# The Watershed

Vol. 4, No. 2

The Oyster Pond Environmental Trust Newsletter
*OPET*, P.O. Box 496, Woods Hole, MA 02543-0496

Winter 1999

*OPET does not have a phone to its name, but you can e-mail brose@mbl.edu or call 508.548.5984 and leave a message. We'll gladly call you back!*

### *OPET* Officers and Directors Elected for the 1999/2000 Term

| *Officers* | *Directors* |
|---|---|
| Birgit Rose<br>*President* | Carl Breivogel |
| Robert Wilsterman<br>*Vice President* | Eric Davidson<br>Jonathan Davis |
| Patricia Kerfoot<br>*Clerk* | John Dowling<br>Lisa Graziano |
| Barry Norris<br>*Treasurer* | James P. Ferguson<br>Stanley R. Hart<br>William B. Kerfoot |
| Dana Rodin<br>*Legal Counsel* | Leonard Kreidermacher<br>Robert Livingstone<br>Cheryl Peach<br>Julie Rankin |

*OPET* Board meetings are open to all *OPET* members. They are usually held on the 3rd Sunday of the month, at 4 pm in the Treetops Clubhouse.

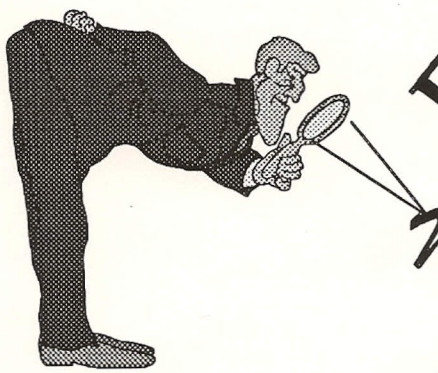
We'ld love to have you come!
For information call 289-7258 or 548-5984

### Year of the Swans in Oyster Pond

*1999 was the **Year of the Swans** on Oyster Pond: up to 40 swans called the pond home for the summer, although none of those raised any young. A pair nesting in the Trunk River Lagoon had 3 offspring. In September, that family also moved to the pond, but only 2 cignets survived. Presumably, the abundantly growing pondweeds were the attraction.*
*Photo by B. Rose*

## Board Member News

Regretfully, ***Erik Zettler*** retired from the Board of Directors after having served one term. Erik decided to pursue a Ph.D. in addition to being Science Coordinator at Sea Education Association (SEA), and could not fit *OPET* into his busy schedule. *OPET* was fortunate to have had him on the Board; he was our first liaison with SEA and he recruited his successors from SEA to the Board for us: ***Lisa Graziano*** and ***Cheryl Peach***, both faculty at SEA. Lisa and Cheryl agreed to share a Director's "slot". They both co-ordinate study projects on Oyster Pond by SEA students as part of the students' landbased curriculum. They then go to sea with them for several weeks at a time on SEA's sailing vessels to conduct research in/on the marine environment. Since their turns at that are not simultaneous, at least one of them should always be in town for *OPET* Board meetings. ***Eric Davidson***, senior scientist at WHRC (Woods Hole Research Center), the new campus of which will be located within the Oyster Pond watershed area on Woods Hole Rd., is another welcome addition. Eric's expertise lies in the global nitrogen cycle (from air, to soil, to microorganisms, to plants, to people, to septic systems, to water, to ponds) and he shares his institution's concerns for environmental issues worldwide. The fourth new member, ***Leonard Kreidermacher***, a Moors resident for nearly 20 years, is not so new to the Board at all: Leonard has been an active *OPET* volunteer since his retirement from Digital Equipment a year ago. He has attended and contributed to many *OPET* Board meetings and has helped with various *OPET* activities. ***Pete Murray*** from Oyster Pond Rd. was also elected to the Board. To our regret, Pete resigned from the Board because of an arising conflict of interest. We hope he will find it possible in the future to serve on *OPET*'s Board!



# Focus on Nitrogen & Ponds

*Fact:* The nitrogen concentration in Oyster Pond was around 0.2 mg/l until the late 1970s. Then Treetops and dormitories at SEA and new single-family homes were built in the pond's watershed, and guess what? The nitrogen increased to 2-5 mg/l. That is four to ten times the upper tolerance limit of 0.5 mg/l for coastal ponds, according to the Falmouth bylaw.

*Nitrogen* in the form of organic nitrates, nitrites and ammonia is a major component of residential wastewater and fertilizers. It also is a major problem in coastal ponds where nitrogen from septic systems within the watershed area can contribute 60 to 80% of a pond's nitrogen load. Another 10 to 20% derive from fertilizer runoff. Too much of a good thing often turns into a bad thing, and so it is with the nitrogen and phosphates in water bodies. Both are nutrients needed for life on land and in water -- it's what microorganisms and plants but not animals can do: convert nitrogen and phosphorus into organic forms. But supply too much and a pond may respond to the overabundance of nutrients with a bloom of algae that then can kill aquatic plants and animals by depriving them of oxygen. Denitrifying (nitrogen-removing) septic systems would be a solution (*see Part 1 below*); they are expensive and are not (yet) required by law even in high-nitrogen load areas. But if you follow the advice on fertilizer use (*see Part 2 below*), you can at least avoid runoff from fertilizers.

## Part 1: Septic Systems that Save Salt Ponds

***What for septic systems?*** *(For your health!)*
Until recently, septic systems have been designed with purely sanitary reasons in mind, namely to prevent bacteria and viruses in the waste water from contaminating human food and drinking water sources. Typically, household waste water is channeled into an underground treatment (septic) tank and from there distributed into a leaching field, the size and composition of which depends on the quality of the soil (so called Title V systems). Most soil in general is a pretty good filtration medium, preventing the diffusion of microbes and even viruses over large distances. For safety, a setback of 100 foot from surface waters (wetlands) is stipulated now by Falmouth bylaw for septic systems.

***What goes on inside?*** *(A microbial paradise – as long as no bleaches and other germicidal agents get there!)*
The septic tank is a hotbed of chemical activity, mainly driven by bacteria, that break down and/or convert a lot of the constituents of human waste. The rich stores of nitrogen and phosphorus in the organic waste matter are attacked and released to the water in soluble form. Much other stuff (for instance fats, soaps, detergents) gets metabolized, some toxins are rendered harmless thereby, but occasionally harmless stuff gets converted into nasty stuff. Insoluble larger stuff stays as sludge, which builds up if not pumped out in regular intervals, and eventually clogs the septic system (toilets won't drain! Yuckk!). The stuff in solution and in suspension reaches the leaching field, where the microbes, viruses and tiny solids are filtered out (the microbes and viruses die there eventually) and where some chemical constituents such as phosphates are retained to a significant extent. Nitrogen, however, in the form of nitrates, nitrites and ammonia, reaches the groundwater – *and from there the ponds* – basically undiminshed.

***How to trap or divert nitrogen***? (*Gassify it!*)
Ever since the number one problem with ponds, streams and lakes has been identified as the overabundance of nutrients -- in salt ponds the accusing finger points at nitrogen whereas in freshwater ponds it points at phosphates – there has been a scramble under way to develop *denitrifying* (nitrogen removing) or *denutrifying* (nitrogen and phosphorus removing) septic systems. How do they do it? Although by different procedures, they all convert the nitrogen compounds into nitrogen gas, a natural and harmless constituent of air, that gets vented to the atmosphere. In denutrifying systems, in addition the phosphorus compounds are converted into forms that then react with the sandfilters and soil.

***Who should install a denitrifying system?*** (*Ideally, every homeowner whose home is not connected to a central waste water treatment facility*!)
Once nitrogen reaches the groundwater, it stays with it until it surfaces as drinking water or as a spring feeding stream or pond. For drinking water, the tolerance level is quite high, also for streams and freshwater ponds and lakes *as long as phosphates are low.* Brackish and saltwater ponds, however, are quite sensitive to nitrogen and respond at rather low levels with rapid growth of algae and the detrimental process begins.

***Why don't we? ?*** *(Why should I be the one?)*
As long as there is no law mandating denitrifying septic systems, it, as usual, is a matter of $$$. A denitrifying system costs up to $10,000 more than a new Title V system; some require maintenance and have associated maintenance costs. The most cost-effective scenario is a cluster system, where several housing units are tied into one denitrifying septic system: the per-unit cost would be considerably less, and sufficient waterflow (required for most effective treatment) would be guaranteed.

***When is the best time?*** *(Some times are better than others)*
It definitely would be the right thing to do when constructing a new home. A new home constitutes a new, additional, nitrogen source for the groundwater and the pond. It also should be seriously considered when upgrading the current system to Title V which is required by law when a house changes ownership, or when a failed system needs replacement. If you need to dig up your underground oil tank, that may be another time to consider upgrading your septic system – the yard is being torn up anyway.
***Any fringe benefits?*** *(Indeed, there are!)*
With a denitrifying system the size of the leaching field may be reduced considerably – a bonus if there's a space problem, especially where setback regulations have to be satisfied. If you are building new or remodeling, with a denitrifying system you may be allowed more bedrooms. And, of course, there is the satisfaction and the great feeling that comes from knowing that you are doing a good thing, the right thing, for our groundwater, ponds, bays, fish, .....
***Which system?*** *(Stay tuned!)*
A Falmouth citizen's committee is investigating the efficacy of various denitri/denutrifying systems. F.A.C.E.S. (Falmouth Associations Concerned with Estuaries and Salt Ponds) has several members on that committee, and together they have sponsored public informational sessions on the issue. Soon, a report will be isued by them. We shall keep you informed! In the meantime, why not check out the locally produced Ruck systems which do not require maintenance?

*Birgit Rose*

# *Part 2:* Fall is for Frugal Fertilization

***When?*** *(It's a* cool *thing to do!)*
If you have trouble remembering when to fertilize your lawn, just remember that ***F*** stands for both ***Fall*** and *Fertilizer*. Why is fall fertilization best? Weeds don't grow very well during the cool autumn weather, but the fertilized grass will grow and turn nice and green. In contrast, some grass varieties don't grow very well in the summer heat, and fertilization then mainly feeds the fast-growing weeds. Fall fertilization also helps the grass be in a healthy condition for surviving the winter. This ***Watershed*** issue may arrive a little late for 1999 fall fertilization, but if the winter temperatures and snow hold off for some more time, a light application may still be possible and worthwhile in early December.
*Spring fertilization* is almost as effective as *fall fertilization (*although the alliteration doesn't work here)*:* temperatures in March, April, and May are cool enough that the weeds won't be able to take great advantage of the fertilizer, whereas the grasses will.
***What kind?*** *(Slowly does it!)*
When choosing a fertilizer, look for "slow release" or organic fertilizers. The slow release fertilizers have a coating that dissolves gradually, so that the fertilizer only gradually becomes available to the grass over the course of days or weeks following your application. Organic fertilizers are also slow acting, because the soil microorganisms must first convert the organic forms of the nutrients into forms that the grasses can use. Dehydrated steer manure is another option which is not as rich in nutrients as commercial fertilizers, but it will add humus to the soil as well as gradual and modest doses of the needed nutrients. Applying manure may seem repugnant, but actually, the dehydrated stuff has no odor, and you wouldn't know it was manure if the package didn't say so.
***How much?*** *(Less is more!)*
The other *F* to remember is for *Frugal*. Unlike the good old days when Brillcream advertised that only "a little dab'll do ya," today's marketing usually recommends over-indulgence, and the instructions on fertilizer packages are no exception. Rather than apply the full dose recommended on the package, apply half in the fall and the other half in the spring. Or if you think that your lawn is really starved of nutrients, apply half of the recommended dose in early spring and the other half in the late spring. In other words, two smaller doses spread out over a few months during the spring or fall is better than one big dose. The reason is simple: the grass and the soil are limited in how much fertilizer they can take up in a short period of time. The excess, often over half of what is applied, runs off into the street, the streams, and *ponds*. The lesson is: more of the fertilizer will stay on the lawn if given in small doses.
***Why care?*** *(Green lawns are healthy lawns but green ponds are sick ponds!)*
The emphasis on *ponds* in the preceding paragraph should explain why advice on fertilizing your lawn is appearing in this newsletter. When nitrogen and phosphorus from the fertilizer end up in the pond instead of in your grass, it promotes the growth of algae. Some algal blooms get so big the pond turns green. When the algae die, their decomposition uses up the oxygen in the pond water. That leaves no air for the aquatic animal life which then suffocates from lack of oxygen. Anyone living near a pond should be especially careful about fertilizer application on their property.
***Who?*** *(It's up to you!)*
Even though fertilizers contribute only about 20% of the nutrients entering the pond, that 20% is the easiest part to cut down. (Septic systems contribute 60-80% – but that's another, longer story.) All that's needed is a little bit of behavior modification on the part of the homeowners: If every one of us applied fertilizer only in the spring and fall and applied only half as much as recommended on the fertilizer package, we could make a substantial dent in the nutrient load of the pond and help prevent harmful algal blooms.
If a lawn HMO takes care of your lawn/yard for you, you need to make sure that he/she understands that protecting the pond is equally if not more important to you (yeah, yeah!) than having a super lush lawn and yard. *You* are the boss, and you can instruct them to apply less fertilizer and less often.
***What's the prize?*** *(Yes,* prize*, not price!)*
Applying only as much fertilizer as the grass can use, and at the times of year when it competes best for the nutrients, will properly feed your green blades while cutting down on your ugly weed problems. This, in turn, will reduce your need to use herbicides, which can also run off into the pond where they could have hazardous effects. So you actually save money on fertilizer, herbicides, and reduced labor cost and instead you get a healthier yard *and* a healthier pond.

*Eric Davidson*

# Pond Samplings

In addition to rather warm temperatures, there was a drought this summer that lasted from mid-May through most of August. This created perfect stress conditions for our pond: no rain to dilute the nutrient-laden water inflow into the pond; essentially no flushing with seawater from Vineyard Sound due to the high silt ledge in Trunk River, and temperatures that were ideal for rapid growth of algae and pond weeds. Would the pond "pull through"? Or would the algae take over and lead to anoxic conditions? There were times in early summer when parts of the pond were dotted with small islands of thick mats of yellow-green algae, when the fish traps came up enveloped by slimy long strings of algae, and the water then had a faint foul reek to it. Yet, there were lots of fish and insect larvae, the algae receded, the pond water became clearer again and no longer smelled foul. The pond did "pull through".

***Pond level***: Although the level in other Falmouth ponds and water reservoirs fell considerably due to the drought, the level of Oyster Pond continued to be 6 inches above "design" level all summer, and up to 10 inches higher in the fall, because of the silt ledge in Trunk River. Few of even the highest tides reached the pond.

***Salinity and Dissolved Oxygen:*** Salinity has become rather low – 1.3 ppt -- and uniform down to 5m. This lack of stratification allowed the bottom waters to mix with the upper layers during stronger winds so that oxygen was found even at the notoriously anoxic 4 and 6 m deep basins during one summer sampling – a most unusual condition.

***Frogs***: Salinity was so low that frogs (bull frogs?) mated in the pond this year, keeping up a bellowing ruckus (quite a contrast to the sweet chiming of the peepers) from spring through at least half the summer. Their tadpoles were numerous and grew big and fat and presumably turned into an army of frogs.

***Turtles***: Sadly, two painted turtles (about 6 inches each) were found dead on the road (one on a Ransom Rd driveway, the other on Oyster Pond Rd), but a live one was also encountered, on Surf Dr by the weir, and duly helped across the traffic-busy road. It is nice to know that there still are some painted turtles left in the Oyster Pond watershed. Snapping turtles on the other hand are quite numerous and reach respectable size in the pond. They apparently are cannibalistic: While inspecting a freshly killed 15 inch turtle on a dock ramp and wondering who the assassin might be, I saw a huge snapping turtle make its escape from underneath the ramp. Presumably, it was the killer who fled the scene of murder.

***Fish***: In the spring, marsh killifish showed up in traps but they vanished later in the summer, at which time rain killifish made their appearance. The most abundant species was the banded killifish. There were plenty of big (1 year and older) but few young (this year's spawn) white perch this year – perhaps the tadpoles got the better of them or the early algae bloom did them in, or has the pond become too fresh for their successful breeding? Alewife, hatched in the pond, schooled at the weir in the fall, gathering courage for the dash through the dark and dangerous culvert into Trunk River Lagoon and from there into Vineyard Sound. Eels thrive in the pond and frequented the minnow traps. Sticklebacks were numerous, silver sides rare.

*Oyster Pond Reflections* *Photo by B. Rose*

***Birds***: The birds wintering on the pond were described in the summer edition of the *Watershed*. The summer's news were the many swans. Up to 40 (yes, forty) of them called Oyster Pond home and grazing ground. Who knows: the pond might have turned into a meadow had they not been around to pull and consume those abundant pond weeds. The ospreys were there again, but not so frequently as last summer, perhaps a sign that fewer herring came to spawn.

***Mammals***: Although I suspect they were around every now and then, I did not see any otters during the summer. However, muskrats were busy, including one that has its burrow right by the culvert. Quite active were Homo sapiens: lots of boating and swimming activity went on. Rowboats, sculls, sailing dinghies, sunfish, kayaks, sail boards, they were all out there as well as the swimmers for fun and for exercise.

# *OPET* Activities Throughout the Year

***Conservation Land***: Trails were pruned and freed of poison ivy and catbriar vines. A giant boulder was cleared as future site for the bronze plaque honoring major donors to *OPET*'s conservation land fund.

***Trunk River***: An Article was submitted by *OPET* for the 1999 Spring Town Warrant, asking the town for funds to draw up plans for the repair of the Trunk River jetties. The article passed. *OPET*'s Board met with Brian Howes, the originator of the weir plan, George Calise, Town Engineer, John Ramsey of Applied Coastal Engineering, and Paul Montague, Shellfish and Herring Constable, to discuss the design. It was decided that the DPW would submit the plans for permitting to the Conservation Commission and would sponsor an article at the Fall Town Meeting (Article 66) asking the town for funds for the repair cost. Getting a permit to eliminate the silt ledge in the Trunk River Lagoon and Trunk River is part of the repair project. It is this ledge and not the weir that currently controls pond level and saltwater inflow. *Last-minute Newsflash: the article passed, thanks to OPET's Barry Norris taking the stand at Town Meeting!*

***Peterson Farm***: *OPET* is represented by *Birgit Rose* on the Peterson Farm Management Subcommittee which is charged by the Conservation Commission with developing a management plan for the 40 acre Farm, a large part of which lies in the Oyster Pond watershed. A conservation restriction will be placed on the Farm; agricultural activity (sheep) will be limited to existing fields; no pesticides will be allowed without permission by the Conservation Commission; no new buildings; no new roads, just passive recreation – good news for our pond.

***Grants***: The Community Foundation of Cape Cod awarded *OPET* $2,500 in support of continued pond studies from June 1999 to May 2000. A report on the studies of the preceding year, financed in part by *OPET* and in part by a grant ($3,000) from the Community foundation, was sent to all Cape towns, as mandated by that grant.

***Affiliations***: *OPET* is a member of the Falmouth Associations Concerned with Estuaries and Coastal Ponds (F.A.C.E.S.) – Board member *Bob Livingstone* is *OPET*'s representative there. *OPET* also is a member of the Massachussetts Congress of Lake and Pond Associations and joined the coalition *Citizens United for the MMR (Massachusetts Military Reservation) Watershed and Wildlife Refuge*. The coalition's members back the proposal to designate the 15,000 northern acres of the Otis Military Reservation as a water protection area and wildlife refuge and to transfer the land from the Army National Guard to state environmental agencies.

***Pond Studies***: Dissolved oxygen, temperature and salinity readings were taken at various pond locations throughout the year, fish traps were set and a plant survey conducted. Water samples were collected by Pond Watcher veterans *John Dowling, Barry Norris, Julie Rankin* and *Marge Zinn*; rookie samplers this year were *Tanya and Martin White*; *Birgit Rose* served as occasional substitute and also made frequent temperature, salinity and dissolved oxygen measurements with *OPET*'s field instrument throughout the year. Samples for fecal coliform counts were taken by *Stan Hart* and *Birgit Rose*. High school student *Eric Vince* trapped fish, *Dick Backus* and *Bob Livingstone* collected and identified plants growing in the pond. For some results *see Pond Samplings*.

***Educational Activities***: *OPET*'s Annual Meeting in July was well attended with standing room only. *Dr. George Woodwell*, director of the world-renowned *Woods Hole Research Center*, was guest speaker. His talk on "*A Building for the 21st Century: Architecture and Manners in a Full World*" was attended by many *OPET* members, by individuals from the town at large, and by a contingent of teachers in town (and even in house) for a summer course at SEA. The *Falmouth Enterprise* and the *Upper Cape Codder* reported on the meeting and the talk. The meeting also "netted" a high school student for a fish study: *Eric Vince* of Gainesville, FL, on summer vacation with his parents in their house on Ransom Rd, set minnow traps at various pond locations throughout the month of July. He identified the species caught, counted them and measured their body length. His parents helped, too, finding minnow literature and taking their turn at hauling traps. The liaison with SEA continues: SEA students use Oyster Pond as their field laboratory, and *OPET* Board member Stan Hart lectured to SEA students on Oyster Pond's geological history.

***Concern with Septic Systems***: *OPET*'s Board's concern about nutrient input into the pond from septic systems was the reason for a special Board meeting at which *Mike McGrath* of *Holmes & McGrath Engineering* explained the denutrifying Ruck septic system to Board members. The Trustees of the Treetops Condominium Association had also been invited to that meeting because Treetops had to tackle several failed septic systems in the past year, and *OPET*'s Board hoped Treetops would consider the possibility of replacing the failed systems with denitrifying ones. None of the Trustees attended the meeting, but Treetops residents *Fred Hilton and Robert Johnson* were there and, of course, *Barry Norris*, Treetops' representative on *OPET*'s Board.

**Why not volunteer for some of *OPET*'s activities? Become a water sampler, fish trapper, Newsletter writer, trail trimmer, contributor of ideas or information! We have the equipment, all you need is enthusiasm!**

# Y2K Appeal for Donations to *OPET*'s Land Conservation Fund

**Want to start the new millenium with a good feeling and get a tax deduction?** Make a generous donation to *OPET*'s Land Conservation Fund and help us pay off the remaining debt. We only have $16,000 left to pay! If every one of you donated $100, if some of you could donate even more, we could cheerfully and gratefully say goodbye to the 20th century and lightheartedly welcome the 21st. A name place is reserved on the bronze plaque that will grace a large boulder in the *OPET* park for those of you who will have donated a total of $5,000 or more for the conservation land. You can also make a gift in someone's memory and have his/her name be remembered on that plaque! Go for it – this is your chance to show you care!

## More Pond Studies

***SEA Students Look at Nitrogen and Phospate***

The most recent class (W-166) of students from the Sea Education Association (SEA) studied the nitrogen and phosphate dependence of the growth of algae in water samples from three different locations: Spohr Gardens dock, weir, and north end of Trunk River Lagoon. Rule of thumb is that algae growth requires nitrogen concentration at least 15 times that of phosphate (N:P ratio = 15). Trunk River Lagoon samples were found lowest in nitrogen and phosphate, with an N:P ratio of 4.2, and addition of nitrogen or phosphate or both showed that growth was stimulated by nitrogen and not by phosphate. At the weir, the ratio was 16, and growth required addition of phosphate. The Spohr dock data were inconclusive other than that there, too, the N:P ratio (12) was higher than in the lagoon. What does it mean? The pond has a higher nitrogen load than the lagoon -- which had a few rinses by high tides -- and algae growth in the pond at this time may be limited more by phosphates (watch those fertilizers!) than nitrogen.

***Botanist at Work***

To learn how the freshening of Oyster Pond affects its aquatic plant community, Board member *Bob Livingstone* recruited *OPET* member *Dick Backus* to "inventory" the pond's vegetation. Bob and Dick could be seen out on the pond in *OPET*'s research vessel -- a sturdy metal row boat donated by the *Hockers*, former residents of Ransom Rd -- collecting aquatic plant species for identification. The Backus method for underwater plant sampling is to drag a rake that lacks its handle but has a rope instead, along the pond bottom and then haul it up. Samples have contained a variety of *Potamogeton crispus* pond weed which occurs "In hard or brackish water, often where polluted; naturalized from Europe" (Fassett, 1940 Manual of Aquatic plants, p. 57). The study will continue next spring and summer when plants bear flowers and fruit – a necessity for accurate species identification.

*Dr. Richard Backus examines specimens of aquatic plants collected from Oyster Pond*

*Photo by Bob Livingstone*

## *"A Building for the 21st Century: Architecture and Manners in a Full World"*

was the title of Dr. George Woodwell's talk at *OPET*'s Annual Meeting. Dr. Woodwell said that the increase of the human population and the spread of technology give us humans the potential to significantly affect the environment. To set an example for living responsibly in a full world, Dr. Woodwell envisions his new campus building on Woods Hole Rd. to use no fuel combustion at all, to be powered by photovoltaic solar panels and by electricity from the grid traded for electricity produced by wind-driven generators to be placed at Otis. The building will have excellent insulation, be heated by electric ground-source heaters, will have no air conditioning but use air circulation for cooling. Lights will be fluorescent ones, computers battery powered. Water from roof run-off will be collected and used for irrigation; wastewater, he hopes, will emerge purer after on-site treatment than the drinking water from the municipal supply. Landscaping will be environmentally friendly as well as educational. The architecture of the present building will be preserved with an addition to the rear of the building. The expense for all this is enormous, but so are Dr. Woodwell's enthusiasm and determination to achieve these goals.