THE BALATON BULLETIN

Newsletter of
The Balaton Group

February 1991

Contents

Steering Committee Meeting

On December 8-9, nine members of the Balaton Group assembled at Joan Davis' home in Zurich for an INRIC steering committee meeting. Present were Joan Davis, Bert de Vries, Genady Golubev, Ginger Gyene, Dana Meadows, and Dennis Meadows, Niels Meyer, Aromar Revi, and Chirapol Sintunawa, with a guest appearance for part of one day from Amory Lovins.

Among the topics discussed were:

<u>The future of the Csopak resthouse</u>

With the economic and political changes that are unfolding in Hungary, the transportation and lodging for our annual meeting have become more difficult and more expensive to arrange. We can expect even greater changes in the future. The resthouse where we meet has belonged to and been administered by the Hungarian Oil and Gas Trust. Rates could be fixed for several years, and negotiations were made with the senior administration of the Trust. Now, however, the resthouse could eventually become private property. Even as a part of the Trust it is expected to cover more of its own costs from its revenues. That fact combined with inflation in Hungary that was over 30 percent last year, certainly means that the rates for staying there will rise sharply. We need to monitor the situation in Hungary closely.

We also need to make a contingency plan in case the resthouse becomes unavailable to us for any reason.

Dennis will keep in touch with the resthouse staff, perhaps with Sandor Striker in Hungary as our contact point (since Ginger will be in India: see News of the Members later in this Bulletin). European members will explore other reasonably priced meeting places in Hungary, Austria, or Switzerland. Meetings in other parts of the world, which we have discussed for years, will depend on the availability of funding and logistic help from those parts of the world. We still expect that the upcoming meeting, our tenth, will be held at the Csopak resthouse.

Computers for the Annual Meeting

By a fortunate accident we had excellent Macintosh computers available for the 1990 meeting, but not nearly enough DOS-based IBM-compatible machines. We will try to organize computer availability better for the next meeting. Joan will check with Jos Radics about the possibility of borrowing both Mac and DOS machines from Budapest. We will make an entry on the registration form asking how many members will be willing to bring their own laptop machines.

Topic for the Next Meeting's Plenary Sessions

This was a long, hard discussion. Out of a long list of good possibilities (which will be saved for future meetings), two hot contenders emerged.

One was the problem of valuing, managing, and maintaining diversity -- in the large sense of ecological, cultural, economic, and technical diversity. Though the rainforest receives most of the attention, in fact ecological diversity is being lost in all parts and most ecosystems of the world. Most people do not even understand why that is a problem. Social and cultural diversity are largely being lost too, as Western industrial culture sweeps all before it. Some people sense that is a problem; others view it as a triumph.

What can we say and learn about preserving diversity, of all kinds? Is diversity the key to stability, as the ecologists once thought? Is diversity necessary to a sustainable world? Is there such a thing as the "right amount" of diversity, neither too much nor too little? Does our systems training give us any insight in answering these questions? To what extent do the principles of ecological diversity (which are themselves not well understood) apply to cultural, technical, economic diversity?

That's one meeting topic we all found of interest, and one that received much support at the last Balaton meeting.

The other possible topic emerged as a surprise. It was not one any of us had considered before coming to the Zurich meeting. Rather, it came out of the reports we gave to each other of conditions in our various parts of the world. War was about to break out in the Middle East, an economic depression has started in North America, a new consolidated West Europe is forming, while East Europe's economy spirals down, governments everywhere rise and fall, oil prices fluctuate, and environmental concern peaks and wanes. How do we keep our bearings in a world of rapid change? How do we keep ourselves and our regions focused on the long term, on the planet, on whole systems, when short-term, partial, local, and economic problems appear so urgent?

The label we applied to this topic was chaos, meant in both the common and the mathematical sense. Is there anything in formal chaos theory that can help us understand, manage, and seize opportunities in a time of rapid change? Is there anything in any theory? What can we learn together that will help us individually and as a group negotiate the turbulence we foresee growing at the end of the 20th Century? We gave this possible conference topic names such as: The Dynamics of Creative Destruction, or Planting Seeds of Sustainability in the Muck of Chaos.

We discussed dealing with both topics in our next meeting and decided that it would be enough of a challenge to do justice to either one. It was a very close vote, but the final decision was -- diversity. More about that later in this newsletter. Maybe chaos will be addressed next year.

Membership

This perennially difficult issue becomes more difficult as we reach the limits to our growth. The dilemma arises from our belief that what is precious about the Balaton Group is its informality and friendliness, which depend, we think, on a small group size -- and yet, our purposes require us to maintain a global discussion, and to include in that discussion as many people as possible. So we keep talking about membership and trying out new ideas for how to develop, as Herman Daly would say, without growing.

One way out of this dilemma is to set up a network of networks. The Steering Committee affirmed our tentative decision at the last annual meeting to try regional networks in any region where members are willing to organize and find funding for meetings. There will probably be regional meetings in Asia and in North America this year. We can learn from them and decide whether to expand this idea.

With regard to the limited space at the annual meeting, the Steering Committee rejected the "first-come-first-serve" policy we tried last year. That policy is unfair to members who are subject to information and mail delays. This year we'll try something else. Application forms for attendance at the meeting will go out with the spring Bulletin, due to be returned in early June. At that time, if there are more than 45 applicants (as there have been the past two years) Dennis, Dana, and Betty will cut the list to 45, with an eye to regional representation and general fairness. Plenary speakers, "core members" (you know who you are), and members who can most clearly benefit from the meeting will receive highest priority. Spaces will be reserved for a few new participants each year, and for the return of former participants who have not been able to attend for awhile.

We are not entirely comfortable with this policy. Dennis, Dana, and Betty are especially uncomfortable with the power and responsibility that have been assigned to them. But, in the best Balaton spirit, we'll try it and see what happens. If we do not like the result, if there are many complaints, if other ideas are put forth, we'll try something else next year.

The Steering Committee also discussed the East European membership, which has undergone rapid change, as has everything about East Europe. Many of our East European members now have assumed major responsibilities within their countries in one capacity or another, and therefore they could not come to the last meeting. For example, when we met in December Stanislav Shatalin was principal economics advisor to Gorbachev and Ferenc Rabar was Finance Minister of Hungary. We decided to ask members from those countries, or members who work with those countries -- such as Csaba Csaki, Miklos Persanyi, Janusz Kindler, Ferenc Rabar, Joe Alcamo, Niels Meyer -- to help us find new members, in particular young ones who have not yet moved up to positions of senior responsibility.

Funding

The Rockefeller Brothers Fund grant that has provided core support for the Balaton Group expires this year. We are in the process of applying for new funding. The Steering Committee spent some time discussing what our needs and priorities will be over the next few years, so we can put together a budget. There is more funding news, good and bad, later in this Bulletin.

The 1991 Annual Meeting - Diversity and Sustainable Development

> In the affairs of men, there always appears to be a need for at least two things simultaneously, which, on the face of it, seem to be incompatible and to exclude one another. We always need both freedom and order. We need the freedom of lots and lots of small, autonomous units, and, at the same time, the orderliness of large-scale, possibly global, unity and coordination..... For constructive work, the principal task is always the restoration of some kind of balance.
>
> Today, we suffer from an almost universal idolatry of giantism. It is therefore necessary to insist on the virtues of smallness -- where this applies. (If there were a prevailing idolatry of smallness, irrespective of subject or purpose, one would have to try and exercise influence in the opposite direction....)
>
> We must learn to think in terms of an articulated structure that can cope with a multiplicity of small-scale units. If economic thinking cannot grasp this, it is useless. If it cannot get beyond its vast abstractions ... and make contact with the human realities of poverty, frustration, alienation, despair, breakdown, crime, escapism, stress, congestion, ugliness, and spiritual death, then let us scrap economics and start afresh.
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> -- E.F. Schumacher, from Small is Beautiful

The following is a tentative schedule by which in the four plenary mornings of the next annual meeting we will study the topic of diversity. The general structure will probably be maintained, but speakers have not been confirmed. If you have suggestions for speakers who could enlighten these subjects (especially non-American ones), or if you could do so yourself, please let Dana Meadows know right away.

Day One -- The Systems Theory of Diversity

When we look at the systems of Earth that have evolved over millions of years, we are struck by the diversity of their elements. Why does the self-organizing biosphere continually move toward diversity? What is the purpose or advantage of diversity in complex systems? What are the feedback processes that create it? What are the feedback processes that stamp it out? How does nature knit together burgeoning diversity into intact and resilient ecosystems? What have ecologists learned, from both observation and modeling, about the relationship of diversity to stability and sustainability? Are there any lessons from the system role of diversity in natural systems that could be applied to human systems as well?

Possible speakers: C.S. Holling, D.H. Meadows, E.O. Wilson, Paul Ehrlich.

Day Two -- Biological Diversity: Its Destruction, Its Preservation

Just exactly what is biological diversity? How is it defined and measured? What is happening to biodiversity in the world? Should we care? What has been learned about how to protect and preserve biodiversity where it still exists? Once it has been destroyed, can it be restored? What position should Balaton Group members take toward the "biodiversity crisis" of the planet, and what concrete steps could we take to help?

Possible speakers: Lucia Severinghaus, Gerardo Budowski, Otto Soemarwoto, Michael Soule, Thomas Lovejoy.

Day Three -- Cultural and Technical Diversity

Can we say that the human cultural system also tends toward self-organizing diversity? Or is it more common that a dominant culture, especially the Western industrial culture, wipes out all diversity that it finds in its path? Is that trend real? Is it bad? Does the human race need more or less diversity of languages, religions, mindsets, cultures, technologies, energy sources, art forms? What is there in our basic natures that is both fascinated and frightened by human diversity? How can society be structured to preserve, enhance, and restore whatever level of diversity is best for our long-term survival and evolution?

Possible speakers: Aromar Revi, Calestous Juma, Mary Douglas, Herman Daly.

Day Four -- Diversity in East and West Europe

Is West Europe moving toward too much homogeneity, at the same time that East Europe splits apart into too much diversity? What are the basic forces driving the trends on both sides of Europe? What are the long-term implications, if these trends persist? What, if anything, can be done to bring Europe to the "right" balance between homogeneity and diversity? What can be said that is also applicable to the Americas, Africa, and Asia, where there are also both "separatist movements" and drives toward common markets and common culture?

Possible speakers: Niels Meyer, Hartmut Bossel, Bert de Vries, Csaba Csaki, Ferenc Rabar, Stanislav Shatalin, Victor Gelovani, Janusz Kindler.

Stability, Resilience, and Diversity

by Dana Meadows

The following is an excerpt from the textbook in preparation by Dana Meadows, tentatively titled *A Sustainable World: an Introduction to Environmental Systems*. This is a brief introduction to the ecological theory of diversity and sustainability, as interpreted by a system dynamicist. Comments, corrections, and rebuttals by the ecologists of the Balaton Group -- and others -- are warmly welcomed.

Ecosystems can put up with amazing insults, over short or long periods, and still recover:

- Every year a temperate forest is subjected to sub-freezing temperatures that stop the photosynthesis of producers, and cause most consumers to hibernate, leave, or die. Yet every year the forest regreens itself; its many life forms persist.
- With every change of tide the plants, animals, and microbes of estuaries undergo shifts from saltwater to freshwater -- and they thrive.
- Savanna, chaparral, and tropical dry forest ecosystems survive long seasons of hot sun with no rain.
- Tundra ecosystems endure months when there is no sun, followed by months when there is no darkness.
- Before the white settlers arrived, New England was almost completely covered with temperate forest. By the mid 1800's 80% of the land had been cleared for cultivated fields or pastures; only 20% remained in forests. Now the ratio has been reversed. New England is only 20% open land; 80% has returned to forest.
- In 1880 the Serengeti plain of Africa was hit by an epidemic of rinderpest, a viral disease of ruminants. Buffalo, wildebeest, and giraffe populations were decimated. Lions, deprived of their prey, began attacking people. The reduction in grazing animals caused the grasslands to be invaded by brush and trees. But by 1910 the native grazers had developed resistance to the disease. The wildebeest population doubled in just six years; the buffalo population grew back at nearly the same pace. Human beings burned back the brush, and the grasses returned. It took 80 years, but the populations on the Serengeti recovered.

We are so accustomed to ecosystems weathering enormous changes like these that we take the phenomenon for granted. An unstated assumption in the industrial mindset is that nature can recover from just about any kind of pounding. But is that true? We have seen that the earth and biosphere as a whole have numerous negative feedback mechanisms to restore their integrity. The smaller subunits of ecosystems have such mechanisms too. Like the self-stabilizing

systems of Gaia, the mechanisms of ecosystem stabilization are amazingly robust -- and, like Gaia, they have limits.

Stability and Resilience

In the strictest sense of the word, the stability of any system is its ability to return itself to its equilibrium state (which might not be a constant or stagnant state; it might be a dynamic, cycling, or evolving one). A stable system resists any departure from its equilibrium condition, and, if it is perturbed, it returns efficiently to that condition.

The system by which the human body maintains its temperature, for example, is very stable; it uses a number of negative feedback responses to keep that temperature within tight bounds -- shivering, sweating, increases and decreases in metabolic rate, and so forth. The rabbit-lynx ecosystem is also stable, although it oscillates.

One major stability mechanism of ecosystems is the interactions of populations at different levels of the food chain. If one population, say of herbivores, grows too large, some predator or parasite of that population will have a more abundant food supply and will grow too, eventually bringing the original population back down in size. At the same time the forage stock of the too-large herbivore population will decline, again bringing the herbivore population back down. You can see that the same loops will also work in the other direction, helping to bring the herbivore population back up, if it falls too low.

Imagine how many such negative feedback loops there are in the complete food web of an ecosystem. No wonder these systems can absorb shocks and changes!

Interacting population stocks, with their abilities to increase exponentially when possible, to maintain themselves in dynamic equilibrium, and to regulate each other, are important structural elements in maintaining ecosystem stability. So are nutrient and water stocks, which act as buffers, smoothing out changes in weather and season.

Ecosystems are more than stable systems, however; they are also resilient. The resilience of a system is its ability not just to return itself to a sustainable system state, but to return itself to a viable system structure. It is the ability to maintain the ability to maintain a given state. Resilience is meta-stability, the presence of feedback loops to restore or strengthen feedback loops, the ability to recreate, if necessary, a whole piece of the system.

Here's an example of the difference between stability and resilience. All warm-blooded animals have physiological mechanisms to keep their body temperatures stable. These are stability mechanisms; they use the existing structure of the body, the sweat glands, the muscles that cause shivering, the metabolic rate. A mammal's body can also exert some resilience, can adapt structurally to long-term temperature stress by changing the body structure -- by expanding or contracting the circulatory system, for instance, or by adding or losing fat. If you move from a hot climate to a cold one, you will "feel the cold" more strongly than the natives of that climate do, but only for awhile, until your body adjusts.

Human beings have not only physiological stability and resilience mechanisms in our bodies, we also enhance our temperature-control system by creating structure beyond our bodies -- clothes, buildings, furnaces, fans, air conditioners, swimming pools. That added resilience expands enormously the range of temperature variations human beings can endure -- we can function, for a time at least, in hot underground mines, on the lips of erupting volcanoes, at the poles, even in the chill of outer space. If the structure we have created to do that, clothes or shelters or heaters, are destroyed, we have the ability to create new ones -- that's resilience, a system structure to enable us to maintain system structure.

The more variable the climate a human culture lives in, the more it develops ways of dealing with climate change. Also with ecosystems, those that exist where conditions are highly variable have evolved more stability and resilience mechanisms than those, such as the tropical forest, that evolved in a nearly invariant climate. It is typical in complex systems that greater variation in the system's environment increases resilience; resilience allows the system to endure greater variation -- up to a point.

Succession is one mechanism of ecosystem resilience -- the system complicates itself, it adds structural elements (new stocks of species and of nutrients) in response to challenges, opportunities, and elements already there. It develops more negative feedback loops, more possible mechanisms to restore stability. Evolution, the ability to alter the genetic information stock and produce new species is an even more powerful, long-term resilience mechanism -- it brings into being system elements that never existed before!

Limits to stability and resilience

Of course there are limits to any system's stability and resilience. Your body can endure an uncomfortably cold or warm temperature for quite some time, but the more extreme the temperature, the less long the body can stand it. And the faster

the extreme comes on, the less time the body has to adjust. At some combination of quick onset, extreme temperature, and long exposure stabilizing negative feedback loops break down. Destructive positive loops take over. The body becomes warmer, which makes its metabolic reactions go faster, heating it even more. Or the colder it gets, the more metabolic systems slow down, making more sluggish the mechanisms for resisting cold. Once these positive loops kick in, the system's self-sustaining limits are exceeded. The result is a shift into a very different system behavior, which could be sickness, or even death.

That's a common behavior for self-sustaining systems. They can be pushed and pushed, without visible effect, for a long time, or over a wide range of conditions. Then a bit more push can overwhelm the control mechanisms. The important messages about the limits to resilience are the following; they are systems principles, applicable not only to ecosystems, but to the human body, the human economy, and Gaia as a whole.

A system's normal stability and resilience mechanisms can be overwhelmed if it is subjected to stress conditions that are:

1. more extreme than normal,
2. more rapidly changing than normal,
3. longer lasting than normal,
4. or some combination of the above.

The breakdown of a system's stability mechanisms is usually highly non-linear, often with a sharp threshold -- the fact that a self-regulating system has survived a certain amount of abuse does not guarantee that it can survive a little more abuse.

The failure of a self-regulating system can appear to be sudden, though the causes of failure are not sudden.

A system may fail, even with its stability mechanisms intact, if its resilience mechanisms are undermined. That is, a system that has adapted to a wide range of variability may suddenly not be able to survive normal variations, because its range of resilience has been narrowed.

Managing a system for stability means, being careful not to drive it to the edge of its stability range; and, if possible, to preserve and strengthen not only its mechanisms of stability, but also its mechanisms of resilience.

Diversity and resilience

Ecologists have hypothesized for a long time that the function of diversity must be to increase ecosystem -- and biosphere -- stability. The more different populations are interwoven into the food web of a system, the stronger the fabric, the more negative feedbacks, the more stabilizing stocks and pathways, the more the system can resist and recover from shocks and changes.

That hypothesis now takes on special urgency, since we know that our one species is presently eliminating others at an unprecedented rate. What are we doing to the stability of ecosystems, upon whose pyramids we sit as high-level consumers? How much further can the human-induced wave of extinctions go, before nature begins to fall apart? Should species be preserved not because they are directly useful to us, but because they hold the biosphere together? How many species? How will we know if we go too far? How will we know before we go too far?

These questions are not easy to answer. The hypothesis that diversity is necessary for stability is neither proved nor disproved. No one understands ecosystems that well. The central words we are using -- stability and diversity -- are not even clearly defined. We don't know how many species of life there are in the first place, nor their exact rate of disappearance, much less what happens to ecosystems when they disappear.

This much we do know -- we think:

1. Species diversity can be a strategy to maintain stability under some environmental circumstances, but it isn't the only strategy, and it isn't necessary for stability in all circumstances.

For example the tropical forest may have evolved so many species of trees as a strategy of stability against the perpetual insect populations that thrive in the always-warm tropical biome. A monoculture would encourage enormous proliferation of insects. A very complex polyculture with individual trees of one species widely separated from each other does not give pests enough food or shelter in any one place for their populations to explode.

Boreal forests, on the other hand, have comparatively low tree diversity. Their pests are reduced each year by frost, so the forests have not had to resort to extreme polyculture to resist them. Their lack of diversity does not imply lack of stability, at least not to the conditions in which they evolved.

2. Diversity, or lack thereof, may provide stability against the kinds of stresses an ecosystem has endured for thousands of years, but not necessarily against new stresses.

Its diversity is one reason that the tropical forest is vulnerable to modern logging. Species occur in such scattered patches that a cut or burn may wipe out all individuals of a local population -- and other populations may be too distant to move back in quickly.

The nondiverse northern forest is able to reseed itself easily, because there are many individuals of each species. On the other hand, the boreal forest's near-monoculture may succumb easily to newly imported pests -- or to a climate change that no longer controls pests by regular hard freezes.

In short, each of these systems, one diverse, one not so diverse, is stable to its normal disruptions and is vulnerable to some abnormal ones.

3. Stability and diversity probably rise and fall together in a feedback relationship.

The presence of many species is probably both a result of and a cause of ecosystem stability. Because its environment is relatively invariant year-round and over eons, the tropical forest has had time to evolve many species. The boreal forest, with historic glaciations, has undergone so many changes that it may not have had time to become diverse. The California chapparal has far fewer species than chapparal ecosystems in South Africa and southern Australia. Chapparal probably only developed in California within the last five million years and has undergone pronounced climate changes since then. By contrast, the shrub ecosystems of South Africa and Australia have been in existence much longer and have accumulated more species.

It seems most likely that stability and diversity are related not through one-way causation, but through a positive feedback loop: stability increases diversity; diversity increases stability.

4. Diversity is probably best defined in terms of numbers of interconnections among species, rather than number of species.

In summary, ecosystems are too complex to give easy explanations for what makes them more or less stable or resilient. We have a general sense that every species plays a role in its ecosystem, though we may not understand that role. We have an intuitive idea that the more diversity is reduced, the less productive and

resilient the ecosystem is likely to be. But when we want to answer the practical question: how much of an ecosystem can we destroy without collapsing the system, the honest answer is: We Don't Know -- and the conservative strategy is: When You Don't Know, Go Slow.

Evolutionary potential: long, long term resilience

Species diversity may enhance the short-term stability of ecosystems. It certainly enhances their long-term resilience. That's because a primary function of diversity, from the ecosystem's point of view, is evolution: the ability to shift the system's structure over time to whole new configurations, appropriate to whole new environmental conditions.

The ability to evolve resides in genetic diversity, which means the variety of genetic information -- codes for creating life -- not only in different species, but also in the variety of individuals within each species.

Individuals of the same species are not at all the same. You can see that by looking around at the species most familiar to you -- Homo sapiens, tall, short, fat, thin, energetic, laid-back, with many colors of eye and hair and skin. The diversity you see is only a small fraction of what's there in human genes. Many genetic traits are not expressed in obvious physical ways, and many are suppressed in one generation and brought forth in future generations. (You might have brown eyes but carry a recessive gene for blue eyes, which can be expressed in your child.) Human beings carry genetic codes for about 100,000 separate traits. For each of those traits there may more than two possible variations, as there are for eye color.

People who breed dogs, cattle, wheat, roses, or apple trees are aware of the tremendous variability carried in the genes of those species -- that diversity is the basic resource with which breeders work. They can bring forth varieties that grow bigger fruits or smell sweeter or resist disease or tolerate cold winters, because the potentials for those traits are already there in the genes carried by some individuals.

We are not so likely to appreciate the genetic diversity within "lower" life forms like ants or crabgrass -- but the diversity is there. Even a simple one-celled bacterium carries genes for about 1,000 different traits; some flowering plants carry as many as 400,000. These genes are not only a resource for the breeders of species useful to us, they are nature's primary resource for resilience.

If the climate changes, if land masses drift apart, if human beings soak the land with toxins, if ecological niches open or close, there may be, lurking within some individuals, a piece of genetic code that allows them to defend against or take

advantage of the change. These particular organisms are more fit for the new environment than others. "Fit" in this case has a precise meaning -- the ability not only to survive, but to breed. Fit individuals have more descendants than others of their species, and those descendants are more likely to carry the fit genetic trait. Then they too breed more successfully. The frequency of some genes increases, of others decreases. The population as a whole takes on more "fit" characteristics -- not really new characteristics, because they were there all the time, but expressed in more and more individuals, newly abundant in the population and ecosystem and gene pool.

This is the process called natural selection, enunciated by Charles Darwin in the landmark book *The Origin of Species*. It is the process, we are told in elementary school, by which giraffes came to have long necks, so they could graze from taller trees. (And then the process by which the trees developed prickles or tough leaves, to repel the giraffes.) Natural selection is the process by which insects become immune to pesticides. It is probably the process by which the AIDS virus appeared, to make use of the exponentially increasing availability of human bodies, those superb breeding grounds for viruses.

Natural selection by itself would gradually change the characteristics of one species -- it would not lead to a multiplication of species. For that it takes two populations of a given species, isolated from one another by a physical or behavioral barrier, so they do not freely interbreed. If then those populations experience and adapt to different environments, they will diverge, genetically and physically. Ultimately, the two populations, even if rejoined, will encounter each other as strangers; they be incapable of breeding with one another. They will be distinct species. This process is called <u>speciation</u>.

The genetic diversity within a population, out of which speciation and evolution arise, comes originally, scientists believe, from mutation. A mutation takes place if part of the genetic code on the DNA molecule is changed, by radiation, by chemical reaction (with a mutagen), or by mistakes in copying. Most mutations are lethal; either they cannot be copied, or they lead to the death of the organisms that carry or inherit them. Nonlethal mutations can be multiplied and carried, expressed or latent, in future generations -- an addition to that species' repertoire of genetic diversity. Very rarely a mutation might lead directly to a new kind of organism, viable but unable to breed back to the species from which it came -- another form of speciation.

<u>Mutation is, as far as we know, a random process</u>, which goes on at a low rate all the time in the trillions and trillions of ever-replicating genes in the biosphere.

Natural selection is not random; it is a systematic selection from the immense library of genetic possibilities of a combination of genes that will increase each population's fitness to its ever-changing environment.

It took billions of years, in fits and starts, for the biosphere to achieve the mind-boggling store of genetic diversity it now contains. That diversity is the key to all further evolution and adaptation. That is why ecologists value biodiversity as the greatest resource on earth, greater than oil deposits or topsoils or fresh waters. It is why they take seriously the loss of even the most insignificant species; why they defend not only the preservation of species, but the preservation of many populations within species; and why they regard the current rate of human-induced extinctions as an unparalleled and inexcusable catastrophe.

Ecologist E.O. Wilson says:

> It might ... be argued that to know one kind of beetle is to know them all, or at least enough to get by. But a species is not like a molecule in a cloud of molecules. It is a unique population of organisms, the terminus of a lineage that split off thousands or even millions of year ago. It has been hammered and shaped into its present form by mutations and natural selection ....
>
> In a purely technical sense, each species of higher organism is richer in information than a Caravaggio painting, Bach fugue, or any other great work of art. Consider the ... house mouse .... The full information contained [in its genes], if translated into ordinary-sized printed letters, would just about fill all 15 editions of the Encyclopedia Britannica published since 1768 ....
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> I suggest that as biological knowledge grows the ethic will shift fundamentally, so that everywhere ... the fauna and flora of a country will be thought part of the national heritage as important as its art, its language, and that astonishing blend of achievement and farce that has always defined our species.

Resistance versus Resilience

by Ian Burton

A column written for the Toronto *Globe and Mail*, June 27, 1990, by Ian Burton. Ian is the director of IFIAS, the International Federation of Institutes for Advanced Study, and he is a long-time correspondent of the Balaton Group from afar.

To be resistant or resilient, that is the question.

Traditional farmers in areas of tropical rain forest plant a wide variety of crops mixed together. It looks untidy and haphazard, but when a drought hits or insects or disease invade the plot, some crops are lost but some survive. The variety provides a built-in safeguard. Resilient, but not resistant.

By contrast, large areas of a single crop, such as we produce with modern agriculture, can be bred for pathogen resistance, but still can be devastated by drought, pests, or disease. Resistant, but not so resilient.

Power grids supply electricity over large areas from a small number of very big generating stations. On rare occasions an unexpected power surge or an accident can lead to a cascading collapse of the whole system, as in the great Northeast blackout of 1965. By contrast, a lot of smaller, decentralized sources of power -- small generators, small hydro dams, wind and solar power, could supply electricity with no danger of major collapse, although minor difficulties would occur more often. Decentralized power would be more resilient and less vulnerable to earthquake, sabotage, or enemy attack.

Systems of any kind can be designed to be resistant or resilient. There's usually a trade-off. More resistance means less resilience and vice versa. Would you prefer to take your losses in small doses frequently? Or would you choose to eliminate the small losses and feel more secure but have the low risk of a total crash? How do you play the stock market? How do you drive your car?

The decision depends on the technology available and on the probability and consequences of a system failure, as well as on the preferences of those making the choice. Over time we have tended to favor resistance over resilience. Resistant systems have a feeling of strength and a sense of greater reliability or safety. It ain't necessarily so. We can all live in a fool's paradise.

One key to resilience -- and weakness of resistance -- seems to be the ability to respond to surprises. In designing for resistance, you have to know what enemy you are dealing with and how the attack will come. The famous Maginot Line was designed to make France impregnable, but the German army outflanked it. Like fortified lines since the Great Wall of China and Hadrian's Wall, its chief effect was to create a false sense of security that failed to take into account mobile warfare.

In choosing resilience it is not so important to know what surprise will come. It's enough to know that the unexpected will sometimes happen. Expect the unexpected.

We hear from many sources that the future is uncertain. The global economy is changing, and we have little idea what is going to happen. Technical change seems likely to continue to be rapid and dramatic, but we can't foresee how. Even the climate is changing. The challenge is to design more resilience into all society's systems to cope with such changes.

On Diversity, Perceptions of the World, and Nature's Economy

by Wes Jackson, with help from Vaclav Havel

The following is excerpted from the most recent issue (Vol. VII, Number 3, 1990) of *Annals of Earth*, the excellent journal edited by Nancy Jack Todd. It comes from a speech given by ecologist/geneticist Wes Jackson of the Land Institute in Salina, Kansas. Wes speaks to the issue of diversity and to the issue brought up by Ulrich Loening later in this Bulletin, of the exploitive industrial paradigm co-opting ideas from the paradigm of sustainability. He also quotes from the unusual ecological awareness of one of the new leaders of East Europe.

Nature is an ecological mosaic, a world of diverse ecosystems. If nature is to be our standard for agriculture and culture, and sustainability our watchword, how are we to handle this mosaic? A tension arises. We are Homo the homogenizer, with a generalizing technical capability and relatively narrow enzymatic demands. Whether it is a Nebraska prairie community or the tropical rain forest, problems will arise because we humans tend to invert what nature does well. If nature is our standard or measure for sustainable culture, then we should expect a mosaic of human cultures or communities across our land. Our problem becomes: how much of this mosaic do we dare aggregate if we are to do it safely, sustainably?

To illustrate the problem: At a recent conference a soil expert cited a fifty-four acre field which had seven mappable units -- not uncommon for the glaciated soils of North America. For corn alone the yield potential of these seven units varied from 112 to 162 bushels per acre. A fertilizer expert could logically recommend anywhere from 88 to 132 pounds of nitrogen per acre depending on where one stands in that 54 acre field. Here is why it is important to think of small scale, or a high eyes-to-acres ratio, in a world of scarce resources.

It would appear that the only solution that is ecologically correct is a cultural solution; one that requires small scale. But this field was described at the conference not to make that point, but to make the point that information from soil surveys is now becoming available on floppy disks, and that one can design a

fertilizer spreader equipped with a microprocessor that controls the distribution of fertilizer as the machine proceeds across the field. This machine is predicted to have a major role in reducing farmers' input costs and reducing pollution from fertilizer runoff. Even here, where cultural intelligence would justify small farm size, technical cleverness is introduced instead. The need for elegant solutions, predicated on the uniqueness of place, can easily become a battlecry for an extension of the old industrial mind into a new technical frontier.

The perception of the world is on the line. Those who propose a cultural solution to an environmental problem will always be faced with a proposed technical solution, from which someone can make a profit.

The perception of the world is on the line, and the question becomes: where do we look for the primordial roots of the necessary perception? Vaclav Havel, Czechoslovakia's leading playwright and new president, provides an insight, in a wonderful essay entitled "Politics and Conscience." He begins by relating that:

> As a boy I lived for some time in the country and I clearly remember an experience from those days. I used to walk to school in a nearby village along a cart track through the fields, and on the way see on the horizon a huge smokestack of some hurriedly built factory, in all likelihood in the service of war. It spewed dense brown smoke and scattered it across the sky. Each time I saw it, I had an intense sense of something profoundly wrong, of humans soiling the heavens. I have no idea whether there was something like a science of ecology in those days; if there was, I certainly knew nothing of it. Still, that "soiling the heavens" offended me spontaneously. It seemed to me that in it, humans are guilty of something, that they destroy something important, arbitrarily disrupting the natural order of things, and that such things cannot go unpunished. To be sure, my revulsion was largely esthetic; I knew nothing then of the noxious emissions which would one day devastate our forests, exterminate game, and endanger the health of people.

Havel describes his feeling as a primordial response, whose source is the natural world, a world to which we are personally bound. He believes that out of this world culture is born, and that there is a moral order in this natural world, in the sense that:

> Any attempt to spurn it, master it, or replace it with something else appears within the framework of the natural world as an expression of hubris for which humans must pay a heavy price, as did Don Juan and Faust.

Returning to the smokestack, he elaborates by saying:

> To me personally the smokestack soiling the heavens is not just a regrettable lapse of a technology that failed to include "the ecological factor" in its calculation, one which can easily be

> corrected with the appropriate filter. To me it is more, the symbol of an age which seeks to transcend the boundaries of the natural world and its norms and to make it into a merely private concern.
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> A modern man, however, whose natural world has been properly conquered by science and technology, objects to the smoke from the smokestack only if the stench penetrates his apartment. In no case, however, does he take offence at it metaphysically, since he know that the factory to which the smokestack belongs manufactures things that he needs. As a man of the technological era, he can conceive of a remedy only within the limits of technology -- say, a catalytic scrubber fitted to the chimney.

Havel is not out to abolish smokestacks or prohibit science or go back to the Middle Ages. He is trying to find the tentacles of the monster we call hubris, the assumption that our knowledge is adequate to run the world. Our task is to deal with the ratio of knowledge to ignorance. Discovering the extent of our ignorance is many times more important than working on the frontiers of knowledge. We are billions of times more ignorant, for example, about the area affected by Chernobyl -- which reaches all the way to the Antarctic now -- than we are knowledgeable, and our ability to correct the consequences of that one accident is clearly zero.

If nature is our standard, then a diversity of human communities should more or less match the diversity of nature's local ecosystems. A human economy in tallgrass prairie country should more nearly resemble the rules of nature's local tallgrass prairie than a human economy in a tropical rain forest. To pin our hopes on community is to acknowledge our evolutionary past, in that human community is civilization's upscaling of the tribe. The mystery as to why human community works is deeply rooted in tribal social organization, which evolved over tens of thousands of years. To deny this is to disrupt what we might call an optimum genotype by environmental interaction, which we have already done with agriculture and even more so with the industrial revolution. A greatly modified environment not only places stress on nature, it denies part of <u>our</u> nature. Acknowledgement that community is the locus sets the agenda for the next century or so and suggests the need to prepare the way for lots of people to build community -- to be homecomers.

The economic order that I hope will emerge from these values will be the result of our becoming better community accountants. I believe our future will depend on a shift to accounting as a most important and interesting discipline. An accountant is a student of boundaries. Ecological accountants will have to think about what we should allow through the boundaries of various communities and at what rate, if we are to prevent squander and pollution and efficiently use the materials and energy within.

No major program, no public policy or project, can account for all the ecosystems from the cold deserts to the tropical rain forest, with the Nebraska prairie in between. Evolving human communities loaded with graduates who have majored in Homecoming perhaps will have to be engaged in a constant struggle of quiet secession from the power structure, which has destroyed natural ecosystems, community, and communion during the extractive process. What the power structure knows at some level is that the reward for destroyed communion is more power. Community economics is the economics of place, where elegant solutions can be predicated on the uniqueness of place.

A Green GDP: Gadfly Dutch Economist Seeks Stricter Environmental Accounting

From the *International Herald Tribune*, December 10, 1990

In a spartan office at the Netherlands Central Bureau of Statistics a shy, stooped man has been quietly plotting a revolution in the way economists look at the environment. For 30 years Roefie Hueting has provoked and prodded planners and policymakers, telling them they are fooling themselves in the way they measure a country's wealth, the welfare of its citizens, the prices of goods and services. He has devised his own set of indicators to arrive at a "green" gross national product, accounting for the harm that economic activity does to the environment. The idea is getting a broader reception in Europe as public opinion now favors more drastic steps to fight pollution.

Mr. Hueting and like-minded economists say that in ignoring or masking economic output's toll on the environment, many countries' GNPs have been inflated and sometime hugely distorted. It is absurd, Mr. Hueting says, that measures to defend nature or to check or clean up after damage have been tallied as growth.

Over the years the meticulous and persistent Mr. Hueting, gadfly economist and jazz pianist, has irritated people on the left and on the right. Surviving politicians who wanted to close down his department, he acquired a reputation as a Don Quixote among economists. Slowly he gained acclaim from his peers; now governments and international institutions are listening.

The Dutch government has asked Mr. Hueting to produce an alternative system of accounting to reflect the damage done to the air, water, soil, and animal

and plant life, and to account for the cost of maintaining or restoring them. Planners at the United Nations Environment Program and World Bank officials have said Mr. Hueting's publications had got them thinking about the need for "environmental accounting" in recent years.

Mr. Hueting is far from the only economist who thinks that the habits of more than 50 years of economic accounting -- using the output of goods and services as the only measure of economic and even social success -- are outdated and misleading. The idea of green accounting has pried its way into more and more European government offices. Sweden is seeking Dutch advice on starting its own project. France and Norway have begun compiling inventories of natural resources, a first step to linking the state of the environment to economic activity.

Germany is working out a system to correct the "double counting" in its national bookkeeping. A 1989 study showed that from 1970 to 1985 West Germany's spending to preserve or restore nature increased from 5 percent to 10 percent of its gross national product, and was consistently counted as growth. That meant, Mr. Hueting said, that measures simply to check deterioration were recorded as a significant contribution.

"Take a water-treatment plant," he said. "Under the present accounting system it is booked as a contribution, though it should be entered as cost. It's built to make up for the loss of usable water. It does not generate growth. You can only count that plant as value added if you have first entered the ruined drinking water as a loss." It would be equally misleading to count clearing up smog as growth, he said.

Redefining such costs and correcting the books is useful, he said, but "it's dangerous if politicians or statisticians present this as the solution, because, as is well known, most environmental destruction is never restored or compensated."

Ultimately, Mr. Hueting and other ecological economists say they hope that a new framework for national accounts will lead to a fundamental change of national goals and even a redefinition of progress. Applying a green GNP, Mr. Hueting said, will make polluting products more expensive and will consequently slow growth. But he said this did not have to mean a decline in employment. "Many activities that protect the environment will have to be more labor-intensive," he said. "An economy that protects the environment will create more jobs."

Mr. Hueting and his team of 30 specialists, among them biologists, chemists, and physicists, figure they need at least two years to come up with a draft for a

green GNP. Even so, the Netherlands seems further along than most nations. Ever since Mr. Hueting created it in 1969, the Department for Environmental Statistics has been collecting data on emissions, concentrations of toxic materials, disappearances of plant and animal species, and other changes. Such an inventory, he said, is vital.

The process, he said, involves establishing norms for "sustainable use" of the environment, i.e. maintaining its capacity to regenerate itself. The next step is to decide what measures are needed to attain sustainable use. The costs of those measures must then be subtracted from the current GNP to calculate the green GNP.

Even if governments use it only as a parallel system, he said, it will help to clarify "our mistaken accounting and demonstrate how we are squandering air, water, ground, trees, spaces, silence, as if they they were free goods instead of assets that we are losing."

Announcements

A Welcome Renewal

The Jessie Smith Noyes Foundation has renewed its exchange grant to INRIC for another three years. Funding will be at a somewhat reduced level -- $25,000 per year instead of $30,000 -- because the current state of the U.S. stock market has reduced foundation portfolios. We are most grateful to Steve Viederman and the Noyes Foundation Board for their continued faith in INRIC, even in hard times.

There are still some unexpended funds remaining from the 1990 Noyes exchange grant. Balaton Group members are reminded that they can apply for these funds for use in joint projects or visits involving two or more INRIC centers. Applications can be made at any time. A letter should be sent to Dana Meadows with a short, clear description of the desired exchange and a budget.

Unfortunate Denials

Three different coalitions of Balaton members sent Collaborative Studies proposals to the MacArthur Foundation, and none of them was accepted for funding. The first was the proposal of our sustainable agriculture group to carry on the five-nation, three-year indicator/monitoring/modeling study described in previous issues of the *Balaton Bulletin*. The second was a six-nation coalition study on sustainable development, headed by Malcolm Slesser and Jane King. In the third,

Dennis Meadows developed a proposal to train East European managers of newly privatized firms in management principles that are consistent with environmental protection. We are told that there were more than 200 applications for these collaborative grants; and only 5 were funded.

Balaton Group members involved in the sustainable agriculture study are now regrouping, to decide whether to re-submit the proposal for the project as a whole, or to try to get each individual country's part of the study funded separately. (Participating countries include the USA, USSR, Hungary, Germany, and Thailand, with considerable interest in adding Mexico, Egypt, and Scotland.)

New Funding for Regional Expansion

Michael Liffman writes the happy news that the Myer Foundation of Melbourne, Australia, has agreed to fund a first Asia/Pacific regional meeting of the Balaton Group. Asia/Pacific Balaton members are now planning how, where, and when to organize this meeting. To minimize costs it will probably be held in Asia, not in Australia as originally planned. The most likely time is next summer

News from the Members

Bert de Vries recently attended a conference in Japan of industrialists interested in making at least an appearance of concern for the environment. "It was a difficult experience with conflicting mental maps," says Bert. At home he is working on chapters about energy, climate change, and ozone for the second Dutch "Concern for Tomorrow" environmental assessment. He is also taking on the job of assembling models and games for an "environmental toolbox" for use by members of the Balaton Group.

Samir Ghabbour writes from Cairo: The October 1990 issue of the *Balaton Bulletin*, which arrived today, was a real treat. I devoured it all in one sitting. I had to. It is marked by such a high quality and a deep insight of the aspects related to sustainable development that I felt much more knowledgeable about it. Congratulations for a most successful Balaton meeting. I am sorry not to have been able to participate, but the *Bulletin* gives me a succinct summary, as if I had been there.

I am glad that the Balaton Group is expanding in membership and in space through regional meetings.

The choice of environmental economics as the topic for 1990 was most fortunate, as the *Bulletin* shows. I was especially interested to read the accounts of discussions, because I am involved in writing a critique of the Brundtland report and the concept of sustainable development, which seems to me a contradictory concept.

I have a Ph. D. student whose research plan is almost exactly the same as that of the sustainable agriculture group. I do hope you will be able to get the necessary funds.

Genady Golubev has been designated chairman of the Standing Committee for Regional Research Centers of the Scientific Committee of the International Geosphere-Biosphere Project. The mandate of his committee is to identify or bring into being a network of scientific centers for research on global change in many parts of the world -- obviously a task of great interest to the Balaton Group.

The regional centers are seen, so far at least, as purely scientific, not concerned with economics or sociology (though he hopes that will change). They will do some basic projects on the geosphere/biosphere cooperatively, and each will also take on other projects that have particular regional importance, such as desertification or rainforest loss. They are seen as places where scientists can be trained as well as where they can practice. Preliminary support has been offered by the U.S. National Science Foundation, and more is hoped for from the French, Dutch, and Japanese governments and from private foundations.

Genady expects that negotiations for this network will take some time, and that the nodes in the network will be set up one by one, as trust in the idea builds.

Genady recently visited **Dana Meadows** in Plainfield,New Hampshire, while he was attending a preparatory meeting for a conference at Dartmouth College to be held next June. He is preparing a paper for that conference on the government of internationally shared water bodies, drawing lessons for the 1992 U.N. Conference on the Environment. He visited **Dennis Meadows** in Durham, New Hampshire to explore for contributions that the University of New Hampshire might make to the Geosphere-Biosphere Project.

Meanwhile, back in Moscow, Genady is lecturing at Moscow State University; serving on the environmental advisory board to the Russian (not Soviet, but Russian) parliament and digging potatoes from his country garden.

Ginger Gyene has resigned from Biokultura, the Hungarian association of organic gardeners, to accept a two-year scholarship that has taken her to India to study classical Indian dancing. She is not sure whether she will stay the whole two years, because she is still very involved in agricultural matters in Hungary. She is currently writing a chapter on ecological landscaping and the principles of organic farming for a book commissioned by the Ministry of Architecture.

Ulrich Loening sends some unhappy news from Scotland: I have to report a minor set-back, which results in my dictating this letter from my bed. In trying to live in a cycling, ecological, nature-centered manner, in which we built solar panels on the roof without falling off, in which we recycled old timber for building without cutting our fingers on the saws or machinery, I have finally managed to compress my right hand in the jaws of a "completely safe" log splitter. The result in the midst of an active period, was 3 1/2 weeks in hospital, four operations, and a long period now starting of physiotherapy. But even with some nerve and muscle now permanently missing from my thumb, it looks as though I will be able eventually to play the cello again. I intend to turn this set-back to positive advantage; I will be doing more thinking and writing now, and less physically exhausting activities.

We are now in a better position to contribute or become one of the partner countries for the Balaton Group's sustainable agriculture project. As you know, we have a 2-year organic research project, funded by the EEC, the supermarket Safeway, and the Scottish Development Agency. This is the largest single grant ever received for organic agriculture in Europe. Yet, perhaps inevitably, this 2-year project has become largely a technical matter, absorbed into the School of Agriculture, which has the technical expertise. The project is aimed at seeing how organics could lower beef production by 20%, as well as being environmentally more benign, and how large-scale organic vegetable production can be developed for supermarkets. We are also developing a large data base on organics.

All this sounds great, but we feel that the project has really become an exercise to see to what extent the organic approach and philosophies can be incorporated into the conventional scene. The very different philosophy and scientific approaches of real organic culture are not widely understood, let alone the societal shifts that it represents. It is now likely that this 2-year project will be extended. A small group of us are looking to ways of bringing the real organic thinking more into the forefront.

Dennis Meadows has been supporting **Csaba Csaki's** scheme to acquire a recently-abandoned, 23 hectare Soviet Army base on the banks of the Danube River a few minutes drive north of Budapest. The facility was used by the Hungarian Army and then the Soviets as a military college. If Csaba's university can gain title to the facility, our colleagues will work to find the funds necessary to renovate the 20 buildings on the site and convert them into an international training center on economic restructuring, environmental protection, energy conservation, and conflict resolution. Are any other Balaton Group members interested in joining the team?

Niels Meyer is organizing an international conference to be held next April in Denmark on the subject: Global Collaboration on a Sustainable Energy Development. The conference is sponsored by the Danish Ministry of Energy and the United Nations Solar Energy Group on Environment and Development. The goal of the conference is to develop methods of global cooperation to prevent global climate change and to ensure a sustainable energy future. Though all parts of the world will be represented, there will be a particular emphasis on countries of the South -- on how they may realize reasonable economic expectations without worsening the global environment, and without triggering international conflict over energy sources, or over pollution rights.

Or, as Niels puts it, "It will not be the rich countries telling the poor what to do. Third World people will be asked to tell their visions for the sustainability of their regions and for the world."

A synthesis paper from the conference will be submitted to the Preparatory Committee of the U.N. Conference on Environment and Development, to be held in Brazil in 1992.

Numerous Balaton Group members are involved on either the advisory committee or the program committee for this conference, including **Dana Meadows, Thomas Johansson, Genady Golubev, Qi Wenhu, Aromar Revi,** and **Chirapol Sintunawa**.

Elena Orlova and **Marina Smetanina** will soon be travelling from Moscow to Copenhagen to meet with **Niels Meyer** and **Jorgen Norgard** on planning for energy efficiency.

John Peet writes from New Zealand: Many thanks for your efforts, yet again, at the Balaton meeting. I found it stimulating, educating, and valuable all around. I came away with resource material and insights that have kept me going, and will keep me going for some time to come. Thanks to everyone.

My bag never did turn up, by the way. The insurance payout was fair, but I still find it a pain to have to do all that shopping. (I lost most of my decent clothes and those little travel accessories I'd gathered over previous trips.) But the experience showed me that one can actually manage on very little, if one is well looked after!

I am off to Kuala Lumpur in January to give an invited paper at a conference on energy and environmental policy sponsored by APDC and supported by the Asian Development Bank, United Nations Development Programme, and the World Wildlife Fund. It should be interesting, and I'll do my best to promote the cause of ecological economics. Given my country's abysmal record in energy use (we're the only country in the OECD, I think, which has a steadily rising energy/GDP ratio!!), I've take the line that ours is an example which others would do well not to follow.

Miklos Persanyi has spent the first semester of his leave from the Hungarian Environment Ministry at Cornell University taking courses in computer programming, English, international environmental policy, and (from the business school) business opportunities in East Europe. He recently visited **Dana Meadows** and **Jim Hornig** at Dartmouth College to meet with students and faculty of the Environmental Studies Program there, and to lecture on Hungary's environmental problems and policy.

Ferenc Rabar, after only a few months as Hungary's Finance Minister, has resigned his post. According to a friend of his, "Ferenc is too honest to ever enjoy that job." Ferenc will be returning to the Budapest University of Economics.

Aromar Revi, like several other Balaton members, has just been faced with a sudden change of government that may, or may not, interrupt his work. He had been preparing a bill for the Indian Parliament as a response to a national campaign for housing rights. As a baseline study for the campaign, he is about to begin a study of the state of housing and living conditions for the Indian Planning Commission -- which will include a large section on the availability of biomass fuel -- and which, if he can find funding, will also include six films.

Lucia Severinghaus and her husband were at Peet's campus a week ago, attending a big ornithological conference. They were very busy, but John had lunch with Lucia, which was very nice. Maybe they will stay longer next time and get to see something of John's home (the southernmost hotel in the Balaton chain!).

Chirapol Sintunawa has just completed teaching six, week-long workshops on the greenhouse effect and energy efficiency, two workshops for students, two for teachers, one for journalists, and one for the general public, including several Buddhist monks. The workshop included 31 demonstration booths in which participants could get hands-on experience with efficient light bulbs, low-flow showerheads, and other efficiency technologies.

A large plastic greenhouse was constructed, and the participants had to stay inside (where it was 48 degrees C!) until they answered correctly 10 questions about the greenhouse effect (on average it took them 16 minutes to come up with 10 right answers!). The schoolteachers liked this device so much that plastic greenhouses are now being planned for schoolyards all over Thailand.

Another activity the participants engaged in was making up slogans for a volunteer energy conservation program. Here are some of the slogans they thought up:

Conservation of electricity and water will help to develop the nation.

Love and support Thailand by conserving energy.

Stop degrading the environment. Support energy conservation.

Reduce your and the government's burdens by conserving energy.

Electricity is cheaper to save than to make.

The workshop ended with a bonfire on the beach, around which the participants took solemn vows to enact six precepts, such as: I will turn off unnecessary lights, I will not use CFCs, I will plant trees every year, I will disseminate this understanding to others. They went home with videotapes, posters, T-shirts, compact fluorescent lightbulbs, and stickers to help them remember to turn off the lights.

Next Chirapol and his students plan to take this workshop on the road to 30 Buddhist temples, including the Buddhist village where the mayor of Bangkok lives.

Malcolm Slesser and **Jane King** have recently visited **Niels Meyer** and **Jorgen Norgard** in Denmark to go over their ECCO carrying capacity model and come to agreement, particularly about its formulations with regard to energy efficiency. Malcolm and Jane presented the concepts behind ECCO and demonstrated the EUROGAME, a gaming version of ECCO. The Danes presented their methods for obtaining data on energy efficiency potential, and the assembled company explored how to use these data within the ECCO model to formulate low energy futures in Denmark, the EC, and the Nordic countries. They came out with a scenario satisfactory to all that involved very high (40,000 MW/year) solar capacity construction coupled with significant efficiency improvements, which produced a sharp reduction in carbon dioxide output, a still-rising GDP, and a stable material standard of living. The discussions, we are told, were "tough and friendly." Niels and Jorgen will soon return the visit.

Otto Soemarwoto and one of his colleagues from the Institute of Ecology in Bandung are currently spending a month with **John Sterman** at MIT, learning system dynamics and the use of STELLA in preparation for the Indonesia 2020 study.

Stories, Quotes, Jokes

More than at any time in history mankind faces a crossroads. One path leads to despair and utter hopelessness, the other to total extinction. Let us pray that we have the wisdom to choose correctly.

-- Woody Allen

The beauty of the living world I was trying to save has always been uppermost in my mind -- that, and anger at the senseless, brutish things that were being done. I have felt bound by a solemn obligation to do what I could -- if I didn't at least try, I could never again be happy in nature.

-- Rachel Carson

This is what you shall do: love the earth and sun and animals, despise riches, give alms to everyone that asks, stand up for the stupid and crazy, devote your time and income to others, hate tyrants, argue not concerning God, have patience and indulgence toward the people. Take off your hat to nothing known or unknown or to any man or number of men; go freely with powerful uneducated persons and with the young and mothers of families.... Re-examine all you have been told in school or in church or in any book and dismiss whatever insults your own soul.

-- Walt Whitman, in the preface to Leaves of Grass

I believe it to be perfectly possible for an individual to adopt the way of life of the future ... without having to wait for others to do so. And if an individual can observe a certain rule of conduct, cannot a group of individuals do the same? Cannot whole groups of peoples -- whole nations? No one need wait for anyone else to adopt a humane and enlightened course of action. (People) generally hesitate to make a beginning if they feel that the objective cannot be achieved in its entirety. It is precisely this attitude of mind that is the greatest obstacle to progress -- an obstacle that each man, if he only will it, can clear away himself, and so influence others.

-- M.K. Gandhi, in Liberty, April 5, 1941

For some people there's a day
when they have to come out with the great Yes
or the great No. It's clear at once
who has the Yes ready in him; and saying it,

he goes on to find honor, strong in his
conviction.
He who refuses never repents. Asked again,
he'd still say no. Yet that no -- the right
answer --
defeats him the whole of his life.

-- C.P. Cavafy

Here are several more economist jokes, courtesy of Amory Lovins and others:

> An economist is a person who lies awake nights wondering how to show that what is possible in practice is possible in theory.
>
> George Bush has 100 bodyguards. One of them is a traitor, and he doesn't know which one.
> Francoise Mitterand has 100 mistresses. One of them has AIDS, and he doesn't know which one.
> Mikhail Gorbachev has 100 economists. One of them is intelligent, and he doesn't know which one.