TEACHING SUSTAINABILITY

Peter Jacques, UCF, Department of Political Science

Introduction

This resources is designed to help UCF faculty think about how to teach sustainability in their specific and individualized courses, and because sustainability is a truly interdisciplinary—perhaps even *trans*disciplinary field and includes so many realms of human existence it is hard to imagine an area or class that would have no relation. So sustainability can be a cross-cutting set of concerns that are widely available across the university curriculum. Indeed, sustainability is addressed at UCF through a number of venues, perhaps most importantly is the UCF Unifying Theme which provides materials for instructors and students about environmental affairs as a cross-cutting theme within the General Education Program. To augment these efforts, this resource is meant to spur on thinking about how to incorporate sustainability across *any* class based on the assumption that sustainability is something more than environmental improvement but is rather a structural concern. Some of these structural concerns are discussed in this resource to provide some framework, especially for those who wish to incorporate sustainability into their class but have thus far elected not to due to a lack of familiarity.

Terminology and Teaching

It is probably also evident in the above discussion that the word "sustainability" is filled with ambiguities and definitional problems. One central feature to all definitions of sustainability, reaches back to the etymology of the term: *sus tenere* or **"to hold up." In other words, sustainability is about survival.** Sustainability however becomes an essentially contested term because the question becomes—"what should be held up, continued, -- sustained?"

This provides an opportunity in so many fields, as we can imagine a number of answers to "what is to be sustained?": "civilization," "the land," "my society," "the community of life," "the world community," "current lifestyles of the affluent and poor" "as many people consuming as much as possible" or something else entirely have all been answers provided. To each of the standard answers we can ask "why" and "how" and "how do we know" type questions that make the issues of sustainability widely applicable to the human experience and thus to the entire curriculum.

The most widely quoted definition of sustainability comes from the Brundtland Commission(United Nations World Commission on Environment and Development, 1987) report issued by Oxford University Press in 1987 who defined sustainability as:

> "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

While the report gave deference to the needs of the poor, some scholars from the Global South (Guha & Martinez-Alier, 1997) have criticized the general idea of "sustainable development" plan as favoring the status quo arrangement of international wealth and not challenging the structural dynamics of poverty enough. These scholars have concluded that any approach to sustainability that neglects either the direct relationship of subsistence people to their ecological life supports (e.g., fertile soil) and distributive (allocation of goods and bads) justice is incomplete. On the other hand, others have cautiously defended the current levels of consumption using ideas of inter-temporal welfare (Arrow, Partha Dasgupta, Goulder, Daily, Ehrlich et al., 2004; contested by Daly, Czech, Trauger, Rees, Grover et al., 2006) or on the basis that broad averaged wealth has generally increased in the world (though the wealthiest have enjoyed most of these gains). Still others, as part of an organized political movement mostly in the US(Jacques, Dunlap & Freeman, 2008), have denied that there are any sustainability problems whatever and that the public has been sold a "litany" of fabrications about the state of the world's ecological systems (for example see Lomborg, 2001) (contested by many, for example see http://www.grist.org/: "The Skeptical Environmentalist: A skeptical look at the *The Skeptical Environmentalist*" which printed comments by E.O. Wilson, Stephen Schnieder, Norman Myers, Lester Brown, Emily Matthews, Devra Davis, David Nemtzow, and Kathryn Schultz).

Nonetheless, as soon as we try to define sustainability in any way, we run up into thick and unavoidable epistemological and ethical questions ripe for the classroom. For this reason there are some who have argued that the word sustainability is just so ambiguous that it is meaningless. However, using an notion of Gallie's (1955 - 1956) "essentially contested concept" we can see that the opposite is true—it is so full of meaning that it is difficult to come to consensus.

An essentially contested idea is one that has multiple usages, and argumentation will not solve the discrepancy or unify dissent. In other words, there are several notions of sustainability in use, and instead of the word and ideas of sustainability being so vague as to be useless, they are so full of meaning that we must clarify what we mean so that we can move on to the critical consequences of non-sustainability. This also implies that even if we don't know what sustainability looks like we might very well understand what non-sustainability is—it is something that cannot continue. As educators, this is an opportunity for inquiry, critical thinking, methodology, and creativity.

Inasmuch as honest education is untamed, disputed terms and ideas can be entry points for examination, questioning of assumptions, beliefs, values, logic, history, empirical facts and a host of other issues that appear inherent to education. Thus, in addition to the urgency lent by drastically changing ecological life-support systems within the last 200 years, sustainability is a fundamental learning opportunity.

Environmental Quality/Improvement versus Sustainability

I am going to make the normative but grounded argument that environmental quality and improvement are different that sustainability, as it is represented in the literature in sustainability. There are more environmental laws now than ever before to help improve environmental quality, but the structure of environmental systems are in the largest stages of change in the record of modern humanity. Specifically, Vituesek et al (1997) note the following minimal examples of global environmental change:

1. "Between one-third and one-half of the land surface has been transformed by human action;
2. the carbon dioxide concentration in the atmosphere has increased by nearly 30 percent since the beginning of the Industrial Revolution
3. more atmospheric nitrogen is fixed by humanity than by all natural terrestrial sources combined;
4. more than half of all accessible surface fresh water is put to use by humanity;"
5. "rates of species extinction are now on the order of 100 to 1000 times those before humanity's dominance of Earth"

Because these are human-induced changes, human behavior and changes in behavior are critical factors, but no matter how much we recycle or gain efficiencies in energy technology, these environmental improvements will not make a difference to sustainability if they do not alter the larger course of human behavior and ultimately the consumption of ecological space (the footprint concept—developed and discussed above).

Notice that the above changes have several characteristics. First, they indicate that human behavior has threatened critical life support systems for itself and for other plants and animals (see #5 in the list, referred to as the Sixth Great Extinction). In fact, many civilizations of the past have collapsed for related changes to ecology (and disease, politics and other complicating reasons) that were more local—like declines in soil quality at the same time that population and food demands rose for the first urban areas, e.g. in ancient Sumer[1]. These critical life support system changes now are global—the global carbon, nitrogen, and water cycles have all been altered. In addition, the changes to each of these cycles and systems affect each other—changes to land use affect all three cycles for example, and they are key to one of the most important threats to biodiversity through the loss of habitat.

So, these systems are interacting, overlapping, and interdependent, and they have been altered in a fairly short time as the human economy and population have changed radically in the last 200 (but especially in the last 50) years. Princen (2003; 2005) therefore argues that we can gain more and more efficiency, cooperation, and improvements in environmental policy, but if they do not affect our consumption of ecology and ecological systems, they do not make gains toward sustainability. Princen notes that we may continue, for example, to make fantastic efficiencies in water delivery but fail to solve the problem of a vastly altered freshwater earth system; likewise, we may make efficiencies in engines but actually increase our greenhouse gas emissions (where we drive more based on say, on cheaper gas). In either case (Princen and others argue), the policies working on water or emissions have not yet made a difference at the systematic level even if these laws are critical for say for air pollution or water pollution etc…

Similarly, Dauvergne (2008) points out that the expansion of worldwide environmental policies have not slowed the consumption of ecological space because even as we make policies we continue to consume more things (that come from ecological space) as well as consuming the ecological systems directly.

[1] For a very readable political history, Clive Ponting's *A New Green History of the World* is a good source.

Similarly, the effects of people and issues of social justice are invisible in our consumption habits—ecological and social impacts of our consumption therefore are leaving some indelible "shadows" even as we have more laws to build them. Dauvergne therefore concludes that environmental policies and quality may actually serve to protect the economic, cultural, ideological, and political systems that drive the systematic changes to ecology generally.

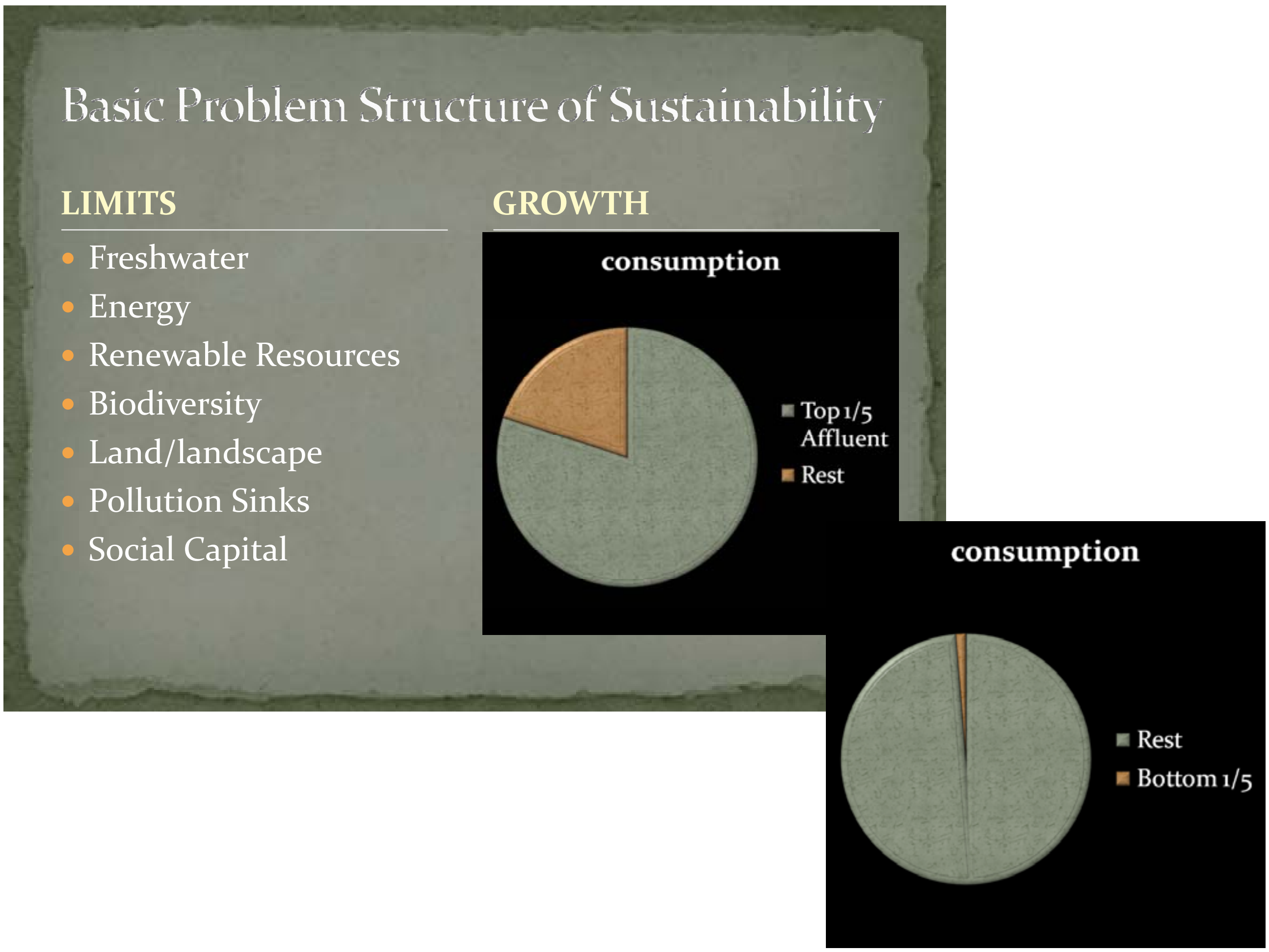
The Basic Problem Structure of Sustainability

While the idea of sustainability contains normative meanings already discussed, the basic problem structure is found throughout all variations in use of the term: limits and growth/consumption. The section will present several notions that explore the limits to growth for sustainability with two initial concerns—systemic and ethical.

Let us first consider that everything we consume (however that consumption operates) comes from earth systems. Minus sunlight, cosmic rays and space dust [other extraterrestrial matter/energy?], the earth system operates as a relatively closed system where there global limits to material such as water, oil, timber, and any other resource are fairly concrete and have specific limits. Limits do not just mean *depletion*, but *change* as well. The idea of how much change or disturbance a system can handle before a fundamental, or "catastrophic" [i.e., sudden and dramatic relative to the system, but not necessarily human time] change occurs and a new regime [order] is created is found in the literature on "resilience" noted below. However, ecological limits are not simply ones about, e.g., how much oil exists, but also about, for example- how much deposition of C02 in the ocean can occur before catastrophic acidification changes the fundamental order of marine habitats.

On one level we might simply consider global environmental change, where the earth system maintains several subsystems, e.g. hydrological, Nitrogen, and Carbon cycles. And we might imagine that a society that avoids fundamental changes in these cycles and functions in ecology will be more sustainable than a society that does change these *structural* conditions for life on earth. The reason of course is that these systems hold up critical life support functions—like the niches for specific diverse organisms including humans. Change the critical life support systems and there must be, sometimes, radical adaptive measures taken, and historically this has posed challenges for prior collapsed civilizations.

One of the more important, if contested, contributions to this problem structure was the book, *Limits to Growth*(Meadows, Randers & Meadows, 2004). This book, over the course of 2 further updated editions, argued that the exponential growth of industrial production and population could not be sustained in the face of a limited set of resources, and that if these two factors were not scaled down then we would face collapse in the human population by 2100 because we would not be able to feed or otherwise care for the vast numbers and consumption. The authors argued that we have already overshot the limits of the earth's systems (like Wackernagel) but that we may be able to correct for it. Obviously, had we done this in the 1970s or the 1990s when they warned of this for the 1st and 2nd times, they say we would have a much easier time of it, and now it may be very hard and require more drastic measures. Interestingly, an article in *Global Environmental Change* (Turner, 2008) took a review of the first book's forecasting and found that after 30 years of data to compare—we were on track for Meadow's et al worst and most pessimistic scenario. This was because the worst scenario was based on no changes to the status quo in growth.



Generally speaking, human-induced environmental changes come from different forms of consumption. By consumption, we might mean consumption of freshwater, habitat, or even larger communities, ecosystems. Based on this, the issue of population increase since the industrial revolution (when we had about 1 billion people in 1800) to current population (well over 6 billion) becomes a concern because the more people we have on earth the more basic level of consumption will theoretically occur.

Joel Cohen(Cohen, 2003 at 1172) puts it this way:

> Earth's population grew about 10-fold from 600 million people in 1700 to 6.3 billion in 2003….It took from the beginning of time until about 1927 to put the first 2 billion people on the planet; less than 50 years to add the next 2 billion people (by 1974); and just 25 years to add the next 2 billion (by 1999). The population doubled in the most recent 40 years. Never before the second half of the 20th century had any person lived through a doubling of global population. Now some have lived through a tripling.

Almost all the growth in population is now occurring in poor countries, which means that any conversation about population includes one of poverty. This is an important opportunity for gender discussions since population policies are first felt in women and children. But population increases have clear indications for demographic dynamics, measurement complications, data manipulation, political implications, rhetoric and representation of the poor, women, children, history, etc…

Once we make the demographic and class distinctions is also evident that not everyone consumes the same amount. Generally speaking in regards to the world's resources in terms of income, the top 20% (income) of the world consume about 85% of the resources, while the bottom 20% consume 1.3%. Thus, the top 20% of the world's most affluent are consuming much more ecological space than anyone else. This information comes from the *Human Development Report 1998.* More specifically it notes,

> Inequalities in consumption are stark. ..More specifically, the richest fifth:
>
> • Consume 45% of all meat and fish, the poorest fifth 5%.
>
> • Consume 58% of total energy, the poorest fifth less than 4%.
>
> • Have 74% of all telephone lines, the poorest fifth 1.5%.
>
> • Consume 84% of all paper, the poorest fifth 1.1%.
>
> • Own 87% of the world's vehicle fleet, the poorest fifth less than 1% (p. 2).

It should be noted that since 1998, the middle classes of India and China in particular have developed more substantially, and the specific ratios may have changed some. At that time, industrialized countries were expanding *per capita* consumption by 2.3%, Southeast Asia by 2%, and East Asia by 6.1% (does not note Latin America) but that African consumption was 20% *less* than it was from the early 1970s. However, even with expanding middle classes in India and China, the poor in these countries are generally worse off, and the explosion of urban slums in poor countries around the world make it hard to imagine that the general relationship of consumption has really changed radically from 1998.

This is further illustrated in the now popular term "footprint."

The Concept of an Ecological Footprint

The concept of the ecological footprint comes from Maathis Wackernagel (executive director of the Global Footprint Network found here: http://footprintnetwork.org/en/index.php/GFN/) and his colleagues who conceptualized the consumption of ecological space, as it occurs through land and marine space needed for current human activities.

While the work of the ecological footprint has grown extensively, the original paper published by Wackernagel et al (2002) in *Proceedings of the National Academy of Sciences* [available online free here: http://www.pnas.org/content/99/14/9266.full.pdf+html] attempts to specifically measure humanity's use of the biosphere through six human activities that require biological space:

1. Growing crops for food, animal feed, fiber, oil, rubber
2. Grazing animals for meat, hides, wool, milk
3. Harvesting timber for wood, fiber, and fuel
4. Marine and freshwater fishing
5. Accommodating infrastructure for housing, transportation, industrial production and hydro-electric power
6. Burning fossil fuel (estimating the "biologically productive area needed to sequester enough carbon emissions to avoid an increase in atmospheric C02")

Each year has a global available equivalent of 1 (earth, ostensibly) and they find that human use of the biosphere has overshot the earth's capacity. They conclude (p. 9268):

> For each year since 1961, we compare humanity's demand for natural capital to the earth's biological productivity. The calculation provides evidence that human activities have exceeded the biosphere's capacity since the 1980s. This overshoot can be expressed as the extent to which human area demand exceeds nature's supply: whereas humanity's load corresponded to 70% of the biosphere's capacity in 1961, this percentage grew to 120% by 1999. In other words, 20% overshoot means that it would require 1.2 earths, or one earth for 1.2 years, to regenerate what humanity used in 1999.

They warn, however that this may be underestimated, depending on a number of variables, but most importantly the "biodiversity buffer." This is the amount of habitat humans are willing to preserve (this does not preclude use however) for the rest of the "7-14 million species with which people share the planet." They say that their analysis does not show how rapidly resources are being consumed nor how long such an overshoot can continue, in part because we are borrowing from others (such as the 7-14 million species). Here (p. 9268) they note that using a 12%, instead of a 10% buffer, means that we have overshot the earth's capacity much sooner than the 1980s:

> Reserving 12% of the biologically productive area for conservation, following the Brundtland Report suggestion, moves the crossing-over point from the 1980s back to the early 1970s, and increases the current overshoot from 20% to nearly 40%.

The findings, theory, method, and presentation provide innumerable opportunities for classes across the curriculum from art (how many earths?), biology, economics, political science, engineering, etc…

A few notes about standard resource dynamics, environmental sustainability, and the "Triple Bottom Line"

Of course, resources are broken into three overlapping types: renewable, non-renewable, and sinks (where waste ends up).

Earth systems find themselves with some fairly standard and well known limits that make up what Goodland(1995) identify as principles of *environmental* sustainability. These principles are also found in Daly and Cobb(1989) and in Meadows et al(2004):

- The "output" rule states that wastes should not be placed in a sink in greater quantity or rate than the sink can assimilate them.
    - One example of this is the atmospheric and oceanic sinks for carbon dioxide. It may be interesting to note also that the climate skepticism counter-movement has argued that CO_2 is "not a pollutant." But not all pollutants are toxic chemicals, rather they are more generally undesirable additives to a sink that must be able to assimilate them. For example, seawater is obviously not a pollutant when it is in the ocean—but when it intrudes into aquifers we consider it a pollutant because it limits our ability to use the freshwater.

- The "Input" rule is broken down into 2 main categories
    - Renewable resources should not be harvested greater than the rate of regeneration, and this includes the capacity of the larger system that facilitates this regeneration.
        - Forests and Fisheries are classic examples.
    - Non-renewable resources should not be depleted faster than substitutions can be found. This generally requires that a portion of the resource or its income generated should be used to conduct research for finding a substitution.
        - The obvious example here is oil, where the rule would indicate we should be spending a much larger portion of income from oil to find substitutes.

- "Operations" principles state 3 general systems constraints
    - the scale of the human economic subsystem (it is subsumed under the earth and human social systems) should be limited to the level of carrying capacity of earth and social systems. Limits by the earth systems are more concrete carrying capacity notions (e.g., available water) but social systems are more about "optimizing" for fairly ambiguous notions like "welfare." Notably, optimizing for the social system is almost always *even more limiting* on economic growth than the earth system limits imposed. While economic growth brings affluence to some, other social issues make these more severe limits more clear such as overcrowding and population demands on subsistence needs, conflict and violence over scarce resources, famine, inequity and justice concerns, and the quality of human life and our relations.

    - Technological advances should bring advances in efficiency, but should not increase "throughput." Throughput is the linear economic process of "Take-make-waste" where we take natural resources, produce commodity chains, and end with waste in multiple forms (pollution, heat, refuse, etc…).

        - For example, we have largely taken efficiencies in car technology by increasing power for our cars and SUVs. This means we are getting more power per gallon than before, but our overall consumption of gasoline (especially worldwide) has been a strong, increasing trend.

    - Renewable resources should be exploited on profit-maximizing and sustainable basis.
        - If the long term is in mind, profit-maximizing of say, fisheries, is actually *much much* lower than the optimal catch based on population of the fish. The economically optimal catch where costs are lower and catch is higher is always much lower than the higher costs to catch more scarce fish.

While these seem like simple and straight-forward notions, in reality there are several issues that make this a much more tenuous "management" problem.

First, all the resource types overlap and affect each other—our sinks are also sources but may be mutually exclusive (polluting fishery nurseries for example may be depleting a resource while using up the sink at the same time).

Second, the work on resilience (below) shows that there are complexities built into the simple use of resources that defy precise prediction. This is because inter-dependencies within ecosystems are so thick we cannot see them all or how they exactly will change or when. Simply, ecosystems have their own cycles of conservation, buildup, collapse, and re-organization. When we are harvesting resources we may calculate the growth in a fish stock and fish as much as we think is sustainable, but then other already at-work dynamics change that very stock and we end up pushing the stock into collapse even when we thought we were using a sustainable method. If we fish salmon to the edge of their “sustainable yield” but warming waters decrease forage and recruitment of young to older members, the population declines and the prior “sustainable” yield is no longer so. Yet, as of this writing, no international fishery bodies are taking climate change seriously by including it in their allowable catch calculations.

Third, the political realities of maintaining a maximum “sustainable” yield in renewable has proven very difficult where countries, industries, harvesters, find it in their short term interest to take as much as they can despite the long term “tragedy” that will eventually occur. This has been one recurring problem in fisheries, even in cases where a catastrophic loss of fish is widely acknowledged as imminent (Atlantic blue fin tuna are a prime example).

Fourth, knowledge about these systems may be substantially incomplete (especially given complexity problems) while scientific findings become more and more contested as actors compete for the resource. In the international arena, there is no world government to force another state to observe scientifically understood limits anyway, which makes other states potentially want to get the resource before others do—making power, not knowledge the key factor. This issue falls within the well-known problems of the “commons” where establishing effective and fair institutions is the solution but it is one that is hard to establish (Dietz, E. Ostrom & Stern, 2003; Hardin, 1968; National Research Council, 2002; Ostrom, 1990; Ostrom, 1999).

Triple Bottom Line

Environmental sustainability is one component of what is often described as the “triple bottom line.” The Triple bottom line is proposed as a fundamental harmony between three critical human and ecological systems: Social systems, Economic systems, and Ecological. So, for example one can imagine a sustainability problem with a society that maintains its own ecological capital (goods and services, functions) but does so through warring with other societies to take theirs. This would be an example of social system problem. This is also where some scholars put amity, virtue, equity, fairness and justice, to name a few, as requirements for a working social order. Economic sustainability reflects the need to consume, where there must be enough food and other basic needs for a society to maintain and reproduce its operation. AND, these ideas are then woven together to account for sustainable economic accounting, environmental values as they fit in social sustainability and how economical or just sustainability measures are themselves.

- Educators will find, for example, ample discussions about business ethics in relation to social and ecological values interesting teaching opportunities relating to the triple bottom line idea.

Of course, this triple bottom line can really be simplified into a double bottom line because social systems encompass economic systems. The point remains however that each system has limits to growth that have to be observed for the basic continuity, let alone well being of each. The idea of resilience attempts to do just this.

Resilience:

Understanding that social and ecological systems each have limits, and that social and ecological systems are deeply integrated in reality, the "Resilience Alliance" [http://www.resalliance.org/1.php] — an interdisciplinary research group who run the highly regarded and rigorous open online journal *Ecology and Society* at [http://www.ecologyandsociety.org/index.php] have begun thinking about resilience of "complex adaptive social-ecological systems." This notion links how people behave (and therefore think, relate, etc…) in ecology (which has its own behavior) and thinks about the ability of each system to operate with resilience—or the ability to experience disturbance without shifting the system to another regime ("order"—e.g., some climate scientists are concerned that if current climate change warms enough of the carbon stored in the permafrost or the methane belts in the deep ocean, the earth could transition to an entirely different climate regime. The degree to which the climate system can absorb the disturbance of higher greenhouse gasses and remain in the current relatively stable and temperate climate it is resilient).

The notion of resilience in this context originates with C.S. "Buzz" Hollings who was the first to effectively explain "adaptive cycles." . Some of his initial research was on the spruce budworm (for a review see Walker and Salt 2006, p. 79). This work was essential to the timber industry because, while there was an (relatively) easy way to figure out the growth patterns of spruce and therefore create a "maximum sustainable yield" of that growth, managers did not know how to work with outbreaks of budworm, which is a moth (in the larvae stage) that eats the new needles in pine forests. The budworm works in cycles where the population is controlled by predators (birds) that can easily find them. However, when the forest grows enough, the budworm are better hidden in the foliage and the birds cannot hunt them as efficiently. The budworm then goes through an explosive population growth. In order to avoid the explosive growth that would eliminate a large part (~80%) of the forest, Canadian timber managers had been attempting to control the budworm with pesticides, but then found themselves locked in to this approach because as the forest matured; if they released the budworm from the pesticide it would devastate the forest. Clearly the combination of the budworm cycle and the harvest of trees had to take each other into account. Hollings demonstrated the cycle of the budworm to the managers so that they could create a "patchy" pattern of forest and better timed use of the pesticide to avoid a collapse of the forest and a more sustainable approach to timber cutting and pesticide use. Many others have recognized the adaptive cycle in many other contexts, and this work has argued that "the key to sustainability was an ecosystems capacity to recover after a disturbance," and that "the ecosystem and the social system needed to be viewed together rather than analyzed independently." Despite the impact of this work, the mainstream and majority mode of resource management still remains focused on a "maximum sustained yield" of single-species resources regardless of the underlying ecological cycles—again, fishery management is a prime example.

Relevance to the UCF Community

While notions of sustainability date back at least to the 19th Century in Western thought (e.g., J.S. Mill), sustainability as a field of inquiry in the curriculum is relatively new. There is much we can try because the options are so wide open for innovation. Paul Wapner(2002 at 20) writes, in fact, that "Humanity has struggled over what 'ecological right livelihood' might mean for so long that the historical record itself underlines the poverty of much conventional knowledge and opinion." In other words, there is a lot for us to do, wide open opportunities for better ideas, and a great deal of urgency for what he calls teaching with a "wild mind"—unattached to ruts of our normal schooling as much as possible. At the same time, Wapner rightly notes that the brilliant people we all know of who had wild minds, operated within specific traditions of thought. This provides the new and pressing issues of sustainability thinking with the traditions of thought we are trained in and which we teach.

References

Arrow, K., Partha Dasgupta, Goulder, L., Daily, G., Ehrlich, P., Heal, G., Levin, S., Ma¨ler, K.-G.r., Stephen Schneider, D.S.a., & Walker, B. (2004) Are We Consuming Too Much? *Journal of Economic Perspectives*, 18, 147–172.

Cohen, J. (2003) Human Population: The Next Half Century. *Science*, 302, 1172-1175.

Daly, H., & Cobb, J. (1989). *For the Common Good: Redirecting Economy Toward Community, the Environment, and a Sustainable Future*. Boston: Beacon Press.

Daly, H., Czech, B., Trauger, D.L., Rees, W.E., Grover, M., Dobson, T., & Trombulak, S.C. (2006) Are We Consuming Too Much—for What? . *Conservation Biology*, 21, 1359–1362.

Dauvergne, P. (2008). *The Shadows of Consumption: Consequences for the Global Environment*. Cambridge, MA: MIT Press.

Dietz, T., E. Ostrom, & Stern, P.C. (2003) The struggle to govern the commons. *Science*, 302, 2-12.

Gallie, W.B. (1955 - 1956) Essentially Contested Concepts. *Proceedings of the Aristotelian Society*, 56, 167-198.

Goodland, R. (1995) The Concept of Sustainability. *Annual Review of Ecology and Systematics*, 26, 1–24.

Guha, R., & Martinez-Alier, J. (1997). *Varieties of Environmentalism*. London: Earthscan.

Hardin, G. (1968) The Tragedy of the Commons. *Science*, 162, 43-48.

Jacques, P.J., Dunlap, R.E., & Freeman, M. (2008) The Organization of Denial: Conservative Think Tanks and Environmental Scepticism. *Environmental Politics*, 17, 349 — 385.

Lomborg, B. (2001). *The Skeptical Environmentalist: Measuring the Real State of theWorld.* New York, NY: Cambridge University Press.

Meadows, D., Randers, J., & Meadows, D. (2004). *Limits to Growth: The 30-Year Update*. White River Junction, VT: Chelsea Green Publishing

National Research Council (2002). The drama of the Commons. Committee on the Human Dimensions of Global Change. In T.D. E.Ostrom, N.Dolsak. P.C.Stern, S.Stovich, and E.U.Weber. Division of Behavioraland Social Sciences and Education.: Washington, DC: National Academy Press.

Ostrom, E. (1990). *Governing the Commons: The Evolutions of Institutions for Collective Action*. Cambridgte: Cambridge University Press.

Ostrom, E., and Christopher Field (1999) Revisiting the Commons: Local Lessons, Global Changes. *Science*, 284, 278–283.

Princen, T. (2003) Principles for Sustainability: From Cooperation and Efficiency to Sufficiency. *Global Environmental Politics*, 3, 33–50.

Princen, T. (2005). *The Logic of Sufficiency*. Cambridge, MA: MIT Press.

Turner, G.M. (2008) A comparison of The Limits to Growth with 30 years of reality. *Global Environmental Change*, 18, 397-411.
United Nations Development Programme (UNDP) (1998). Human Development Report 1998. New York; Oxford: UNDP.
United Nations World Commission on Environment and Development (1987). Report of the World Commission on Environment and Development: Our Common Future United Nations World Commission on Environment and Development.
Vitousek, P.M., Mooney, H.A., Lubchenco, J., & Melillo, J. (1997) Human Domination of Earth's Ecosystems. *Science*, 277, 494-499.
Wackernagel, M., Schulz, N.B., Deumling, D., Linares, A.C., Jenkins, M., Kapos, V., Monfreda, C., Lo, J., Myers, N., Norgaard, R., & Randers, J. (2002) Tracking the ecological overshoot of the human economy. *Proceedings of the National Academy of Science (PNAS)*, 99, 9266–9271.
Wapner, P. (2002). Ecological Thinking: Studying Global Environmental Politics with a Wild Mind and a Mindful Heart In M. Maniates, *Encountering Global Environmental Politics: Teaching, Learning, and Empowering Knowledge*. Lanham, MD: Rowman and Littlefield.