortage of any would have differing, and severe, ramifications for the human community, only water and land shortages threaten the very foundations of human civilization. Agriculture is the primary user of fresh water worldwide, and as such, the preservation of fresh water is closely tied to agricultural practices. When we add to this the fact that agriculture produces not only food but also fiber and myriad other products including, with the progress of biotechnology, fuels like gasoline, various chemicals, medicines, and non-petroleum plastic materials, it becomes pertinent to examine agricultural practices and how these techniques can aid or detract from efforts at human sustainability. Policies both from governments and in firms that act in the market are the primary tools with which these problems can be addressed.

By educating producers and consumers on sustainable practices, and overcoming obstacles to their implementation, sustainably produced goods and services can enter the marketplace, thus preserving a functional economy while mitigating environmental damage. Ensuring that supply and demand efforts work in concert will be essential; stimulation of consumer demand must coincide with appropriate supply side action. Conversely, supply-side efforts are likely to fail without adequate consumer interest, knowledge and motivation.

Behind the exchange of goods is the market. The intangible field where goods are valued and sold; on a small scale your local grocer is a representation of the market, or a market, but behind most businesses is an international web of exchange involving trade policy and bureaucracy. Here prices are set, restrictions are made and the first limitations are placed on consumer choices. Currently the market is focused on cheap efficient production, with little consumer attention paid to many attributing factors of the production. A market has been started that is concerned with the process and the out puts of production, it is titled the “eco-market.”

The eco-market is the one of the essential concepts behind this project; it consists of consumers who make purchases that support sustainability whether they notice it or not. Some consumers may purchase organic produce because they prefer the taste, but they are inadvertently supporting sustainability and the eco-market. It is one of our goals to identify the elements of this planned behavior through the implementation of a survey. The survey will be based on the Theory of Planned Behavior, which is used to break up a planned behavior into various elements that influence the end behavior. These include identifying their:

- Intentions behind the purchase: the why?
- The social influences on their purchasing: Has it been supported or discouraged by anyone?
- The consumers' attitudes toward the behavior: how do they feel about making purchases of this type?
- Perceived behavioral control: do they have the ability to, and how much do they control their decisions?

The reason these elements of decision-making have been highlighted is that our first major goal is to understand the green consumers' behavior. This method, developed by Ajzen, reduces the consumers' behavior and preferences into finite quantifiable parts. By breaking the behavior up into these categories it allows us to rank the different influences on their behavior and see which bear more weight than others in hopes of finding the best way to present the consumer information or alter his or her behavior to increase green consumption. By gaining understanding of an underserved expanding market that supports ecological concerns, it makes way for sustainably minded businesses to emerge and flourish.

This green consumer profile forms the base for the next step, an experiment on consumer information media. This second goal is to identify, using the behavioral influences we have deciphered, an optimal or effective way of displaying information to the potential customer. One of the things that drive green consumption is information. This information is likely to center about the life cycle of the product: how it was made? What is was made from? How did it get to the consumer, and what things were done to it

in the process? It is our goal with this media design experiment to assess the best way to present this information to a consumer, be it by:

- Using positive statements informing consumers of the benefits of green consumption
- Using negative statements about the by-products and results of "non-green" consumption
- Or using a mix of the two

To perform the media design experiment we kept the target in the same range as for the consumer profile, but instead of using exclusively green consumers, all consumers were polled. This was done in the Worcester Polytechnic Campus Center, giving us a similar demographic range as the consumer survey, but removing the target market scope specification. The survey and the experiment go hand in hand: the first identifies the market segment we seek to understand, the second works to isolate a major factor in its expansion. The information yielded about the consumer population is likely to be valuable in laying the groundwork for the sustainable economy.

In order to market goods, consumer demand must exist and producers must have economically viable means by which to procure goods. Creating an informed consumer base that makes mindful purchases is beneficial to the market, the individual, society at large, and the global ecosystem as a whole; increasing rationality in economic agents benefits economists and the environment alike. Sustainability, while largely an anthropocentric ideal, allows careful human economic growth to coexist with the biosphere upon which we ultimately depend.

Because agriculture is such a substantial and vital human activity, and because of its ever increasing utility, its sustainability should be a priority. Attempts to make agriculture more "green" must be approached not only from the consumer and market angles, but also from the government policy arena. While proponents of the "invisible hand" denounce government involvement in markets, history shows that in agriculture, this is largely unavoidable, and generally regarded as impractical. An analysis of farming policy, its effects on the market, and how these significant artificial effects might be altered to further green consumerism and sustainability will be included.

Farming policy has a long but relatively simple history. Government subsidies in U.S. agriculture are well entrenched, and support for sustainable practices is existent, but limited. After an examination of U.S. policies, we will broaden our discussion slightly, by examining policies and paradigms from other areas of the globe; particular emphasis will be placed on Cuba, whose bootstrap-style organic revolution shows that wholesale conversion to a green economic base is possible. Through a review of the history of farming policy, we will be able to discern the effects these policies may have had both on producers and marketers.

As the 20th century progressed, farms got larger and farmers became fewer in number. This trend of conglomeration and centralization appears not only in producer ownership, but also in market actors in conventional and green markets alike. We will discuss how this main pattern and other patterns in market activity can denote successes, failures, and unintended consequences of the implemented policies. Once an assessment of the regulatory and policy actions is available, recommendations to improve their sustainability and effectiveness can be made.

With a cohesive view of sustainable consumption, marketing and policy, we will be able to draw a clearer picture of what a sustainable economy might look like. The complexity of economic systems cannot be overstated, and therefore, as comprehensive a view as possible must be established. We will discuss interactions of the various elements of the market and describe how sustainability of the economy as a whole can be improved (ref. graphic on cover).

Finally, vision in hand, possibilities for the next steps toward sustainability can be explored. When weaknesses in the market and counter-sustainable activities and behaviors are isolated, alternatives and improvements will emerge that may offer the next generation of production, marketing and consumption paradigms. By basing economic measures on real wealth, and closing the cycles whose open nature exacerbates problems of wasted resources and energy, the future of human industry can begin to approach a sustainable scenario.

1.2. A Sustainable Economy

'Sustainability' is a buzzword, and an ideal; rarely is it a realistic goal or an accurate descriptor of a practice. Economists use it to describe a business that can turn a profit over extended periods of time; ecologists use it to describe practices that can continue indefinitely without degrading environmental conditions and biodiversity. The idea of sustainable agriculture has a relatively short history:

> The first reference point should be placed in the early 1980s , with the emergence of the concepts of regenerative agriculture (Rodale, 1983) and the articulation of sustainable agriculture (Jackson, 1980). The early concept has evolved into a construct of [production] based on principles of ecological interaction. It is referred to as an ecological definition of sustainability. This concept now forms the philosophical basis for most alternative agriculture groups.[1]

This definition appeals to the ecological community, but leaves much to be desired in a world where market economies are the major distributors of resources, and corporate entities are the basis of production.

> A second reference point is the increased use of the term sustainable, starting in 1987, to refer to a "stable" agriculture in the global sense, involving all faucets of [production] and its interaction with society.[2]

It is this second definition of sustainability that is useful to us in trying to assess the long-term viability of our farming and other production paradigms. It is therefore useful to define and examine the specific dimensions of sustainability, all of which are necessary if green production and consumption are to remain economically advantageous to all those involved, and the resources upon which it depends are to persist indefinitely.

1.3 Achieving Sustainability

The first and most basic check on sustainability is the physical constraints on the particular activity to be examined. Mining cannot continue where there is no ore, drilling

[1] Harwood, Richard R. A history of sustainable agriculture. Edwards, Lal, Madden, Miller and House, eds. Sustainable Agricultural Systems. C. 1990 Soil and Water Conservation Society. p. 3
[2] Ibid p. 3

where there is no oil, and logging where there are no forests. Inputs are obviously limited, but just as the larger ecosystem provides a source for most of the materials necessary for production, it also acts as a sink that absorbs toxins and other byproducts and wastes. Neither the source nor the sink capacity of the global ecosystem is unlimited, and therefore, as the scale of human activity grows exponentially, we must me prepared to examine the extent to which we are approaching any potential ecological boundaries to economic growth.

Within the macroeconomic system, there are artificial, but still very real forces that directly control an activity's viability within the market's boundaries. While study and understanding of these market forces is not severely lacking in government and academic circles, what is lacking is an integration of these ideas into the broader ecological context. Theories about unlimited "backstop resources" that will become economically viable as current resources become prohibitively expensive may offer some hope to optimists in averting shortages, but laws of thermodynamics dictate that all nonrenewable resources must ultimately be finite if waste is allowed to be prevalent.

Environmental economics is an anthropocentric field, meaning that above all else, it values humanity. Although inclusion of interactions between ecosystems and economies will undoubtedly be a boon for the environment, it is no guarantee that environmental quality and biodiversity will improve; in its infant stages, this new understanding of economic activity accounts for environmental damage and resource depletion that would otherwise be known as "externalities," but may often explicitly hold one species or ecosystem to be of more value than another, perhaps to the detriment of the latter. Nonetheless, leaving such costs uncounted is likely to be worse across the board for all areas and forms of life that are becoming extinct or threatened by human activity.

In the policy arena, there is much to be done in terms of environmental accounting. Tradable SO_2 credits are an example of a market-based system that has been fairly successful in recent years. While environmentalists may decry the idea that pollution is institutionalized, and thereby the object of some degree of approval, assigning (negative) value to pollution gives the much-needed economic incentive to polluters; suddenly, polluting less is worth money!

This approach was taken by the newly ratified Kyoto Protocols, which not only creates a pollution disincentive, but rewards forest-rich nations for acting as global carbon sinks. The United States' conspicuous abstinence from this measure (which began with Clinton's decision not to send the treaty to congress, where it was certain to fail) reflects the view, held by many U.S. policymakers, that the protocol would dampen U.S. economic growth. While this is an understandable stance politically, it seems likely, if one accepts the premise that a finite ecosystem cannot support consistent exponential growth of its economic subsystem, that at some point economic growth will necessarily slow, and perhaps, reach a steady state where growth is not only impossible, but unnecessary.

In his book *Beyond Growth*, Herman Daly paints a picture of such a sustainable economy, positing that, "once that point is reached, production and reproduction should be for replacement only. Physical growth should cease, while qualitative improvement continues."[3] Daly is clear to contrast economic development and economic growth: the former being a question of wellbeing and technological progress, the latter being a question of the scale of enterprises and total throughput of materials through the economy.

By using entropy (a relatively un-biased term, borrowed from Georgescue Rogan's Solar model) as his basis to define the value of resources, he is able to simultaneously categorize the usefulness of resources and waste products in terms of economic potential. Materials with highly organized energy (low-entropy) are more useful, and are generally the products of an ecosystem that has converted sunlight (the only unlimited energy input to the earth) into some useful resource. Materials with high entropy tend to have little value, and generally end up as waste. One defining characteristic of an unsustainable economy is that it tends to consume low-entropy materials and expel the resulting products, with higher entropy.

Entropy is a good theoretical way to assign value to materials, because it also allows us to assign values to ecosystems like forests, wetlands, lakes and rivers. If we suppose that coal (energized carbon and the remnants of ancient plants which absorbed solar energy) has some positive value, and the results of its use, mercury and atmospheric

[3] Daly, Herman E. Beyond Growth. C. 1996 Herman E. Daly. p.3

CO_2, are assigned negative values, then by estimating the propensity of various ecosystems to absorb or otherwise neutralize these pollutants, they can be measured and evaluated for economic-ecological merit.

So far, we have discussed sustainability and its relation to the environment and the economy, but we have spent little discussion on how these ideas might be integrated into or materialized by government policies. On all levels of government, there are already some efforts: municipal recycling, state hazardous waste management programs and federal soil conservation subsidies just to name a few. These approaches, while certainly concrete and positive, are limited because they are piecemeal approaches to the symptomatic effects of the current economy. If complete sustainability is to be achieved, a broader scope must be developed federally, so that the holistic nature of economic and environmental interactions can be understood.

Recycling is an excellent example of the incorporation of ecological principles (where waste of one organism is re-used by another member of the ecosystem) into the human economy. By contracting waste management to private firms, some municipalities have contributed to a market sector that is fundamental to sustainability. With the advent of "pay as you throw" systems where special trash bags are required for pickup, some cities have effectively implemented a household waste tax. It is not difficult to envision more technologically complex systems where residents held accounts that were charged for waste disposal and credited for properly prepared recyclable materials. Such an initiative may be too granular to implement fully on a nation-wide level, but federal frameworks can be established so that local governments could have an array of options tailored to their demographics and geography such that recycling waste becomes not only a profitable industry, but also a substantial supplier of resources.

Additionally to this, in order to promote consumption of recycled goods (or any sort of goods or services that are considered beneficial to society or sustainability efforts) that might not be as profitable or inexpensive as those which require virgin resources, taxes and subsidies could be implemented. A program where unsustainable or otherwise unfavorable practices are penalized monetarily and the proceeds are used to support alternatives is known as a "fee-bate" program. The idea is that by adding artificial economic costs, as approximated facsimiles of the "real costs" (in resources as opposed

to money), we can promote alternative development before scarcity of resources or energy drives prices up so far that technological innovation, itself part of the solution, is impeded. By subtly manipulating markets, it is possible for the federal government to foster growth and innovation in a burgeoning industrial sector while simultaneously offering incentive to shift away from unsustainable consumption practices.

Economists may scoff at the suggestion of such tampering; claiming that the "invisible hand" works to solve such problems on its own, and that government intervention only hinders its work. While it is difficult to deny the efficiency and importance of markets, it is crucial to keep in mind that their allocation of resources is driven by monetary optimization. There is no concern in the workings of the market for human or environmental health, the degradation of which can in fact often have secondary effects that boost gross national product. Sustainable economics, rather than registering positive effects from treating the symptoms of social and environmental ills, looks to the sources of problems and creates incentives to eliminate their causes.

Already, governments levy taxes on employment and consumer spending, which are both generally regarded as good for the economy, while at the same time distorting the agricultural markets with price supports and conservation subsidies. Why then, one might ask, do we not shift the tax burden from things generally regarded as beneficial, to those like pollution and unsustainable resource use, which detract from quality of life? Such programs would do humanity a great service by tying currency to something real and material besides precious metal: human health and ecological capital.

Some of the precedents for such government intervention have already been discussed. State bottle and can deposits are so effective that in the city where I attend college, discarded containers are unlikely to remain on the street overnight. This market-based approach, in addition to creating viable commercial recycling operations, serves to keep the streets clean and provide a marginal, but not inconsequential income to poor and homeless individuals who might otherwise be completely destitute. This serves to illustrate an important point that corresponds to economic thinking: if there is an incentive to carry on an activity, someone will do it, even if it is not an organization or business. Sustainable development necessarily entails creating these incentives so that the invisible hand can be guided by what is of actual value.

A transition to complete sustainability may yet be a long way off. It is unlikely that humanity will one day wake up to discover that they are no longer outliving their ecological limits; instead the transition will be gradual, and may remain a constant evolution, rather than a final steady state. Because of the enormity of the problem and the relative lack of data, it is impossible to know exactly how far we are from sustainability. Nonetheless, it is never too early nor is it ever too late to address the problems we may face in the future. Ensuring, or at least working towards sustainability is a goal that should be common to not only environmentalists and economists, but also to those concerned with national security, those in industry and even the consumers and citizens who wish to leave their descendants with a world that is rich with health, happiness and resources in addition to money and goods.

National attention is required for these matters. While international accords may create frameworks from which to work, the vast majority of governmental power lies in the nation-state. Differing government policies will provide experimentation, and may be necessary depending on economic and geographic conditions. The United States, a major focus of economic activity, is responsible for a disproportionate amount of resource and energy consumption, and therefore it is well-within U.S. interests to bring this substantial clout to bear in pushing for sustainability worldwide. The U.S. federal government is in a unique position to pioneer sustainable policy, which will not only benefit humanity and the nation in the long run, but will also promote the image of the U.S. as a conscious and responsible global citizen.

2. The Current Market

The promotion of destructive consumption is a problem. Constantly, consumers are sent messages by companies encouraging them to buy things that will solve their problems, be they acne, depression, boredom, etc. Firms encourage this consumption whether the consumer needs it or not. This results in the use of natural resources that could be saved or applied to more meaningful uses; these resources are in essence being wasted. Currently the methodology of reaching consumers has received great attention due to the growing availability of mediums, or channels, which make nearly everyone subject to constant commercial messages. Through an understanding of this market, the nature of green consumers and the promotion of green products, we hope to offer strategies that further sustainability though marketing techniques.

The current market views all people as potential customers. This is due to the omnipresence of marketing efforts. The American Marketing Association currently defines marketing as "the process of planning and executing the conception, pricing, promotion, and distribution of ideas, goods and services to create exchanges that will satisfy individual and organizational objectives." This promotion of goods to satisfy the individual and organization in a "free-market" has turned producers into hunters and consumers each into targets, as they are potential consumers of the product. These hunters realize their limits; they dare not try to hunt duck with the same tools they would a bear. Marketers need to use specific tools to capture specific target consumers, or larger target markets.

Each person is part of a target market in some way. A target market is "a group of potential customers toward which a firm directs its marketing mix."[4] This marketing mix is a collection of methods and messages used to bring information to a potential customer's attention and in the hopes of the firm, effect the potential consumer's consumption. Target markets can be segmented by many different attributes, from demographics, areas of interest, areas of business … etc. In this survey, the target market is comprised of those who make green consumer decisions. We insured the target

[4] Marketing Principles and Best Practices 3rd Edition Thomson South Western 2005

consumer's participation by conducting the survey with the campus group GAEA, Global Awareness of Environmental Activities making this a select sample. Due to their efforts to join an organization focused on the environment and sustainability we made the assumption they would be most likely to have come across current green marketing campaigns and efforts.

Key Focus areas in marketing are:

- **Product :** Item, Service, or object of transfer
- **Price**: **VALUE, WORTH**, the amount of money given or set as consideration for the sale of a specified thing.
- **Promotion**: the act of furthering the growth or development of something; *especially* **:** the furtherance of the acceptance and sale of merchandise through advertising, publicity, or discounting
- **Distribution:** the position, arrangement, or frequency of occurrence (as of product purchase and use) over an area or throughout a space or unit of time

These elements are commonly referred to as the marketing mix. They set a product's position in the market, relative to competition. The power of marketing is shown not only by the increase in overall consumption but reflected in the investments companies are making into their marketing campaigns and departments. An example of spending in marketing and its result on the market is shown in the marketing of prescription drugs. Merck's ad Budget for the prescription drug Vioxx topped both PepsiCo's spending on Pepsi and Budweiser's budget for hyping beer. TUFTS doctors opposed this large spending by drug companies on marketing their most profitable drugs not the most necessary ones. When a company invests this amount into an advertising campaign it increases demand for products, in turn increasing the cost of prescription medication for everyone. Some of the drugs have the same effect on patients as medication that would cost them ten times a day less instead. The visibility of their products produces sales results.[5]

[5] WellFeature Tufts Health Plan Spring 2002 p. 10

It seems that the idea of "a need" creates the need itself. This is true to the market and there is an emerging sector: the eco market, which offers a group of products that have a goal of supporting sustainability in a consumer society. These items range from organic produce, which decreases in the degradation of soil, to biodegradable cleaning products that do not create harmful wastes when used. The idea behind these products is that there are consumers who care about the results of their consumption, as well as quality and price of their products.

The basis of the marketing system is "Groups take part in an exchange process, 'process by which one or more parties give something of value to each other to satisfy perceived needs.'"[6] The needs that are being addressed by the producers are consumer's perceived need for everything from food to chemicals. The groups we are looking at in our survey are green consumers and green producers so that the green producers can gain the ability to inform and penetrate their target market. To do so we decided to look specifically at the behavior of green consumption.

2.1 Theory of Planned Behavior

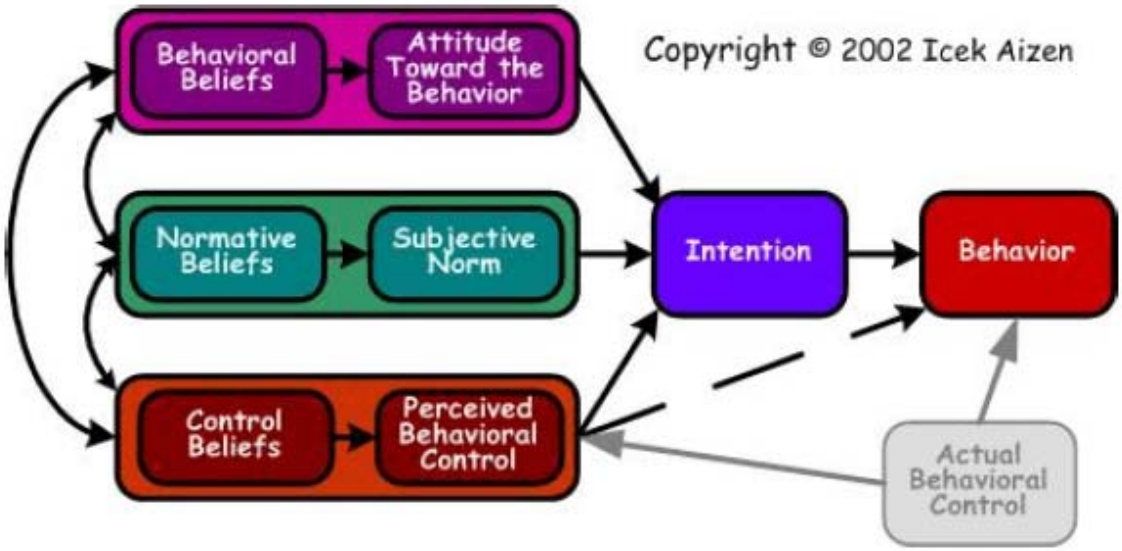
The first step was to define the question or problem we were looking to solve; this question being how the planned behavior of "green consumers" is influenced to be "green" and why? Also sought are the elements of the behavior that we could in some way quantify and alter given the correct set of marketing tactics. Before starting to discover the attributes of a green consumer we must decide on a definition of what a green consumer is; let us suppose a "green consumer" is someone who "considers the consequences of consumption and attempts to minimize the demand placed on the biosphere, whenever they decide to consume."[7]

Once the goal is isolated, it becomes time to select questions, and a format by which to interpret these results. We selected Azjen's Theory of Planned Behavior questions, forms, and techniques to collect the data. Azjen's Theory of Planned Behavior was chosen for this project for several reasons. Because our goal was to identify the motivation, or the cause behind green consumption, it was important to be able to break

[6] Marketing Principles and Best Practices 3rd Edition Thomson South Western 2005
[7] Definition taken from http://utopia.knoware.nl/users/oterhaar/greens/america/consumer.htm

down and analyze different aspects of behavior, in this case planned behavior. With the model created by Ajzen, the different elements of planned behavior can be isolated and identified using the proper questioning technique. Behavior is broken up into three base beliefs.

The behavioral beliefs are the beliefs held by a person about a behavior and its outcome. Normative beliefs are conceptions about what others think and or feel about an action and a person's regard for how others think or feel. Control beliefs are about the amount of control a person feels he or she has over a situation or making a decision. These beliefs all interact with one another and form an individual's "attitude toward the behavior," a "subjective norm" which is an individual's level of perceived social pressure, and a "perceived behavior control," a measure of how much influence a person has over a particular behavior. This mix of influences forms an intention, which leads to a behavior, or a planned behavior. In this specific case we are identifying these elements and their effect on green marketing and sustainability.



3. Survey Design

The goal of this survey is to identify:

- Intentions behind green consumer purchase: the why?
- The social influences on their purchasing: Has it been supported or discouraged by anyone?
- The consumers' attitudes toward the behavior: how do they feel about making purchases of this type?
- Level of perceived behavioral control do they have the ability to, and how much do they control their decisions?

For reference purposes the survey can be found in **Appendix A**.

Questions 1-3

Ask the subject to mark the percent of his or her consumption that is "green" in the fields of use of recycled paper, organic produce purchase, and bio-degradable/earth friendly cleaning products. These questions give the first look at the amount of "green consumption" the participant takes part in. It is broken down into these three areas to try and disseminate if they have a stronger feeling toward one of these fields.

Question 4

Has the participant to rank his/her green consumption by selecting a statement, as opposed to a percent. This built in redundancy can be used to compare the results submitted for the first three questions. For example if the participant marked she consumed 75% recycled paper, 50% organic produce, and 75% bio-degradable/earth friendly cleaner and then checked the line next to "_____ A number of times, but less than half" on the sentence question it would be obvious the data lacked congruence. Also asking the participant to make a numerical assignment and one in the form of a statement could touch on different levels of awareness.

The next set of questions addresses purchase made in the past month. By setting a period of time for the participant to consider, results are more grounded giving the subject a time period to think about instead of the complete history of their consumption. The opening question of this section forms almost a third redundant connection with the first three and fourth. The only change is now the survey is setting a time frame.

Questions 5 - 8

To measure the intent of the consumer, the survey next asked the participant to rank the likelihood of the following statement on a scale from one to seven. “I intend to make purchases that support ‘green consumption’ in the forthcoming month.” To measure the willingness of the consumer, the survey next asked the participant to rank the truth of the following statement on a scale from one to seven. “I will try to make purchases that support ‘green consumption’ in the forthcoming month” To measure the planned behavior of the consumer, the survey next asked the participant to rank their level of agreement with the following statement on a scale from one to seven “I plan to make purchases that support ‘green consumption’ in the forthcoming month.” By breaking the question up into its different parts, intent, willingness, and future planned behavior the subject is revealing different elements of their behavior.

Questions 9 - 13

The participants were then asked to look at the statement “For me to make purchases that support ‘green consumption’ in the forthcoming month is” and mark on a seven-point scale the position that best reflected their feeling between “green consumption” being Harmful/beneficial, un/pleasant, bad/good, worthless/valuable, and un/enjoyable. This lets the subject express the feelings they have associated with the purchase, and gives insight into what needs to be changed or played up to make the subject consume more of those products.

Question 14

The next questions focus of the social impact and the effects of other peoples views on the participants “green consumption.” The first question in this section asks, most people who are important to me think, “I should not” / “I should” make purchases that support “green consumption.” Again a seven-point scale is used to determine the

level of agreement with the statement. This shows us the level of acceptance “green consumption” has gained with the participant’s friends and family.

Question 15

Following the identification of the level of social acceptance displayed in the previous question is questioning the level of expectation placed on the participant. It is expected of me that I make purchases that support “green consumption” extremely unlikely / extremely likely. This uses the same seven-point scale

Question 16

“The people in my life whose opinions I value would disapprove / approve of my making purchases that support ‘green consumption.’” This question shows us the level of approval green consumption has gained with people important to the participant. It differs from the “I should not” / “I should” make green purchase is the sense that there is a difference between someone thinking something isn’t the best idea, and disapproving of it. The disapprove / approve seems to carry a greater level of judgment and hold more weight in the mind of the participant.

Questions 17 and 18

The next question asks the participant to rank the level, on a scale from one to seven, which people important to them support or act as “green consumers” themselves. The form of the question is “Most people who are important to me make purchases that support ‘green consumption’ completely false / completely true.” This gives information regarding the support and level of “green consumption” the participant is exposed to socially. If a person has many friends who support green consumption it is more likely they will consume green. To follow this up the statement “The people in my life whose opinions I value (do not / do) plan to make purchases that support ‘green consumption’” is used to differentiate people who are important to the participant and people whose opinions they value.

Questions 19 - 22

Another important variable to identify is the feasibility of the participant to consume green products. To open up this section the survey asks “For me to make purchases that support ‘green consumption’ in the forthcoming month would be impossible / would be easy.” This lets us know the level of difficulty to the participant in

making “green consumption” decisions. Next we identify the ability of the participant to make purchases by the participants rating of the statement “If I wanted to, I could make purchases that support ‘green consumption’ in the forthcoming month definitely false / definitely true.” Building off of the “If I wanted to,” part of the last statement, the next, “How much control do you believe you have over making purchases that support ‘green consumption’ in the forthcoming month? No control / complete control” tells us the level of control the participant has over what actually ends up being purchased. “It is mostly up to me whether or not I make purchases that support ‘green consumption’ in the forthcoming month strongly disagree / strongly agree.” This rating is used to identify the perceived level of input control of the participant, as well as serve some redundancy for the earlier questions.

Question 23 -25

These questions were write-in questions asking the participant to write the advantages and disadvantage of their green consumption as well as any other associated feed back. The write in questions offer participants a chance to express feelings not listed in pre-selected statements or ranking brackets.

Questions 26 and 27

An interesting part of Azjen’s Theory of Planned Behavior asks the consumer to make some insight into the result of a proposed action. It starts by asking the participant to rank the likelihood of the result of an action. In this case, “My making purchases that support “green consumption” in the forthcoming month will increase the amount of nutritious food that is in my diet.” This gives us a view into the consumer’s expected or ‘preconceived’ outcome of the decision. To follow this up the participant ranks the benefit of eating more nutritious food on a scale from one to seven ranging from very bad to very good.

Questions 28 - 30

The next section is a yes or no section, where the participant is asked about other individuals or groups that come to mind and whether they would either approve or disapprove of green consumption. As well as if any other groups come to mind when thinking about green consumption.

Question 31 – 33

This is a second set of write in questions it focuses on factors or circumstances that would enable the participant to make purchases that support “green consumption” in the forthcoming month. Again the write in technique is used to collect information that may escape the pre selected form.

Question 34

Is a yes or no question asking participants if they are willing to trade off large portions for smaller more nutritious organic portions. This trade off of quantity for quality is a trait we wish to capture in the green consumer.

Questions 35 -42

These question sets identify whether participants were willing to participate in a trade off between their current product, or a standard industry product and one that supports sustainability. First the participant is asked to rank their willingness to partake in the trade off. Then participants are asked to rank using numbers from 1, being the most important and up for less important factor in their decision.

Questions 43 - 45

The last section of the survey addresses organic and natural product awareness and identification ability. Asked the participant to rank how well had distinction been made between organic and natural products. The follow up was a yes or no question asking if the participant had sought out information about the differences them self. To complete this inquiry the participant was then asked to rank the level of difficulty in finding additional information.

Questions 46 and 47

A concern had been raised that the packaging distinction for USDA organic and natural products wasn’t clear enough, so participants were asked if they thought it was, in the form of a yes or no question. To capture the level at which the participant viewed the clarity of the label they were asked to rank it again on a seven-point scale.

Questions 48 - 50

The participants are then asked if they would be interested in more, easy access information. This question confirms or disproves an interest, where the next question asks them to rank their level of exposure to the benefits of being a “green consumer.” This

provides background for the next question, concerning whether or not retailers of organic products should have information posted in stores.

Questions 51 and 52

The next two questions are put in to get an idea of the feeling about the participant toward their surroundings. It asks them to rank their feeling of connectivity first between their self and environment and secondly between their health and the health of the environment.

Question 53

To capture the willingness to pay more, for green goods, participants are asked to select the percentage they would be willing to pay more for products that support green consumption.

Questions 54 and 55

The next set of questions are paired for redundancy, by using different phrasing the participant is asked to rank their fulfillment with their "green consumption" in terms of satisfaction and feeling worthwhile

Questions 56 and 57

These two questions were set up to gauge where the participant is and where they would like to be. If it is shown that consumers rank their current consumption at a level of 3 and wish it to be higher, then there is room for innovation and problem solutions in making this desired product more available.

Question 58

The last question is left very open ended; it is with this question we want to catch the participants' response that didn't fit into a response to earlier questions. Asking them what turned them to green consumers will identify the channels and methods that could be used to create more green consumers.

3.1 Survey Implementation

In the implementation of the survey and the collection of data assumptions were made. The group who would provide the consumer response to the survey was "GAEA" the school's environmental group. We assumed that due to their self-selection in joining this group due to environmental issues concern and interest that from them we could

collect a profile of a "green consumer." The group is known on campus for managing recycling drives as well as fund raising to bring guest speakers to the school to address environmental and social issues. Age is another factor that comes into play; the people questioned in the survey were all college undergraduates ranging in years from freshman to senior; the age range is 18 – 22. The survey was administered at the group's weekly meeting, suggesting that environmental matters may be already in their minds or in their agenda. An added important factor is that they all attend a private technical university in the North East.

The survey was implemented in the WPI Forkey Conference room, on Monday, February 7th 2005 in the Harrington auditorium. There were 12 GAEA members present who participated in the survey. Due to the fact the participation in the survey was voluntary we provided snacks and refreshments for the participants. Many participants commented the survey was long, but all were very cooperative.

3.2 Green Consumer Profile (Survey Analysis)

The survey has given us greater insight into the mind of the green consumer. What follows is an outline of the identified aspects of green consumption, according to Azjen's Theory of Planned Behavior. (**Note: A copy of the raw data can be found in Appendix C.** All conclusions are based on our sample group; results may vary over demographic range and/or geographic area.)

Our goals again were to identify:

- Intentions behind the purchase: the why?
- The social influences on their purchasing: Has it been supported or discouraged by anyone?
- The consumers' attitudes toward the behavior: how do they feel about making purchases of this type?
- Level of perceived behavioral control do they have the ability to, and how much do they control their decisions?

Behavioral beliefs of the green consumer:

Green consumers see added value in nutrition and environmental sustainability in products. They see value in reducing larger portions for more efficient smaller portions. Green consumers are willing to pay more for products that offer them these qualities. Currently green consumers are on average satisfied with the quality of green products. This, combined with their normative and control beliefs, gives them a positive attitude toward the behavior. Respondents claimed to be extremely willing to try new green products. Also green consumers had only positive connotations associated with green consumption behavior, including showing past satisfaction, as well as expected future satisfaction.

Normative beliefs of the green consumer:

Green consumers that receive support from friends and family are more likely to continue to consume green, as well as expand their green consumption. Green consumers don't see their behavior as widespread but they individually see value in it. Overall despite green consumption's not being a mainstream trend, support within families and social groups is strong, and a seemingly powerful influence. This behavior may be one handed down in families, where the individual is exposed to those who are concerned with their consumption's effects on the ecosystem. This care and mindfulness then continues to be spread. Respondents noted that some of them felt as if they were expected to make green consumption choices, although this was not as atrong with certain individuals.

Control beliefs of the green consumer:

Green consumers believe they have a moderate level of control over their consumption of green products; the main factors limiting their consumption are price and availability. Green consumers would like easier access and expanded availability of green products. In places that lack providers of green items and services the individuals perceived behavioral control is lowered. If a green consumer wants organic peanut butter, but they are in a city without an organic food store, this would have a major impact on perceived control. This response indicates a lack of penetration of organics and green products into the mainstream; this not only hampers green consumers' ability to satisfy

their desire to be green, but also prevents potential green consumers from trying new products.

Intention:

The intent of green consumers is to consume sustainable products. Over numerous trials and numerous situations, environmental sustainability was marked in the top two factors when making a decision. Green consumers also noted awareness between their health and the health of the ecosystem. It is the goal of the marketing community to take this intention, make it grow, and turn it into a behavior, specifically consumption. There are holes with in the eco-market. One of the main complaints of green consumers was the limited availability of green products. As green consumers they cannot make green consumption choices unless there is a product present and in many cases there isn't. The other complaint was the price. High prices that are the result of internalizing economic costs are not only a hindrance to green consumers, but a deterrent to would-be green consumers as well.

Survey Response Break Down:

Questions 1-3

The three percentage based questions opening the survey, ask the subject to mark the percent of his or her consumption that is "green" in the fields specifically of recycled paper, organic produce purchases, and the purchase of bio-degradable/earth friendly cleaning products. These three categories break down the fields of green consumption. When asked to rate the percentage of paper products purchased with recycled components the average percent of paper products used recycled paper products were 50% of use. When asked to rate the percentage of the produce they purchased that was organically grown 25% was the average percent of produce that was consumed. The percentage of cleaning supplies they used that were biodegradable 50% was the average use rate of biodegradable to non-biodegradable. The amount extra participants would be willing to pay for green products was ranked on average at 20% according to the closing redundancy check question. The raw data broken down by respondent is in Appendix C.

Questions 4 and 5

These questions ask the participant to select a statement that properly labels their green consumption. The time frame of the past month is imposed as the current focus and participant are asked to consider green consumption in that time period. When asked how much of their consumption was green the average reply was a little over half. This question also serves as a form of redundant check to see if the green consumption broken down into categories matches the consumers overall consumption. This check showed consistency in participants' responses, as both the two averages are close, between 50%, 25% and 50% being labeled as a little over half. (Note when calculating the %'s numbers were rounded in individual trials results, but to form a more accurate total, the numbers were not rounded. Also, all rankings are done on a seven point Likert scale unless otherwise noted)

Question 6

The measure of the intent of the consumer to purchase green products was measured next. The survey asked the participant to rank their intent to make green purchases in the next month, on a seven-point scale. The average intent was ranked at 5, showing that consumers had an above average level of intent to purchase green products.

Question 7

The "willingness to try" of the consumer was next being identified on a scale from one to seven. The average willingness to try was ranked at a 6 (6.3), which shows that green customers are more than willing, nearly extremely willing to try to use more green-marketed products.

Question 8

To identify the level of planned behavior of the consumer, they were asked to rank the amount they agreed with the statement "I plan to make purchases that support 'green consumption' in the forthcoming month." The average ranting in this was 6. (5.67) Identifying different parts, intent, willingness, and future planned behavior of a subject in relation to the behavior one wishes to effect gives quantitative measures of where information and motivation are lacking. These results made it clear that the sample group has an above average intent to make green purchases in the next month. They have a high willingness to purchase them, which shows they are interested or see benefits in them.

Question 9 -13

With the elements of planned behavior involving green consumption coming to light, capturing the associations or feelings related to it by consumers is important. To ascertain this, consumers were asked to relate the following polarities to green consumption, the polarities being: Harmful/beneficial, un/pleasant, bad/good, worthless/valuable, and un/enjoyable. This section made it clear that green consumption had an overwhelmingly positive connotation among green consumers. The average ranking of each was over 6, showing that all respondents linked green consumption to positive poles not negative ones, affirming the result that they see value in what they are doing and are please with its results.

Question 14 and 15

The social impact and the effects of other peoples' views on the participants "green consumption" is the next item to be identified. The level of acceptance "green consumption" has gained with the participant's friends and family is measured next to see if perhaps other people view of the behavior prevents the respondents or restricts the respondents from performing it. The average for the first inquiry regarding "people who are important to me" yielded a 5, showing support for green consumption is a little above average among those who are important to the target green consumers. Next was the identification of the level of expectation of the respondent to consume green products. This question showed had an average of 4 (3.92), which reveals that slightly over half of the respondents felt it was **expected** of them to purchase green products.

Question 16

A semi-redundant question, "The people in my life whose opinions I value would disapprove / approve of my making purchases that support 'green consumption." is asked to check the consistency of respondents but also to allow room for judging an unseen influence, the phrasing is changed to catch any difference in cognitive thinking. The average score of this was 4 (4.3). This shows a small change from the first question but shows that consistency is still present.

Questions 17 and 18

The source of green consumption could be the influence on planned behavior from ones parents, friends or siblings being green consumers. When asked the average response was a 4 (4). This shows that a majority of the respondents have friends and or

family that are green consumers. The following question is used as a redundancy check of the pervious question. The average response to this question was 4 (4.3). Keeping this in mind it is safe to say that most green consumers are exposed to green consumption when with friends and family, however it may not be constant or intentional.

Questions 19 - 22

If the consumer wanted to make green purchased could they? If the consumer wants to buy a product but is unable to this does nothing for the market. When asked about their ability to make green purchases the average response was 6 (6.03). This shows that the participants have the ability to make green purchase if they so choose. Following this line of questioning the question of the participants control over making green purchases was asked next; to place a quantitative measure on the participant's level of perceived behavioral control. The average response was a 5. This shows that participants on average feel that they have control over their ability to acquire green products. This is checked by the next question by redundancy. The average score for the redundant check is 5 (4.75). This affirms that the participants have a feeling of perceived behavior control. It must be noted that participants wrote in that due to the meal plan in place at school they have less control then they normally would.

Questions 23 – 25

There were seven questions that asked the participants to write in responses to a question. These were the first set. The first of these asked them "What do you believe are the *advantages* of your making purchases that support "green consumption" in the forthcoming month?" For a response to this question there was an underlying trend of consumers seeing their purchases as their effort to aid in sustainability, a few mentioned a feeling of "peace of mind" or "less guilt."

The next question in this line asked the same question just referring to the *disadvantages* of making green consumption purchases. Every participant mentioned something regarding the cost of green consumption being too high. Participants noted that they knew they were investing their money into what they saw as a good cause, supporting a good industry. There was also many mention of the limited availability of green products, and when available the limited vendors and product line width and depth.

One respondent made mention of investing heavily in the green consumption sector of the market to increase the number of product vendors, to decrease the cost.

Question 26 and 27

The participants' insight into a green consumption situation was next examined. The participants were prompted about the positive effects of eating organic produce. They where then asked to rank their belief in the amount of extra nutrition received from eating organic produce. The average response was 5 (5.45). This shows that consumer see an increased value in the nutrition provided by organic produce. The participant was than asked to rate the importance of eating more nutritious food to them. The average response was 6 (6.3). This shows that the participants highly value eating more nutritious food, and they realize that this desire can be met by consuming organic foods.

Questions 28 - 30

All participants responded that both had people in their lives who approved of green consumption about half had someone in their life who disapproved of their green consumption.

Questions 31 – 33

Participants were asked to write in response about things that would aid in their consumption of green products, as well as the things that restrict or prevent it. In this section many reoccurring things were highlighted. First of all, every one of the participants mentioned that if the prices for green products were more affordable they would be able to purchase more of them. A restriction noted was the limited availability of green products. Many participants responded that if they had consistent transportation to the local Whole Foods or other green super market they would increase their consumption. Over all the major items that arose were: limited access to the places where the goods were available and the lack of information about them, as well as the comparatively high price.

To follow this up, the participants were asked what factors would make it difficult or impossible for them to make green purchases. The need to search out a store and products in general was mentioned as raising the need for increased availability. Cost again was mentioned, mainly in the context of other products being on sale or cheaper, as well as the participant's lack of funds.

Again a question was asked to make sure no feelings or issues were left undressed in the form of "Are there any other issues that come to mind when you think about the difficulty of making purchases that support "green consumption"? The responses to this question included concern for fake "green" products and lack of awareness of them. Also mentioned was uninformed consumers view of green consumption being "stupid" or "a scam."

Questions 34 - 37

Respondents also all noted that they were willing to sacrifice large portions of less nutritious food for smaller portions of more nutritious organic food; this was followed by the participants' ranking of the decision-making factors. In this decision situation participants said that environmental sustainability was on average the number one concern. The second was the taste followed by price then nutrition. The willingness to sacrifice the larger wasteful portions shows insight into the value of food, as well as the green consumers willingness to sacrifice.

The ranking of environmental sustainability as number one may be influence by the situation that the participants were put into. To test this the following question asked them to rank their willingness to pay more for a product that supports green consumption, the average willingness ranking was 5 (5.3). This shows that the group is willingness to pay is high. When asked to rank the factors involved in making a decision about purchasing produce there was a tie for the top ranked item between nutrition and environmental sustainability. The next highest concern was price followed by taste, concerns about the use of pesticides followed and last was concern with genetic modification.

Questions 38 and 39

The next focus was placed on cleaning products. Participants ranked their willingness to pay more for a green cleaning products, and the average willingness was 5 (5.1). To dissect the decision we had the participants rank the factors of their decisions. The number one concern was the quality of the product followed by sustainability then price. This shows that the overall concern with the cleaning product isn't the waste it produces but its ability to serve its cleaning function. Allergies and availability were two written in factors.

Questions 40 and 41

Energy was the next area of focus. The willingness of the consumer to pay more for green energy was ranked at 5 (5.3). The number one concern was environmental sustainability followed by quality of service then price.

Questions 42 and 43

The participants willingness to pay more for meat that was raised and feed according to humane conditions was ranked at a 6 (5.8) When asked to identify the factors in the decision the order of importance was price, ethical treatment, environmental sustainability, nutrition, then taste. Three of the participants did not fill out this question because they are either vegetarians or vegans.

Questions 44 - 46

For consumers to identify their consumption as organic they rely on the products labeling. The distinction between organic, natural and made from organic products was ranked 3 (3.5). This shows that the distinction is not overly or adequately clear to consumers. Nine out of the twelve's respondents looked for information on their own. This shows that information isn't being displayed to them directly about this sector of the market and its products. Those who looked found finding information with time, the easy of finding information was ranked at 4 (4.1).

Questions 47 - 51

Participants noted that the distinction of green products was not well marked: when ranking the clarity of the marking of ecological products, participants gave it on average a 3 (3.29). All respondents also said they would like more easy access information on green consumption. Participants ranked their awareness of the benefits of a green lifestyle at 5 (4.9), but all said that they though stores that vend green products should have in the store more information about them.

Questions 52 - 56

One of the questions connected to this survey was the understanding of the participant's views of sustainability. When asked how strong they perceived the connection between them and the environment to be the average was 6 (6.1). Participants ranked the connection between their health and the environments at a 6 (6.1). These two statements reflect the participants understanding of the implications of sustainability and

the reasoning behind the eco or green market. Respondents rated satisfaction with green purchases at 6 (5.9). They also for the most part found their green purchases to be worthwhile.

Questions 57 and 58

Participants were asked to rank their current level of green consumption and their ideal level. Current consumption was ranked at a 4 (3.8) and their ideal level was set at 7 (6.6). This shows that participants would like to consume more green products if they were more fitting to their lifestyle. Showing the prospect in the eco-market.

Question 59

The survey is closed with a question asking participants what turned them into a green consumer. This question was designed as a blanket question, to catch any underlying feelings, or thoughts that couldn't be captured anywhere else in the survey. There is little overall correlation in these answers, but a majority of them address social, environmental, political and health concerns.

The green consumer values information about the products they purchase. They wish to know: How it was made? What it was made of? And what the consequences of its use are on themselves and the environment? Currently green consumers feel that packaging lacks clarity and distinction. This is disrupting their flow of information. Green consumers are also concerned about the prices they are paying for goods; although they are willing to pay more to increase sustainability, they have their limits.

4. Medium Design Experiment

In “eco” or green marketing, the advertising is based on giving the consumer more information about their product. We will be comparing the relative effects of various themes and messages of informational media. Specifically, we wish to discover whether consumers react more favorably (in terms of information absorption and effects on planned consumption activity) to information about positive aspects of green consumption or negative aspects of conventional products and services. The name for this type of inquiry is framing. Two examples are given below:

Different products tend to different areas of information, for example, an eco-marketing campaign for “Green Up” a green energy effort in New England informs consumers about the harmful bi-products and effects of coal, oil, and natural gas produced electricity. At the same time it informs them about their opportunity to start to receive some of their power from “100% renewable sources” being solar, wind, hydro, and landfill gas through the effort. They expose you to the harm caused by your current consumption trend; they inform you about the cleaner alternative.

The company Aveda applies another technique; it is explained in their slogan “Beauty rooted in Environmentalism.” They sell health and beauty products made from “pure flower and plant essences.” When selling their product they inform the customer of their attempts to further the efforts in sustainability and assist natives in keeping their cultural traditions. In this specific campaign they highlight the use of “certified organic Brazilian bassu nuts hand collected by women’s collectives.” They are informing you about a natural alternative, which not only promotes sustainability, but also preserves native culture and provides support to a struggling economy.

With the media experiment we will fulfill our next goal to identify, using the behavioral influences we have deciphered, effective methods of displaying and conveying information to the customer/consumer. This is also known as how to frame the information. To do this we constructed a small pamphlet (For reference purposes the medium can be found in **Appendix B)**. The reason we have used a pamphlet is that many

of the industry leaders currently capturing the green market (Whole Foods market especially) have taken the time to construct pamphlets and other media for their stores. Our assumption is that it would be better to identify the influence of a currently used and popular methodology than to attempt to identify all the factors surrounding selecting the media type and information to display. The different displays we are testing are as follows.

- Using positive statements informing consumers of the benefits of green consumption
- Using negative statements about the bi-products and results of "non" green consumption
- Using a mix of the two

To perform the media design experiment we kept the target in the same range as for the consumer profile, but instead of exclusively using green consumers, all consumers were polled. This was done in and around the Worcester Polytechnic Campus Center, giving us a largely similar demographic range to the consumer survey, but removing the specifications of the targeted audience (students, staff and faculty, as well as guests, will all be encouraged to participate). To provide participants with a small incentive, organic candy will be given out after the completed pamphlet is submitted.

The framing of a question effects the readers initial feeling about or toward the information they have just received. "A frame can establish the status quo or introduce an anchor"[8] The tone or the comparison that a frame sets up gives the reader the initial view point. It gives them an initial push to one side, and depending on the issue they may be more or less likely to agree or disagree. When looking at the research of Daniel Kahneman and Amos Tversky different frames produced different results, they tested Frames as gains versus losses. Using examples about a shipping company losing cargo at sea, and depending on how they framed the loss, respondents selected different options. With this knowledge, it is the goal of the media design experiment to test the framing of organic produce. The question to answer is do consumers want to read about produce in a positive, negative, or mixed frame?

[8] Thinking About … "The Hidden Traps In Decision Making" Harvard Bussiness Review Sept – Oct 1998

4.1 Medium Design Experiment Implementation

Because media aimed at promoting green consumption must target the general public, no effort was made to isolate green consumers as respondents. Nearly all experiment pamphlets were distributed publicly at the center of the WPI campus. Students, as well as professors and administrators were solicited for responses. Most of the pamphlets were filled out and returned at the time of distribution, midday April 12 2005, but a few were taken and returned later.

As incentive for participation, subjects were given the Endangered Species Chocolate Company's 'Chimpmints" brand organic chocolate candy, each of which comes with a miniature chimpanzee trading card.

4.2 Medium Design Experiment Results

The results of the design experiment are:

1. Statement set 2: Mixed Framing, preferred by 18 respondents.
2. Statement set 3: Negative Framing, preferred by 17 respondents.
3. Statements set 1: Positive Framing, preferred by 15 respondents.

The most popular form of framing, or most preferred was the use of mixed comments; this set included facts both positive about organic agriculture, and negative about the alternatives. Respondents noted that they liked the presence of the other side, meaning that they didn't like statements sets one and two because they seemed too one sided. Mixed framing only was the most popular by one vote to negative framing. Which was only two above positive framing. There are many variables that affect this ranking, ranging from personal preference to structural imperfections.

After reviewing the results of the medium design experiment the responses demonstrated several ways that future media experiments could be improved. We selected our statements from a single medium and altered some of them slightly for tone. By selecting from a wider array of statements, some of the confounding aspects that obscured the effects of the framing might have been eliminated. Despite their effect on the numerical results and the conclusiveness on the effect of framing in ecomarketing,

many of the responses to the statement's other perceived aspects will provide valuable consumer preference information.

Respondents noted that some of the information in various columns was preferred to others. They found some of the information to have more over all quality as far as objectivity, (some mentioned the use of taste as inherently subjective) so this influenced them as well as the framing. Another unnoted variable was the framing of GMOs (Genetically Modified Organisms) in one of the statements sets. Some respondents didn't like the way the statements negatively framed them, and didn't mention them in other statement sets.

As we were creating the medium it was hard to gauge the level at which to address the respondent; what level of education to assume or what level of awareness regarding the subject matter to expect. Some respondents thought Statement set two was easier to understand than the others, so they found it the most appealing. This has nothing to do with the framing of the statements more with the method of their structure. Apparently, the assumptions that average consumers can parse a phrase like "the agricultural practice of chemical-intensive, mono-crop farming" may be something of a leap of faith. Respondents mentioned not knowing what BSE (Bovine Spongiform Encephalitis, or mad cow disease) was, and overall seemed to prefer simple, apparently factual material.

Given these confounding influences on our data collection, the results on the framing are less decisive, but much valuable information was collected on consumer preferences, and many of them reflect on framing. This is shown in readers identifying the different frames and responding their preference, for example, one respondent wrote in response to statement set one "I prefer positive to negative promotion." When statement set one was the positive frame. This occurred in other instances involving other statement sets and correlating comments, many seemed offended by the overtly negative framing used in statement set three.

Nonetheless, one respondent commented that "disgust is a powerful tool," indicating that negative framing may be effective if it does not inspire a doubting or averse reaction in the audience. It is difficult to conclude on whether positive framing or negative framing would be preferred, largely because of preexisting knowledge,

misinformation and preferences. Rather than finding the "best" way to frame information (mixed framing was the favorite), much of our data reflect helpful or troublesome aspects of the three methods of framing. Aspects of ecomarketing media that will be crucial to foster if the market is to expand include maintaining simplicity and reducing apparent biases. Simple, attractive, educational materials that allow an understanding of the underlying issues necessitating mindful and directed consumption may be more effective than unsupported statements on the supposed benefits of being a green consumer. An educated and self-motivated consumer base is part of what gives the current market the robust characteristics it needs to survive its economic disadvantages; ecomarketing materials should be geared toward promoting these characteristics in their audience, rather than resorting to the treacherous techniques used to promote products that hinder sustainability.

5. The Ecomarket

The ecomarket is made up of all of the producers, retailers, consumers and other marketers that are involved in the production, trade and consumption of sustainable products. This includes many firms, from those that grow and handle organic produce, to those that manufacture biodegradable cleaning supplies and other ecologically benign materials. This market may well become the heart of an economic system that moves increasingly toward environmental harmony without sacrificing quality of life of its participants.

Green consumers are the heart of this market; currently, they support beneficial production through their supernormal efforts to purchase green. This effort is evident to varying degrees, but is most apparent in the green consumer's willingness to pay, in some cases up to 15% more for products that support sustainability. Part of the nature of this market is that green market actors have incentives additional to and in some cases superceding price. This abnormality should catch the eye of product manufacturers and retailers.

We have found in our study that the green consumer values information; as part of green consumption one values awareness of the production methods and bi-products. For example, on the sides of Green Mountain Organic Coffee, it is clearly marked that the container is completely biodegradable, after the aluminum tie is removed. A note about the production of bags follows this with information about their substitute for the tin lining. The green consumer sees this effort to produce sustainable goods and is willing to pay more for the product, because of this foresight and consideration. This willingness to pay, the trade off of a low price for a sustainable solution, is the key to the eco market, and the green consumer.

A note must also be made that green consumption is more expensive due to this trade off and small size of the eco market. So green consumers exist in the upper and middle class mainly due to increased cost of living associated with green consumption. When performing the survey and the medium design experiment we were on a college campus

that includes people of this demographic. In order to expand the ecomarket beyond the confines of those with extra disposable income, certain changes are likely to be necessary.

One of the key aspects of green consumers is a willingness to sacrifice some aspect of cost or convenience to support ecological concerns. This shows a strong core market, but it is also a major barrier to promoting green consumption among society at large. However, as the survey demonstrated, even green consumers do not like the idea of throwing their money away. To the green consumer, there is some increased value inherent in green products and services that is worth paying for. Formalizing and raising awareness of this value may be integral to the promotion of green consumption and the discovery of a path to sustainability.

In attempting to understand consumer receptivity to green media, much information became available about the varying perceptions of different aspects of green practices. Ecomarketers may pander to their market segment by tailoring their advertising to the environmentally minded, but it is critical that they do not alienate the general populace in the process. Factual, simple, unbiased statements will provide the best method for doing so.

There is currently a lack of members in this market. The cost of green consumption is inflated by the lack of competition and implicit subsidies that often skew markets in favor of the status quo. Not only are the retailers of green goods few and far between, but the width and depth of product lines is also somewhat limited. The problem with this is that production of sustainable goods is the only method of production that offers us a secure future and consumption of green products is the only type of consumption that can persist indefinitely. Blind, unchecked design and production practices have produced many problems that pose challenges to sustainability. By furthering an understanding of green consumption, and by examining the policies that guide markets toward or away from sustainability, we hope to offer a better view of what a sustainable economy might look like.

6. The Policy Environment

Now that we have explored that nature of green consumption, and taken a look at its underlying behaviors and patterns, we can progress to a discussion of policies that shape producer preferences and practices that comprise the other main variable set in our market analysis.

To call current production practices "unsustainable" might seem to some like stating the obvious, simply because production has rarely been intended to be sustainable. In fact, "sustainability" is a new and nebulous idea, and few human undertakings were conceived even with sustainability in mind. The idea is so new in fact and so misunderstood, that to many ecologists, "sustainable development" is all but an oxymoron. Some dare to question whether a sustainable industrial human society is even possible. The idea of sustainability is so critical and ill understood that a discussion of possible definitions and dimensions, with special regard to agricultural production, has been included.

A sustainable economy rests on the premise that natural capital must increase over time, or at least reach a stable equilibrium with the processes that deplete it. Because solar energy (and its secondary and tertiary effects) is the only indefinite source of energy currently available, its use will be instrumental in a fully sustainable economy. While solar and wind power generators are in their budding stages, agricultural practices have for millennia harnessed the power of the sun for human food, fuel and chemicals. Agriculture, both for its historic role and its future potential deserves great consideration in our discussion of sustainability.

Agriculture is also a prime target for examination because of the entrenchment of the U.S. federal government in the fabric of the farming industry. Subsidies and price supports have for years caused farmers to lean in favor of one crop or practice over another, mostly because farmers have become largely dependant on federal subsidies to remain profitable. It is with this in mind that we will take as an axiom the involvement of

the federal government in the farming and agricultural business sector, and seek to ascertain how policies contribute to or detract from sustainability.

The fate of the sustainability of farming rests largely in the hands of the United States. The U.S. has the resources, technology, research capital and interest necessary to make the foremost efforts at achieving agricultural and industrial sustainability and permanent food security. It also has significant involvement in marketing and production of food within its borders, and to some extent abroad in the world. If there were ever an important legacy for humanity, the quest for sustainability is certainly it.

But supposing for a moment that sustainability really is impossible, and that a large-scale ecological or economic collapse is some fifty, one hundred, or any number of years off, and is more or less inevitable. While the feasibility of sustainability in industrial society is and may remain unknown, making efforts toward it can offer nothing but benefits both to us now, and to whatever society remains once the international economic machine slows or grinds to a halt; minimizing the damage to ecological systems, the source of most natural resources, should always be a priority.

> Unlike railroad tracks, economic development and environmental protection really do converge if you take a long enough view – William Ruckelshaus[9]

It might go without saying that security of agricultural production should be seen as one of the most pressing matters, if not the pinnacle concern, of an expanding human species on a finite earth. For millennia, surplus agriculture has been the foundation upon which the majority of 'civilized' humans have relied. It has allowed technological innovation through specialization and study, and granted to its users the strength and population density to ensure that cultures that adopted it displaced those that did not.[10]

As we enter a century in which non-agricultural people are nearing extinction, our sense of need to ensure indefinite agricultural sustainability must be emboldened, for it is quickly becoming the case that surplus agriculture is the only way to live. World population density and growth render foraging for food and subsistence agriculture

[9] Edwards, Lal, Madden, Miller and House (eds). Sustainable Agricultural Systems. C. 1990 Soil and Water Conservation Society. p. xvi
[10] Diamond, Jared. Guns, Germs and Steel: The Fates of Human Societies. C. 1999 Jared Diamond. p. 87

insufficient to avert massive famines both in the developed and developing worlds. With this in mind, it becomes clear that it is in the interests of all people, consumers, market actors and policy makers alike, that agriculture continues indefinitely into the future.

It must be our goal, regardless of our position in society, to assess threats to continued production, trace their roots and find their sustainable solutions wherever possible. Policies need to be focused, not on slowing the problem, or merely reducing harm caused by human activity to the biosphere, but on halting the net loss of fertility that is slowly reducing our ability to feed the sprawling growth of humanity. Stabilization of soil health and fertility is the first step to long-term agricultural sustainability, and is absolutely necessary if food output as well as production of biofuels and other biologically produced goods is to increase in the future, without corresponding or disproportionate increases in agricultural inputs.

Keeping in mind these goals, we will now progress to a discussion of the state of farming, and take a summary but moderately comprehensive look at the problems facing it. Selected "trouble practices" (management policies that may degrade fertility) will be enumerated and discussed so that complementary or improved practices can be sought and implemented. Underlying each of these practices is a lack of understanding of the complexity of the systems that the practices seek to modify or influence.

6.1 Agricultural Problems and Trends

The story of the beginning of modern agriculture (also referred to as "intensive," "conventional," etc.), known as the "Green Revolution," is in many ways part of a chapter in the story of human technological progress. This chapter also features mastery of chemistry, the beginning of the atomic age, and the seed of the biotech revolution. Complex machines, including those that would make nearly all calculations previously churned out by humans, rose to prominence, reshaping much of the world in the process. Even the ancient practice of farming would not go unchanged—on the contrary—it would emerge vaster, thirstier for inputs, and far more productive in terms of total output. This metamorphosis has had severe and far-reaching repercussions on food production and markets in the U.S. and worldwide.

As earlier mentioned, two of the driving forces in the conversion from small-scale, self-sufficient, family-owned farms to large, commercially managed operations would not have been possible without intimate knowledge of chemistry and sophisticated machinery to deliver the fruits of the chemist's labor. Mechanical technologies set the stage so that "after [WWII], farmers began using heavy applications of chemical fertilizer to ameliorate the problem of soil depletion, caused in part by intensive wartime production."[11] But these synthetic chemicals have not been successful in solving soil and agricultural problems associated with intensive production; on the contrary, in many cases they shock an ecosystem into a disequilibrium from which it may be costly to the farmer to recover.

In spite of the claims made by critics that these chemicals are responsible for exacerbating some of the agricultural problems they had been intended to solve, high-input methods have become an increasingly accepted part of the farming paradigm, to the point where they are more or less the norm. A table of the relative share of the economic activity associated with different sectors of the agricultural market is included to demonstrate this point.

Share of Economic Activity within the Agricultural Sector Accounted for by Farmers, Input Suppliers, and Marketers: 1910 and 1990

Year	Farmer	Input supplier	Marketer
1910	41%	15%	44%
	$24 billion	$13 billion	$35 billion
1990	9%	24%	67%
	$23 billion	$58 billion	$216 billion

Lyson, Thomas A. Civic Agriculture: Reconnecting Farm, Food and Community. C. 2004 Tufts University. p. 58

As the table shows, over the course of the 20th century, the farmer yielded much of his economic influence on the agribusiness system to input suppliers, but even more to the marketers who now control two thirds of economic activity within this sector. This centralization of market power leads some to posit "for the industrial type of agriculture to expand, it must convert family farms into factory farms. The transformation of family farms into factory farms requires not only a change in the size of the farm operation but a change in management strategies as well. It means locking the farmer into the orbit of the large agribusiness corporation."[12] This "vertical integration" will be discussed at

[11] Hurt, Douglas R. Problems of Plenty: The American Farmer in the Twentieth Century. c.2002 Ivan R. Dee, 2002. pp. 115-116

[12] Lyson, Thomas A. Civic Agriculture: Reconnecting Farm, Food and Community. C. 2004 Tufts University. pp. 57-58

length when we analyze the effects of policy on the industry, but for now suffice it to say that it is one of the overwhelming trends in modern agriculture, one that serves to disempower small farmers, absorbing them into the increasingly dense fabric of the agribusiness tapestry. This density gives rise to the first of many problems to be discussed in this publication.

Transportation, Centralization

The main effect of centralization, itself a result of exploiting economic "comparative advantages" between localities, is that "today, no region of the United States can be said to be even substantially self-sufficient in food production. Consumers depend heavily on imported products that can be produced only in climates and soils outside their regions. In many areas of the country, there is little or no locally produced food in commercial channels."[13] While this offers increased profitability in degrees ranging from marginal to substantial, it creates an increasingly fragile system, very sensitive to exogenous shocks.

From an engineer's perspective, the consolidation and regionalization of such a large system causes it to be highly reliant on transportation infrastructure, a potential critical point of failure if fuel supplies remain low relative to increasing demand on them. Even without a substantial failure of economic viability of large-scale food transportation, rising fuel costs will mean rising costs for all goods that must be transported long distances. "Food miles are the distance food travels from where it is grown to where it is ultimately purchased or consumed by the end user."[14] It has been estimated that the "odometer" on the average piece of American produce would read about 1,500 miles,[15] meaning that even a slight increase in the cost per mile could effect the industry and the consumer in a significant way.

Additionally, the increase in centralization has created market conditions such that many farmers who previously marketed their goods to their community are having difficulty competing with large-scale production and distribution concerns that buy and sell in bulk and almost exclusively to large supermarket chains. The situation of farmers

[13] Lyson. p. 4

[14] Pirog, Rich and Benjamin, Andrew. "Checking the food odometer: Comparing food miles for local versus conventional produce sales to Iowa institutions." Leopold Center for Sustainable Agriculture, Iowa State University.

[15] Hendrickson, John, "Energy in the U.S. food system: A summary of existing research and analysis." Sustainable Farming-REAP-Canada. Ste. Bellvue, Quebec, Fall 1997. Vol 7, No. 4.

resisting vertical integration has become one in which "only by working together with other farmers, can smallholder farmers accumulate enough supply-power to fulfill the market demands for quantity and continuity of production."[16] Integrating "horizontally," with peers (as opposed to vertically, which implies a power hierarchy) is one of few remaining options for farmers seeking to remain autonomous in an industry increasingly fraught with dependencies.

Erosion/Soil loss

One of the most glaring and ominous factors endangering agricultural sustainability is the rapid erosion of topsoil from our agricultural centers. Due to the difficulty of conducting a comprehensive planetary soil survey, it may never be known exactly how fast, or at what rate (relative to total soil stocks) the earth's topsoil is eroding, but estimates have been made that as much as 1/3 of arable land has been lost to erosion.[17]

> Globally, some 24 billion tons of soil are lost annually in excess of the natural rate of regeneration, and it is being estimated that the remaining topsoil on Earth's cropland is being lost at an average rate of 7 percent per decade (Brown and Wolfe, 1984). Even if this estimate were several times too high, current agricultural practices would still be unsustainable in the long term (Daily and Ehrlich, 1992).[18]

While physical erosion of soil particles by fluid movements (i.e.: wind or water) is significant, other factors, such as macro- and micro-nutrient depletion, add to degradation of soil fertility. Repeatedly cropping similar plants in an area will result in depletion of the elements most used by the plants, while chemicals given off by crops can go unused by other organisms and accumulate in soils over long periods of time.

Many processes contribute to soil degradation, and which factors cause it and to what extent they each contribute is largely still up for debate, as consensus on long-term and ecological effects of agricultural technologies is sorely lacking. One thing is certain, however, and that is that "soil is the most important resource for ensuring sustainability; loss of topsoil through erosion and a reduction in soil fertility by not replacing nutrients

[16] Hellin, Jon and Higman, Sophie. Feeding the Market: South American farmers, trade and globalization. C. 2003 Hellin and Higman. Kumarian Press, Inc., 2003. p. 197
[17] Pimentel, D.C. et al., Science, 1995. v. 267 n. 1117
[18] Ehrlich, Paul R. and Anne H. and Daily, Gretchen C. Food Security, Population, and Environment. Printed in Lorey, David. Global Environmental Challenges of the Twenty-First Century. c. 2003 Scholarly Resources Inc. p.23

both turn a renewable resource into a nonrenewable one."[19] The idea that soil can be "used up" is not a comfortable one, nor one we are used to contemplating; nonetheless, the possibility must be considered so that worldwide decline of fertile soil can be predicted and avoided.

Monoculture

In order for industrial agriculture to flourish, old technologies and crops needed to be adapted to mechanized harvest and processing. Whereas hand labor was careful, slow and expensive, mechanized labor is careless, fast and relatively cheap. In order to capitalize on these attributes, farmers needed to adapt crops to be more uniform and amenable to mechanical processing. This has led to large fields of crops bred to be as similar as possible, in an attempt to facilitate machine harvesting, and as tough as possible, to resist damage in automated processing.

As hinted at above, one of the most damaging practices that modern agriculture engages in is intensive monoculture. The abandonment of crop rotations, while a representing a profit boost to farmers who wish to specialize, breaks ecological and nutrient cycles, resulting in a stagnant soil ecosystem. Repeated over-cropping of "trouble crops" such as corn, cotton and tobacco, which absorb many nutrients and deposit relatively few, accents the trouble associated with this practice.

Water/Runoff

Another unpalatable (and almost unthinkable) criticism of modern agriculture is that it is contributing to the depletion of fresh water sources worldwide. While water is generally regarded as "renewable," deep underground stocks tapped by humans, known as fossil water, do not recharge on a timescale we are accustomed to thinking in. This warning is especially pertinent to agricultural policy as "agriculture is the principle user of water globally; inefficiently using fossil water and overdrafting rechargeable aquifers can result in another renewable resource being eroded."[20]

Add to this the damage to natural aquifers caused by agricultural runoff, and we begin to see that agriculture, a technology dependant on water above all else, is being

[19] Plucknett, Donald L. International goals and the role of the international agricultural research centers. Edwards, Lal, Madden, Miller and House (eds). Sustainable Agricultural Systems. C. 1990 Soil and Water Conservation Society. p. 36

[20] Plucknett. p. 36

threatened by its own overuse and misuse of its most necessary resource. Practices that reduce runoff and mitigate use of the less renewable water sources will be essential to agricultural sustainability on a large scale.

High Inputs

Aside from water and soil, plants also require various elements and chemical nutrients to produce good, nutritious crops. While artificial production of these nutrients (mainly nitrogen [N], but also phosphorus [P] and potassium [K]) is expensive in terms of energy required in their manufacture, "energy consumption required by high-yielding production systems will probably be justified in the foreseeable future as using a nonrenewable resource, oil, to protect soil from being reduced to a nonrenewable resource."[21]

Nonetheless, relying on high-energy inputs links agricultural sustainability to sustainability of petroleum markets, a tenuous situation at best. An explanation of greater economic "efficiency" (usually measured on a per-dollar basis) relies on the fact that providing wages to a human being is more expensive in the long run than purchasing and maintaining capital for the same purposes. However, when "energy accounting was divided into inputs (labour, fuel, fertilizers and so on), output (yield) and input/output ratios (energy efficiency). … The input/output ration for the organic [no synthetics] system during [a] six-year period … was 7% greater than that for the conventional system and 5% greater than that for the integrated [reduced synthetics] system, making the organic system the most energy efficient."[22] These results are bolstered by "results from a 21-year study of agronomic and ecological performance in biodynamic, bioorganic, and conventional farming systems in Central Europe…[which] found crop yields to be 20% lower in the organic systems, although input of fertilizer and energy was reduced by 34% to 53% and pesticide input by 97%. Enhanced soil fertility and higher biodiversity found in organic plots may render these systems less dependant on external inputs."[23]

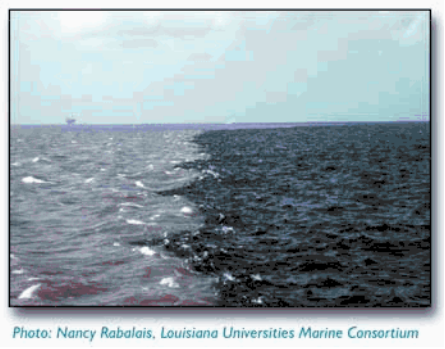
Rapid or total elimination of chemical inputs to agricultural systems is an unlikely prospect. Nevertheless, those concerned with the energy-dependence of farming are

[21] Plucknett. p.36
[22] Nature, April 2001. v.410 n. 683 p. 928.
[23] Mader, Paul, Fliebach, Andreas, Dubois, David, Gunst, Lucie, Fried, Padrout and Niggli, Urs. Soil Fertility and Biodiversity in Organic Farming. Science, May 2002. v. 296 n. 5573 p. 1694.

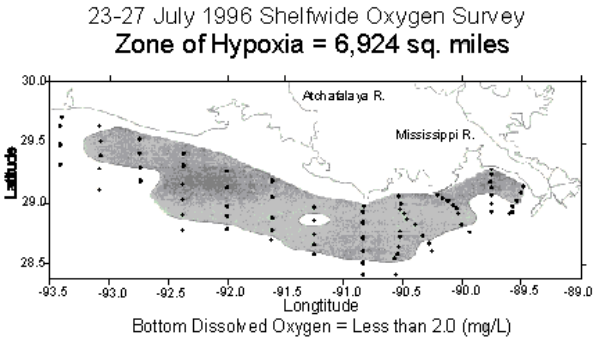
likely to suggest that development of cost-effective low-input methods will be necessary for ensuring sustainability and security of agriculture.

Factory Meat Production

During recent years, rising global incomes have heralded an era of increasing meat consumption, driving per capita meat production up more than 60%[24]. This trend is the result of consumer demand on the most basic level: every-day personal consumption choices, which are definitively outside the realm of government control. This poses a problem, as cereal production levels off, and meat production climbs linearly, considering that production of a single pound of meat necessitates three to ten pounds of grain input[25]. Nonetheless, an epidemic of vegetarianism and green consumption, while it exists in its beginnings, is not yet and may never be ripe to sweep the nation or the world. Market barriers and consumer alienation drive ecological ignorance in the economic sphere, and interests exist that have significant investments in the status quo.



Mississippi River/Gulf of Mexico Watershed Nutrient Task Force. 2001. Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico. Washington, DC. http://www.epa.gov/msbasin/actionplan.htm



Source: Center for Sponsored Coastal Ocean Reseach, NOAA http://www.cop.noaa.gov/pubs/copnews2.html

Externalizing costs that remain hidden from consumers boosts rising meat consumption. The Union of Concerned Scientists has posited, "household meat and

[24] Tilman, David (Department of Ecology, Evolution and Behavior, University of Minnesota), Cassman, Kenneth G., (Department of Agronomy and Horticulture, University of Nebraska), Matson, Pamela A., (Department of Geological and Environmental Sciences, Stanford University), Naylor, Rosamond and Polasky, Steven. (Department of Applied Economics, University of Minnesota) Agricultural sustainability and intensive production practices. Center for Environmental Science and Policy, Stanford University, USA

[25] Tilman et al.

poultry consumption alone is responsible for about a quarter of threats to natural ecosystems and wildlife."[26] In their defense, "producers argued that odors were merely annoying, even a nuisance, but smell did not create a health risk. Their opponents pointed to evidence that hydrogen sulfide and ammonia emissions from livestock confinements caused respiratory problems for workers in those facilities, while phosphorous from poultry manure caused algae problems in nearby streams. County governments [have] increasingly fought with state legislatures over regulatory control of factory farms and corporate livestock and poultry confinement operations while environmental groups demanded strict regulation of such facilities."[27]

A major result of confinement farming practices, (aside from what animal rights activists describe as "holocaust-like" disregard for animal life, welfare, and suffering; as well as the proliferation of antibiotics in food) is the Gulf of Mexico's Hypoxic (oxygen devoid) area, also known as the 'dead zone.' "The hypoxic zone in the Gulf of Mexico has been measured since 1985. Since 1993, the average extent of mid-summer bottom-water hypoxia in the northern Gulf of Mexico has been approximately 16,000 square kilometers, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2002, when it was about 22,000 square kilometers – larger than the size of the state of Massachusetts."[28] While it cannot be solely attributed to factory farming (other runoff plays a part as well), the hypoxia depicted above is largely the result of high-input, high-yield agricultural practices, and animal confinement farming operations that create huge amounts of runoff that are polluting the oceans in a globally significant way.

Toxic chemicals

The introduction of chemistry to agriculture represented not only a change in fertilization techniques, but also pest control. Many of these chemicals were greeted with skepticism from the environmental community, but by in large, it was not until their unintended effects manifested following intense and widespread use that corrective action was taken.

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[26] Brower, Michael and Leon, Warren. The Real Impacts of Household Consumption. Printed in Lorey, David. Global Environmental Challenges of the Twenty-First Century. c. 2003 Scholarly Resources Inc. p.300

[27] Hurt. p. 165

[28] U.S. Department of the Interior, U.S. Geological Survey, Toxic Substances Hydrology Program. http://toxics.usgs.gov/hypoxia/hypoxic_zone.html

The standardization of toxic chemicals in agriculture represented a shift in farming mentality: "[in the 1960s] Farming was now a business to be run as efficiently as any other industrial enterprise. … We were structuring our farms and our technologies around valid Newtonian Principles, applied with full intentions to dominate the earth. There was little or no debate during those years, in the biological sciences at least, on development direction. The success of current technologies was so overwhelming that it stifled serious debate of alternatives. … I remember clearly graduate school discussions in 1964 about the 'crackpot Rachel Carson and her whistling in the wind" against the great benefits of DDT."[29]

While not all synthetic chemicals used in agriculture are as dangerous as DDT, many are associated with problems relating to human health, damage to ecosystems and biopersistence. Additionally, even when their use is prescribed and carefully controlled, chemicals intended for wholesale eradication of certain pests and weeds are rarely specific in their targeting. Pesticides that are designed for termination of a pest problem may also serve to eliminate competitor or predatory species, thereby exacerbating the original problem, and reinforcing the need for pesticide application.

Suffice it to say that extermination of parasites is a simplistic approach that leaves natural systems in a state of disequilibrium, a condition that can become increasingly costly to maintain over time. Their indiscriminant nature and the difficulty associated with their control after application makes the search for alternatives at the very least an intriguing proposal.

Reductionist science

Many of the problems of conventional agriculture stem from the belief that natural systems can be simplistically or intuitively understood. Whether or not this belief is explicitly stated, it is implicit in the approaches to food production that emphasize additions of raw chemicals, open biological cycles, and reduction of both inputs and yields to dollar amounts. Irene Diamond, an ecofeminist critic of many of the bridles mankind implements in its attempt to constrain nature writes,

> In the twentieth century, advances in the mechanization of agriculture, the application of petrochemicals, the harnessing of earths waters, the development of hybrid seeds, the breeding of vegetables for harvesting and processing

[29] Harwood. p. 10

> specifications, the development of total confinement buildings for farm animals, and the routinized use of antibiotics, medicated feed, and hormonal growth stimulants, together with advances in energy-intensive processing, transportation, and refrigeration have created a situation in which our food, formerly the fruit of the Earth's fertility, has become just another factory product.[30]

This extensive list, used to make what might seem to some a quasi-Marxist point about "alienation" of people from the sources of their food, offers a criticism of contemporary factory faming where rules of markets, advertising, and The Bottom Line all have stronger sway over the majority of food production than do environmental or ecological concerns. Brute force applications of reductionist science have brought genetically engineered horrors doomed to lives of agony-by-design into this world, and although such matters are not directly related to any threat to the human food supply, they do reflect the heedless forays made into science in the name of profit.

"For the last 400 years science has advanced by reductionism... The idea is that you could understand the world, all of nature, by examining smaller and smaller pieces of it. When assembled, the small pieces would explain the whole."[31] But the reductionist viewpoint, which reduces physical objects to Newtonian bodies, and aggregate human welfare to GNP dollars, proves ineffective at describing complex biological organisms and ecological systems, which often do not act as the sum total of the behaviors of their components. Natural cycles and processes had been developing long before humans even graced the earth with their presence; to think that we are masters of these systems and comprehend their inner workings reveals ignorance of the massive complexity of organisms and their interactions, and an arrogance that endangers our continued existence on this planet.

6.2 Levels of Sustainability

"A workable definition [of sustainability] is '[a method of production] that can evolve indefinitely toward greater human utility, greater efficiency of resource use, and a balance with the environment that is favorable both to humans and to most other species."[32] While this definition is visionary, and incorporates both humanitarian and

[30] Diamond, Irene. Fertile ground: women, earth, and limits of control. c. 1994 Irene Diamond P.119
[31] John Holland as quoted on dictionary.reference.com
[32] Harwood. p. 4

ecological concerns, it is far too broad for the purposes of policy analysis. Instead, it will be necessary to isolate several aspects of resource management that must at least be present before an enterprise can even be considered sustainable. These aspects can be understood by examining farming at its different levels of organization:

> Understanding the economic implications of alternative farming practices requires research at several levels of aggregation, including the individual component of a crop or livestock enterprise, the entire enterprise, a whole farm, commodity markets, and national and international agricultural economies.[33]

Resource productivity and enterprise management

As previously stated, maintaining a healthy base of soil is the simplest and most necessary element of a sustainable agricultural production paradigm. Soil ecosystems must be managed so that each individual plant grows healthily, and the entire crop matures and offers a high yield to the farmer. Increasing sustainability at this level means maintaining volume and nutritional density of soils, and reducing reliance on exogenous inputs.

The enterprise level refers to a particular crop or crop rotation regimen, as an example of an aggregate undertaking on a particular farm. This level can be expanded to include any practice that uses renewable resources; at the end of the day, sustainable use requires a net benefit to its resource base. Agricultural enterprises that are sustainable necessarily maintain or improve soil and environmental quality in the long term. Often different enterprises are combined so that complementary crops and livestock contribute to each other's productivity and viability, placing emphasis on practices that close biological cycles as much as possible within the enterprise itself. Closed biological cycles are necessary for strong, stable ecosystems, and are therefore a priority at this level of examination.

Firm micro-economy

When enterprises are aggregated and their inputs and outputs tallied, the result is a picture of the firm itself as a microeconomic entity. Sustainability in this dimension requires a business be profitable, or at least cover costs and be capable of maintaining production and presence in the market. In the long term, this level is entirely dependant

[33] Madden, J. Patrick and Dobbs, Thomas L. The Role of Economics in Achieving low-input farming systems. Edwards, Lal, Madden, Miller and House, eds. Sustainable Agricultural Systems. C. 1990 Soil and Water Conservation Society. p. 461

on the resource base and enterprise levels, but whereas enterprises can come and go, and a farm may continue to operate at a net loss of nutritive resources, especially when inputs are substituted for native fertility, a failure on the microeconomic level is likely to be the most directly and immediately threatening to the owner of the operation.

Additionally, it is not always possible to infer that success at lower levels necessarily implies success on the microeconomic level. "Frequently, a farming method that appears to be very profitable or otherwise advantageous per acre, per cow or at the individual enterprise level may prove to be much less attractive from the perspective of the whole farm or the household. … The successful, commercial scale farmer must assess the compatibility of proposed alternatives with the various practices already in place, taking into account the farm's physical and biological resources and anticipated changes in crop yields, livestock enterprise productivity and production costs, all of which strongly affect the farm operator's cash flow and equity position."[34]

It is not enough for a farmer to know how to grow crops. He (or she; of course, it is assumed that gender-specific pronouns not used in reference to a specific person are not meant to be gender-exclusive) must at least be literate in accounting, marketing and distribution, and any of the other management strategies necessary to run a viable business. Business operators must have reliable methods to consider not only their present situation, but also how future decisions are likely to affect them economically and ecologically.

To this end, models can be employed to analyze likely effects of management decisions:

> A key decision at the outset of any whole-farm analysis involves the type and degree of sophistication of the economic models to employ. Options range from relatively simple microcomputer spreadsheet models to the most complex computer optimization and simulation models. Each has its place. Disciplinary pressures tend to encourage model "sophistication," regardless of whether available data and research resources warrant that.[35]

"Disciplinary pressures" refer to the ingrained mindsets that permeate the scientific communities, which often serve as distorting influences that obscure the original goals of research. This narrowness of focus, while not directly related to our current definition of

[34] Madden and Dobbs. pp. 463-464
[35] Ibid. p. 464

sustainability, is important in that it provides one of the chief impediments to implementing sustainable paradigms; the cloistered nature of the academic and research communities, along with their generally reductionist nature contribute to the "ivory tower" effect, where despite noble intentions, thinkers and decision makers keep themselves too far removed from problems to see it them any light except that cast by their own discipline. Let us keep this fragmentation of understanding in mind as we aggregate a level further and enter the macro-economy.

Sustainable Production Macro-economy

> "The U.S. economy is not yet on a sustainable growth path"
> - Federal Reserve Bank of Chicago President Michael Moskow, Wednesday March 9, 2004."[36]

Economies are studied in great detail, and numerous economic theories offer explanations for the various ups and downs they experience. While attention paid to economies is plentiful, accurate understanding and predictions are generally in short supply. Just as biological systems often are so complex as to defy and intuitive or comprehensive understanding, economic systems are influenced not only by irregular shocks that can be difficult to predict, but aggregate behavior of thousands, millions or billions of agents acting in concert. Sustainability at this level means that not only national economies, but also the emerging global market must be able to work together, using equitable trade to ensure the economic sustainability of all participants. If areas are allowed to become critically impoverished, or depleted of economic resources and productive cropland, the market system has failed for those people and the failure needs to be examined and rectified if those in the first world, the major beneficiaries, are to assert that "promoting an open international economic system is good for American economic growth and is good for other countries as well."[37]

What would the economic ramifications be of a large-scale shift to a more sustainable lifestyle? It seems likely that if consumer preferences changed, either through the cessation of market-warping advertising and marketing, or through greater

[36] Reuters. U.S. expansion not sustainable yet - Fed's Moskow. Wed Mar 9, 2005 02:40 PM ET
[37] Nye, Joesph S., Jr. The Paradox of American Power. C. 2002 Joseph Nye Jr. p. 144

awareness of the implications of their consumption, there would be some sort of significant restructuring of industry and macro-economies. Consensus on the subject is, however, largely absent.

> The one study (Langley et al, 1983) that has attempted to estimate quantitatively, in a comprehensive way, the macroeconomic or market-level impact of widespread adoption of organic farming is seriously flawed. … Among other deficiencies, the study also seems to have overstated the dependence of organic farms on livestock manure, erroneously assumed that organic farmers apply no fertilizers, and underestimated the contribution of legume-based crop rotations to soil fertility. Because of the procedural flaws, the substantive findings of this study are of no value.[38]

The difficulties with such a study are obvious: in order for meaningful and accurate results, great detail is required at the same time that various biological, economic, and ecological fields must be combined to grant a comprehensive picture. For such a project to be successful, it would require a diverse multidisciplinary team that could seamlessly combine their specialties and discard any limiting preconceptions that might conflict with specialties of others.

Despite the difficulty with predicting macro-level ramifications of significant concerted individual behavior changes in such a complex system, reasonable conjecture can be made about some of the probable effects:

> Of particular interest are the positive and negative effects of sustainable agriculture might have on the rural economies of farming-dependant regions. Does low-input or sustainable agriculture have the potential to be a vital force in the rural revitalization of such regions? From the standpoint of added on-farm employment and enterprise diversification, possibly yes. From the standpoint of reduced demand for purchased farm inputs, possibly no. The net, overall impact is not known at this time.[39]

Assessing sustainability at this level is near impossible, as an exponentially growing economy produces changes far faster than can be analyzed effectively. Nonetheless, macroeconomic sustainability of production techniques, management strategies, and marketing and distribution are all-essential to a secure food supply, and should be pursued and improved wherever possible.

<u>Broad Ecological Sustainability</u>

[38] Madden and Dobbs. pp. 466-467
[39] Ibid. p. 467

Sustainability in the broad ecological sense is even more ephemeral. Some even question whether sustainability is possible in a growth-oriented economy, claiming that

> Proponents of sustainable development [as it stands] do not respect environmental constraints, and they ignore the fact that the first world has long lived beyond sustainability. Indeed, they hold up the overconsumptive lifestyle of industrialized society as the standard to which the rest of the world should aspire.[40]

This strong statement asks us in the G-8 Nations, who have the time and resources to study, address and promote issues of sustainability, whether our very way of life necessarily makes us hypocrites when we give these issues attention, be it genuine or lip service.

Critics even go as far as to portray sustainable development as a "green washing" campaign, wherein a company or organization makes great efforts to improve its public image without substantially changing its practices or their effects on the environment:

> Sustainable development is one of the most insidious and manipulable ideas to appear in decades, and because the multifaceted, global offensive to sell it is essentially unopposed, it is perceived as something of an axiom by the public. ... Growth, which has grossly exceeded the bounds of reasonableness and which is ancestral to hosts of environmental and social ills, long ago became the enemy of the natural world. If this simple fact fails to sink into the global mind, then hopes of restoring ecosystems, countering the tide of extinctions, and dealing effectively with a vast array of environmental problems all will have to be recognized, in the end, as having been nothing more than pipe dreams.[41]

The essential message that policymakers can take from these bold criticisms is never to let success in improving sustainability lull them into the complacent belief that their actions have been sufficient. A continually adapting economic model may be turn out to be the only truly sustainable one.

Necessity for all

If humans have an interest in their continued existence on Earth, (it is assumed here that they do) sustainable production and consumption patterns and practices should be a primary focus of attention for decision makers and policy makers alike. This is hardly a cry to abandon technologies, but rather a plea to recover our right, ability and inclination

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[40] Willers, Bill. Sustainable Development: A New World Deception. Conservation Biology © 1994 Blackwell Science, Inc.

[41] Ibid.

to reject those that are shown to be harmful while adopting counterparts that mitigate social and ecological damage. The first step in this process is acquiring a broad consensus on what exactly is sustainable, or at least a comprehensive and meaningful way to assess and compare practices. This will enable determination of directions for research and policy, as well as predicting and compensating for side effects of new technologies before symptoms become a problem.

Sustainability is not absolute, must be pursued, not implemented.

Due to the difficulties of modeling complex systems, we are unlikely to ever produce a completely accurate representation of our sustainability.

> Lack of understanding; or hard data; or of consensus on resource bases, global climate and its variation, technologies of the future, the role of people in agriculture, and the relationship between people, agriculture, and the environment all make prediction of an end point a futile exercise. Others could argue as well that there may never be an end point or equilibrium but, as with the rest of the universe, a continual process of evolution[42]

The dynamic nature of all complex systems may mean that we will never arrive at a final set of practices that serves to provide for humanity indefinitely into the future. If soil-building and -enriching practices are adopted, it may be possible to increase output over the long run while simultaneously ensuring continued use of the land for unlimited future generations.

6.3 Sustainable Agricultural Practices

Keeping in mind our four dimensions of sustainability (local ecological, microeconomic, macroeconomic, and global ecological), we turn now to examine several farming techniques, both new and old, which may boost sustainability. It is important to emphasize that adoption of these techniques is not the immediate goal of this essay—rather it is my hope to spur the drive to understand *to what degree* and *in what manner* these ideas may further our sustainability.

Some things are agreed upon: "Overall, the emerging literature on U.S. farming systems that emphasize legumes in the rotation and minimize or eliminate the use of synthetic chemicals for fertility and pest controls tends to offer encouraging farm-level

[42] Harwood. pp. 3-4

profitability prospects."[43] But nearly no study is without another that somehow contradicts it or detracts from its thesis. This is not surprising, as varying conditions and management practices inevitably introduce confounding effects to the data.

What makes a practice sustainable?

Sustainable practices add to resource bases and minimize ecological damage and erosion. Often, a single practice is not sufficient so maintain ecological balances that are necessary for a stable ecosystem. Sometimes damage to soils and ecological imbalance result more from poor technique in the application of a practice than from the actual practice itself; implementation tactics are just as important as strategy. It is therefore crucial that research be conducted with the priority of not only accurately describing processes, but portraying in detail the specific circumstances and means of their application.

This section will offer examples of practices that have shown to be, when properly implemented, potentially beneficial to the sustainability of agriculture. Some of these practices relate to inputs used, others to on-farm practices related to preparing soil for planting. Many use biological organisms to complement existing field species and create a more complete ecosystem. Whatever the method, the primary focus here is not to advocate the adoption of one or the other, but rather to offer examples of differing avenues that can be further perused in research. Mindful of the intentions of the essay, let us now proceed to the following, admittedly cursory, examination of potentially sustainable practices.

Tradeoffs, combinations

Most "green" consumers are aware of "organic" produce (note that organic here takes a different meaning from "organic," or hydrocarbon chemistry), which is made without the use of artificially produced chemical fertilizers and pesticides. "The ideas of an integrated, decentralized, [artificially produced]-chemical-free agriculture were advocated by Northburn (1940) in a largely overlooked work. As far as we can tell, he was the first to use the word organic to refer to the entire philosophy and practice."[44] In

[43] Madden and Dobbs. p. 471
[44] Harwood. p. 8

the United States, the US Department of Agriculture (USDA), has a subsidiary National Organics Program (NOP) that regulates certification and organic management in the US.

While many alternative methods are organic, however, elimination of artificial chemicals is not always absolutely necessary to improve sustainability. Often, alternative agriculture is aided by new technologies, and not resistant to them. "Alternative agriculture evolved during the 1900s in a course parallel to that of industrial agriculture, borrowing liberally but selectively from technologies, such as new crop varieties, mechanization and soil nutrient testing. A review of that evolution [would] help greatly to understand today's debate."[45]

Alternative agriculture need not be an either-or proposition. Just as methadone clinics are often effective in bringing human bodies back into a natural balance from more extreme disequilibria, "withdrawal" from chemical agriculture may disappoint farmers who see their yields drop initially upon adoption of alternative techniques. Considerations for the transition away from intensive chemical agriculture are nearly as important as discovering stable techniques that work in the long term. Altering chemical management techniques so as to make them less intense and more precise is an excellent starting point for discovering transitional techniques.

Proper application of technique, modified conventional methods

Plants, like animals, go through biological stages as they progress from seed to adult, and, like animals, plants have differing needs throughout these stages. Pinpointing times of greatest nutrient needs and timing fertilizer application accordingly can not only eliminate economic waste and reduce runoff, but can contribute to crop yields by reducing ecosystem shocks associated with strong sudden nutrient inputs. "Economically optimal fertilizer use depends upon crop rotation, weed control, soil fertility, previous fertilizer usage, and rainfall."[46] Because of the complexity associated with timing in accordance with biological cycles amid such a massive array of variables, additional research is necessary in this area so that ecological interactions can be understood and catered to, rather than subdued and exploited.

[45] Ibid. p. 6
[46] Plucknett. p. 42

There is reason to believe that even a shift toward a more precise conventional agriculture could be a sizable boost for sustainability.

> Fertilizer nitrogen recovery is only 30 percent or less if fertilizer is broadcast into field water, the most common practice. Incorporating fertilizer into the soil before planting can double its nitrogen efficiency.[47]

Simply by adjusting management tactics, without necessarily changing overall methods, carefully applying inputs, and being mindful of the condition and requirements of the recipient crops, farmers can mitigate environmental and local damage while improving input efficiency.

Green manure

Animal manure has been a staple fertilizer for centuries; but with animals now largely isolated in confinement buildings, nearly all animal waste from the 10 billion animals slaughtered per year[48], is now concentrated in a few areas and is pumped into "lagoons" where it festers, and is slowly leaked into major river systems. This makes it unusable for agricultural purposes, so despite an abundance of meat consumption, the byproducts of that consumption go unused.

Due to the often-vast separation between where crops and animals are raised, farmers have adapted other practices to compensate for the lack of animal manure, or to replace it altogether. A popular alternative that not only increases fertility, but also yields a marketable crop is the addition of legumes to crop rotations: "After four years of cropping [with legumes as N fixers] the organic carbon content of soil in the live mulch plots approached the level in newly cleared tropical forest, while that in no-till and conventional tillage sites remained relatively low."[49]

The relatively low price fetched by legume crops does, however lead to some market disincentives:

> Two of the major financial disincentives to using legumes are the high cost of establishing a stand and the opportunity cost (profit forgone) in delaying production of higher value crops. Both of these disadvantages seem to have been overcome at least partially by an alternative rotation studied in the Palouse area of eastern Washington (Goldstein and Young, 1987; Young and Goldstein 1987). This rotation, called the perpetual-alternative-legume-system, or PALS, features a

[47] Ibid. p. 41
[48] Jones, Dena, "Crimes Unseen." Orion Magazine: July/August 2004. Orionline.org
[49] Plucknett. p. 45

biennial legume (black medic) that has been observed to reseed itself for as long as 30 years following establishment.[50]

Further experimentations with legumes and their ability to complement current practices seem likely to yield fruitful findings.

Legumes, however, are not the only crop that is beneficial to soil, various clover varieties, and other beneficial weeds, (including hemp, which is also a staple industrial fiber and potential fuel crop where it is not prohibited) can be used. If animals are distant from the cropping operation, and will not contribute to consumption of plant waste, it can be returned to the soil to decompose. Experiments in Cuba (to be discussed later) involving fungal cultures and mycorrhizal organisms represent yet another cutting edge in agricultural technology.

Reduced Tillage

A major practice that has already been fairly widely adopted is the reduction or elimination of the plow. One can imagine intuitively how leaving soils unperturbed could reduce erosion, but there are other benefits as well. "Zero-tillage also benefits the planet in general. Unploughed soils hang onto carbon that would otherwise escape into the air as carbon dioxide when organic matter rots. A one-hectare field left unploughed can absorb up to a tonne of carbon every year says [Jules] Pretty [of the University of Essex], making soils a vital element in preventing global warming."[51]

This practice, and its widespread adoption, represents a simple change for sustainability that ran counter to years of farming history. This example shows that, despite the stereotype that farmers tend to be old fashioned, or set in their ways, many are just as eager to advance the state of their art as any technophile or academic would be. It is the goal of this essay to encourage synergy in the research, marketing, policy and farming communities, in order to foster fair, profitable and sustainable interactions.

Rotation and Intercropping

Crop rotation, another centuries-old technique, has been largely abandoned by certain agricultural sectors during the Green Revolution. This unfortunate abandonment of a tried and true technique, partially the results of overconfidence in chemical cultivation,

[50] Madden and Dobbs. p. 469

[51] Pearce, Fred. An ordinary miracle. New Scientist, February 2001. v.169 n. 2276 p. 17

represents a step away from sustainability. Using crops that complement one another, inputs and pest problems can be reduced, and soil can better preserve fertility:

> An eight-year experiment conducted recently by University of Nebraska scientists compares 13 cropping systems, including an essentially 'organic' rotation that used manure for fertilizer and no herbicides or synthetic fertilizers. (Helmers et al., 1986). The crops grown included corn, soybeans, grain sorghum and oats with sweet clover in various rotations and in continuous cropping systems. The results confirmed the findings of studies done in the first half of the century using more primitive cultivars and no synthetic chemical pesticides: rotations have higher yields and higher net returns per acre than continuous mono-cropping systems… Different fertilization regimes were found to have little impact on profitability. The continuous cropping systems were found to require a higher expenditure for pesticides and to be subject to greater year-to-year variation in yields and profits per acre compared to the various rotations.[52]

While seasonal rotations allow crops to work in synergy, it is in effect a rotation monoculture. New practices that simultaneously grow mixed crops in the same field offer great promise at designing a more complete crop ecosystem. Research both into fruitful combinations and economically efficient harvesting techniques will be necessary to bring that idea to marketable viability.

This type of practice, while promising, is likely to be complex, and at times, confounding, as ecological interactions are still not widely or completely understood.

> [Anthony] Trewavas [of the University of Edinburgh] acknowledged that [monoculture] crops rapidly disappear from fallow fields because they cannot compete with weeds. 'But wild, stable monocultures of species such as phragmites, wild wheat, genetically uniform spartina, and mangroves indicate that ecological stability is not understood,' he said 'furthermore, although mixed cropping (supposedly mimicking ecological diversity) can reduce diseases, some combinations accelerate disease spread.[53]

These criticisms of a rush to implement eco-farming must be well understood. Research of productive, sustainable techniques and their advancement into practice must be separate drives, the former always preceding the latter.

Biological pest control & IPM

A major concern of produce consumers and ecologists alike is the proliferation and bio-persistence of pesticides in food. These problems have made finding biological alternatives (as opposed to chemical methods) a major priority. One of the sweetest fruits

[52] Madden and Dobbs. p. 469

[53] Tracey, Patrick. Organic farming as harmful as conventional methods, U.K. scientist says. International Environmental Reporter, April 2001. v.24, n. 8 p. 286.

of this ongoing research is Integrated Pest Management, or IPM. “several studies have estimated the farm-level and aggregate monetary benefits and costs associated with development and adoption of IPM programs (Osteen et al., 1981). Economic analyses at the farm level take into account the increase in sales value, cost of pest scouting, and changes in pesticide application costs.”[54]

The increased labor associated with creating a specific pest control regimen may seem like an additional farm cost, but specific knowledge of pest problems, even without an IPM regimen, can be beneficial to the farmer for reducing or specifying pesticide application.

> A recent report (Allen et al., 1987) included a review of 42 IPM evaluation studies. In the vast majority of cases, crop yields were reported to have increased as a result of adopting IPM, and in all instances that reported pesticide use and/or production costs, a lower cost per acre was noted. The difference in production costs between IPM users and other growers varied greatly from state to state and by crop grown. In this national study pesticides were estimated to account for 2 to 22 percent of individual farmer total production costs.[55]

Reduction in pesticide costs are good, but further research into IPM and its results should be further studied, so that erroneous data do not taint the promises of such a useful endeavor.

> A recent national study of IPM programs found that the various IPM programs typically resulted in significant increases in farm profits (Allen et al., 1987). The findings were somewhat problematical, however, in that the bases for comparison were not always apparent. Nonetheless, the evidence seems to indicate that IMP increases the profits of farmers who use it and may also decrease the environmental loadings of certain pesticides, primarily insecticides. In other cases, detection of potential insect damage results in an increase in insecticide use as compared with farmers who do not use IPM monitoring of pest populations (Allen et al., 1987). IPM generally does not result in decreased use of fungicides or herbicides.[56]

<u>Agroforestry/Sylvopasture</u>

The practices of agroforestry and sylvopasture are essentially a new branch of intercropping that incorporate trees into drop fields. Planting trees in “alleys” can shelter fields from wind erosion, foster more stable and robust soil, and contribute to ecological completeness within a field. Incorporating persistent trees into agricultural practices is a

[54] Madden and Dobbs. 467-468
[55] Ibid. p. 468
[56] Ibid. p. 468

revolutionary new idea that may offer some of the most ecologically sound management regimens ever developed.

Biodynamic

The biodynamic paradigm is the closest to an ecologically holistic technique. Biodynamic management generally includes traits of organic, IPM and intercropping, views the farm as an ecological organism. Great care is taken to see that exogenous inputs are reduced to virtually nil, and that those that cannot be eliminated are locally sourced and produced in an ecologically sound manner. Biodynamic farms are designed in such a way that crop and livestock operations are balanced in terms of inputs and outputs so that inputs required by one enterprise are supplied by another.

By closing biological cycles on the farm, biodynamic farmers mimic ecological interactions, giving the closes approximation of a stable ecosystem. Because of these traits, it holds great promise for developing sustainability. The differences in soil conditions are apparent from a simple visual inspection:

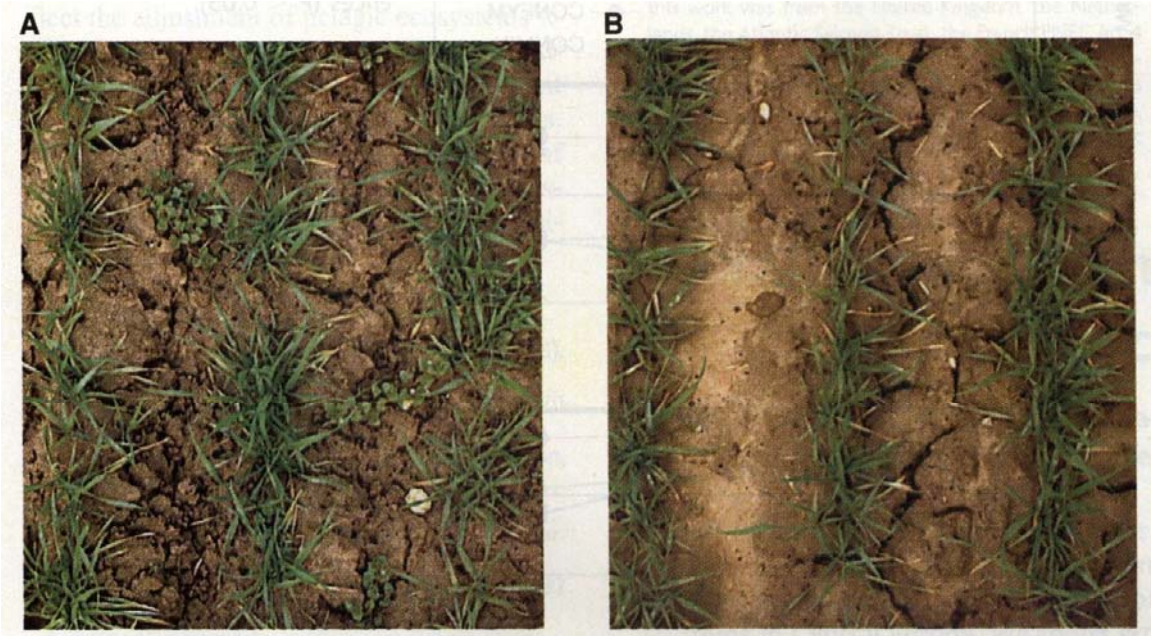

Fig. 3. Biodynamic (**A**) and conventional (**B**) soil surface in winter wheat plots. Earthworm casts and weed seedlings are more frequent in the biodynamic plot. Disaggregation of soil particles in the conventional plots leads to a smoother soil surface. Wheat row distance is 0.167 m. Source: T. Alföldi, Research Institute of Organic Agriculture [Forschungsinstitut für biologischen Landbau (FiBL)].

Additionally, because they provide a more balanced ecosystem, beneficial symbiotic organisms are able to exist in and around the farm such that infestations of pests becomes

almost a non-issue. Additional research into biodynamic principles and their incorporation into the mainstream of production hold some of the most promising prospects for sustainability.

Examples

What follows are examples of farms, largely taken from the essay "Sustainable Agriculture in the United States."[57] These offer a view of real-life applications of some of the above mentioned techniques, and how they have been affected (or not affected) by government policy.

> The key to success [on the Heiniger Dairy Farm in Fairview Kansas] has been computerized feeding and record-keeping, intensive production of a balance of high quality forage, and reducing the need for chemical fertilizers and pesticide. … Recycling of nutrients and organic matter in the manure and a sod-based rotation has enabled the Heinigers to improve soil productivity, fertility and tilth, thus reducing the need for chemical fertilizers. Their long-range goal is to eliminate the need for purchased fertilizers and pesticides. The Heinigers do not participate in the USDA farm program.[58]

This first example offers a look at a farmers trying to transition away from chemical agriculture. We see that the adoption of information management technology is one of the key elements of their strategy. By keeping track of soil conditions and according practices, the Heinigers can more effectively manage their resources, while simultaneously cataloging conditions, which will allow them to better understand the ramifications of their management changes. Participation in the USDA farm program, which requires approval of a conservation plan for highly erodible soils and wetland conservation, does not appear to be a priority for the Heinigers.

Some farmers are independently pursuing sustainability, not because of federal incentives, but because they have seen the damage inflicted by intensive agriculture:

> Jim Bender operates a farm [in Weeping Water, Nebraska] with 650 acres of cropland… Bender's Main approach to achieving sustainability involves implementation of an effective soil and water conservation program, use of sod-based crop rotations, and a reduction in the need for chemical fertilizers and pesticides in the cropping system. Bender acquired his farm in 1975 in "a poor condition" after many years of intensive row-cropping by previous owners who had used high levels of chemical inputs. In his current state of transition back to

[57] Parr, J.F., Papendick, R. I., Youngberg, I. G., and Meyer, R. E.. Sustainable Agriculture in the United States. Edwards, Lal, Madden, Miller and House (eds). Sustainable Agricultural Systems. C. 1990 Soil and Water Conservation Society.
[58] Parr, et al. p. 54

> crop rotations, he has not used herbicides for eight years or chemical fertilizers for two years.[59]

Bender's case is clear on his personal devotion to sustainability; some federal efforts, to him, are more hindrance than help:

> Bender participates in the USDA farm program… But he feels the current farm program is an impediment to his goal of establishing a long-term, sustainable agricultural conversion and production system with primary emphasis on sod-based crop rotations, diversification and integration of crops and livestock. … Bender has been working on a special market certification to qualify as a certified organic producer. To date, however, he has been marketing all of his produce through regular commercial channels.[60]

This grassroots sustainability effort is encouraging because it reveals a fierce drive on the parts of some to reach a sustainable situation, but it also points out a disconnect between policies aimed at sustainability and farmers with similar ends in mind. It also reveals the weakness of certification and labeling programs, as there is no way to discern Bender's more sustainably produced food from that grown using ecologically harmful methods.

Further evidence of weakness in government aid to sustainable farming is revealed in the following example:

> Delmar Akerlund's [of Akerlund Grain an Livestock Farm, Valley Nebraska] 760-acre grain and livestock farm emphasizes low-input methods to reduce operation costs and soil improvement practices to maintain crop productivity. Akerlund estimates that his variable costs of production average about $30 per acre across all crops in his diversified rotation. This compares with $65 - $75 per acre for neighboring farms committed to chemical-intensive corn-soybean production. Akerlund made the transition from chemical-intensive, monoculture-based farming to his present system more than 20 years ago because of concern for pesticide effects on his family's health. It took three years, he said, to make the change and to eliminate the residual phytotoxic effects of pesticides in his soil. No pesticides or commercial fertilizers have been used on his cropland since 1967. … over the years, the manure application has increased the soil organic matter content from 0.5 percent to more than 6 percent in some fields.[61]

Again, it is revealed that this farmer's experience and concern with pesticides led him to abandon conventional techniques for alterative methods. Increases in organic soil content demonstrate that the effects his activities have been mostly beneficial for overall soil health. Akerlund's case also defies conventional beliefs on labor and wildlife, by showing that "labor is not a constraint. Akerlund and a single hired man perform all of

[59] Ibid. p. 54
[60] Ibid. p. 55
[61] Ibid. p. 56

the farm operations. … results [of studies of his land] have shown that his farming methods have greatly improved bird habitat and populations on his land."[62]

When it comes to sustainability, however, Akerlund is far from indifferent about participation in the USDA Farm Program:

> Akerlund does not participate in the USDA's farm program because he feels it is of no benefit to him. In fact, he feels it would be a constraint to his low-input/sustainable farming system. He strongly believes that such participation would force him back into the monocultural production of feed grain crops and heavy use of chemicals.[63]

Policymakers must be sure to turn their ears and attention to concerns like this; consciousness of biases or favoritism implicit or explicit in legislation is necessary for enabling a forward-moving regulatory structure. Such a policy structure, one that works not only to further itself, but also to correct its past failures, will need to combine a forward-looking attitude with keen hindsight so that sustainable systems can be realized.

The farm policy however, despite its inadequacies, is not simply a boost to intensive agriculturalists repugnant to grassroots proponents of sustainability. "The Rosmanns [of Rossmann Diversified Grain and Livestock Farm, Harlan, Iowa] currently participate in the USDA farm program, though reluctantly, because they are young farmers who inherited a relatively small corn base acreage. This base, they feel, must be maintained for now because of federal farm policy and economic uncertainties."[64] As it stands, farm policy can aid small farmers working for sustainability, but it offers them little incentive to make a shift toward sustainable management.

The next example farm borrows some of its management philosophies from the biodynamic paradigm:

> The 320-acre Richard and Sharon Thompson [of Thompson Grain and Livestock Farm, Boone, Iowa] farm approaches a self-contained ecosystem. … All manures and those crop residues not fed to livestock are returned to the soil. In addition, all of the sewage sludge from the city of Boone (population 12,000), approximately 200 dry tones annually, containing about four percent nitrogen, is applied to the fields. No herbicides and only a small amount of fertilizer is used [to combat K deficiency, especially for soybeans].[65]

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[62] Ibid. p. 56
[63] Ibid. p. 56
[64] Ibid. p. 57
[65] Ibid. p. 57

In addition to attempting to make their farm a closed ecological system, the Thompsons' farm makes use of human waste that might, if otherwise disposed, turn into an ecological burden, rather than a benefit.

It is no surprise that there is such interest on this farm in sustainable practices, as "Thompson is also a past-president of the Practical Farmers of Iowa. This organization is an on-farm research and demonstration network of Iowa farmers who are interested in shifting to low-input/sustainable production systems."[66] Grassroots collectives have great potential to spread and foster sustainability among farmers themselves. It may be more effective for government agencies to work with and through these kinds of organizations, rather than trying to implement bureaucracies that would serve similar purposes.

Our final examples are drawn from a study of several apple production systems with varying management practices:

> Here we report the sustainability of organic, conventional and integrated apple production systems in Washington State from 1994 to 1999. All three systems gave similar apple yield. The organic and integrated systems had higher soil quality and potentially lower negative environmental impact than the conventional system. When compared with the conventional and integrated systems, the organic system produced sweeter and less tart apples, higher profitability and greater energy efficiency. Our data indicate that the organic system ranked first in environmental and economic sustainability, the integrated system second and the conventional last.[67]

While claims about improved taste or nutrition of organics have been furthered by some research and contradicted by others, the above-mentioned study offers comprehensive support of alternative practices in terms of product quality, energy efficiency, and ecological sustainability.

The article went on to expand on the improved quality of organic goods:

"Mechanical analysis of fruit firmness at harvest and after storage in 1998 and 1999 showed that organic fruit was firmer (a positive

Cumulative energy assessment

	Organic	Conventional	Integrated
Labour (h ha^{-1})	2,921	2,008	2,147
Labour (MJ ha^{-1})	2,337	1,607	1,718
Machinery (MJ ha^{-1})	73,974	73,560	73,560
Fuel (MJ ha^{-1})	173,400	182,919	182,919
Electricity (MJ ha^{-1})	10,794	10,794	10,794
Fertilizer (MJ ha^{-1})	311*	16,255	8,901*
Insecticide (MJ ha^{-1})	22,159	42,313	40,375
Fungicide (MJ ha^{-1})	18,023	12,922	12,855
Weed control (MJ ha^{-1})	141	31,931	13,350
Infrastructure (MJ ha^{-1})	144,188	144,188	144,188
Total input (MJ ha^{-1})	445,328	516,489	488,661
Total output (MJ ha^{-1})	526,544	570,745	550,076
Output/input (MJ MJ^{-1})	1.18	1.11	1.13

*This includes composted poultry manure from a local commercial composting facility. The poultry facility from which the raw manure was obtained is assumed to be responsible for the energy charges required for composting the waste; consequently only energy requirements for transporting the compost to the orchard (63 MJ Mg^{-1}) are charged against the organic and integrated systems. For details on fertilizer inputs, see Table A7 in Supplementary Information.

NATURE | VOL 410 | 19 APRIL 2001 | www.nature.com

[66] Ibid. p. 58
[67] Nature, April 2001. v.410 n. 683 p. 926.

consumer attribute for apples) than or as firm as conventional and integrated fruit. Ratios of soluble solids (sugar) content to acidity (tartness), an indication of sweetness, were most often highest in organic fruit. These data were confirmed in taste tests by untrained sensory panels that found the organic apples to be sweeter after six months of storage than conventional apples and less tart at harvest and after six months than conventional and integrated apples."[68]

This final example offers an academic view of the viability of organic systems to complement the largely anecdotal views offered previously. Together, they portray a system where ecological sustainability and produce quality can increase, while simultaneously preserving economic sustainability in both the micro and macro scales. There is no lack of interest in these areas, but government regulation has proved to be less than optimal in the conversion of this interest to understanding and results. Let us now progress from our discussion of farm-level practices to one of large-scale production and distribution paradigms.

6.4 Civic Agriculture

The idea that agriculture should be participatory, and to some extent considered a public good, has all but disappeared as production from the soil has made the transition from a way of life to just another business. Farmers, mindful consumers and farm-based communities have all felt the shocks of this transition, and for some it has become a reason for concern. It is just this concern that gave rise to a largely grassroots movement toward what has been termed "civic agriculture."

Largely Unknown

Due to its naturally-occurring grassroots methods, "The organizational manifestations of civic agriculture, such as farmers' markets, community gardens, and community-supported agriculture are not monitored by most federal or state agencies, so what we know about this new form of agriculture and food production comes mainly from the civic agriculture community itself."[69]

[68] Ibid p. 928.
[69] Lyson. p. 1

While there is no particular reason to distrust the civic community, independent confirmation of its claims will be necessary for any sort of objective study. This 'civic' paradigm, itself an amalgam of many related practices, is of potentially great value to limiting the risks imposed by a heavily centralized food distribution system, and therefore should be investigated, with an eye especially turned toward macroeconomic sustainability.

Decentralized

The main effect that a more 'civic' agriculture would have is to re-establish locally produced foods in market arenas. Connecting a community's production and consumption create local economies that better resemble natural cycles, and offer to reduce America's alienation from its food. Centralization also tends to threaten small, independent farmers who wish to remain that way, and civic agriculture offers these farmers market access without needing to go through major distribution channels.

More sustainable & secure

Civic agriculture, while not a farming practice per se, is readily amenable to the sustainable management strategies we have already discussed.

> Civic agriculture rests on a biological paradigm best described as "ecological." As such, civic agriculture is not readily amenable to incorporating [some of] the techniques/technologies of reductionist science. Ecological approaches to agriculture seek not so much to increase the output/yield but to identify and moderate production practices that are 'optimal'[70]

The compatibility with sustainable practices is an important factor, but civic agriculture also offers increased security in the macroeconomic arena.

By keeping a short path between producers and consumers, with as few intermediate steps as possible, food security is enhanced because, as they say, "a chain is only as strong as its weakest link." If environmental ends are attained, and production becomes sustainable and ecologically sound, transportation and processing infrastructure become the most tenuous part of the agricultural industry. Centralization of these sectors and their reliance on fossil fuels make them increasingly economically volatile and vulnerable both to internal failure and outside attack or sabotage. While terrorism may not (and probably should not) be the chief concern of the agricultural arena, one can imagine that an attack on or contamination of centralized processing plants or

[70] Ibid. p. 75

commercial farms would be far easier than a similar attack on a widely dispersed, decentralized agribusiness.

The impact of civic practices remains largely unknown, but to its proponents, "it represents a sustainable alternative to the socially, economically, and environmentally destructive practices that have come to be associated with conventional agriculture."[71] Efforts to move agriculture in this direction are recommended for a number of reasons.

Democratic

Because food is a universal human need, many are calling for some increased degree of control over the food they eat. This includes concerns with production, processing and marketing of food, whose current undemocratic nature is highlighted by believers in civic agriculture.

> The centralized food system that continues to emerge was never voted on by the people of this country, or for that matter, the people of the world. It is the product of deliberate decisions made by a very few powerful human actors.[72]

Even if the above citation is read without the implied connotation of greed on the part of marketers, it reminds us that ultimately, it might be advisable to rethink throwing a universal need to the neoclassical markets to be treated as just another commodity. The continued involvement of the federal government in agriculture reinforces the fact that agriculture is something of a special case in terms of economic considerations, and may deserve some sort of special treatment by policymakers that does not seem to be readily amenable to economic "laws."

Cultural advantages

Benefits from local connections between producers and consumers are not limited to the arena of sustainability; on the contrary, some of the greatest benefits are realized at the community level, both economically and culturally. Removing intervention by agribusiness allows farmers to look locally for necessary inputs, and brings local enterprises into a tightly knit community that has far more cohesion and solidarity due to geographical proximity, common interests and personal familiarity.

> The term 'civic agriculture' references the emergence and growth of community-based agriculture and food production activities that not only meet consumer

[71] Ibid. pp. 1-2

[72] Heffernan 1999. Consolidation in the Food and Agriculture System. Quoted in Lyson, Thomas A. Civic Agriculture: Reconnecting Farm, Food and Community. C. 2004 Tufts University. p. 60

> demands for fresh, safe, and locally produced foods, but create jobs, encourage entrepreneurship, and strengthen community identity.[73]

Economic advantages

Due to the integration of the farm into the community, the farm becomes not only a food producer, but also a local employer that can aid sustainability by promoting awareness in its surrounding area.

> Civic agriculture increases agricultural literacy by directly linking consumers to producers. Likewise, civic agricultural enterprises have a much higher local economic multiplier than farms or processors that are producing for the global mass market. Dollars spent for locally produced food circulate several times more through the local economy than money spent for products manufactured by multinational corporations and sold in national supermarket chains.[74]

Civic agriculture is a prime example of "horizontal integration," which is an alternative to the vertical integration so well characterized by the agribusiness industry. Civic agriculturalists point to this as an important aspect of their practices, which they feel are of great value to society, both economically and from a humanitarian perspective.

Yet, it is hardly a new idea the horizontal as opposed to vertical integration is usually preferable for any number of reasons:

> Mills and Ulmer [in their 1946 study *Small Business and Civic Welfare*] showed that communities in which the economic base was composed of many small, locally owned firms manifested higher levels of well-being than communities where the economic base was dominated by large, absentee-owned firms. In particular, they found that the small-business communities provided their residents with a considerably more balanced economic life than did the big-business communities. They also reported that the general level of economic opportunity was considerably higher in the small-business communities.[75]

Despite political rhetoric on the value and priority placed on small businesses, policy actions to prevent the sprawling growth of big business seem much less ardent. Much of the genuine progress toward a more civic agriculture is made at the grassroots level, usually unassisted, and sometimes hindered by government policies. Still, civic agriculturalists are eager to clear these hurdles, and emphasize that their ways are not exclusive to rural communities.

> Urban gardens can teach entrepreneurial skills and spawn and sustain a broad range of new employment opportunities. Not only do community gardens teach

[73] Lyson. p. 2
[74] Lyson. p. 62
[75] Ibid. p. 65

> horticultural skills, but in some cases, they encourage new marketing initiatives, environmental management activities, and community development processes.[76]

The democratic nature of civic agriculture necessitates that all communities have access to its benefits, including urban communities, which are currently the least able to achieve agricultural sustainability and food security. Reducing agricultural dependence of large population centers is a goal of civic agriculture, and should be considered as an important agenda item for policymakers.

Paradigm Shift

Halting the trend of vertical integration will help preserve an agricultural production/distribution paradigm that has improved prospects for sustainability, promotes community vitality and is less susceptible to hostile attacks. While protecting "family farms" is generally agreed to be a good and noble thing, and some amount of political rhetoric has been devoted to the subject, the policy environment has had little slowing effect on the vertical integration process. It is largely due to this that "Civic agriculture does not currently represent an economic challenge to the conventional agriculture and food industry, and it is unlikely to pose a challenge anytime soon."[77] While a wholesale conversion is far from likely, it is in the national interest of the United States (or any nation) to foster a secondary, decentralized network of food and material production that can be maintained independent of vulnerable, distant or unsustainable central infrastructure.

Aside from concerns of security or otherwise susceptibility to failure, a shift toward civic agriculture would likely serve to revive local economies, improve farmer's financial security, and reduce ecological stress. While much of the focus of civic agriculture is on promoting farmer's access to local markets, 'civicness' is an idea applicable to nearly any economic enterprise, and likewise, large agribusiness firms can develop management practices that promote an increase in the civic contributions of the company.

> Obviously, no agricultural or food enterprise is without some civic merit ['civic merit' referring to its local business, humanitarian and ecological interactions with and economic value to the community, not the individual civic participation of its owners or managers]. However, large-scale, contract poultry and hog

[76] Ibid. p. 96
[77] Ibid. p. 1

> operations—farmers who sell only to large food corporations such a Tyson's Perdue, or Hormel—would lie at the far outside end of civicness. Likewise, large-scale, absentee-owned, factory-like fruit and vegetable farms that rely on large numbers of migrant workers and sell their produce for export around the world would not be deemed very civic.[78]

Without drastic changes, factory-style farming operations are unlikely to become major civic contributors, nonetheless, civic agriculture can be fostered with two simultaneous efforts: local grassroots reclamation of commercial markets surrounding the region of production, and increased attention to civic efforts by large enterprises.

On the local level, there is something of a local communication and market infrastructure that must be developed. "Local producer and marketing cooperatives, regional trade associations, and community-based farm and food organizations are part of the underlying structure that supports civic agriculture."[79] This infrastructure requires planning, and synergistic cooperation between all parties involved from production to consumption. Because of the community ties and familiar nature of civic agriculture, this vertical integration adds personal interaction for a common interest, which strengthens economic ties, promotes compromise and partnership, and above all allows a more holistic understanding of the entire agricultural system that will lead to more rational actions within and better control over agricultural markets.

> Communities can buffer and shelter themselves from the global food system only if they develop the needed infrastructure, maintain a sufficient farmland base, and provide enough technological expertise so that local farmers and processors can successfully compete in the local marketplace against the highly industrialized, internationally organized corporate food system[80]

Many see the invasion of supermarkets, Wal-Mart style warehouse super-stores, and other large national or international chains as threatening both to the local economies' vitality and to the local community's culture. Images like this can pose problems for companies, and to the extent that the image is justified, for the host community as well.

This image can best be counteracted by genuine actions and policies from management aimed at promoting civic wellbeing for surrounding communities through specific, targeted and long-term programs, rather than symbolic, sporadic or unrelated philanthropic activities (not that these should be frowned upon, unless they are designed

[78] Ibid. p. 62
[79] Ibid. p. 63
[80] Ibid. p. 6

to distract from harmful or irresponsible behavior by a firm). There are no major impediments to supermarkets' development of management positions to scout and work with local producers to provide an opening by which locally produced crops could enter commercial channels. Such processes may defy standardization to an extent, and may be differently applicable in different regions, but civic innovation is a real and implementable way that businesses can work to further and formalize the shaky and economically dubious ideas of "Social Responsibility." Voluntary attention to, and identification and mitigation of social externalities associated with business helps communities and provides genuine tangible claims for businesses looking to improve their corporate images. While these measures may add monetary costs to business transactions, making consumers feel good about their purchases adds to brand or store loyalty; "green washing" campaigns, which may provide a temporary boost in positive image, usually prove ineffective (or even backfire) in the long run, as consumers learn claims were overstated or untrue, and public trust in the company is shaken.

Civic, community and cooperative paradigms all have similar aims, and are all compatible parts of a potential sustainable agricultural system. While they may not replace modern agribusiness, it seems possible that with proper management and government attention, civic agriculture could be a supplement to and fallback option to the systems currently in place. Indeed, when problems have arisen in the past, it always has:

> Community or urban gardens are probably the most visible form of urban [civic] agriculture. The first community gardens were organized by the mayor of Detroit in the 1890s to help families cope with the effects of the economic depression of that era. Throughout history, wherever there has been a shortage of food or money, community gardens have flourished.[81]

There is ample evidence to argue that parts of the civic paradigm have always been and will likely remain potent antidotes to the effects of economic hardship on communities and individuals. Nonetheless, their prevalence and utility has largely been the result of resourceful grassroots efforts.

Not since the "victory gardens" of World War II has civic agriculture been aggressively promoted on a wide scale. Nonetheless, government policy progress toward a more civic agriculture has been made (largely on the state level), and if proper attention

[81] Ibid. p. 96

is devoted to it from industry actors and policymakers, the civic paradigm may flourish alongside and positively affect the existing agricultural system.

Proponents of civic agriculture have some success from which to draw inspiration and encouragement:

> The number of small-scale organic farmers increased over tenfold between 1988 and 2002, while the number of community gardens increased threefold since 1978. The number of farmers selling directly to the public increased by nearly 600 between 1992 and 1997. Today, nearly one in seven farmers in New York sells directly to the public.[82]

This growing trend, which benefits communities locally, security nationally and sustainability for all, is ripe for adoption as it stands as well as for additional research into methods to further embed civic benefits into existing practices. Well-designed action in the community, industry and policy/legislative realms could do much to support and secure a place for this beneficial agricultural paradigm.

[82] Ibid. p. 98

7. Farming Policy

Farming policy is essentially ubiquitous, as agricultural production is the basis of dense populations and food shortages are often historically linked to popular revolution. While shortages in developed nations have largely disappeared in the last several decades, and overproduction is often a converse problem that takes on national priority, problems of distribution in the world have arisen, and been bolstered by specialized regional production for export. This inequality means that different strategies may be necessary for states at differing levels of development. Fostering specialization in a country too poor to import foreign-produced goods necessary for a balanced diet may provide some superficial economic benefits, but neglects the citizens whose interests in state matters should take priority over those of foreign investors and merchants. In short, development planning should be undertaken only after first developing a thorough understanding of the context in which the development is to take place.

Introduction of sustainable agriculture worldwide is certainly a cooperative global effort; yet, it cannot be centrally planned and exported, it must be compatible not only with local soil, climate and water availability conditions (resources), but also the regional way of life, and existing economic, governmental and physical infrastructure. The focus of this document is on the United States, and its particular and important role in world markets and sustainable practices, but other regions will also be discussed to provide contrasting or comparative approaches to broaden and provide support for discussions of possible U.S. policy alternatives. Policy and market actors can use the conclusions of these discussions as starting points for concrete action in their respective realms.

Brief History in US

The story of early 20th century agriculture in the U.S. is largely a story of overproduction and government attempts to control prices in a way that allowed farmers to stay profitable, or at least financially secure. "No one seemed capable of solving the problem

of surplus production and high government expenditures for price-supporting loans. The principles of the Agricultural Adjustment Act of 1938, as amended by the Agricultural Act of 1949, remained the foundation of American farm policy. …Neither has been repealed."[83] Except for a short-lived attempt to wean farmers from subsidies in 1996, it has been generally accepted that supporting farmers with federal money is next to necessity for the maintenance of financially sustainable market conditions in the United States.

Sustainable Farming policy

In the sustainable policy arena, food production has historically been a focus, which is not to imply that sustainability has been a major focus of agricultural policy. Proponents of sustainable practices, even within a nation can have differing ideals: the security-minded, the business community, environmental protection and health interests, animal rights groups, community activists, and consumer groups all bring differing motivations to the discussion table. Nonetheless,

> It seems that consensus is possible on three major points: (1) Agriculture must be increasingly productive and efficient in resource use, (2) biological processes within agricultural systems must be much more controlled from within (rather than by external inputs [such as] pesticides), and (3) nutrient cycles within the farm must be much more closed.[84]

Different supporters may stress these core beliefs differently, but few will argue that their ultimate aims are not essentially similar.

7.1 In the US

In the U.S., where effective farm policy is essential for market stability and financial equity, some attention has been devoted to promoting sustainability. The following excerpt from the 1990 Food, Agriculture, Conservation and Trade Act (FACTA) offers one of the strongest, most comprehensive statements defining sustainable agriculture in terms of U.S. government policy; it is defined as,

> An integrated system of plant and animal production practices having a site-specific application that will, over the long term: 1) satisfy human food and fiber needs; 2) enhance environmental quality and the natural resource base upon which the agricultural economy depends; 3) make the most efficient use of non-

[83] Hurt. p. 110
[84] Harwood. p. 15

> renewable resources and integrate, where appropriate, natural biological cycles and controls; 4) sustain the economic viability of farm operations; and 5) enhance the quality of life for farmers and society as a whole.[85]

This explanation of sustainability is largely compatible with civic and other sustainable practices discussed earlier, and sets the stage for further action.

While there has been some considerable effort to further sustainability of agricultural production in the U.S., there have been only a handful of major efforts made in that regard, and few have been groundbreaking or revolutionary in their approach. U.S. actions have included payments for a specific range of soil conservation practices, promotion of erosion prevention programs, and an organic certification and labeling program.

NOP

The National Organics Program (NOP) is a major part of U.S. sustainable agriculture efforts. It is a solid and successful first attempt at creating a combined certification and marketing campaign based on beneficial production practices. It addressed the need for standards in organic production, and facilitated informed consumption practices.

> Congress passed the Organic Foods Production Act (OFPA) of 1990. The OFPA required the U.S. Department of Agriculture (USDA) to develop national standards for organically produced agricultural products to assure consumers that agricultural products marketed as organic meet consistent, uniform standards. The OFPA and the National Organic Program (NOP) regulations require that agricultural products labeled as organic originate from farms or handling operations certified by a State or private entity that has been accredited by USDA.[86]

Through accreditation and stiff penalties for falsification of credentials, the U.S. has implemented a system wherein consumer confidence in organics can remain high. This is one of the chief benefits of the NOP, which, despite its successes, is restricted in several ways because of regulatory oversights and limitations.

Essentially, for organic certification, producers and handlers must avoid a number of synthetic chemicals and ensure compliance with USDA guidelines. If a producer can

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[85] Food, Agriculture, Conservation and Trade Act of 1990 (FACTA), Public Law 101-624, Title XVI, Subtitle A, Section 1603 (Washington D.C.: Government Printing Office, 1990).
[86] National Organic Program Background Information. www.ams.usda.gov/nop/FactSheets/Backgrounder.html 2002

comply with the organic regulations and afford certification, the producer is allowed market goods that can be labeled and listed on ingredient lists as "organic." However, charging producers for certification discourages those with smaller operations whose profits are smaller.

> In 2002, the USDA began an organic certification program. However, it is unclear how many "organic" farmers will participate in the National Organic Program, in part because many smaller-scale producers already have a customer base for whom national certification is not needed.[87]

This certification barrier, which can alienate small operations, is contrary to civic ideals and could prove an obstacle to achieving sustainability. Reexamining certification standards and implementation may prove fruitful in attempts to further sustainability.

What is organic?

The specific definition of organic defined by the USDA is fairly detailed, but generally:

> The regulations prohibit the use of genetic engineering, ionizing radiation, and sewage sludge in organic production and handling. As a general rule, all natural (non-synthetic) substances are allowed in organic production and all synthetic substances are prohibited. The National List of Allowed Synthetic and Prohibited Non-Synthetic Substances, a section in the regulations, contains the specific exceptions to the rule.[88]

The ideas that naturally occurring chemicals have limited risk for ecological damage and that artificial chemicals in general have nearly unlimited potential in terms of effects on the environment are both appealing and intuitive; they make good rules of thumb, but should by no means be considered universal truths.

Naturally occurring chemicals, while less likely to create unpredictable ecological effects, cannot be considered universally benign. As with artificial chemicals, certain applications can be toxic to human and ecological health.

> [Anthony] Trewavas [of the University of Edinburgh] said that approved pesticides for organic farmers include rotenone, recently shown to induce Parkinson's disease; copper sulfate, which he said has caused liver damage in vineyard workers and will be banned by the European Union after 2002; and Bacillus thurigiensis spores, which he said were known to cause fatal lung infections in mice.[89]

This is not meant to discredit organics programs, but rather to serve as admonishment for those who would pursue ideological rather than factually based, and rigorously tested

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[87] Lyson. p. 97
[88] National Organic Program Background Information. www.ams.usda.gov/nop/FactSheets/Backgrounder.html 2002
[89] Tracey. p. 286.

practices and policies. NOP certification is by far the U.S. program most visible to its consumers, and is very successful from a market perspective. Awareness of this program in the public mind, and existing organic infrastructure are concrete steps toward a more sustainable U.S.

Is Organic Sustainable?

If we wish to specify the question and ask "Is organic more sustainable than conventional methods?" the answer is likely to be yes in most cases. Organic practices reduce exogenous inputs, encourage diversification of enterprises, and generally reduce ecological damage in the fields and the surrounding environment. It is important to remember, however that just as organic guidelines are not insurance against harmful effects of natural toxic chemicals, they are also no guarantee that the practice involved is necessarily ecologically benign.

> Trewavas [has also] said chemical-free farming relies on more manure to boost soil quality, but this poses problems for the environment. 'Manure breakdown cannot be synchronized with crop growth but continued throughout the growing season … When legume crops are ploughed in, the continued breakdown leads to nitrate leaching into aquifers and waterways at identical rates to conventional farms. Degradation of organic material from manure produces significant amounts of nitrous oxide and methane, potent greenhouse gasses.[90]

Organic regulations, like all farming policy, should be self-improving by design, and should work to identify shortcomings and oversights that are contrary to the overall goals of the organics movement.

The benefits of organic practices are not limited merely to their primary effects on local ecosystems, and consumer and soil health. An organic industry infrastructure is useful because organic management, while not intrinsically or necessarily a completely sustainable practice, is compatible the other sustainable practices discussed earlier. Working other ecologically sound agricultural methods into the organic paradigm, and expanding education programs to foster their adoption can boost the sustainability of organics so that some of the impediments it offers to sustainability can be avoided and mitigated.

Conservation subsidies

[90] Ibid. p. 286.

Offering payments for practices that conserve soil is a policy option that has both precedent and promise.

> In 1935 the government … created the Soil Conservation Service (SCS) in the department of agriculture to help farmers conserve their land. The SCS provided experts and funds to support the application of various wind and water anti-erosion techniques, such as the building of terraces, emergency plowing for erosion control, and the seeding of grass on sub-marginal lands. … The SCS in 1936 drafted a model law for the states, which authorized the creation of soil-conservation districts by local petition and referendum. After districts organized under the guidance of a state soil-conservation committee, and signed a cooperative agreement with the USDA, district supervisors worked on various conservation programs, extended federal financial aid to farmers, signed contracts for specific practices, bought lands for retirement, and formulated land-use ordinances subject to farmer approval.[91]

The heavy involvement of the federal government in production, and the prevalence of economic aid to farmers make subsidizing farmers for soil conserving practices a reasonable and intuitive way to support farmers while promoting sustainability.

Soil conservation subsidies are a start, but they beg expansion. By offering economic benefits for practices that nutritionally enrich fields, reduce ecological harm, promote civic practices and enhance agricultural security, the federal government would be able to use its significant leverage to promote sustainability while at the same time offering farmers the price supports upon which they largely depend. Adjusting and fine-tuning the practices rewarded by government actions can, without substantial increases in financial commitment, better steer agriculture in a direction beneficial to the nation and the greater global community.

<u>Other Sustainable polices?</u>

Many policies encounter resistance because they neglect to consider local and regional considerations; others are reactionary and lack the foresight to prevent new or reoccurring problems. Many see sustainable agriculture as the solution to the problems of the preceding paradigm:

> Those national definitions [of sustainability] are now focused on many of the shortcomings of the Green Revolution Model: the problems of equity, of rural income, of product diversity, of environmental impact, and of huge neglected

[91] Hurt. p. 86

> areas of poor soil and water resources that must support increasing numbers of people.[92]

This history of relying on hindsight as a guide seems consistent with human nature, but as humanity becomes vaster and more powerful (increasing exponentially), it becomes more and more critical that our major decisions are made as correctly as possible. Sustainability by definition looks to the future for the ultimate measure of success.

Proactive legislative efforts have been made in recent years, although effects of fiscal concerns may reduce their efficacy.

> [In 2001], the Senate Agriculture Committee … approved a plan called the Conservation Security Act. This bill called for the federal government to pay farmers as much as $50,000 per year for practicing soil and water conservation, and for commodity price-supporting loans. It did not require farmers to take land out of production but would pay them for conservation work done on their land. Farm state senators were divided over the merits of the proposal, not because they opposed payments to farmers for practicing conservation, but rather because the bill did not always provide as much aid to their constituents as they wanted.[93]

Even without sufficient financial resources, this act sets an important precedent in furthering sustainable agriculture. Sure enough, a year later, a similar act reinforcing the support of soil conservation, and adjusting price supports.

> In May 2002, Congress approved new farm legislation known as the Farm Security and Rural Investment Act that provided $82 billion in additional spending over ten years, with increases in government payments for major commodities based on production controls. The program recalled the Agricultural Adjustment Act of 1938 and the Agricultural Act of 1949. The legislation also provided payments to farmers who practiced designated soil conservation practices.[94]

The recognition of the federal government's role in promoting land stewardship is an important first step to effective implementation of sustainable policies. The United States, in many ways a global leader, is stepping up its commitment to sustainability, positioning itself to take a leadership role in the sustainable technology revolution.

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[92] Harwood. p. 11
[93] Hurt. p. 169
[94] Hurt. p. 170

But the U.S. is not the only government working to implement sustainable solutions. In the following section, we will examine approaches to policies abroad, and legislative structures designed to address problems of food security. These are provided as examples of possible alternatives (or compliments) to U.S. regulatory strategies; both foreign problems and tactics applied to those problems will be compared and contrasted to problems and solution approaches in the U.S.

7.2 Abroad

Other nations differ from the U.S. in many ways and to varying degrees. Economic "development," physical and policy infrastructure, and climate are all factors outside of the agricultural arena that have sweeping affects on the paradigms that can, or will be adopted in differing localities.

> The priorities change with the resource base, stage of agricultural development, and national politics. The consistency and speed with which particular items reach policy status [from agenda item status] depends upon the size and influence of the proponent group, the perceived seriousness of the problem and government responsiveness. Those relationships are little understood, even here in the United States.[95]

The interaction of geography, politics and the market can create patterns in agricultural development that are difficult, if not impossible, to predict. Nonetheless, differing environments around the world can be viewed as experimental laboratories where, although variables may not be isolated, conditions and results can be compared to better understand happenings in agricultural markets.

In the policy context, it is important to remember that differing levels of infrastructure of all types, including and especially education, can be the most decisive factors in determining the success or failure of regulations and policies, as "Land tenure system[s] can discourage farmers from conserving natural resources and investing in future productivity; many countries do not have laws to protect forests and rangelands from indiscriminant exploitation."[96] These factors are important not only for analyses done in the developed world, but also for confronting agricultural and ecological

[95] Harwood. p. 14
[96] Plucknett. p. 37

problems with global dimensions, which will likely prove necessary for truly sustainable development.

EU

Because of its level of economic development as well as similar climates and cultures, the EU is a good beginning for an international look at sustainable farming.

> The EU's Common Agricultural Policy, or CAP… has played a key role in the EU's development. It covers the bulk of the EU's agricultural production and has been accompanied by structural policies, which reflect the various faucets of the CAP, including the social role of agriculture in the EU, its regional and national diversity, and the need to take account of consumer and environmental concerns.[97]

Although it is composed of numerous and differing member states, the EU has managed to overcome many of the nations differences of interest, and to promote policies more or less supported by the continent at large. However, the CAP, as is often the case with agricultural legislation, has been criticized from many angles:

> A number of groups have called for major reforms in the CAP, including curbing subsidies provided under the program. …Criticized not only by environmentalists, but economists, human rights groups and others, [CAP] is expected to be revised by 2006 at the latest, Swedish Agriculture Minister Margareta Winberg told journalists March 14 [2001].[98]

Despite the fact that these diverse groups have in common their disagreement, their specific problems and solutions are likely to differ based on their disciplinary biases. In general, however, the EU has taken harder-line stances regarding organics, sustainability and skepticism toward marketing genetically modified food products.

This, however, does not mean that the EU is making great strides toward sustainability, as "France's agriculture sector remains the world's third leading consumer of agricultural chemicals, with about 100,000 tons used in 2002, just behind the United States and Japan."[99] The French too are struggling with the shift away from chemical-intensive production, despite government efforts to increase organic and otherwise sustainable production.

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[97] Joyce, Stephen. Organic farming may not be solution to pollution problems. International Environmental Reporter, March, 2001. v. 24 n. 7 p. 264

[98] Joyce. p. 264

[99] Speer, Lawrence J. Pesticide-free farming growing in France, Government agency says. International Environmental Reporter, March, 2003. v. 26 n. 6 p. 282.

While the growth of sustainable farming in France has been significant, as with much of the rest of the world, there is still much distance to be covered.

> The surface area devoted to organic, or pesticide-free, farming grew by 21 percent in France during 2002, with total land coverage passing the symbolic 500,000-hectare (about 1.24-million acre) mark, according to information released Feb. 23 by [the French Agriculture Ministry's Agence Bio]. … The 509,000 hectares… still only represent 1.7 percent of all French cropland.[100]

France's position as the third largest consumer of chemical agricultural inputs gives it interest, leverage and a leadership role in furthering the development of alternatives. Its increasing success in crop production may have aided or be responsible for corresponding progress in other sustainable production:

> Aside from statistics on farmland, the [Agence Bio] survey shows impressive growth in 2002 in a host of linked organic farming sectors. These include 21 percent growth in dairy and grazing cows carrying the organic certification, 12 percent growth in organic goat herds, and 9 percent growth in organic sheep herds.[101]

It should not be very surprising that the European continent, and France in particular, follows a similar trend to the one in which the U.S. is currently engaged. The position of the EU as a major economic power in the 20th century positioned it to benefit from, but also later be hindered by, the Green Revolution and its paradigms. The slow, plodding progress being made across the Atlantic largely parallels that within the U.S. as dependency on agricultural chemicals and resistance to their abandonment have been recurring themes. It is likely, therefore that despite recent transatlantic tensions

Growing organically

In 2000, the organic food market grew but is still only a fraction of the trade

Markets	Retail sales (in billion US $)	Total food sales (in per cent)	Expected growth (in per cent)
Germany	2.2-2.4	1.25-1.5	10-15
United Kingdom	1.0-1.05	1.0	25-30
Italy	1.0-1.05	1.0	15-20
France	0.75-0.80	1.0	15-20
Switzerland	0.42-0.45	2.0-2.5	15-20
Denmark	0.35-0.37	2.5-3.0	10-15
Austria	0.25-0.30	2.0	10-15
Netherlands	0.22-0.27	0.75-0.10	10-20
Sweden	0.12-0.15	1.0	20-25
Other Europe*	0.30-0.40	N.A	N.A
Sub-total (Europe)	7.0	–	–
United States	8.0	1.5	15-20
Japan	2.50	N.A	N.A
Total	17.50		

* Belgium, Finland, Greece, Ireland, Portugal, Spain, Norway

NOTE: Official trade statistics are not available. Compilations are based on rough estimates. The figure for Japan is particularly uncertain. (This figure also include non-certified products, e.g. "Green Products".

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Source: Compiled by ITC, May 2001, based on trade estimates

Down To Earth September 15, 2001

[100] Ibid. p. 281.
[101] Ibid. p. 282.

over geopolitical security, there is potential for strong bonds and cooperation between U.S. and EU advocates of sustainable production practices. Likewise, successes in Europe are likely to be emulable in the States, and vice versa.

India

India is one of the areas facing explosive population growth in combination with increasing concerns of long-term agricultural production. Because it was heavily colonized by the British (to be a colony, not to be an independent nation), it is a nation that contains elements of both the developed and developing worlds. It inherited from its invaders systems of governance and infrastructure development consistent with western models.

India has recently begun to make moves for sustainability, especially in the agricultural realms. Some programs have met with success, but there are certain aspects of the regulatory atmosphere that limit sustainable efforts. Explicit support of organic agriculture is expressed by proposition and implementation of revenue-neutral "feebate programs" (wherein charges levied on practices seen as harmful are used to subsidize alternatives):

> In an attempt to assist organic farmers, the Union government is intending to clamp one per cent tax on chemical fertilizers. Union minister of state for finance Balasaheb Vikha Patil recently said that the funds collected through the cess would be utilized to help agriculturalists cope with the changes in farming techniques, heighten application of biofertilizers and create the required infrastructure to certify the organic produce[102]

Such a bold policy is likely to be met with resistance from the firms whose major products include agricultural chemicals, as well as the objects of their lobbying; nonetheless, a regulatory structure that used similar tactics might be useful in monetizing costs that would otherwise be externalized.

India's direct and forceful pushes for sustainability may be a source for inspiration, but the incomplete nature of the Indian government's action in this regard shows through in the lack of certification standards that ultimately harm Indian consumers and organic producers.

> In the [Indian] domestic market, lack of standards and mandatory certification make it easy for spurious producers to cash in on the 'organic fad.' Absence of any proper mechanism to certify the organic products gives rise to the lurking

[102] Down to Earth, Feb 28, 2002. v. 10 n. 19 p. 15

> doubt in the consumer's mind over the authenticity of the product being sold as organic.[103]

This is an area where the United States, through rigorous and harsh certification standards, combined with a moderately effective consumer information campaign has been quite successful. American consumers know that Products bearing the USDA Organic seal have been certified as organic and that fraudulent use of the seal can draw thousands of dollars in fines; such assurances are not available to the Indian Consumer.

> To put it in a nutshell, the factors that have contributed to a lack of development in the organic market in India include low awareness of the perils of chemically farmed products, high prices of organic produce, lack of consumer confidence in organic food standards, and their erratic supply.[104]

Volume and consistency of supply is a top concern to agricultural marketers, but underlying any marketing plan must be a consumer population who have not only access to, but also confidence in and information about their purchases and the benefits thereof. The lessons to be drawn from the Indian experience with the organics market is that piecemeal approaches to implementing sustainable agricultural policies are likely to be fraught with problems. Comprehensive approaches must be taken to ensure that fraudulent behavior is not rewarded in the marketplace, and that genuinely sustainable practices are the result of the policies; shortcomings in any critical aspect of policy can doom efforts to failure despite fervent efforts: "though India announced the National Programme for Organic Production (NPOP) in March 2000, to promote organic agriculture export, progress on it would put even a snail to shame."[105]

South/Central America

Less developed nations, those historically too poor to import large amounts of agricultural inputs, are not always at a disadvantage. Although research and information propagation becomes more difficult, farmers are often less dependant on chemical inputs, and lack of long distance communication can serve to increase "civicness" by making local economic interactions necessary. The relative progress of sustainable agriculture in the global south is evidence that high technology may not necessarily be prerequisite to achieving sustainability.

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[103] Not a Cakewalk: Bottlenecks and hassles confront the Indian Organic Producers. Down to Earth, September 2001. v. 10 n. 8 p. 37

[104] Down to Earth, September 2001. v. 10 n. 8 p. 37

[105] Down to Earth, September 2001. v. 10 n. 8 p. 37

Positive changes in agricultural paradigms can do not necessarily require capital inputs or advanced knowledge.

> The success of sustainable agriculture is dispelling the myth that modern technology is the most productive method, says Miguel Altieri of the University of California, Berkeley. 'In Mexico, it takes 1.73 hectares of land planted with maize to produce as much food as one hectare planted with a mixture of maize, squash and beans.' The difference, he says, comes from 'the reduction of losses due to weeds, insects and diseases and a more efficient use of the available resources of water, light and nutrients.' Monocultures breed pests and waste resources, he says.[106]

Successful use of intercropping is only one of the simple but effective methods being adopted by farmers worldwide. While a precise understanding of ecological interactions may require in-depth analysis, the application of ecological principles to farming techniques is intuitive, once connections that cause ecological relationships are noticed.

Another simple approach to agriculture adopted in Latin America and elsewhere around the globe is reduced tillage agriculture.

> Worldwide, one of the most widely adopted sustainable techniques has been to throw away the plough… Ploughing aerates the soil, helping rot weeds and crop residues. But it can also damage soil fertility and increase erosion. Now millions of Latin American farmers have decided it isn't worth the effort. A third of Argentina's farms no longer use the plough. Instead, they fight weeds by planting winter crops such as black oats, or by spraying a biodegradable herbicide such as glyphosate.[107]

This is a prime example of rejecting a technology that had for millennia been intrinsic to surplus agriculture. It is also exemplary of a simple approach that incorporates biological processes in the place of technological solutions.

Africa

Africa's history of European colonization left it with less infrastructure and technology than the Indian "Jewel of the British Empire." The haphazard national borders imposed by the colonists combined with the more exploitative nature of the European occupation of Africa left the continent largely without wealth or benefit from contact with the northern hemisphere. Although G-8 nations now work actively to "develop" 3rd world economies, the overall trend in the distribution of wealth between the global north and south has not much changed.

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[106] Pearce. p. 16
[107] Pearce. p. 17

Because of the underdeveloped nature of the economies and infrastructure, it has not been easy for African nations to adapt to the capital-intensive methods of production necessary to compete in global markets. The specialization emphasized by current economic thinkers allows more African produce onto the world market, thereby increasing African GNP, but often at the cost of the civic nature of the African farmers. Despite increased national wealth, capital resources may be insufficient to import substantial quantities of foods necessary for a healthy diet, making malnutrition prevalent where local producers once provided a healthy variety of food.

The geography and greatly varied climates of the African continent also make its situation unique. Because many areas experience periods of extremely intense or extremely scarce rainfalls, agricultural practices must adapt to local conditions, especially with regards to water availability.

> In the Sudan savanna and Sahel of West Africa, cowpea fodder is as important to farmers as grain because of dry-season shortages of fodder. A dual-purpose variety that produces 600 to 800 kilograms of grain per hectare and retains its foliage through the end of the season is valued because both grain and fodder attract almost equal prices in times of scarcity.[108]

In addition to improving the selection of available crops for farmers, many research organizations are working to improve the crops themselves in pest resistance, yield and nutritional density.

> In Niger, ICRISAT/IITA [International Crops Research Institute for the Semi-Arid Tropics/International Institute of Tropical Agriculture] work on early maturing cowpeas, widely intercropped with millet, the best dual-purpose line[s of which] yielded 1,600 kilograms of grain per hectare and 2,070 kilograms of hay per hectare in fewer than 70 days[109]

This type of research and outreach operations are critical to promoting sustainable practices; while global cooperation in their governance is likely to further research progress, these organizations are likely to be most effective when regionally oriented, due to climactic and ecological peculiarities of the world's various regions.

Aside from improving crops, research in intercropping is becoming more and more widespread. By naturally altering ecosystems, through the inclusion of additional organisms, farmers can often overcome the most prevalent regional problems.

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[108] Plucknett. p. 45
[109] Ibid. p. 45

> In East Africa, maize fields face two major pests, and [Ziadin] Khan [originator of the techniques] has solutions to both. The first in an insect called a stem borer. … Its larvae eat their way through a third of the region's maize in most years. But Khan discovered that the borer is even fonder of a local weed, napier grass. By planting napier grass in their fields, farmers can lure the stem borers away from the maize—and … the grass produces a sticky substance that traps and kills stem borer larvae.
>
> The second major pest is *Striga*, a parasitic plant that wrecks $10 billion worth of maize crops every year … but [Khan says]… another weed, called *Desmodium* … 'seems to release some sort of chemical that *Striga* don't like. At any rate, where farmers plant *Desmodium* between rows of maize, *Striga* won't grow.[110]

These are examples of simple intercropping that cause the field's ecological conditions to become unfavorable to pests. The technique's ease and low cost makes it ideal for locations where capital and chemicals are not a favorable option for production of food.

Because many of the problems associated with high-input, monocultural production are exacerbated by a relative lack of wealth and often-harsh African climates, alternative agricultural practices can be appealing because of the simple and sustainable nature of these methods. The fact that these practices are often apparently comparative to competing conventional methods while requiring little outside input makes them even more appealing to farmers who cannot rely on a steady infrastructure and government aid. Due to the less-developed nature of Africa, practices developed there may be useful in the developed world if oil shortages or other resource or infrastructure problems threaten to reduce efficacy of current paradigms. While the developed world is considered the "core" of the global community, there is no reason that those who see themselves as global leaders cannot learn from the successes of those they consider themselves to be leading.

7.3 In Cuba

The particular history of this island nation has made it a crucial part of any discussion of sustainable agriculture. International political turmoil during the Cold War set up a scenario of nation-wide failure of conventional agricultural infrastructure. The Cubans were faced with a necessity to develop alternative paradigms quickly, and applied their substantial scientific resources to solving the problem.

Cuba's revolution

[110] Pearce. p. 16

Cuba's 'fall' to communism made the tiny state one of great geopolitical importance. Its location off the coast of the U.S. posed a threat to the NATO leader, making Communist Cuba a pariah among the Americas. Its high dependence on the Soviet Bloc was no less prevalent in the agricultural sector than the military arena.

> From the Cuban revolution in 1959 through the collapse of trading relations with the socialist bloc at the end of the 1980s, Cuba's economic development was characterized by rapid modernization, a high degree of social welfare and equity, and strong external dependency. While it ranked high on most quality of life indicators, Cuba depended on its socialist trading partners for petroleum, industrial equipment and supplies, agricultural inputs such as fertilizer and pesticides, and foodstuffs. Possibly as much as 57 percent of the total calories consumed by the population came from foreign suppliers.[111]

A tenuous situation like this is the antithesis of civicness, and serves to illustrate the potential calamity that can occur in a system fraught with dependencies:

> This demonstrates the degree of dependency exhibited by this style of farming, and the vulnerability of the island's economy to international market forces. When relations with the socialist bloc collapsed, pesticides and fertilizer virtually disappeared, and the availability of petroleum for agriculture dropped by half. Food imports also fell by more than half. Suddenly, an agricultural system almost as modern and industrialized as that of California was faced with a three-prong challenge: to essentially double food production while more than halving inputs—and at the same time maintaining export crop production so as not to further erode the country's desperate foreign exchange position.[112]

With the flight of agricultural capital, the Cubans were largely left to discover for themselves alternative strategies to keep their economy afloat and its people fed. The result was a necessity-driven revolutionary development of new agricultural methods. "What [happened] in Cuba is the largest conversion in world history from conventional agriculture to organic or semi-organic farming."[113]

Practices implemented

The Cuban approach to sustainable agricultural solutions was groundbreaking not only because of the scope and scale of the transformations, but also because it took a revolutionary path to discover a new branch of green technologies:

> In the United States, biotechnology is often associated with the release of genetically engineered organisms into the environment, posing [potential and largely unknowable] ecological and public health risks that are not consistent with

[111] Rosset, Peter. Organic Farming in Cuba. Multinational Monitor, Nov 1994. v. 15 n. 10 p. 13
[112] Ibid. p. 13
[113] Ibid. p. 13

> the goals of organic farming. What Cubans are doing is different. They have collected locally occurring strains of microorganisms that perform useful functions in natural ecosystems. These range from disease microbes that are specific to certain crop pests, and thus non-toxic to other forms of life, to other microorganisms that fix atmospheric nitrogen and make it available to crop plants or that aid in natural processes of nutrient cycling. These are then reproduced massively to be used as biopesticides and biofertilizers in agroecosystems. Some such products are available commercially in the United States as well, but Cuba is way ahead in terms of diversity of such biological preparation that [is] in widespread use.[114]

The development of such ecologically benign agents was so rampant in Cuba because it was based on necessity. It would be inadvisable for other nations to ignore the Cuban developments, as the current lack of necessity is not guaranteed for the future.

General Policies

Much of the mechanics of the revolution was engineered at the national policy level.

> The government has adopted a strategy of mobilizing Cuba's substantial scientific infrastructure—both physical plant and human resources—to substitute native technology for the no longer available inputs. This, farmers are combining what Cubans call biopesticides and biofertilizers (Cuban-made microbial pesticides and fertilizers that are non-toxic to humans) with earthworm culture, waste recycling, biological pest control, composting and other ecologically rational practices in an attempt to avert a catastrophic shortfall of food availability for the population. At the same time, government planners are creating the smaller scale management units that are essential for effective organic farming, and providing ownership incentives to farmers.[115]

Cuba's sustainable blitz implemented a multi-facetted strategy that improved practices while simultaneously reorganizing management strategies to complement the new management methods. While Cuba's geographical constraints make the conversion a smaller undertaking than would be necessary in larger nations with scattered population centers in differing climates, larger developed nations are likely to have more capital and governmental resources with which to accomplish the task, provided that management strategies are both coherent for all national regions and cohesive across the nation.

The transition was also eased by the strength of the Cuban scientific community:

> In some ways, Cuba was uniquely prepared to face this challenge. With only 2 percent of Latin America's population but 11 percent of its scientists and a well-developed research infrastructure, the government was able to call for 'knowledge-intensive' technological innovation to substitute for the now

[114] Ibid. p. 13
[115] Ibid. p. 13

> unavailable inputs. Luckily, an 'alternative agriculture' movement had taken hold among Cuban researchers as early as 1982, and many promising research results—which had previously remained relatively unused—we available for immediate and widespread implementation[116]

The agricultural revolution in Cuba was not the product of cutting edge chemistry or genetics, although it certainly relied on both of those fields; Instead of finding new methods of control over the biology, agricultural researchers in Cuba sought to understand and exploit natural ecological interactions to produce an agricultural that is both accessible and sustainable. "Cuba is demystifying biotechnology for developing countries—showing that it does not have to rely on multi-million dollar infrastructure and super-specialized scientists, but rather can be grasped and put into production even on peasant cooperatives."[117] By putting the emphasis on local management, the Cubans incorporated some degree of civic practices into their agricultural strategies as well.

The success of the Cuban conversion seems like a compelling and concrete (though somewhat small-scale) piece of evidence that sustainable agricultural solutions are not only potentially beneficial, but also practically achievable. It is not entirely accurate, however to depict the nation as single-mindedly striving for sustainability.

> Cuba's shift to organic agriculture is not taking place without controversy. … One common point of view holds that what is taking place is not a process of conversion, but rather a temporary substitution during a period of crisis. This viewpoint holds that once trade conditions change, agrochemical inputs should be once again used vigorously. The opposite point of view, put fourth by the Cuban Association for Organic Farming, a non-governmental organization, holds that the previous model was too import dependant and environmentally damaging to be sustainable, that the present change is long overdue and that further transformations are needed to develop truly rational production systems.[118]

This divide mirrors many of those around the globe, where the arguments are largely over the relative weights of the costs and benefits associated with each kind of system. While the benefits may be debatable in the short term, there can be little doubt about which techniques will be viable further into the future. Just as Cuba's revolution showed the feasibility of a paradigm conversion, reactionary forces now threaten to demonstrate that sustainable technologies can just as easily be abandoned once profitable conventional techniques resurface. A retreat from the drives toward sustainability made on the island

[116] Ibid. p. 13
[117] Ibid. p. 13
[118] Ibid. p. 13

would be a monumental setback to the development of secure and sustainable agriculture. Now that the threat of nuclear war with Soviet states is largely a ghost of the past, there is little reason to continue to shun Cuba; diplomatic ties with the U.S. would benefit the island greatly, and with Cuban collaboration, attempts to improve agriculture worldwide are likely to be far more successful.

8. Policy Analysis

While there are varying approaches to improving domestic agricultural productions, and despite regional and climatic differences, there are common goals that remain consistent across national borders. The following priorities, although specific to the U.S. are generally applicable to all nations and governments:

> Present U.S. agricultural development agenda items [those which are widely recognized and persistent] can be grouped into the following five categories:
> *Increase the utility of agriculture.* Maintain adequate production. Provide adequate livelihood for a desired number of participants. Provide food of acceptable quality and diversity.
> *Increase productivity.* Develop more productive biotypes. Maintain soil organic matter, tilth. Maintain crop diversity. Practice rotations. Use integrated animal/fish/crop/tree systems. Practice nutrient cycling.
> *Maintain an environment favorable to humans and most other species.* Protect groundwater from contamination. Reduce or eliminate use of pesticides. Reduce use of synthetic fertilizers. Encourage wildlife maintenance. Recognize animals' rights (reduce stress in confinement, provide for a degree of natural activity) [these are rights to dignity and freedom from unnecessary suffering, not political rights]
> *Assure the ability to evolve indefinitely.* Minimize soil loss. Stop overdraft of fossil groundwater. Reduce energy use (especially of fossil fuels). Develop better technologies for biological nitrogen fixation. Develop perennial cereals. Maintain existing genetic diversity.
> *Develop patterns of geographical distribution and scale (macro structure) consistent with national agendas.* Create adequate physical and institutional infrastructure. Develop market channels that respond to market and social needs. Manage corporate activities that may control portions of the agricultural sector. Monitor (or manage) land ownership (land is usually considered to be a quasi-public resource).[119]

In order to offer a useful portrait of U.S. policies, the following analysis of policy will focus on the successes and failures of that nation's agricultural policies.

This focus on American action is intended, due to the power of the government over farmers' practices, to provide possible scenarios for furthering sustainability of

[119] Harwood. pp. 13-14

"American agriculture [, which] in the twentieth century is the story of farmers' dependency on the federal government."[120] Critics of this dependency are warranted in their concerns, but generally have little in the way of feasible solutions to work for farmers' independence. Despite some efforts in this area, even very early on, federal involvement in agricultural production quickly spread and increased ten-fold over the USDA's first two decades.

> The growing involvement of the federal government in agriculture also became apparent in the increased congressional appropriations for the USDA, which jumped from $2.8 million in 1899 to 28 million by 1917.[121]

The increase in attention served to improve agricultural efficiency, but such improvements often came as a two-edged sword, as they exacerbated another major intractable agricultural problem.

Overproduction is a counter-intuitive problem that, while seemingly a positive influence on food availability, can serve to devalue commodities on the market, and threaten farmers' fiscal security. Despite efforts to control prices, limiting production has proved to be a problem that defies simple solutions.

> Dramatic scientific and technological change, however, continued to make farmers more productive, despite government attempts to limit production. As a result, farmers came to depend on the federal government for price support programs that would enable them to earn a living comparable to the non-farm population. Government economic aid would also help farmers remain on the land even though they continued to produce price-depressing surpluses of many staple crops such as cotton, wheat and rice, and dairy products. By the late twentieth century, this dependence was not only willful but long established. Farmers considered federal aid—in the form of price-supporting loans and acreage reduction payments—nothing less than an entitlement. By the turn of the twenty-first century, farmers remained even more dependant on the federal government after a failed attempt to free them from economic support was replaced by a return to income support through direct payments for participation in commodity-reduction and environmental programs.[122]

Overproduction and farmers' reliance on federal aid have largely become facts of the U.S. agricultural system. While efforts to counteract these trends may not prove fruitful, it may instead turn out effective to utilize the heavy reliance on subsidies in

[120] Hurt. Preface
[121] Hurt. p. 34
[122] Hurt. p. x

combination with excess production capabilities to make forward progress on furthering U.S. agricultural security.

Overview of Market structure

Another overwhelming and seemingly irreversible side effect of agricultural market developments is the growing trend, especially in the U.S., toward greater industry standardization and centralization.

> A consolidated, corporately controlled food and agriculture system is able to provide vast quantities of standardized fare. The foundation of this system rests on a set of very large farms articulating with a small number of global food processors, who in turn link with another small number of very large and increasingly global food retailers. For the system to run *efficiently* it must standardize and rationalize both production and transaction costs all along the food chain. The smaller the number of players in the system, the easier it is to standardize and rationalize.[123]

The mass-produced nature of food products available to American markets makes standardization of inputs and outputs necessary for the increased efficiency cherished by economic analysts. Very often, however, this trend results in increased control over the market by a smaller number of interested parties--increasing centralization and the effects that accompany it are nearly universally contrary to civic ideals. In the coming discussion, we will examine, one at a time, the affected sectors of the agricultural market from production, through marketers and finally, the broader ecological community.

8.1 Effects on Farmers

Farming has changed enormously over the past century, and especially within the last five decades. In many ways, what was once a way of life idealized variously as proud, noble, simple and sane is slipping further along the transition to becoming just another industry. Farmers have faced problems of falling prices, rising costs, and have increasingly been forced to substitute mechanical methods and chemical inputs for hand labor and native fertility. Not since the beginning of the century has farm life been an economically equitable occupation:

> In 1910 farmers paid an index price of 97 for production costs, including interest, taxes and wages. The price relationship between farm and nonfarm products became so favorable to farmers that the period from 1909 to 1914 became the base period used to judge the fairness of agricultural prices in terms of “parity,”

[123] Lyson. p. 57

> that is, when the comparative purchasing power of farmers to nonfarmers was about equal.[124]

There has not since been a time when parity was so close to 100 percent equitability, despite increasing government efforts in this area. Government subsidy programs have become a de-facto part of the U.S. agricultural system, to the disgust of economists and foreign competitors alike. Falling parity and increasing cost of living have made farm subsidies an entitlement in the eyes of dependant farmers.

> By the mid-1990s, 21 percent of net farm income came from government payments for participation in a variety of price-support, acreage reduction, and other programs, while 23 percent of available cropland was idled under government programs.[125]

The necessity and predicament of farmers has been scrutinized and prioritized, but still understanding has lagged. "Since the 1920s, government economic aid through a number of programs and formulas failed to stabilize agricultural production markets and shield farmers from the "cost-price squeeze"[126] The falling prices for farm commodities, largely spurred by overproduction follows a "tragedy of the commons" model in a peculiar way. Rather than detracting from finite physical resources, farmers are creating more food than is useful to accessible markets, depleting the unseen commons of the consumer's demand:

> As always, increased production exacerbated the problems of surpluses and low prices. Thus increased efficiency in the long run offered no solution to the farm [price] problem. Contrary to other businesses, farmers [as a whole] were penalized in the market for their efficiency.[127]

This has not only displaced or impoverished many farming families, but also detracts from the economic wellbeing of rural areas that formerly thrived on jobs and food that small farms provided. The overall effect on farmers has been a change in technology, and some reduction of sustainability, but the more pronounced effect is the loss of civic ties within agricultural markets and communities. Trends in the market have served to concentrate wealth, capital, market shares, and control over the direction of the industry. "We must see the drain of wealth from rural areas as the result of inappropriate structure of the agricultural system." [128]

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[124] Hurt. p. 12
[125] Ibid. p. 152
[126] Ibid. p. xi
[127] Hurt. p. 134
[128] Harwood. p. 15

Centralization and Aggregation

The decrease in civic interactions and local economies has been marked and widespread. Farmers have not only become specialized at the level of the individual farm, but also regionally, not only globally, but within nations:

> Farmers in areas that were once characterized by diverse agricultural activities have been driven to exploit their 'comparative advantage.' Producers in the Great Lakes states, for example, have been able to establish and maintain a niche in dairy production. Producers in the Plains states have been able to raise hogs cheaper than farmers elsewhere, while farmers in California and several other Sunbelt states have used subsidized water and a favorable growing climate to become the leading producers of fresh fruits and vegetables.[129]

Many of these comparative advantages are artificial, as in the case of water subsidies, and represent only distortions in the macro economy. Others are climatic or other variations that result in entirely "natural" economic phenomena. Whatever the case, these regional inequalities are manifested and exacerbated in and by the market. "Time and again, … farmers and development workers [have] brought up the issues of market demands for good-quality produce, adequate quantities to interest buyers and consistent supply of both quality and quantity"[130]

By tailoring distribution to large producers and marketers, due to their relative efficiency (under a system that allows externalized costs to persist), certain market actors have effectively centralized control. This self-reinforcing trend has not been considerably slowed, and without consumer and policy attention, seems unlikely to stop. Reducing centralization of production is good not only for communities, and society, but also reduces vulnerability to accidental or malicious failures.

Capital intensive vs. Labor intensive

The shift toward larger farms has been a significant factor in increased centralization and reduced civicness. This is another long-term trend that resulted from attempts to increase economic efficiency (in output per dollar) that has shaped the agricultural market.

> In the late 1940s farmers also became increasingly specialized and mechanized—they relied on one or two crops and more technology. This trend contributed to the continued decline of the farm population and the number of farms.[131]

[129] Lyson. p. 3
[130] Hellin and Higman. p. 196
[131] Hurt. p. 120

Whereas alternative methods rely on long-term soil fertility and ecosystem health in addition to per dollar output as measures of success,

> In contrast, the conventional approach to farming features a capital-intensive system, continuous cropping, and a substantial reliance on manufactured inputs and extensive use of credit. Conventional agriculture also stresses high levels of production—'more is better.' Yet, agricultural economists point out that the most profitable output on a farm is usually something less than maximum physical output[132]

How can we cope with the idea that strategies that are optimal in term of real costs are not always optimal economically? Actions to "level the playing field" for ecologically- or civically-minded producers and consumers are not guaranteed to benefit everyone in the market:

> Small farms with low yields stand to benefit the most and agribusiness the least. But [civic or sustainable agriculture] does offer an alternative for millions of small farms that have plenty of hands to work the land but not the skills or financial resources to adopt conventional or mechanized farming[133]

The farmers' perspective is the base level of production. The trends in farming have largely both determined and been determined by larger patterns in the industry as a whole. Keeping the farmers' situation in mind, let us step back and examine the activity after harvest, through processing, up to consumption.

8.2 Effects on Industry

Just as farms have become larger, fewer in number, and increasingly centrally controlled, firms involved in handling and processing products have slowly shifted to become more centralized. As these firms increased their market share, and thereby their economic power in the marketplace, they were able to implement structural changes in the industry suited to their ends:

> Contract farming [an example of an industry practice that has centralized control, wherein farmers in effect work for a company rather than themselves] is known as 'vertical integration' because the agricultural company involved with the farmer controls the commodity from production on the farm to its processing and marketing to the consumer.[134]

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[132] O'Connell, Paul F. Policy development for the low-input sustainable agriculture program. Edwards, Lal, Madden, Miller and House (eds). Sustainable Agricultural Systems. C. 1990 Soil and Water Conservation Society. p. 454

[133] Pearce. p. 17

[134] Hurt. p. 117

Policies like this allow large and powerful agribusiness (and other) firms to gain some aspects of what is a de facto monopoly advantage. Even without inter-business collusion, it is not unreasonable to posit that various types of market actors share common interests, and therefore require little collaboration to make concerted efforts to solidify their advantages.

While government policies may be partially responsible for allowing such a sweeping rash of conglomeration, through offering comparative advantages to larger businesses, and offering too little in the way of small enterprise support, direct effects of policy and legislative actions are much more profound. In recent decades, with the USDA NOP, increasing conservation subsidies, and diversification of crops eligible for subsidies, some progress has been made. Nonetheless, despite the fact that "changes made in the 1990 farm bill and other legislation have broadened farmers' crop choices somewhat, [Michael] Duffy [of Iowa State University] says, subsidies still favor high input agriculture and its favorite crops"[135] In addition to this, lip service given to farmers, while often genuinely intended, does not usually translate to decisive, comprehensive or aggressive action nor concrete solutions to the problems facing producers, as "financial and administrative programs often are biased toward urban consumers."[136]

Much of the details of what transpires in industry remain a mystery, because of the quantitative measures that are necessary for meaningful market analyses. Qualitative measures, which are often more meaningful from a humanitarian perspective, critics of classical economics point out, are nearly universally overlooked by economic census.

> Ignoring important values is nothing new to mainstream economics, … As globalisation [sic] pulls hundreds of millions of self-reliant farmers off of the land, they vanish – poof! – from [economic] analysis, allowing [economists] to argue that higher living standards among the few that survive prove that 'farmers' have benefited.[137]

This glib shot at the economic discipline is not meant to be an argument against its use, but rather to draw attention to the problems with taking a highly aggregated view of such a complex system; if one reduces the complex workings of an automobile to the readout

[135] Holmes, Bob. Can sustainable farming win the battle of the bottom line? Science, June 25, 1993. v. 260 n. 5116 p. 1893.
[136] Plucknett. p. 37
[137] Gorelick, Steven. Printed in The Ecologist, Feb 2001. v. 30 n.1 p. 23

on the speedometer, subtleties of its behavior will not be realized, and pieces of the whole may go neglected.

Another part of the trend towards centralized industry is the relatively few market actors were mostly surrounded, both on the supply and demand sides, by individuals who are not organized and cannot operate collectively.

> [in the beginning of the century, a prosperous time] some farmers complained that they had no control over marketing and prices because they sold wholesale and bought retail. Since they could not control production, they could not control prices like the large gain and meatpacking companies did.[138]

This proves problematic for farmers, as

> Increasing competition and the relentless drive to reduce cost, also means that buyers continually seek to reduce transaction costs: those costs related to the trading of products. Transport, processing and transaction costs are all disproportionately high for products sold in small quantities. These economics of scale, particularly on the international level, mean the buyers seek to purchase large quantities of produce.[139]

Because farmers were not able to organize autonomously in such a way that met buyer demand for quantity, the buyers were able to reshape the market, and vertically integrate much of the production so as to bring it under their control. What all this means is that, despite ecological, moral and farmers' objections, farming has become just another industry.

> But by 1960 farming had become more than a way of life; it was a business where only the most efficient survived. The days of the small-scale, diversified farmer were gone. Government policy in the form of loans, price supports and acreage reductions favored large-scale farmers who could produce more for less cost than small-scale landowners.[140]

These effects have not been isolated to the U.S.; while policies vary from state to state, seemingly no part of the world is immune to the market forces we see domestically

> Research illustrates that way that farmers' participation in international and national markets involves a complex system of agricultural inputs, technical extension, packing, processing, and marketing activities. These demands are being placed on farmers at precisely the same time that structural adjustment and cuts in fiscal deficits have led to dismemberment of classical agricultural extension and research services, to the extent that these services are unable to serve the needs of farmers living in complex, diverse and risk-prone environments.[141]

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[138] Hurt. p. 13
[139] Hellin and Higman. p. 197
[140] Hurt. p. 122
[141] Hellin and Higman. pp. 195-196

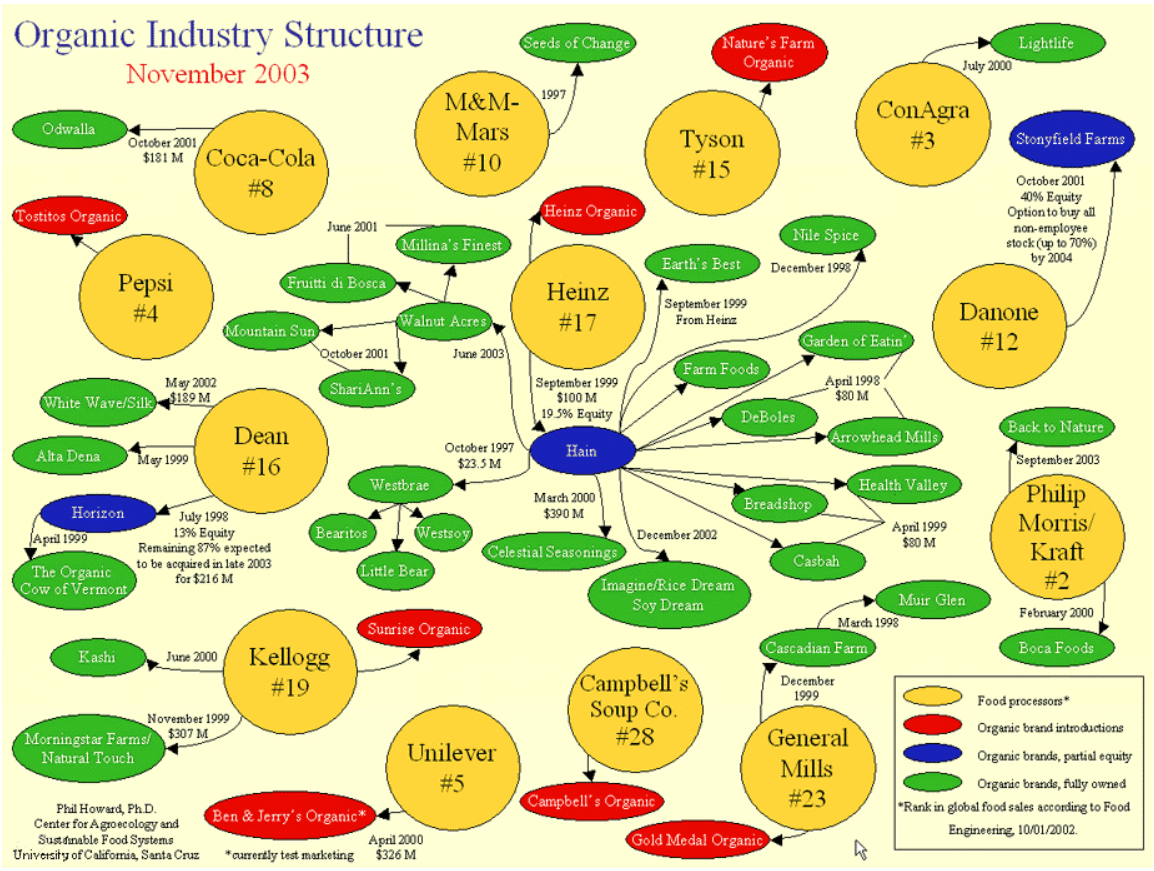
Despite trends that some would characterize as detrimental to humanitarian goals, there is no reason to believe that these changes are irreversible, or that compensatory practices-those that mitigate the adverse effects of their counterparts-will not be implemented. Policy and legislation are certainly a critical aspect of enacting positive changes in the market, but historically, collective consumer action has shown to be far more potent than regulatory approaches.

> Although scientific research had not proven that beef and dairy cattle treated with growth hormones (with the exception of DES) or genetically modified corn and soybeans were hazardous to human health, many consumers, domestic and foreign, did not care to eat hormone-treated beef or genetically altered corn or soybeans. Consumers' rejections of these agricultural products may have been based on poor science, but their perceptions were decisive. Farmers began halting the production of those commodities because they could not market them easily, if at all.[142]

The Organic Market

Results of consumer activities are also apparent in the recent acquisitions (depicted below) of organic firms by larger conglomerates. The show of confidence in the future of the organic industry, represented by expenditures in the hundreds of millions of dollars, bodes well for the possibilities of bringing organic products into the mainstream. With the backing of major industry players, the risk of failure of any particular business diminishes significantly. While this seems a boon to the organic industry, conscious consumers raise concerns that the flow of information between the conventional and organic industries might be bi-directional.

[142] Hurt. p. 166



The graph above also serves to illustrate that organic marketers are not immune to overarching trends of centralization that have emerged in other agricultural sectors. Far from being overjoyed that their favorite products have increased market security, some green consumers may be disillusioned to learn that their favorite smoothie is Coca-Cola in disguise or that their Boca Burger is a product of tobacco giant Phillip Morris (Altria). Skepticism of parent companies may erode confidence in the core of the organic consumers, as standard business practices infiltrate the organic firms, who are (theoretically) more likely to have civic and sustainable ideals in the minds of their executives.

Regardless of the dynamics of the interactions between the green and conventional firms, the prevalence of business mergers and acquisitions (symptoms of the ever-ubiquitous centralization) shows that organic marketers are not immune to the trends that have largely defined the rest of the market for decades. If broader challenges of sustainability are to be met, green industries must adapt to broaden their markets, or existing large firms must adopt practices that are sustainable in terms of ecology, resources and economy.

8.3 Policy Successes

In the United States, conservation practices (essentially an isolated element of sustainability) have a fairly long history and have been quite beneficial to progress toward sustainability. Over a century ago, experimental and demonstration farms, showcases for improved or innovative techniques were instituted to aid farmers in conserving their soil and improving output. Language emphasizing personal interaction and hands-on experience, hallmarks of civic organizational structures, was incorporated into the programs even before the turn of the 20th century.

> Seaman A. Knapp, a farmer and professor of agriculture, … and a contributor to the 1887 Hatch Act, which established the state experimentation station system, directed a USDA program to create five demonstration farms in Louisiana and Texas… Knapp believed that farmers would improve their agricultural practices if they could see the results of applied techniques instead of relying on lectures at the farmers' institutes or bulletins from agricultural experiment stations.[143]

By bolstering the civic nature of the outreach programs, a more practical understanding of concepts was achieved while simultaneously strengthening trust and facilitating flow of information, both from the researcher to the farmer, and from the farmer to the researcher.

In addition to research and outreach programs, the practice of applying subsidies to foster soil conservation is not unheard of.

> The [Roosevelt] Adminsitration worked rapidly to achieve congressional approval of the Soil Conservation and Domestic Allotment Act, which became law on February 29, 1936. Although policy makers still emphasized the increase of farm income, this new legislation authorized the AAA to pay farmers for planting soil-conserving, rather than soil depleting, crops. Of course, the soil-depleting crops were those the USDA considered to be in surplus. [Thus using the environment as an excuse to tamper with the economy][144]

Regardless of whether Roosevelt saw the ecological and soil fertility crisis as a way to further his semi-socialist domestic agenda, or was appealing to farmers' declining wealth to move toward sustainability, the policy served both purposes, and was a limited but tangible step forward for farmers and the (at the time virtually nonexistent) environmentalists. While *The New Deal* is generally glorified historically by all but the

[143] Hurt. p. 30
[144] Ibid. p. 81

staunchest conservatives, at the time of its conception, its tactics were unheard-of, and were often regarded skeptically.

> By the time the Soil Conservation Service took over [purchasing land to address concerns over wind erosion] in 1938, the land-purchase program had become an unprecedented experiment in state-sponsored environmental and social planning.[145]

Dustbowls, droughts and other agricultural disasters of the early 20th century were fierce encouragement for humankind to work with nature to reduce erosion and depletion, but within a decade, World War II was well underway, and the new technologies that sprang from the technological and economic expansion during that era were largely effective at producing items that alleviated many of the farmer's soil fertility problems.

It was not until these technologies' effectiveness began to decline that national attention returned to ways to work with natural systems as opposed to manipulating then with chemicals.

> On March 8, 1987, Assistant Secretary Bentley established a task force on alternative farming systems to explore the implications for the USDA of the growing interest in this topic and to recommend actions for dealing with Subtitle C [The Agricultural Productivity Act] of the Food and Security Act.[146]

Following initial steps in the 1980s, further progress was made in 1990, with the passage of FACTA, and its articulation of a sustainable vision.

The vision is powerful, but the mechanisms to reach it are still lacking. There has been increasing attention given to these issues, at least in the policy arena, but so far the effect on actual market activities has been marginal. Just as sustainable production practices must take into account complex, interactive ecological cycles, policy approaches much address all areas of the market, from producers, through marketers, to the consumers; it must be cost-effective for every economic agent to act in a manner that promotes rather than prohibits sustainability.

8.4 Policy Shortcomings

It turns out that, much to the dismay of sustainability advocates, much of the regulatory structure systematically favors practices and industry structures that are not sustainable,

[145] Ibid. p. 85
[146] O'Connell. p. 455

and reduce the civic benefit of economic transactions. Disproportionately allocating farm aid is one example of the policies that are detrimental to a civic industry.

> In 1985 the large-scale farms that sold more than $500,000 worth of products annually received approximately 15 percent of all federal payments, though those farms comprised only 2 percent of the total.[147]

This macroeconomic discrepancy does a disservice to smaller farms, which are more likely to contribute to community wellbeing and promote individual ownership.

In addition to reducing diversity in the national economy, on-farm enterprise support has historically been narrowly focused, and often inadvertently encourages practices that are wasteful and polluting.

> Critics have argued that federal farm programs prompted farmers to produce those commodities for which they could receive guaranteed income from the federal government through a number of programs. These income-support programs encouraged maximum production [per acre], which in turn fostered environmentally damaging practices that led to soil erosion and water pollution, among other environmental problems.[148]

By subsidizing only certain practices, a situation is created wherein economic incentives do not correspond to ecologically sensible management practices. As a result, economic interests, which are much more quantifiable than those that are environmental, tend to take precedence, leaving ecological cycles systematically unclosed, and suppressing sustainability across the board nationwide.

When policies create conditions that cause market actors to suffer economically for the sake of improved environmental conditions, conflicts of interest arise; because the microeconomic dimension of sustainability is often the most critical from the position of the farm-owner, it us unlikely that farmers will make good ecological decisions if it significantly and negatively impacts their bottom line. Policies that have a nation-wide effect must always be analyzed to ensure that the goals and ultimate effects are consistent. If a policy is effective economically but hinders sustainability it cannot be considered a success; likewise unless conservation practices and other sustainable paradigms can be made fiscally feasible, policies aimed at their promotion have failed.

[147] Hurt. p. 149
[148] Hurt. p. 151

Failures

Well-meaning, and even well designed policies are not necessarily destined for success. Early attempts to remedy the farmers' situation proved largely unfruitful:

> "Introduced as the Agricultural Act of 1956, and informally known as the Soil Bank Program, this legislation authorized the federal government to pay farmers a fixed amount per acre for removing cotton, corn, wheat, peanut, rice and tobacco lands from production. … [T]he lands were designated a conservation reserve for a maximum of ten years. Weeds would grow and help conserve the soil. With fewer acres in production, surpluses would diminish and agricultural prices would rise. Farmers would receive federal payments for reducing their allotted acreage of certain crops if they used those acres for conservation purposes. … Soon, however, many farmers realized that the program would not solve the cost-price squeeze. After payments under the program severely taxed the federal treasury, the government abandoned it in 1959"[149]

This act, which aimed to provide a national "bank" of unplanted fallow soil, did not prove effective at eliminating the overproduction of staple crops. Its simplistic approach did not take a holistic view of the market, and farmers continued overproducing, while costs at the federal level built. Taken from the view of sustainability, the act did little to alter the way in which the problem crops, in the fields that were not fallow, were produced.

More recently, in an era of increasing market "freedom," other approaches were taken to curb subsidy spending and encourage an independent agricultural market:

> The Federal Agriculture Improvement and Reform Act (FAIR) or, colloquially, the Freedom to Farm Act, was the first major change in farm policy since 1949. It provided for a systematic reduction in federal payments to farmers over seven years, regardless of the amount of commodity surpluses or the level of market prices. At the end of seven years, farmers would no longer receive payments in any form for production. … though previous contracts for withdrawing acreage from production under the Conservation Reserve Program remained in force.[150]

This attempt to bring the market back under the control of "natural" as opposed to deliberate influences was well meaning but short-lived.

> In 1998 Congress responded [to market problems caused in part by FAIR] by providing emergency payments to farmers, thereby doubling instead of reducing the cost of the farm program and making government pay about half of net farm income. Yet 150,000 of the largest farmers received nearly half of that money. Approximately 80 percent of farm payments went to large- and medium-scale

[149] Hurt. pp. 113-114
[150] Ibid. pp. 152-153

> farmers. … As a result [despite the intentions of the 1996 FAIR act] farmers became even more dependent on the federal government.[151]

This example serves to demonstrate the counter-intuitive nature of systems; much like a buoyant object forced under water, attempts to remove supports for farm income exacerbated the need for such support, making the return of subsidies inevitable.

The removal of subsidies, however gentle or well planned, must correspond to alternate strategies to support farmers if farming is to become less federally reliant. Had the FAIR Act somehow diverted subsidies to the support of conservation behavior (rather than eliminating them entirely), it might have served to improve sustainability, even if it did little to increase farmers' financial independence.

Reductionism

As proposed earlier, many of the problems of sustainability currently facing humanity are the products of our reductionist assumptions that the effects of artificial shocks to natural (or in the case of the economy, artificial) systems are likely to have understandable effects. This view is usually proved naïve, as shocks can work their way through a system's components and serve to intensify the problems they were intended to solve. Breaking down the whole into its parts and acting on them individually is often counterproductive, as it necessarily excludes some understanding of the relationships between system components.

This approach is prevalent in farm assistance, as some researchers focus on individuals, and others on collectives. Ultimately, successful policies must consider both so that neither the individual nor the community benefits at the other's expense.

> The role of the USDA's Cooperative Extension Service, which is still the primary educational outreach organization for farmers, has been to provide each producer with the knowledge, skills and information necessary to make the best decisions within the parameters of his or her own farm. The individual, not the community, has been the sole focus of attention (for program development) and of action (for outreach efforts).[152]

Here we see the farming community's neglect as a result of over-attention to the microeconomic dimension of farming. Raising overall productivity may be beneficial to a farmer's bottom line, but if output increases throughout the market as a whole and if this increase in productivity comes at a sacrifice of future resources, then we see that in

[151] Ibid. p. 158
[152] Lyson. p. 63

the end, neither the farmer nor the market as a whole benefits. Individualism often serves to enrich an individual only temporarily, whereas a communal outlook (provided that individuals are not neglected) serves the entire population.

Part of the reason for the prevalence of reductionist thinking is its apparent success in controlled environments. A scientific experiment within a laboratory may be convincing, but taken out of such a sterile context, many of its findings, while still technically valid, may be confounded by elements that are not only prevalent in the world, but also ubiquitous and inherent. Chemistry, biology and other scientific fields have all made great strides in understanding of natural processes, but success in their application have been a more complex endeavor.

Much of the green revolution technology epitomizes the belief that nature can be simplistically and reliably controlled:

> Conventional agriculture is anchored to a scientific paradigm that is rooted in experimental biology. It embodies an approach to farming that focuses on creating and enhancing "favorable" traits of crop varieties and animal species. … As such, the reductionist nature of experimental biology [as it is currently applied]… dovetails nicely with the reductionism of neoclassical economics, which provides that framework for turning these traits into 'property.'[153]

Neither hard sciences nor neoclassical economics, in their current applications, do justice to the underlying connections between the elements of the systems they claim to study. Part of the problem is that rather than understanding, the (indirect) aims of scientific investigation are usually to find applications for new technologies. The result of this in the agricultural sector is that "as different production-oriented agricultural disciplines were formed over the past 120 years such as agronomy, plant pathology, the animal sciences, plant breeding and entomology, they broke apart "farming" bit by bit into disciplinary niches."[154] Such thinking is contrary to biodynamic and ecological models, which stress interdependence rather than isolation of system elements.

Similar approaches to legislation have led to over-specific programs that undercut effectiveness in a broader context. Particular wording of legislation, and a focus on certain costs to the exclusion of others have historically plagued farming policy, which in some respects has served to detract from sustainability. "The federal government pays

[153] Ibid. p. 74
[154] Ibid. pp. 99-100

most subsidies in the form of per bushel price supports, which historically have encouraged farmers to pile on the fertilizer and pesticide to boost yields. In addition, government programs support only a handful of crops, including wheat, corn, and cotton."[155] Making programs, policies and legislation very specific may serve to focus them, but if the programs are to be successful, it is critical that they not lose sight of broader views, where conflicts may emerge if policies exclude their consideration.

This is not to belittle current measurements and indexes; instead it is a call for the expansion of tallied costs so that ugly 'externalities' can become a thing of the past.

> Although crop yield and quality are important products of a farming system, the benefits of better soil and environmental quality provided by the organic and integrated production systems are equally valuable and usually overlooked in the marketplace. Such external benefits come at a financial cost to growers. Currently, growers of more sustainable systems may be unable to maintain profitable enterprises without economic incentives, such as price premiums or subsidies for organic and integrated products that value these external benefits. Equally important, upon incorporation of external costs into economic assessments of farming systems, we may find that many currently profitable farming systems are uneconomical and therefore unsustainable. The challenge facing policymakers is to incorporate the value of ecosystem processes into the traditional marketplace, thereby supporting food producers in their attempts to employ both economically and environmentally sustainable practices.[156]

Sentiment like this is not limited to the agricultural arena, as sustainability is a concept that applies nearly universally to human enterprise. If costs of production in any industry remain external to considerations, it becomes nearly impossible to control the damage inflicted by unintentional effects on the environment.

Even in the case where costs and benefits are accurately and completely tallied, the presentation of this data can give it bias that belies the value of the underlying processes. Such selective measurements have lead to distorted pictures of the efficiency of large-scale operations, but "even World Bank economists now agree that there is an inverse relationship between farm size and total farm output. … Focus on 'yields' of individual commodities, rather than total output, unfairly stacks the deck by ignoring a large measure of what small farms produce."[157] Selective comparisons can reduce the

[155] Holmes. p. 1893.
[156] Nature, April 2001. v.410 n. 683 pp. 928-929.
[157] Gorelick. The Ecologist, Feb 2001. v. 30 n.1 p. 22

apparent efficiency of certain operations, where practices like intercropping may reduce yields but increase overall output.

Similarly, dollar amounts as measurement leave many things unaccounted for. A decline in field fertility or an increase in pollution output may have effects that are very real financially, yet the environmental damage itself defies quantification in dollars. By instituting money as the primary (or, in some cases, the only) dimension of value, we have done ourselves a disservice; when a system, like an economy, necessarily favors one type of value, things that defy that conception of that value will suffer systematically.

> Conventional economic thinking famously 'externalizes' anything that can't be monetized – family, community and the environment among them. It is the same logic that makes the price of food important, its quality irrelevant.[158]

Disinterest, Self Interest and Confusion

Many of the concerns that have been raised here are not news to policy makers. Small business is one of the primary objects of political rhetoric directed at the economy. Yet trends of centralization in industry are hardly unique to farmers, and it is unclear what action, if any, is to be taken to combat this trend.

> While GoldSchmidt's (1978) and Mills and Ulmer's (1946) studies affirmed the social and economic benefits of small business and the family farm for community life, and the deleterious effects of big business and big agribusiness, little, if anything, was done to stem the trend toward economic concentration.[159]

It is very easy to assume that the increased power of larger businesses gives them the ability to shape their policy environment more favorably than can their smaller counterparts; yet that assumption jumps to a conclusion that such conditions are intentional, whereas (it can be argued) they are in fact at least partially the result of 'natural' market phenomena.

That said, it is no surprise that chemical companies lobby against aggressive promotion of organic farming techniques, and large agribusiness firms are opposed to policies that favor smaller-scale business. There need not be any sinister motivation for this to take place, as institutional momentum exists in firms and governments alike. This inertia tends to counteract change within a system, and may be responsible for much of the slow nature of the transition to alternatives.

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[158] Gorelick. The Ecologist, Feb 2001. v. 30 n.1 p. 23
[159] Lyson. p. 84

> By the end of the [1980s], farmers, agricultural organizations, and political supporters could persuade Congress only to make minor changes in farm policy with the Food, Agriculture, Conservation and Trade Act of 1990. The basic support, production, and marketing philosophy for farm policy remained little changed since the 1930s.[160]

No malevolence is needed to have a biased perspective, and it should be no surprise that experts who hone their knowledge in industry necessarily carry the ideas and goals with them into consulting and government work. Although it is likely that some former industry actors intentionally skew policy whenever possible in favor of business profits, such intentions are not necessary for decision makers to carry their biases through the transition from the private to the public sector.

> It may well be that President Clinton's Council on Sustainable Development will, in the end, inflict more violence on the natural world than did the Bush [I] Administration's Council on Economic Competitiveness. … Co-chaired by Dow Chemical vice president David Buzzelli, it has eight representatives from the corporate sector, with connections to such groups as the chemical manufacturer's association, the Committee for economic Development, the American Petroleum Institute, and the Business council for sustainable development. … Only five members of the council have environmental ties.[161]

While it is essential that industry voices be incorporated into any promotion of sustainable business practices, the nexus of the environmental and business realms must not be skewed too far to either side, lest it be unsuccessful. Such efforts have historically come down in favor of industry, an example of which is the World Business Council on Sustainable Development; CorpWatch, an independent NGO gave "a Greenwash Award to the WBCSD for its continuing, albeit somewhat muted efforts to portray itself as the savior of the world's environment and the force that will eliminate poverty."[162] The prevalence of independent organizations like Corpwatch demonstrate the growing need to have business' environmental claims verified or discredited, at present, there is no officially recognized body to carry out such work.

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[160] Hurt. p. 138
[161] Willers.
[162] CorpWatch June 1st, 1997. http://www.corpwatch.org/article.php?id=4071

9. Policy Recommendations

Given than we accept the need for improvement of sustainability in any number of ways, how can these ends be reached? An increase in availability of verified consumer information and sustainably produced products is a necessity for our current consumer economy to make the transition to sustainable development. However, such changes are unlikely at best without appropriate policy and market action to not only develop such sustainable practices, but also to see that they are implemented in an cost-effective manner that is appropriate for regions that vary economically and geographically.

In terms of farming sustainability, resources and leverage are not in short supply, and there is little argument to be made against federal support of such practices.

> At century's end…[policy proponents] argued that price- and income-support and environmental programs for farmers benefited the general welfare because abundant food supplies and soil conservation were essential to national security.[163]

This interest in national security has historically overpowered concerns for economic naturalism; this outlook supports an underlying theme of this writing: that farming is so crucial to our way of life, that consideration of it as 'just another industry' is not only dangerous, but nearly impossible.

Agriculture may not benefit in the long run from economies of scale, as they depend directly on irreplaceable natural capital; lasting damage to soil stocks is almost certain to outweigh short-term benefits, as even economists regard land as a resource that is fixed in terms of quantitative supply. Advocates of sustainable agriculture, which necessarily values the long run, suggest that new organizational paradigms may be a necessity:

> An effective agricultural development strategy for civic communities should be geared toward problem solving. Policies to promote and strengthen regional trade

[163] Hurt. p. 173

> associations, local agricultural districts, producer cooperatives, and other forms of locally based economic activity should be part and parcel of a comprehensive community-based agricultural development strategy.[164]

Additionally, as environmental economics is generally regarded as anthropocentric, it dictates that attention be paid not only to environmental, but also humanitarian issues.

> Most [current] certification standards did not include social criteria. … There are no major differences in living conditions, labour practices or pay for a farm-worker working in an organic versus conventional farm operation.[165]

Just as consumers have been made aware of the growing conditions of organic food, an educated consumer base must also be knowledgeable with regards to environmental, social and economic ramifications of their consumption patterns.

It is also critical that these effects be placed in the proper context, so that simplified analyses do not gloss over cultural or regional difficulties adapting to such measures. Globally as well as nationally, this is a concern.

> Standardization processes [in organic certification] proved particularly culturally and economically inappropriate to small farmers in the developing world whose farming rationale is rooted in biodiversity and traditional knowledge. In fact, many people in the South perceive organic standards as a form of protectionism from the North.[166]

Appropriate techniques and approaches to sustainability are likely to vary greatly in differing contexts, it is critical to avoid the idea that we may have discovered 'the right way' to do something, as that way may be unfeasible or problematic in regions that defy our limited conceptual models of reality. Flexibility, inclusion and modularity must all be prized ideals in the transition to a sustainable economy.

<u>Quality Food as a Human Right?</u>

Issues raised by proponents of environmentalism often overlap those touted by social activists; this is self-evident once the close ties many people still share with their surroundings are accepted not as 'underdevelopment,' but as a necessary interface between the human economy and the natural world in which it exists. It should come as no surprise then that many people now support the idea that access to potable water and nutritious food should be elevated to the level of human rights.

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[164] Lyson. p. 104

[165] Alteiri, Miguel A. and Nicholls, Clara I. Agroecology rescues organic agriculture from corporate takeover. Third World Resurgence, September/October 2003. v.157 n.158 p.3

[166] Alteiri and Nicholls. p.3

> By the end of the twentieth century the nonfarming public … had become increasingly concerned about agricultural practices that endangered or might threaten public health. These concerns superceded economics. They included, for example, the safety of drinking water and the preservation of wetlands and wildlife habitat. Environmental policy had become an important and highly visible public issue for rural areas, and it no longer remained the provenance of farmers.[167]

Nonetheless, much degradation of common resources like drinking water is the result of individuals acting in their own interest. "The nonfarming public demanded clean water for daily life, and that meant governmental regulation of farmers to prevent contamination of drinking water from fertilizers remained the provenance of farmers."[168] Effective measures to limit damage, and provide equitable (or at least, ethical) resource distribution, without inflicting excessive economic harm must be a priority of changes in policy and legislation.

9.1 Regulatory Revisions and Subsidy Reallocation

The largest problem to be tackled in the agricultural and business policy arenas is to put in place some sort of check against the increasing centralization taking place in the markets. The benefits of civic agriculture to producers, communities, and national security are all reasons that it is in the national interest to promote programs that are already taking hold.

> A growing number of community groups across the united states are recognizing that creative new forms of community development, built around the regeneration of local food systems, may eventually generate sufficient economic and political power to mute the more socially and environmentally destructive manifestations of the global marketplace. A turn toward a more civic agriculture is both theoretically and practically possible. Indeed, the seeds have been sown and are taking root throughout the United States. Civic agriculture represents a promising economic alternative that can nurture community businesses, save farms, and preserve farmland by providing consumers with fresh, locally produced agricultural and food products.[169]

As national attention is increasingly focused on homeland security, it would be inadvisable to allow vulnerable nodes and single points of failure to emerge in the

[167] Hurt. 164
[168] Ibid. 164
[169] Lyson. p. 98

national food distribution network. Civic agriculture can help prevent this and benefits not only security, but also the economy and the environment.

Environmental and humanitarian concerns also present the need to reduce effluent emissions from agricultural sites. As the effects of runoff and even atmospheric pollution became manifest,

> The nonfarming public['s] demand[s for] clean water … meant governmental regulation of farmers to prevent contamination of drinking water from fertilizers, pesticides, and herbicides. Investors in recreational and tourist areas also wanted livestock confinement facilities kept beyond "smelling distance." Some scientists even advocated state regulation of odors and noxious chemicals emitted from livestock facilities.[170]

While a more civic agricultural model would mitigate much of the environmental damage by reducing its geographic concentration, effectively enforced limits on existing emissions are unlikely to cause additional harm. Whether a coercive regulation, or economic disincentive for pollution is the solution has yet to be seen, but either approach (or both approaches) is likely to have a positive effect ecologically, and possibly economically, as new incentives stimulate innovation.

Such economic incentives are present in current regulations, but they beg expanding. It is likely that the agricultural producers would be heavily in favor of green incentives over strict regulatory limits, as the market is already rife with federal subsidies.

> "[Farmers] had no desire to give up their dependence on the federal government for financial support [as the FAIR Act had encouraged]. Rather, they favored government "green payments" for conservation practices and alternative energy development, such as ethanol and other farm-based lubricants.[171]

Federal thinking has, much to the detriment of the development of sustainability, been trapped "inside the box" for decades regarding the utility and applications of agriculture. Because agriculture has historically been seen almost exclusively as a producer of food (a changing perception with the continuance of the bio-tech revolution), federal policies have largely been limited to staple crops. This narrow approach contorts the market by offering incentives for certain enterprises and not for others. To combat this, "[Paul] Faeth [of the World Resources Institute] suggests leveling the field by making farm subsidies independent of what crops a farmer grows. This would clear the way for

[170] Hurt. p. 165
[171] Ibid. p. 171

farmers to choose techniques based on their costs and benefits without the distorting effect of selective subsidies. To encourage even further reductions in environmental costs, Faeth says, the government could offer subsidies that actively reward land stewardship."[172]

Just as inclusion of additional crop choices expands variety of output, limiting centralization of alternative producers fosters variety in production. If civic and alternative practices are to be promoted together, new approaches must be sought.

> By not limiting the maximum amount of land that a particular farm or company could certify as organic, it has allowed big corporations to join the fad, displacing small organic farmers. In California, over half the value of organic production was represented by 2% of the growers who grossed over US$500,000 each; growers grossing $10,000 or less comprised 75% of all growers and only 5% of the sales. … This system is excellent for consolidating wealth and power … but it is antithetical to the goals of community and local control that were part of the original inspiration of the organic movement.[173]

Similarly, current certification paradigms pose a lose-lose scenario for organic producers who wish to market their goods as such, but have little money to afford certification. They must either absorb the cost (unlikely considering the financial straits of most small farmers) or (as is typical) expect the consumers to pay a premium for their certified goods. Although placing the cost burden on the consumer is generally the most economically viable strategy, it hurts producers by dissuading would-be green consumers and thereby stifling the organic market. Some agricultural activists even recommend the USDA "democratize and provide flexibility to the certification process, [thereby] encouraging emergence of solidarious (no-cost certification based on mutual trust) locally adapted certification."[174] By 'democratizing' such certification processes, or by placing the costs on marketers (as is done with fair trade certification), economic barriers that have stunted the growth of the organic market can be removed, and progress toward sustainability can be made.

[172] Holmes. p. 1893.
[173] Alteiri and Nicholls. p.2
[174] Ibid. p.6

9.2 Market-Based Strategies

The market is inherently undemocratic because individuals with more economic clout (money) have more influence over it than those with little capital. Because of its somewhat single-minded focus on profits and efficiency, it may be (as it has been in the past) necessary to limit the market for the good of society.

> The free-market neoclassical system of conventional agriculture … does not necessarily benefit from democracy and, in fact, may be constrained by the politics put into place by democratic actions of citizens. … The freedom of consumers to choose which food products to purchase should not be confused with their freedom to shape the practices or regulate the companies that produce, process and sell the food.[175]

Much of this shaping is done through the institution of artificial costs that are meant to reflect the "true costs" of resource depletion and damage to ecological capital. Yet,

> Some experts question whether society should even try to assign dollar values to environmental costs and benefits. Unlike an egg or an automobile, whose value can be pegged precisely at its selling price on the market, human health and scenic countryside aren't bought and sold, so it may be impossible—even immoral, some suggest—to put a price on them. Others counter than dollars are the only meaningful way to add up the costs and benefits of different options when policymakers come to the table.[176]

Moral arguments tend to weigh heavily on the human mind, but it is important for environmental activists to remember that, like it or not, markets are largely determinant of the activities in which we engage as a society. Those who question the benefit of assigning a value to what they consider priceless must remember that anything neoclassical economists cannot find explicit value for, they generally grant a price of zero by ignoring it altogether; this includes wildlife, water and air quality, and the health and welfare of human and nonhuman animals. While no economist sees these things as totally devoid of value, very few would have an easy time finding a place for them in their equations unless they were explicitly profitable, or served to reduce an existing cost.

Just as the "real costs" of resource depletion often go unnoticed, economic costs can be skewed by well-meaning but misguided legislation.

> The entire system of commodity production is being propped up by large government subsidies. These subsidies favor some producers over others (usually

[175] Lyson. p. 77
[176] Holmes. p. 1893.

> large ones over small ones) and certain production practices over others (usually capital-intensive over organic).[177]

Removing artificial market impediments to green production is an essential first policy step to making the markets work for sustainability. In many ways, the transition to a sustainable economy is undercut by previously existing market supports. In this bizarre situation, resource security is hindered by policies designed to favorable shape the market; coping with these inequities often leaves green producers, and more often green consumers absorbing the final cost. This extends beyond produce, as "Livestock producers also wanted support to pay for new environmental regulations that mandated specific practices such as sewage treatment and requirements for animal confinement."[178] Approaches to sustainability must be holistic by design and work to ensure that all market sectors are prepared to make the transition.

Price premiums are the current method by which organic farmers retain comparative revenue with intensive operations. Prices vary seasonally and organic produce is sometimes, though not often, cheaper than conventionally produced food, but generally speaking, consumers who choose to buy organic pay a premium for what they perceive to be a better product. In a comparative study of three farming systems, one conventional, one organic, and one that employed a combination of the two:

> Without price premiums for organic fruit, the conventional system would break even first, the integrated system second and the organic system third under measured or non-russetted [a condition that changes the appearance of the fruit's skin, but leaves the nutritional value intact, making the fruit suitable for processing] fruit quality conditions. For breakeven points of the organic and integrated systems to occur in the same year as the conventional system, price premiums of 12% for the organic system and 2% for the integrated system would be necessary under measured fruit quality conditions. Under non-russetted fruit quality conditions, premiums of 14% for the organic system and 6% for the integrated system would be necessary to match the breakeven point of the conventional system.[179]

Whether consumers purchase organic or green products for environmental concerns or reasons of quality, their willingness to pay additional dollars or cents is evidence that there is definite (and perhaps measurable) value in green products that conventional products lack. If part of this value lies in the preservation of food or resource security, it

[177] Lyson. p. 100
[178] Hurt. p. 172
[179] Nature, April 2001. v.410 n. 683 p. 928.

is in the government's interest to internalize this cost so that consumption of green products is not hampered by high consumer premiums.

Consumer demand (perhaps assessed by market-optimal premiums) may be one way to approximate the additional value of green products. Because costs of pollution and ecosystem damage are difficult to measure in dollars, it may be more fruitful to approximate such values with applicable market data. But internalization of premiums may not be the only way to shift the market; some suggest that demand-inflation programs like the school lunch program might be applied to expanding green or civic market share. Representatives would need to "create policies that intervene in the market by opening opportunities for local organic producers (i.e., ordinances that mandate all food served in school and university cafeterias should be organic)."[180] Rather than direct subsidies, industries seen as beneficial to sustainability might be favored in municipal state and federal product purchase decisions.

Until green consumption enters the mainstream, temporary strategies to grow the green sectors, especially in food production will be necessary.

> If smallholder farms are to take advantage of the market, they need to be able to seek out and develop opportunities. In particular, for them to benefit from the niche markets, such as organic, fair trade, gourmet and FSC certified markets, they need marketing skills. … This might seem rather self-evident, but in development circles there are still those who focus on the existence of a market per se and do not question whether farmers have the technical skills and knowledge to take advantage of these market opportunities[181]

The identification of organics and fairly traded goods as 'niche markets' may be accurate, but if macroeconomic sustainability is to be achieved, that position must be seen as temporary and transitional. Widespread increases in civic and green production should be goals of sustainably minded decision makers. In short, green advocates want "changes in policies to stop subsidies of conventional technologies and to provide support and incentives for agroecological approaches."[182]

Civic and organic should also not be seen as terms that relegate an operation to being a small, hokey, homespun affair. Indeed, if urban areas are to be fed civically produced food, large-scale organic operations will likely grow in size; "there

[180] Alteiri and Nicholls. p.6
[181] Hellin and Higman. pp. 207-208
[182] Alteiri and Nicholls. p.6

is substantial evidence that, although organic farms tend to be smaller than conventional ones, large organic farms do exist, and there are no inherent diseconomies of scale in low-input agriculture."[183] In light of this, to ensure green production continues even as operations grow in magnitude, ecologists recommend that policy makers "include farm size and social-labour considerations in organic standards, and limit certification against operations that leave a large ecological footprint."[184]

9.3 Informational Campaigns and Research

A major stumbling block for the sustainable movement is the difficulty in articulating both the problems it is to solve and the effectiveness of the solutions it presents. The confounding and often conflicting studies of vast complex systems can trap policymakers and scientists, leaving them mired in debate.

> Evidence can be produced to show that organic farms have higher or lower yields, produce more water-fouling nitrogen runoff or less. The resultant morass makes it tough for farmers and policy-makers to pin down the relevant facts.[185]

Such an uncertain and tenuous situation may be confounding to observers, but to those involved in the market (who cannot afford to be distant or objective) it makes sustainability a questionable business goal.

> While it is certain that uncertainty in research exists (known unknowns),
>
> This doesn't mean that the studies are necessarily flawed. It simply reflects the complexity of the systems being studied, and the number of variables involved. Straight comparisons of organic and conventional practice can often be misleading. … A better approach is to focus studies on particular issues of interest, such as soil conservation, nutrient retention and pest control. These should be done by collaborating researchers who have held differing views in the past. For too long, agricultural studies have tended to involve like-minded researchers and to be supported by a non-profit group, industrial company or government department that has an interest in the outcome.[186]

As much as scientists would like to believe in their objectivity, often they are subject to contracts that grant ownership of their research to the companies that provide their

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[183] Buttel, Frederick H., et al. Sociological Aspects of agricultural sustainability. Edwards, Lal, Madden, Miller and House, eds. Sustainable Agricultural Systems. C. 1990 Soil and Water Conservation Society. p. 519

[184] Alteiri and Nicholls. p.6

[185] Organic farming enters the mainstream. Nature, April 2004. v. 428 n. 22 p. 783

[186] Ibid. p. 783.

funding. Once a higher degree of consensus exists in the scientific community, direct paths to sustainability can be approached with minimal bickering from the misinformed or the self-interested.

In general, it is easier for the similarly minded to work together, and there are other incentives to keep oneself isolated from differing perspectives.

> Disciplinary work generally receives greater recognition and acceptance than does multidisciplinary work in peer-oriented professional journals. Add to that the fact that multidisciplinary work has several inherent tensions (Dobbs, 1987) and it sometimes slower to bear visible fruit than is disciplinary work. All of these factors cause multidisciplinary farming systems work to be avoided or to be given only lip service by many agricultural researchers. … One challenge is to maintain and strengthen such a multidisciplinary environment where it exists presently, and to create and foster that environment in institutions where it is lacking.[187]

It is important to note that while economic considerations have historically trumped those of the environment, an approach that neglects the economic dimensions of certain problems is no more effective than one that omits the ecosystem.

> Collaborative research between agronomists and agricultural economists with experiment station trials is another approach that has been used over the years. Where such collaborative research still exists in the U.S., agricultural economists are often brought in too late in the effort, after the trials have been designed are underway for a number of years. Thus, data important to enterprise budgeting have sometimes not been incorporated into the trials and measurements. Research on low-input agriculture will require greater emphasis on truly collaborative efforts when experiment station trials are part of the research.[188]

Just as with civic agricultural paradigms, sustainability research will necessarily be a community-driven affair. "Because it is important to do preliminary economic analyses of low-input farming system alternatives, somewhat eclectic approaches will be necessary in the early stages of most research efforts."[189] Correct assessment of problems and the avenues to their solutions cannot occur if certain disciplines are not included because their integration would be inconvenient or considered "impure science."

This holistic understanding will necessarily involve the industry, policy and academic arenas, all of which have critical roles to play.

> [Of four challenges to sustainability, the first being understanding sustainability in all geographical contexts, the second to work with developing nations to develop appropriate new technologies,] Third is the challenge to create an economic and

[187] Madden and Dobbs. p. 472
[188] Ibid. pp. 462-463
[189] Ibid. p. 463

> social environment that will encourage the adoption of new technologies and systems. Policies must encourage this adoption, and needed outputs must be made available. Universities, public and private, voluntary organizations have a key role to play in helping to identify needed policy changes and to encourage their implementation. [Fourth is to develop cooperation worldwide.][190]

This foundation of understanding will allow the market to adapt to new conceptions of value. Once this thought pattern has infiltrated and developed within the necessary areas of society, it will be ripe for dissemination to people whose actions dictate the direction of the market and human endeavors.

In most cases of green production, the agricultural community will be the most critical element in the procurement of environmentally sound products. A firm understanding of the ends to be attained will allow effective outreach and informational campaigns to distribute this information nation- or world-wide.

> To meet quality requirements, farmers need to understand what is needed, have facilities and technical ability to meet them, and the management skills to maintain quality and adapt to changing demands. Similarly, farmers need to work together in order to be able to specialize in the production or particular crops, and to offer adequate quantities to buyers. Working together successfully requires that farmers have management skills, institutions that allow them to make decisions and to delegate responsibility for negotiation, quality control and decision-making. Farmers must agree to establish and comply with rules.[191]

If sustainable techniques can be developed and their dispersal implemented, sustainability may become a realized vision. Nonetheless, much work remains to be done, as the transition is unlikely to be a simple affair:

> A major challenge to those concerned about meaningful economic research on low-input agriculture in to enhance the rewards and acquire the necessary resources for developing an improved database for whole-farm analyses. … Adequate financial resources must be provided for research assistants and technicians to be employed in ongoing capacities for such work. Much of the money for this assistance has to come from core budgets of experiment stations and Cooperative Extension service units because grant funds are difficult to attract for enterprise budgeting work and, even when they can be attained, generally do not provide the necessary continuity.[192]

To allow the evolution of sustainable technologies, which is likely to be necessary for true indefinite sustainability, new research models beg development.

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[190] Brady, N.C. Making Agriculture a Sustainable Industry. Edwards, Lal, Madden, Miller and House, eds. Sustainable Agricultural Systems. C. 1990 Soil and Water Conservation Society. p. 31

[191] Hellin and Higman. p. 206

[192] Madden and Dobbs. p. 473

> Increase public investments in agroecological research methods with active participation of organic farmers, thus replacing top-down transfer of a standardized technology model with participatory technology development and farmer-centered research and extension, emphasizing principles rather than recipes or technological packages.[193]

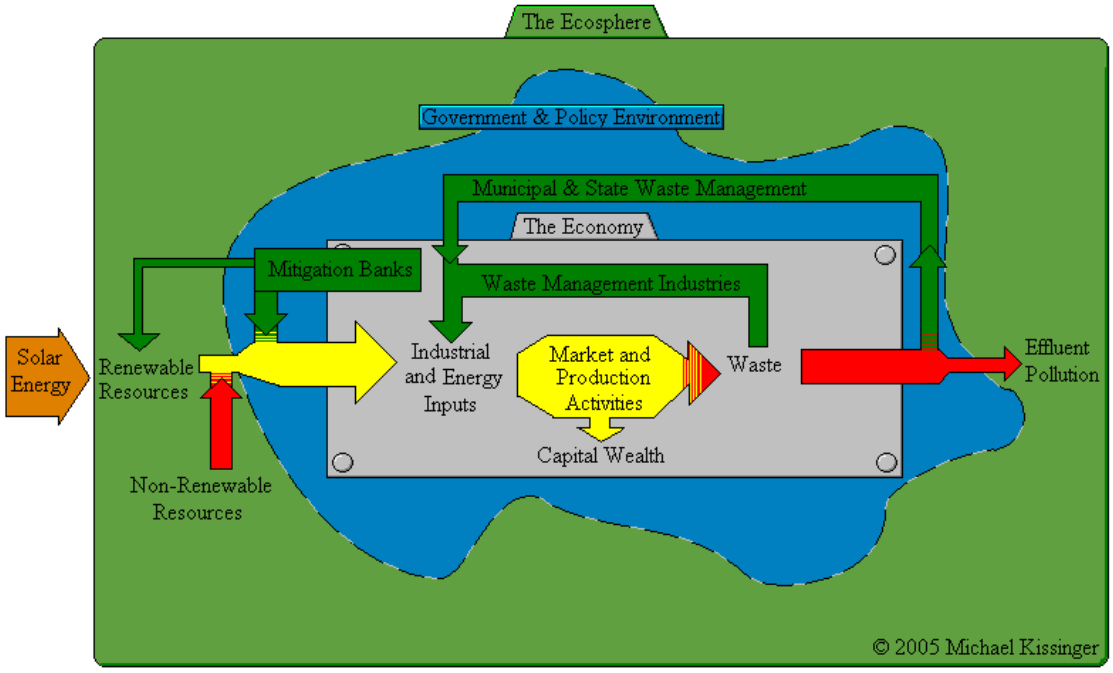
The civic organizational structure applies an ecological interaction model to human economic actors. It is not unlikely that such a structure might also be applicable to efforts to further knowledge, where information flows between participants, rather than unidirectionally.

By broadening the understanding of interactions within the various systems (from the soil ecosystems to the entire world economy), as well as between them, humanity will gain the opportunity to holistically and meaningfully impact their surroundings in a positive manner. Within the restructuring of our thoughts, consumption, and industries lies the hope for future generations who must subsist on whatever remains of the earth once we have departed. We owe it to the future stewards of the planet to provide them with a foundation upon which they can build a secure, stable and strong world economy that works for the benefit of all life, and the improvement of the ecosphere.

[193] Alteiri and Nicholls. p.6

10. Visions of a Sustainable Economy

Armed with our understanding of the interplay between markets, the economy and the policy arena, we may now begin to lay out possible scenarios for transitional and sustainable economies based on ecological, economic and physical laws. A sustainable economy is defined by several characteristics illustrated below:



This visual aid (based loosely on Herman Daly's economic/ecological model) is intended to explicitly demonstrate the flow of capital into, out of and through an economy. There are several key flows that will be the main criteria for sustainability: the flow from renewable resources to industrial inputs, from non-renewable resources to industrial inputs, and from waste to effluent pollution. Because we are concerned at this point mainly with sustainability of the macro-economy as a whole, most of our attention is diverted to its sustainability, and the sustainability of its parent system: the ecosphere.

The flow from non-renewable resources to the economy's inputs is the first check on sustainability. For a sustainable economy, this flow must diminish over time, as non-renewable resources do not replenish on any timescale worth considering; eventually, the drain on non-renewables necessarily approaches zero. While a zero-level drain on the strictly finite resources is not feasible at present, a reduction in dependence on them is possible and important to develop. Contrary to this, spiking oil prices (a result of genuine supply/demand ratios, as opposed to artificial shocks) indicate that reliance on our petroleum resources is increasing relative to available supply. If the economy continues to increase its dependencies instead of diminishing them, it has no chance of attaining a sustainable growth path.

Similarly, overtaxing renewable resources is likely to lead, in the long run, to their depletion and collapse. Unlike their non-renewable counterparts, however, there is much to be done regarding their preservation. It is likely to be discovered that extractions that were optimal in terms of profit generation do not result in optimal sustainable resource extraction. A larger, more stable ecosystem will grow at a faster rate, meaning that reducing demands on it in the short run may increase the sustainable yield of resources. By the same token, anything that diminishes the robustness or health of an ecosystem can be seen as reducing the potential for its future use.

Aside from resource extraction, ecosystems also serve to break down the waste produced by human enterprises. If, however, the absorption capacity of an ecosystem is exceeded, it can stop functioning altogether, and may even create circumstances wherein pollution problems are exacerbated by natural processes. Add to this the fact that it may be more efficient to process waste products than to extract virgin resources, and it becomes apparent that recycling waste offers a two-fold benefit: pollution reduction and resource procurement via a single process.

Failure to meet sustainability criteria in any of these flows will yield differing results. A collapse of critical non-renewable resources would result in a fallback to either substitutable renewables or less efficient non-renewables. An example of such a fallback scenario is the possible shift back to coal as a primary energy source following exhaustion of petroleum stocks. This need not be a total exhaustion, it requires merely that the demand for oil outpaces supply in such a way that it is no longer feasible to use

oil as the primary energy source. In this case, it is likely that the response would increase draws on both nonrenewable and renewable resources alike, as wood and coal both became cost-effective sources of heat and/or electricity generation. A smooth transition to an oil-less economy is unlikely, as gasoline and plastics are currently integral to economic function, and other sources for these products are unlikely to meet demand without aggressive development. In many ways, the exhaustion of non-renewable resources, rather than a distant disaster, should be seen as a grim eventuality, for which the economy must prepare.

A more dire situation would be the over taxation of renewable resource stocks. Such a scenario has nearly played itself out already, as is exemplified by declining fisheries the world over. Although it quickly becomes financially inefficient to catch every last fish in the ocean, pushing fish stocks to the brink of exhaustion not only reduces the possible output in the short run, but also diminishes sustainable catches for years to come. Resources that can be more systematically harvested (like forests, which do not move) face the threat of being totally wiped out, meaning that regeneration is effectively zero. If soil stocks are allowed to continue to their depletion, a once-renewable resource may give out, and the search for a substitute is likely to be fruitless.

The final potential failure of sustainability is the over taxation of ecological processes with effluent pollution. Because pollution is often concentrated at its point of origin, many ecosystems across the country and around the world are already well beyond their sustainable thresholds. Other times, pollution is dispersed far from its point of origin (as is the case with sulfur oxides in the atmosphere and the hypoxic zone in the Gulf of Mexico) and it enters the domain of the global ecosphere. The results of this type of sustainability failure may be less immediately apparent than those associated with resource shortages, and in fact are already manifested in some places. Because of separations between cause and effect, both in space and time, the insidious nature of pollution-related problems often causes them to go unnoticed. Such was the case with lead-added gasoline, which was not halted until health effects manifested themselves in children.

In order to maintain favorable levels of resource use and pollution generation, a paradigm shift in economic and regulatory thinking must be attained. By changing

marketing and production activities, resource use and waste creation patterns can be altered so as to be maintainable in sustainable terms. Creating adaptive government policies that facilitate this sort of market activity will likely be indispensable. Other actions in the policy environment include protection and subsidization of socially beneficial industries that cannot independently operate in an economically competitive environment. By providing a regulatory framework that values resource preservation and waste reduction, governments and markets can work in tandem to ensure a symbiosis between the economy and the ecosphere.

10.1 Green Production and Consumption

A complete transition to a sustainable economy is likely to have many aspects; some will likely develop serially and others in conjunction with each other. As agricultural products take the place of inputs derived from non-renewable sources, fertile soil becomes an even more valuable asset. As nearly all energy from production currently comes from (or came from long ago, as is the case of fossil fuels), harnessing as much solar energy (including the resulting atmospheric turbulence, the hydrologic cycle, etc.) as possible will involve making use of photosynthetic processes to the fullest extent that technological and agricultural understanding allows. Unfortunately for sustainable producers, harvesting incoming energy may not be a profitable as using latent materials that were formed by solar radiation long ago. The fact that sustainable technology is not (currently) as efficient on a per-dollar basis creates a barrier in an economy where profitability is the major constraint on enterprise viability.

Part of the impediment to sustainable consumption is the difficulty in consumers' attainment of information. Campaigns like Energy Star and the NOP's labeling program are beginning to fill this role, but green consumption cannot become prevalent without widespread collective understanding of its underlying issues.

The consumer must become aware that their current means of consumption cannot be continued -- and if they are future life projections and biodiversity may decline. The consumer population must be provided a selection of green alternatives at a competitive market price. Consumers need to be made aware of the effects of their consumption in a constructive way the promoted their personal action in remedying and

easing ecological problems and limits. The market's responses to this will be crucial. With evidence that green consumers are willing to pay 15% premiums, there is plenty of incentive for firms to enter this market, as economies of scale are likely to increase profits as the market expands. With visible success and long-term longevity shown in green, worker friendly companies such as the Whole Foods Market, the ecomarket is likely to expand as green firms grow their consumer base and conventional firms begin to enter the ecological sector.

10.2 Green Policies

Many green policies have already been discussed. However, sustainable agriculture will only provide the base for a sustainable economy. Once production of industrial materials from solar inputs can be substituted for drains on terrestrial resource stocks, the challenge will be to effectively introduce these materials to the market and ensure their adoption. For this to happen successfully, it will be necessary to enact policies that direct, rather than constrain, the market toward sustainable consumption. By fostering consumption that is increasingly green, standard of living will be maintained, while the central economic flow in the diagram above (from inputs to waste) will tax resources less and produce less output destined to become effluent pollution. While many difficulties of promoting sustainability revolve around price, and can therefore be solved with various subsidization methods, changing the market and production activities will likely not in itself ensure sustainability in the greater context.

In order to create a flow of capital such that resource depletion is overtaken by resource restoration, policies both in industry and government can be implemented so that conservational resource flows (those that are a green color in the economic diagram) are maximized, while harmful or limited resource flows (those colored red) can be minimized. Creating a policy environment that continuously works to minimize the negative flows while simultaneously increasing those that are beneficial will allow net positive flows into both industrial inputs and natural capital, provided that strategies are well managed and do not succumb to diminishing expectations. If resource regeneration outpaces depletion, and pollution is reduced to levels that are tolerable to the ecosphere, then a major step toward macroeconomic sustainability will have been made.

Additional to changes in the industrial and government paradigms, new institutions may emerge that close resource cycles that are currently linear, thereby incorporating an ecological dimension into human production. The "mitigation banks" shown in the diagram are firms designed to do just that. The premise of such organizations is that resource extraction must be accounted for in order to reach a sustainable situation, and such extraction must be constrained such that it does not exceed sustainable capacity. A system of credits necessary for users of resources is built on restorative practices--the firms that work to conserve and restore resources are issued these credits, which are then sold for revenue. Contrary to some sustainable visions in which "net change in environmental resources [will remain] zero"[194] an ideal situation would be one in which not only would natural resource regeneration *exceed* extraction, but that it should do so at an ever-increasing rate.

By assigning a (negative) value to using natural resources, real (meaning in terms of material, not dollars) efficiency is encouraged rather than externalized, and economic incentives are introduced for behavior that is immediately beneficial environmentally, and beneficial in the long run economically. Mitigation banks have potential to create positive economic conditions by ensuring resource security, as well as positive externalities due to the potentially enormous potential for employment and profit in this new sector. The critical element of this (and any ecologically conscious program) is to assign concrete and positive economic value to activities whose positive benefits had previously been externalized. In order to make peace between environmentalists and economists, each must willingly admit that the other has something to offer.

The mitigation banks are depicted in the diagram as being a part of both the economic sphere and the policy environment. This is because

> Many opinions exist about how the mitigation banking industry should be instituted and regulated, but few of them are based on a clear understanding of how the proposed institutional arrangements and regulatory policies would affect its performance in terms of supporting economic activity, preserving the environment, and minimizing organizational costs and social conflicts. Pricing of environmental credits is an important aspect of the mitigation banking system,

[194] Saeed, Kalid. Designing an Environmental Mitigation Banking Institution for Linking the Size of Economic Activity to Environmental Capacity. JOURNAL OF ECONOMIC ISSUES Vol. XXXVIII No. 4 December 2004. p. 909

> and complex engineering methods connecting price to cost have been proposed as pricing criteria.[195]

Because of uncertainty about availability and regenerative capacity of natural resources, it may be difficult to find a concise method for pricing resource credits. Environmentalists would have regulators (a regulatory framework is likely to be indispensable) price extraction credits high to discourage slow (or worse, negative) regeneration, while economists are likely to argue that credits should be introduced at prices that do not negatively impact economic growth. While a middle ground must be struck, environmentalists must realize that immediate and radical changes are unlikely, while economists accept that the very purpose of these institutions is to place reasonable limits on economic scale. The policy environment (depicted in the above illustration as a dotted line) is intended to show that policies, while largely nebulous and malleable, are in place to shape and direct economic development.

The placement of mitigation banks, neither wholly within the economy, nor outside it, reflects the varying strategies that may be successful in their implementation:

> A mitigation banking system may function under a variety of organizational and regulatory arrangements. It can be established in the public or private sector. The price of the mitigation credits it creates can be fixed, tied to restoration costs using engineering methods, supported by subsidies, determined by the market, or influenced by combinations of all of these factors. Furthermore, the regulations governing the requirement of mitigation credits for the formation and operation of the built environment may be fixed or tied to the condition of the environment.[196]

It is unlikely that one of the strategies mentioned above will emerge as dominant over all others. Instead, differing baskets of these approaches will probably be applicable to different environmental sectors. Those that are immediately and sustainably profitable (the banks will be subject to sustainability constraints like any other business) are likely to be private efforts within the economy, while those that are slower to come on line or which cannot turn a consistent profit will be the object of subsidies. The varying nature of different possible implementations offers a robust variety of available strategies to those seeking to make conservation economical.

Mitigation banks represent a key strategy for making environmental conservation economically viable. The major obstacles to their implementation are likely to be the

[195] Saeed. p. 910
[196] Ibid. p. 913

firms whose businesses depend on use of such resources, and who will potentially be harmed financially by the necessity that they purchase credits to continue their activities. This debate is already apparent in the "loggers vs. owls" scenario wherein the livelihood of timber industry employees conflicted with protection of endangered species' habitats. A well-implemented mitigation program should be able to sidestep this debate altogether, by providing enough resources to compensate for destruction of existing natural capital and ecosystems. It may in fact turn out that because the banks are so well designed (and designed to be used as resources), certain costs of resource extraction decrease enough to compensate for the costs of purchasing credits. Eventually, given proper attention, environmental mitigation industries may provide not only materials, but also employment opportunities sufficient to improve economic conditions universally, thereby making their adoption a win-win situation.

Assigning value to resources need to be relegated only to those in the business of environmental enrichment. Assessing the resource efficiency and ecological footprint, itself potentially another market sector, would allow firms to be rewarded materially for improvements made in mitigating environmental damage. To make an example of the electronics industry, which is notorious for its use of toxic compounds like mercury, lead and hexavalent chromium, internal efforts to make toxics more safely extractable and recyclable could be rewarded, while implementation of designs that create waste that is difficult to recycle would be taxed. By expanding crediting regimes to include waste management industries and government programs, such efforts can be freed from the battle of the bottom line and the whims of politicians and budgeters.

Managing waste products is another area where government policies can complement industry actions. If we assign credit values to recycling firms based on the waste they reduce and the materials they procure, then waste management firms could earn mitigation credits, either instead of or in addition to any current revenue generated from materials production. This would mean that such businesses would produce not only resources, but also credits that could be sold to companies that whose products were excessively harmful to the environment. Such a strategy encourages industry innovation by creating incentives for designs that minimize ecological footprints and rewarding firms whose products are by design environmentally friendly. Espousing a "cradle-to-

cradle" mentality in production will be a far simpler proposition when there are immediate and concrete rewards actors who make efforts toward that end.

What lies at the heart of this sustainable model is the idea that there is a cycle between resources and production. Solar energy (the only input at this high level of aggregation) allows resource generation, which is checked by natural limits. These resources are then extracted at a cost that reflects not only monetary costs of extraction, but also approximations of values intrinsic to the resources themselves. Once natural resources adopt "true" economic costs, economic efficiency necessarily incorporates judgments about its merit with relation to sustainability of resource use. Some portion of resources that are used in production becomes waste, and another portion becomes capital; through economic activities, profit is generated, some of which flows back to support the mitigation banks that provided for the original materials. Through depreciation and consumption, however, nearly every produced good ends up as waste. Private industries and government programs to manage these materials already exist; these organizations work in the public and private sectors to reduce pollution and unusable waste by turning them into usable resources. If the combination of solar-sourced energy, mitigation bank activity and resource reclamation by waste management is sufficient to provide for production material and energy inputs, then the cycle is closed, and the economy becomes a stable, artificial ecosystem.

Creation of such a scenario is not a simple proposition, but it is not unattainable either. It will require that each flow within the economic and natural cycles be suited as closely as possible to the needs of the others. Resource banks must produce in such a way so as to properly supply needs for inputs, while products are designed either to break down naturally, or to be broken down artificially and re-used. Although laws of entropy and thermodynamics preclude a completely closed situation, an ideal environmental-economic scenario is one in which effluent pollution, decline in natural resources and extraction of non-renewables all approach zero.

What is missing is connection between various sectors of the economy and its resource base. Because of the prevalence and potency of market forces, they are likely to be the most effective, if not the only, approach to moving toward economic measures that value sustainable efforts. Just as money was created ages ago to facilitate exchange and

represent value, a sustainable economy must have new measures that allow natural wealth and capital to be accounted for and valued. If current thinking prevails, natural resources are likely to retain their current value in times of plenty: zero. Once humanity and (perhaps more importantly) government decision makers, see alternatives to the neoclassical vision of the world, we may arrive at a system that values not only human wealth, but also the long-term health of humans and their ecosystem.

> Sadly, most government policies are steered by such economic thinking. Amid discussions about the best way to add speed, we are all headed for a very steep cliff. Our direction will change only when enough people, seeing what lies ahead, demand it.[197]

[197] Gorelick. The Ecologist, Feb 2001. v. 30 n.1 p. 23

Appendices

The following supplemental materials are included to fully illustrate the green consumer survey, and media design experiment.

Appendix A1: Green Consumer Survey

What follows is a copy of the green consumer survey utilized in the data gathering.

Green Consumption Study

As green consumers, we are asking you to take part in a study on green consumption.

The researchers want to know more about the motivations and level of information you, the green consumer, possess.

If you choose to take part, we will ask you to answer some questions about your consumption pattern. We will ask you about your intentions and past actions in an attempt to understand behavior. You may also get questions where you use a scale to rate your feelings toward or level of satisfaction with something.

There are no risks to you in participating. Potential benefits might include insight into consumption traits and steps of planned behavior.

Your responses to all of the questions will remain confidential.
We will ask you not to put your name on any response sheets or the computer.

Taking part is voluntary.
If you choose not to take part, you may choose to do so at time.

If you have questions about the study, please contact either Chris Baker or Mike Kissinger @ cbaker66@wpi.edu or mis4mike@wpi.edu

_____ _____

Subject Signature Date

_____

Printed Subject Name

DEFINITIONS: In this survey when the phrase “green consumer” or “green consumption” is used. A “green consumer” is someone who “considers the consequences of consumption and attempts to minimize the demand placed on the biosphere, whenever they decide to consume.” [198]
We ask you to take into account attributes of products that include personal and environmental health (ex: organic produce and biodegradable cleaning products), social and animal humanitarian concerns (ex: fairly traded coffee or free range meat), as well as the business practices of producers.

How many (in %) of the purchases that you have made in the past month support green consumption?

1.
What percent of paper products do you buy with recycled components?
_____ 100%
_____ 75%
_____ 50%
_____ 25%
_____ 0%
_____ Don’t Know

2.
What percent of produce do you purchase that is organically grown?
_____ 100%
_____ 75%
_____ 50%
_____ 25%
_____ 0%
_____ Don’t Know

3.
What percent of the cleaning supplies do you use are bio-degradable?
_____ 100%
_____ 75%
_____ 50%
_____ 25%
_____ 0%
_____ Don’t Know

[198] (http://utopia.knoware.nl/users/oterhaar/greens/america/consumer.htm)

4.
In the course of the past month, how many of the purchases that you made supported "green consumption"?

_____ Every purchase
_____ Almost every purchase
_____ Most purchases
_____ On about half the purchases
_____ A number of times, but less than half
_____ A few times
_____ Never

5.
Please estimate over the past month how many times when making a purchase did you purchase an item that supported "green consumption"?
Please circle the interval on the following scale that best represents your estimate.

Never 1_____2_____3_____4_____5_____6_____7 All

6.
I intend to make purchases that support "green consumption" in the forthcoming month
extremely unlikely 1_____2_____3_____4_____5_____6_____7 extremely likely

7.
I will try to make purchases that support "green consumption" in the forthcoming month
definitely false 1_____2_____3_____4_____5_____6_____7 definitely true

8.
I plan to make purchases that support "green consumption" in the forthcoming month
strongly disagree 1_____2_____3_____4_____5_____6_____7 strongly agree

9.
For me to make purchases that support "green consumption" in the forthcoming month is

harmful 1_____2_____3_____4_____5_____6_____7 beneficial

10.
unpleasant 1_____2_____3_____4_____5_____6_____7 pleasant

11.
bad 1_____2_____3_____4_____5_____6_____7 good

12.
worthless 1_____2_____3_____4_____5_____6_____7 valuable

13.
unenjoyable 1_____2_____3_____4_____5_____6_____7 enjoyable

14.
Most people who are important to me think that
I should not 1_____2_____3_____4_____5_____6_____7 I should make purchases that support “green consumption”

15.
It is expected of me that I make purchases that support “green consumption”
extremely unlikely 1_____2_____3_____4_____5_____6_____7 extremely likely

16.
The people in my life whose opinions I value would
disapprove 1_____2_____3_____4_____5_____6_____7 approve
of my making purchases that support “green consumption”

17.
Most people who are important to me make purchases that support “green consumption”
completely false 1_____2_____3_____4_____5_____6_____7 completely true

18.
The people in my life whose opinions I value
do not 1_____2_____3_____4_____5_____6_____7 do plan to make purchases that support “green consumption”

19.
For me to make purchases that support “green consumption” in the forthcoming month
would be impossible 1_____2_____3_____4_____5_____6_____7 would be easy

20.
If I wanted to, I could to make purchases that support “green consumption” in the forthcoming month
definitely false 1_____2_____3_____4_____5_____6_____7 definitely true

21.
How much control do you believe you have over making purchases that support “green consumption” in the forthcoming month?
no control 1_____2_____3_____4_____5_____6_____7 complete control

22.
It is mostly up to me whether or not I make purchases that support “green consumption” in the forthcoming month
strongly disagree 1_____2_____3_____4_____5_____6_____7 strongly agree

23.
What do you believe are the *advantages* of your making purchases that support “green consumption” in the forthcoming month?

_____
_____
_____

24.
What do you believe are the *disadvantages* of your making purchases that support “green consumption” in the forthcoming month?

_____
_____
_____

25.
Is there anything else you associate with your making purchases that support “green consumption”?

_____
_____
_____

26.
Assume that one of the benefits of making purchases that support “green consumption” is eating organic produce, and that it is healthier than conventional produce.

My making purchases that support “green consumption” in the forthcoming month, will increase the amount of nutritious food that is in my diet.
extremely unlikely 1_____2_____3_____4_____5_____6_____7 extremely likely

27.
Eating more nutritious food is
extremely bad 1_____2_____3_____4_____5_____6_____7 extremely good

28.
Are there any individuals or groups who would *approve* of you making purchases that support “green consumption” in the forthcoming month?
___ Yes ___ No

29.
Are there any individuals or groups who would *disapprove* of you making purchases that support “green consumption” in the forthcoming month?
___ Yes ___ No

30.
Are there any other individuals or groups who come to mind when you think about making purchases that support “green consumption” in the forthcoming month?
___ Yes ___ No

31.
What factors or circumstances would enable you to make purchases that support “green consumption” in the forthcoming month?

_____
_____
_____

32.
What factors or circumstances would make it difficult or impossible for you to make purchases that support “green consumption” in the forthcoming month?

_____
_____
_____

33.
Are there any other issues that come to mind when you think about the difficulty of making purchases that support “green consumption”?

_____
_____
_____

34.
Are you willing to sacrifice larger portions of less nutritious food for smaller portions of organic, more nutritious food?
___ Yes ___ No

35.
Please rank from 1 to 4 (with 1 being the most important and 4 being the least important) the following concerns as being factors in your decision.

___ Price
___ Taste
___ Nutrition
___ Environmental Sustainability
___ Other (Explain) _____

36.
When purchasing produce are you willing to sacrifice a low price for a product that costs more, but supports “green consumption”?
Extremely unwilling 1_____2_____3_____4_____5_____6_____7 Extremely willing

37.
Please rank from 1 to 6 (with 1 being the most important and 6 being the least important) the following concerns as being factors in your decision. When purchasing produce (apples, carrots, tomatoes .. etc) what in order are the factors in your decision?

___ Price
___ Taste
___ Nutrition
___ Environmental Sustainability
___ Concern with Pesticides
___ Concern with Genetic Modification
___ Other

38.
When purchasing cleaning products are you willing to sacrifice a low price, for a product that costs more but supports “green consumption”?
Extremely unwilling 1_____2_____3_____4_____5_____6_____7 Extremely willing

39.
Please rank from 1 to 3 (with 1 being the most important and 3 being the least important) the following concerns as being factors in your decision.

___ Price
___ Quality of product
___ Environmental Sustainability
___ Other (explain) _____

40.
When purchasing energy services are you willing to sacrifice a low price, for a service that costs more but supports “green consumption”?
Extremely unwilling 1_____2_____3_____4_____5_____6_____7 Extremely willing

41.
Please rank from 1 to 3 (with 1 being the most important and 3 being the least important) the following concerns as being factors in your decision.

___ Price
___ Quality of service
___ Environmental Sustainability
___ Other (explain) _____

42.
When purchasing meat are you willing to sacrifice a low price, for a product that costs more but supports “green consumption”?
Extremely unwilling 1_____2_____3_____4_____5_____6_____7 Extremely willing

43.
Please rank from 1 to 5 (with 1 being the most important and 5 being the least important) the following concerns as being factors in your decision.

___ Price
___ Taste
___ Nutrition
___ Environmental Sustainability
___ Concern with Ethical Treatment and Handling
___ Other (Explain) _____

44.
How well has the distinction between organic, natural, and made from organic products been made?
Extremely unclear 1_____2_____3_____4_____5_____6_____7 Extremely clear

45.
Have you sought out information on your own?
___ Yes ___ No

46.
If so how hard was it to find?
Extremely Hard 1_____2_____3_____4_____5_____6_____7 Extremely easy

47.
Do you feel the distinction is clearly marked on packaging?
___ Yes ___ No

48.
How well is it marked?
Extremely badly 1_____2_____3_____4_____5_____6_____7 Extremely well

49.
Would you be interested in more easy access information?
___ Yes ___ No

50.
How would you rate your exposure to the benefits of living a “green lifestyle”?
Extremely unclear 1_____2_____3_____4_____5_____6_____7 Extremely clear

51.
Should carriers of organic products display more, clearly stated information in their stores about organic products?
___ Yes ___ No

52.
How strong do you see the connection between your self and the environment?
Weak Connection 1_____2_____3_____4_____5_____6_____7 Strong Connection

53.
How strong do you see the connection between your health and the health of the environment?
Weak Connection 1_____2_____3_____4_____5_____6_____7 Strong Connection

54.
How much extra would you be willing to pay for products that support "green consumption"?
_____ 5%
_____ 10%
_____ 15%
_____ 20%
_____ 25%
_____ 30%
_____ 35%

55.
How satisfied have you been with past purchases of organic, and other "green consumption" products?
Extremely unsatisfied 1_____2_____3_____4_____5_____6_____7 Extremely Satisfied

56.
Do you find your organic and "green" purchases to be worth while?
Never worthwhile 1_____2_____3_____4_____5_____6_____7 Always worthwhile

57.
How much of your consumption is "green?"
None 1_____2_____3_____4_____5_____6_____7 All

58.
How much of your consumption would you like to be "green?"
None 1_____2_____3_____4_____5_____6_____7 All

59.
What turned you into a “green” consumer?

Appendix A2: Media Design Experiment

The following is an image capture of our media design experiment.

On the inside of this pamphlet are three sets of statements. We would like you to read through the statements, considering each column separately. Once you have read through each of the three statements sets and left your comments, please turn back to this area and select which statement set you thought was the most effective in conveying the benefits of organic production methods.

Most effective

- ☐ Statement set 1
- ☐ Statement set 2
- ☐ Statement set 3

Why?

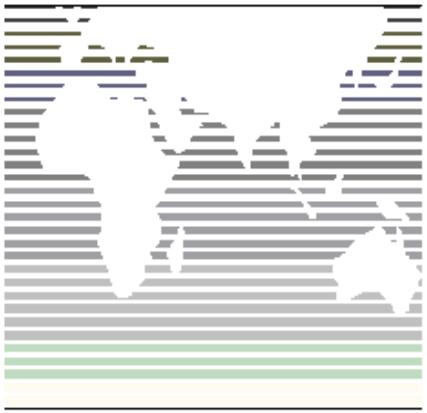
_____
_____
_____
_____
_____

Thank You!

Chris Baker cbaker66@wpi.edu
Mike Kissinger mis4mike@wpi.edu

DESIGN EXPERIMENT

IDENTIFYING AND INCREASING THE QUALITY OF GREEN MARKETING METHODS



We will ask you to read some statements about organic production methods and evaluate them.
There are no risks to you in participating.
Your responses will remain confidential.
Taking part is voluntary.
If you have any questions about the study contact information is on the back

_____ _____

Participant signature Date

STATEMENT SET 1

Organic production systems support natural ecosystems by using long-term farming solutions. This restores, maintains, and enhances ecological harmony, and positively affects the health of the environment.

Choosing organic foods positively impacts our own health, the health of our children, the health of farm workers, and the health of future generations.

Organic certification is the public's assurance that products have been grown and handled according to strict procedures that ensure their quality and nutrition.

Chefs across the country are committed to using organic ingredients because plants from healthy soils and organically fed livestock provide us with more flavorful food. Organic foods allow true flavors to shine through!

Response to statements: (Likes dislikes)

STATEMENT SET 2

Organic agriculture builds productive nutrient-rich soil that resists topsoil erosion, which has been linked to the agricultural practice of chemical-intensive, mono-crop farming.

Buying organic is a direct investment in the long-term future of our planet. The choices we make now can free us from costly pesticide-related environmental clean-ups in the future.

Organic farmers are less reliant on non-renewable fossil fuels due to the integration of practices such as natural insect control, cover crop systems and rotation planting, and the avoidance of synthetic fertilizers, which require a high energy consuming production process.

Although more large-scale farms are making the conversion to organic practices, most organic farms are small, independently owned and operated family farms.

Response to statements: (Likes dislikes)

STATEMENT SET 3

The elimination of polluting chemicals and nitrogen-leaching fertilizers, done in combination with organic soil building practices, reduces the degradation of our lakes, rivers, estuaries, ground and drinking waters.

The continuing loss of a large variety of species (biodiversity) is an important environmental concern. Organic foods are never grown from genetically engineered seeds, which may threaten biodiversity.

Organic meat is raised the way nature intended, without the use of antibiotics, added growth hormones or animal by-products in the feed.

Organic beef is from cattle, including the parenting stock, that are fed a 100% vegetarian diet. No animal by-products, the use of which has been linked to BSE in humans, are ever fed to cattle in our program.

Response to statements: (Likes dislikes)

Appendix A3: Survey Results

The following is a comprehensive catalog of the results of the green consumer survey.

Question Number		1	2	3	4	5	6	7
Name	% Paper		% Prod	% Clean	How Many	Support	Intent	Try
Respondent 1		4	3	5	4	4		7
Respondent 2		4.5	5	NA	6	NA	1	
Respondent 3	NA		2	NA	3	5	6	6
Respondent 4		3	5	5	4	5	5	7
Respondent 5		4	2	3	3	4	6	7
Respondent 6		3	4	3	4	5	6	5
Respondent 7		1	0	NA	2	4	6	6
Respondent 8		3	2	1	2	3	5	7
Respondent 9	NA		1	NA	2	1	4	5
Respondent 10		4	4.5	2.5	5	5	7	7
Respondent 11		2	1	NA	2	2	4	5
Respondent 12		4	2	NA	5	5	5	7
Average Response Rank:		3.25	2.625	3.5	3.25	3.909091	5	6.272727

Question Number		8	9	10	11	12	13	14
Name	planning		harm/ben	un/pleasant	good/bad	worth	un/enjoyable	People
Respondent 1		7	7	7	7	7	7	6
Respondent 2		7	7	7	7	7	7	6
Respondent 3		6	6	6	7	7	5	5
Respondent 4		5	6	6	7	6	5	5
Respondent 5		5	6	7	7	6	6	6
Respondent 6		6	6	7	7	7	7	6
Respondent 7		4	7	6	7	7	6	5
Respondent 8		7	5	7	4	5	4	5
Respondent 9		4	7	7	7	7	7	4
Respondent 10		7	7	7	7	7	7	5
Respondent 11		4	6	5	6	6	5	4
Respondent 12		6	5	4	6	6	7	4
Average Response Rank:		5.666667	6.25	6.333333	6.583333	6.5	6.083333	5.083333

Question Number		15	16	17	18	19	20	21
Name	Expect		Approve	Relation	Value	Ease	Ability	Control
Respondent 1		2	7	6	6	4	7	6
Respondent 2		7	6.5	5	6	6	5.5	5
Respondent 3		6	6	4	5	5	6	5
Respondent 4		5	6	4	5	5	6	5
Respondent 5		2	6	4	4	5	6	5
Respondent 6		6	5	6	5	6	6	5
Respondent 7		3	6	3	3	5	6	6
Respondent 8		1	6	3	4	7	7	7
Respondent 9		1	7	2	2	3	4	3
Respondent 10		4	7	4	5	5	6	5
Respondent 11		4	6	4	4	5	6	3
Respondent 12		6	4	3	3	4	7	5
Average Response Rank:		3.916667	6.041667	4	4.333333	5	6.041667	5

Question Number		22	26	27	28	29	30	34
Name	Decision making power		Insight	Result of	Approval	Disapproval	Individuals	Portion
Respondent 1		5	6	7	1	0	0	1
Respondent 2		5	7	7	1	1	1	1
Respondent 3		4	6	7	1	0	1	1
Respondent 4		6	5	7	1	0	1	1
Respondent 5		5	7	7	1	0	1	1
Respondent 6		5	7	6	1	1	1	1
Respondent 7		5	5	7	1	0	1	1
Respondent 8		5	2	2	1	1	1	1
Respondent 9		3	7	7	1	0	1	1
Respondent 10		4	5.5	6.5	1	0	1	1
Respondent 11		4	4	6	1	1	1	1
Respondent 12		6	4	7	1	1	0	1
Average Response Rank:		4.75	5.458333	6.375	1	0.416667	0.833333	1

Question Number		35	Ranking Decision Making Factors: Smaller portion size			
Name	Price	Taste	Nutrition	Env. Sus.	Other	
Respondent 1	4	2	3	1	NA	
Respondent 2	1	4	2	1	NA	
Respondent 3	3	4	2	1	NA	
Respondent 4	4	1	3	2	NA	
Respondent 5	1	1	2	1	NA	
Respondent 6	3	2	1	4	NA	
Respondent 7	3	1	1	2	NA	
Respondent 8	3	1	4	2	NA	
Respondent 9	1	3	4	2	NA	
Respondent 10	3	4	2	1	NA	
Respondent 11	1	2	4	3	NA	
Respondent 12	2	3	4	1	NA	
Average Response Rank:	2.416667	2.333333	2.666667	1.75		
Average overall ranking	3	2	4	1		

Question Number		36	37	Ranking Decision Making Factors: Produce				
Name	Produce	Price	Taste	Nutrition	Env Sus	Pests	GM	Other
Respondent 1		7	6	3	4	1	2	5 NA
Respondent 2		6	4	5	3	2	1	6 NA
Respondent 3		5	2	3	1	4	5	6 NA
Respondent 4		4	4	2	3	5	1	6 NA
Respondent 5		5.5	2	1	4	3	5	6 NA
Respondent 6		6	5	2	1	3	4	6 NA
Respondent 7		5	4	2	1	5	3	6 NA
Respondent 8		5	4	1	2	3	5	6 NA
Respondent 9		4	1	3	5	2	4	6 NA
Respondent 10		5.5	5	6	2	1	3	4 NA
Respondent 11		5	1	2	6	3	4	5 NA
Respondent 12		5	4	5	6	1	2	3 NA
Average Response Rank:		5.25	3.5	2.916667	3.166667	2.75	3.25	5.416667
Average overall ranking			5	2	3	1	4	6

Question Number	38	39	Ranking Decision Making Factors: Cleaning Products		
Name	Clean Pro	Price	Quality	Env Sus	Other
Respondent 1	7	4	2	3	1 Allergies
Respondent 2	5	1	3	1	NA
Respondent 3	4	2	3	1	availability
Respondent 4	5	2	1	3	NA
Respondent 5	6	3	1	2	NA
Respondent 6	5	2	1	3	NA
Respondent 7	5	2	1	3	NA
Respondent 8	5	3	1	2	NA
Respondent 9	4	1	3	2	NA
Respondent 10	6	3	2	1	NA
Respondent 11	5	1	2	3	NA
Respondent 12	5	3	2	1	NA
Average Response Rank:	5.166667	2.25	1.833333	2.083333	
Average overall ranking		3	1	2	

Question Number	40	41	Ranking Decision Making Factors: Green Energy		
Name	Energy	Price	QOS	Env Sus	Other
Respondent 1	7	3	2	1	NA
Respondent 2	2	1	2	3	NA
Respondent 3	3	2	4	3	1 availability
Respondent 4	6	3	2	1	NA
Respondent 5	5	2	3	1	NA
Respondent 6	6	3	1	2	NA
Respondent 7	5	2	1	3	NA
Respondent 8	6	1	3	2	NA
Respondent 9	6	3	2	1	NA
Respondent 10	5.5	3	2	1	NA
Respondent 11	5	1	2	3	NA
Respondent 12	7	1	2	3	NA
Average Response Rank:	5.291667	2.083333	2.166667	2	
Average overall ranking		2	3	1	

Question Number	42	43	Ranking Decision Making Factors: Meat				
Name	Meat	Price	Taste	Nutrition	Env Sus	ET and Hand	other
Respondent 1	7	5	3	4	2	1	NA
Respondent 2	7	4	5	3	1	2	vegan
Respondent 3	NA	NA	NA	NA	NA	NA	vegetarian
Respondent 4	6	4	1	5	3	2	NA
Respondent 5	5	2	1	3	5	4	NA
Respondent 6	6	4	3	1	3	5	NA
Respondent 7	N/A	N/A	N/A	N/A	N/A	N/A	NA
Respondent 8	2	1	5	2	4	3	NA
Respondent 9	6	1	5	4	3	2	NA
Respondent 10	7	4	5	3	1	2	NA
Respondent 11	5	1	2	5	4	3	NA
Respondent 12	7	3	2	1	4	5	NA
Average Response Rank:	5.8	2.9	3.2	3.1	3	2.9	
Average overall ranking		1	5	4	3	1	

Question Number	44	45
Name	Distinction	Info seeking
Respondent 1	1	1
Respondent 2	4	1
Respondent 3	4	1
Respondent 4	6	1
Respondent 5	5	1
Respondent 6	5	1
Respondent 7	4	1
Respondent 8	2	0
Respondent 9	1	0
Respondent 10	4.5	1
Respondent 11	3	0
Respondent 12	3	1
Average Response Rank:	3.541667	0.75

Question Number	51	52
Name	Info Disply	Connection
Respondent 1	1	6
Respondent 2	1	7
Respondent 3	1	5
Respondent 4	1	6
Respondent 5	1	6
Respondent 6	1	7
Respondent 7	1	6
Respondent 8	1	5
Respondent 9	1	7
Respondent 10	1	7
Respondent 11	1	5
Respondent 12	1	6
Average Response Rank:	1	6.083333

Question Number	58
Name	Like
Respondent 1	7
Respondent 2	7
Respondent 3	6
Respondent 4	6
Respondent 5	7
Respondent 6	7
Respondent 7	7
Respondent 8	6
Respondent 9	7
Respondent 10	7

Respondent 11	6
Respondent 12	6

Average Response Rank: 6.583333

Response to write-in questions

	Question 23: Advantages
Respondent 1	Reduction of waste, sustainability, less pollution
Respondent 2	Purity of food, positive use of money, influence on sustainability
Respondent 3	Sustainability, peace of mind
Respondent 4	Sustain Resources
Respondent 5	Health, sustainability, taste, quality
Respondent 6	Health, Taste, Nutrition, Sustainability
Respondent 7	Conscientious consumption, health
Respondent 8	Sustainability, feel better/less guilt
Respondent 9	Positive use of money
Respondent 10	Health, sustainability
Respondent 11	Sustainability
Respondent 12	Support industry, promote type of product

	Question 24: Disadvantages
Respondent 1	Cost
Respondent 2	Unavailable, Cost, Need to travel
Respondent 3	Cost, Not convenient
Respondent 4	Cost
Respondent 5	Cost
Respondent 6	Cost and limited availability
Respondent 7	Cost
Respondent 8	Cost and limited availability
Respondent 9	Cost and limited availability
Respondent 10	Cost, quality
Respondent 11	Cost and limited availability
Respondent 12	Cost is burdensome

	Question 25: Associations
Respondent 1	No
Respondent 2	Peace of mind
Respondent 3	na
Respondent 4	Quality, presentation
Respondent 5	na
Respondent 6	na
Respondent 7	na
Respondent 8	na
Respondent 9	Need to make informed decisions
Respondent 10	Organics, simple green
Respondent 11	na
Respondent 12	responsibility to

	Question 31: Enabling Factors
Respondent 1	Availability
Respondent 2	Spreading into mass markets
Respondent 3	Cost, Availability, Mood
Respondent 4	na
Respondent 5	Price, availability of products
Respondent 6	Transportation assistance, coupons, reduced cost
Respondent 7	na
Respondent 8	Transportation assistance, Cost
Respondent 9	Transportation, cost
Respondent 10	Availability, cost
Respondent 11	Availability, cost
Respondent 12	Cost, Availability, Mood

	Question 32: Limiting Factors
Respondent 1	Availability
Respondent 2	Availability, cost, need to search
Respondent 3	Need to search
Respondent 4	na
Respondent 5	Cost, travel, availability
Respondent 6	Lack of transportation
Respondent 7	Lack of transportation
Respondent 8	Lack of time to travel
Respondent 9	Cost, other items on sale or cheapest
Respondent 10	Cost Availability
Respondent 11	Cost Availability
Respondent 12	Availability

	Question 33: Other associations
Respondent 1	na
Respondent 2	Need for brand competition to drive down price
Respondent 3	Meal plans and gifts
Respondent 4	na
Respondent 5	na
Respondent 6	na
Respondent 7	na
Respondent 8	View of it being worthless/a scam/ stupid
Respondent 9	na
Respondent 10	Unprepared suppliers, less availability
Respondent 11	na
Respondent 12	Sustainability and false green products

	Question 58: Initial Green Influences
Respondent 1	Passion for sustainability
Respondent 2	Experience, Exposure to information about environment
Respondent 3	Expectation from friends, knowledge, and common sense
Respondent 4	Respect for environment, and early education and interaction
Respondent 5	Concern for health and sustainability
Respondent 6	Books, Movies, exposure to information
Respondent 7	digestive disorder, knowledge, compassion

Respondent 8	Concern for sustainability, taste, want to make a difference
Respondent 9	Not wanting to be a hypocrite, health, sustainability, ethics
Respondent 10	Social concerns, sustainability concern, political concern, animal rights
Respondent 11	Not really a green consumer yet
Respondent 12	Information, eyes opened to a problem now un ignorable

na = Non Applicable