

SEI NOW

Sustainable Ecosystems Institute

Fall, 1997

In This Issue

1. Montserrat Oriole
2. President's Column
SEI What? - Q&A's
3. El Nino
SEI Snippets
4. Headwaters Project
5. Year of the Reef: Montserrat
Emergency Jetty
6. Research: Tidepools: Life on the
Edge
7. SEI Who?
Acknowledgements
8. A SEI Moment

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MONTSERRAT ORIOLE

Here today... an effort to prevent extinction

The Montserrat Oriole (*Icteris oberis*) is found only on the island of Montserrat. It's black and orange plumage once graced rainforests over the whole island. The arrival of humans, and the ensuing deforestation reduced the Oriole's habitat. It is now restricted to the slopes of the active volcano, and to the central mountain range. The IUCN listed the Montserrat Oriole as a species under threat from human activities. Montserrat has been devastated by an ongoing volcanic eruption that began in 1995. Pyroclastic flows and ash eruptions have destroyed homes and ecosystems on this lush tropical island. Volcanic activity continues to escalate, and already two thirds of the island has been evacuated. The Oriole is now in danger of extinction because the eruption has eliminated much of the bird's main refuge on the volcano.

The loss of the Oriole will not be a natural event. The Montserrat Oriole has survived hurricanes and previous volcanic explosions. Large eruptions occurred 400 and 16,000 years ago, before the onset of deforestation. Human activities later reduced the numbers and range of the Oriole leaving it vulnerable to chance events. This is one of the tragedies of extinction: Humans push a species beyond its ability to cope with natural changes. What then appears as a natural event is, in fact, a human-caused extinction.



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Scientists agree that the Montserrat Oriole is a unique and important species. The people of this tiny island know the Oriole as the National Bird of Montserrat. Brought to national attention through the activities of the Montserrat National Trust and conservation organizations, the Montserrat Oriole is now a matter of pride. Songs, poetry, and billboards all highlight the Oriole and its place in Montserrat's culture. The extinction of the people's main cultural icon would be a devastating blow.

SEI is working to ensure that the Oriole does not go extinct. Together with the IPEAT, American Bird Conservancy, the National Fish and Wildlife Foundation, Sedgwick County Zoo and other North American partners, we are evaluating the bird's situation. SEI is currently conducting a Population Viability Analysis. If this and other analyses indicate that the situation is desperate, we will advocate a rescue effort to hold a small breeding population in captivity until the eruption is over and the birds can be returned home. Scientists, bird-husbanders, and conservationists have already pledged their time. SEI is committed to ensuring that local Montserratians are involved in all phases of the project.

The plight of Montserrat and its wildlife has captured the interest of many. Dr. Brosnan and Jon Seltz of SCZ and IPEAT just returned from visit to Montserrat. Schoolchildren from around the country have written to ask "what can we do?" The extraordinary response of Baltimore middle school in Baltimore Maryland is one example. The 6th Graders have adopted the Oriole for a penny drive, and they are collecting school supplies to send to Red Cross of Montserrat. The PVA will soon be available on the web along with updates on activities and the situation in Montserrat.

President's Column

by
Dr. Deborah Brosnan



When I founded SEI in 1992, I struggled to find a name that reflected our mission, and that we worked with both biological and social systems. The name is a mouthful! but it reflects our philosophy and what we do.

Since that day in 1992, sustainable, sustainability, and ecosystems have become global buzzwords. Sustainable development is a mantra. But what do we mean by sustainable? How do we know when we've "developed sustainably"?

In the past few years, every academic discipline has claimed the concept, and there have been many definitions. Lester Brown (Worldwatch Institute) succinctly noted that "A sustainable society is one that satisfies its needs without diminishing the prospects of future generations." Callicott and Mumford (1997) defined sustainability in ecological terms: "meeting human needs without compromising the health of ecosystems" But actually measuring "sustainable" is far more challenging and may even be impossible today. We are more likely to develop a process towards sustainability that incorporates known key elements. We will hopefully evaluate our progress, and refine our methods, and thresholds, in light of new knowledge. Scientists don't have all the information on the sustainability of an ecosystem, but we have a reasonable

idea of the processes that are essential for ecosystems to function. Like most people, scientists are more aware of non-sustainability - and when the system is broken than when it is functioning properly. The fact remains we don't yet have a global method for evaluating sustainability.

Our inability to fully understand when systems are "sustainable" can potentially lead us to lose focus. For instance in the absence of clear ecological guidelines, sustainability and sustainable development may be defined primarily on economic terms. It's assumed that once the economics are defined, scientists will find ways to fit the ecology within economically sustainable confines. This is unlikely to work, and we need remember that the central core of sustainability is ecological. Human well-being is a goal of sustainability, and in the long-run we are more likely to prosper economically if we do not destroy our natural resource base. We have learned that lesson the hard way, e.g., from ancient Mesopotamia river systems, to Georges Bank fisheries and global forests.

From another perspective, scientists may assume that once the ecological parameters of sustainability have been

defined, they will lead to practices that are also economically viable. This is not always true. Fishing practices that sustain marine life may not provide the income necessary to sustain a family, or a community. Situations like this pose hard choices, that are often only made when the crisis forces a clear winner and loser; community or environment. It is crucial that we all anticipate these situations and try to develop solutions before they reach crisis point. Transitions to practices that are both ecologically and economically stable will be difficult and we need to find ways to minimize ecological and social hardships.

While we can't clearly point to a sustainable society, the very fact that there is tremendous energy devoted to defining, implementing, and evaluating the concept is exciting. We're fortunate to live in a time when these issues are being discussed at local and global levels.

Sustainability is not an environmentalist's concern! It's everyone's concern and it's our hope for the future. At SEI we're committed to living up to our name: using science to find cooperative ways to sustain natural ecosystems and the people that depend on them.

Q & A: SEI What?

Why did you chose such a long name and what does it mean? From: Dee vonEntress, Center for Natural Medicine, Portland, Oregon

Sustainable Ecosystems Institute, SEI (The acronym SEI is pronounced *say*) is named after the Sei Whale. Sei is the norwegian word for pollock, one of the main food items of the whale. Fishermen named the Sei Whale after the fish; a sighting of Sei whales indicated the presence of fish and the promise of a good harvest. Once, the Sei whale was a sign of a rich, complex, healthy, and viable ecosystem. Humans depended on that ecosystem. This is the Institute's model. SEI's goal is to maintain ecosystems and the human communities that depend on them. SEI does this through science, particularly the science of ecology, and by bringing diverse groups together.

The name was chosen because the Institute is concerned with finding solutions promoting sustainability. By definition this encompasses the human-nature link. The ecosystems part of SEI refers to the fact that we work with at the level of maintaining ecosystems. This includes the species and the processes that are essential to ecosystem functioning. Finally, we are set up as an Institute.

The Sei whale appears on our logo, which was designed by Mariann Koop, to represent the diversity of ecosystems that the Institute works with, and the human links with nature that SEI strives to maintain.

Another grand disturbance-1997 El Nino

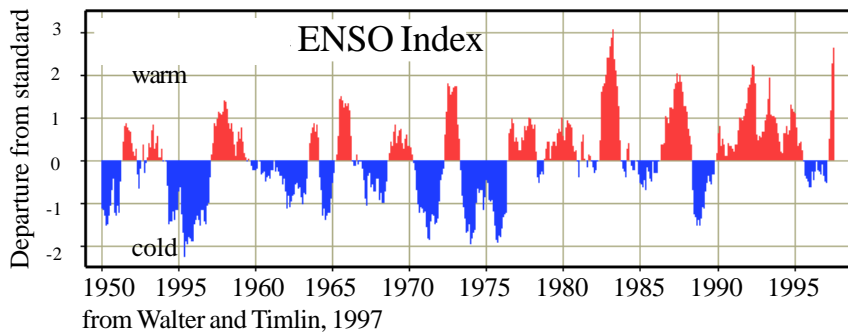
The summer of 1997 surprised the scientific community with a very warm El Nino; anomalous conditions are currently being noted as far north as Alaska. El Ninos used to be considered an occasional summertime phenomena along the west coast of South America. The name originates from the Christmas season (El-nino means the boy child) during which El-ninos had their strongest effects. But they begin far from the South American coastline, over on the other side of the ocean. The easterly tradewinds decrease or completely reverse and warm ocean currents travel in from the west. Sea surface temperatures and sea levels increase on the eastern side of the tropical Pacific. Local plankton, fish, and bird populations can all be devastated by this warming, as coastal upwelling temporarily stops providing the system with nutrients which remain locked deep under the thermocline. Inland deserts receive torrential rainfall from storms. All of these conditions can upset the balance of life for ecosystems and the people that depend on them.

Global coalescence of both atmospheric and oceanographic data has linked these anomalously warm water currents of the Tropical Pacific with the Southern Oscillation. El Nino-Southern Oscillation, or ENSO events, are now known to be associated with complex changes in typical wind, weather, and temperature patterns around the world. This is why El Nino has become such a frequently discussed issue. Although detailed descriptions of global patterns of energy transfer, or telconnections, are available, an ENSO event is still unpredictable in frequency, magnitude, or duration. It is currently under debate as to whether this warming trend will soon decline or not. Generally, ENSO events last from 8 to 18 months before conditions return to normal. Monitoring these climatic and other long term changes, and how they effect biological communities, is an important aspect to understanding the natural limits of viable populations. This becomes especially important when a population becomes stressed from adverse human interactions or resource utilization.

The 1982-83 El Nino, until this year, was the strongest ENSO event recorded to date with total collapse of the anchovy fishery off South America, decline of many seabird species in South America, such as the Great Frigate Bird (*Fregata minor*) which dropped from 20,000 individuals down to 100 (Barber and Chavez, 1983). There were similar declines in seabird populations farther north, for example, Hodder and Graybill (1985) reported depressed reproduction in Brandt's (*Phalacrocorax penicillatus*) and Pelagic Cormorants (*P. pelagicus*) and Pigeon Guillemots (*Cepphus columba*) on the Oregon coast.

Current reports include atypical range extensions for Tiger Sharks in waters north of Wakniasawa, Japan and Striped Marlins off Washington State, USA. There are also bizarre weather patterns such as drought and brush fires in Papua New Guinea, and rainfall in the deserts of Peru and northern Chile. For more information on these and other events you can visit <http://darwin.bio.uci.edu/~sustain/ENSO.html>

The scientists at SEI continue to collect data for ongoing surveys of bird and mammal populations. It is long-term work such as this which allows for future discoveries of important patterns in distribution, abundance, and demography. Keeping in touch with exciting developments in this years' El Nino is possible by monitoring the many web sites devoted to tracking and discussing its progress. For more information on websites, books or articles on this subject contact Chris Becker (becker@sei.org). The graph below depicts warm and cold cycles over time.



SEI SNIPPETS

Puget Sound Seabird Study Update: I have been finding myself deep into the analysis phase of the Puget Sound seabird study. I'll take this as a good opportunity to come up for air and tell you what I know so far about our cute feathered friends that bob along in the beautiful Sound all day long. You may recall this study is focused on the distribution and community relationships of the endangered Marbled Murrelet (*Brachyramphus marmoratus*). To date we have found Pigeon Guillemots (*Cepphus columba*) are associated with Murrelets in specific locations. This may be due to the fact that in certain areas, a food source may be so abundant that it is worth tolerating each other to reap its bounty. However, for the most part the murrelet is a loner.

The little acid is most abundant in the Hood Canal and in the northern Puget Sound waters. Within these bodies of water the Murrelet appears to actively seek out protected waters, specifically with a tidal current influence. In these situations a Murrelet can be relatively safe in calm waters while still enjoying the bounty that can be associated with tidal fluxes. Within these waters they are found between 250 - 350 meters off shore and are typically in 60 - 120 feet of water. These findings also support previous work conducted from Washington to Alaska. -By Rick Merizon

Purple Martins saved: Boat owners at the Port Ludlow Marina, WA, were annoyed by bird droppings, and blamed the nearest suspect: Purple Martins in nest boxes. SEI scientists saved the boxes (and the birds) by pointing out the real culprits (starlings and gulls), and that the Martins were actually removing many mosquitoes!

Puget Sound Species: During our summer and fall surveys, SEI scientists have been noting unusual species in the Sound: Steller's Sea Lions, very early Ancient Murrelets, and Harlequin Ducks, and an outstanding number of Phalaropes. It must be El Nino!

NEWS FLASH! SEI and partners captured and radio-tagged two Marbled Murrelets in Puget Sound in August. Both are still being tracked, going about their daily MM business.

The Headwaters Project - Science and Ancient Redwoods

Headwaters: the name is synonymous with environmental dispute. No area of the country has been more hotly contested than the old-growth Redwoods of Northern California. Emotions run high here, where conflicting interests clash over the fate of ecosystems and human communities. SEI's mission is to find solutions where *all* needs are met, and SEI is applying science to the Headwaters controversy. We aim to make scientific analysis the common ground between opposing parties.

At issue is the management of several thousand acres of old-growth forest. Most remaining old-growth Redwoods are protected in parks. The Pacific Lumber Company lands in the Headwaters include the last significant stands in private hands. A proposed land exchange, brokered by Senator Feinstein, would lead to protection of the Headwaters Grove. However management of the other PL old-growth stands is undecided. SEI is analyzing how different options would affect the Marbled Murrelet, a key resident species, which is listed under the Endangered Species Act.

SEI's Headwaters Project, led by Dr. Steven Courtney, is coordinating several studies by eminent scientists. For instance, biologists at the U.S. Forest Service Redwoods Science Laboratory are analyzing habitat use by Murrelets and also determining the health of the local population. Mathematical ecologists from Applied Biomathematics (NY) are carrying out a Population Viability Analysis, to determine the likely consequences of alternative management options. The PVA process itself is overseen by a committee of 5 scientists from academia and government agencies.



SEI is committed to making science useful and available. The latest results of all these studies are updated regularly at our website <http://sei.org/headwaters.html>. The process thus far has been extremely effective in establishing consensus on major issues. While the negotiations over the Headwaters are still ongoing, we are confident that, ultimately, an agreement will be reached that satisfies all parties. Success for us will be to keep the decisions on these Redwoods out of the courts, and yet to meet both human and conservation needs.

SEI's other Redwood projects

SEI is committed to sustainable management of forest resources, and conservation of Redwood dependent wildlife. We have several completed or ongoing projects. In 1996, we analyzed the effect of limited harvest on nearby Marbled Murrelet reserves, using innovative experiments carried out by Big Creek Lumber Company. In 1997 SEI biologists helped to find and monitor Murrelet nests, and delineate habitat from Mendocino to Big Sur. We are also involved with cooperative studies of Red-Legged Frogs and other wildlife.



Project Headwaters:

- Will help determine management of 200,000 acres of Redwood forest.
- Will lead to increased conservation of the Marbled Murrelet.
- Is coordinated with academic, agency, industry, and public interest scientists.
- Take a pictorial tour of the Headwaters at <http://sei.org/headwaters.html>

-International Year of the Reef. Focus On The Emergency Jetty on Montserrat: Safe Harbor Amidst Volcanic Eruption

Sustaining natural ecosystems and the human communities that depend on them is challenging. There are scientific questions and there are the moral issues. In this article, we relate the history of SEI's role in the emergency jetty project at Little Bay to illustrate the types of decisions that we often face, and to show how scientists, science, and decisions based on science can impact peoples lives.

In summer 1996, as volcanic activity continued to escalate on Montserrat, the airport and Port of Plymouth came under threat from the eruption. The loss of these ports would deprive Montserrat of its main entry and exit ports for people, supplies, and goods. The British Government contacted SEI to ask for input on the potential impacts on the marine environment of an emergency jetty in the north of the island.

Little Bay had been chosen as the site for the new jetty because of hydrographic conditions and its location in the safe zone. Situated in the picturesque northern section of Montserrat, the bay was used by a few tourists, divers, fishermen and the occasional hiker. Only the previous year, the area encompassing Little Bay had been zoned for ecotourism in a Physical Plan developed by the government. At SEI we faced a difficult choice. All of us who had been to Montserrat loved this pristine area. But if the volcano destroyed the ports, there was little chance of being able to evacuate rapidly, or of bringing much needed supplies to and from the island.

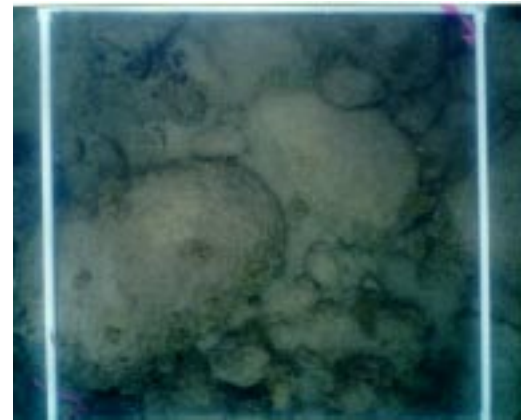
The British Government (through DFID) appointed Mouchel Consulting Ltd. to design and manage the construction of an emergency jetty. The Physical Planning Unit of Montserrat put together an Environmental Review Panel to assess the scientific results and implications. SEI's biological assessment showed that Little Bay is a major recruitment and nursery area for marine life, including commercial species. SEI scientists concluded that the proposed location would destroy a large part of this vital resource. They further concluded that the original design (to use shipping containers) was unsuitable because of degradation and impacts on water flow. They recommended that a new design be developed and

a new location be identified that would have minimal impact on the coral reef, and meet environmental and constructional requirements. Mouchel created a new design, and prepared a new location, minimizing reef impacts.

SEI scientists predicted that the new jetty would destroy a narrow band of corals around the construction zone. They recommended transplanting this band of corals to a safer area, and monitoring the health of the reefs during the construction. The British Government agreed to a short-term monitoring program which included photoquadrat analysis; fish and invertebrate transects; sediment and water clarity analysis; and coral transplants. As part of the project SEI trained local people in coral reef monitoring and sponsored SCUBA diving certification, thus ensuring that reef monitoring skills were left on Montserrat. Dwayne Cassell of Montserrat worked as part of the SEI team on the project.

The results of the monitoring program showed that jetty construction led to an increase in sedimentation close to the construction area. At one stage, fine materials used for construction caused large-scale sediment plumes in the bay. When SEI scientists expressed concern, a new coarser material was quickly procured by Mouchel, thus alleviating the problem. As predicted, the jetty had a negative impact on the reef in the zone within 50m of the jetty (figure 1a). Here marine life was buried. However, also as predicted, the new jetty design and location preserved most of the reef in the bay, where there were no changes in the abundance or health of corals and other sessile species (figure 1b). Corals were removed from the zone of greatest impact (fig 1a), and transplanted to a new site about 500m from their original habitat, where they are they flourishing.

The hard work and dedication by all concerned, including the local groups and citizens who served on the Environmental Review Panel, scientists, government and private sector, made it possible to make difficult decisions together. Without scientific analysis and local input, the main reef at Little Bay would no longer exist, and the habitat that is so important to divers, fishermen, and tourists would be another sad chapter in international reef loss.



1a (above) . Reef close to the jetty is buried in construction sediment. 1b About 100m west of the new jetty, the reef remains healthy. The proposed original jetty location would have destroyed this reef. The new location preserved most of the reefs in the bay.

As we were preparing this article, we got word that the Montserrat airport had been completely destroyed by a pyroclastic flow. Parts of Plymouth are burning; the eruption claimed lives in that city. The Port is unusable, and surrounding buildings have been destroyed as pyroclastic flows head towards the sea. An emergency helicopter flies between Montserrat and Antigua, when there isn't too much ash in the air. The main entry and exit point for people, goods, medical supplies, essential housing, is via ferry at the emergency jetty at Little Bay.

Summary scientific reports and more information on the web <http://sei.org/jetty.html>

Marine Conservation: Tidepools, Life on the Edge

On shores around the world, the tide recedes twice daily, and exposes a vast intertidal wilderness of marine plants and animals. This is a tough environment. Battered by storms and baked by sun and wind, intertidal organisms must withstand extreme conditions. These rugged creatures have evolved to cope with harsh environmental stresses. But, as a series of studies show, they are poorly adapted to cope with the millions of visitors who are literally loving tidepools to death.

Observing a general deterioration of life on the shore, Dr. Deborah Brosnan started a program to study human impacts on marine organisms. Since then her students and SEI scientists have continued the work, including Lana Crumrine, and Tim Grubba in Oregon, John Elliott and Ingri Quon in California. The scientific results from this team have enabled better management of the coastal zone in ways that protect marine life and that still allow for recreations and education. One of the first studies (Brosnan and Crumrine 1994) centered around a marine park, the Yaquina Head Marine Gardens, in Oregon. Scientists and managers noticed that the marine life appeared degraded. Instead of being covered in lush plants and animals, the rocks were bare. Working with the Bureau of Land Management, the managing agency for Yaquina Head, scientists and park staff, isolated a patch of the shore from human traffic for six months. The results were astonishing. In the absence of humans, marine plants rapidly covered the rocks, and diversity increased. But all this new life disappeared within two months, when humans were allowed back to the patch. By contrast, the control areas continually subject to human traffic remained unchanged. Trampling was the main culprit. Experimental studies on shores in Oregon and California confirmed the widespread and devastating effects of human trampling (fig 1). Clear patterns emerge from the teams studies:


“ Large patches of bare rock and low-lying algal turf are indicative of trampled shores.



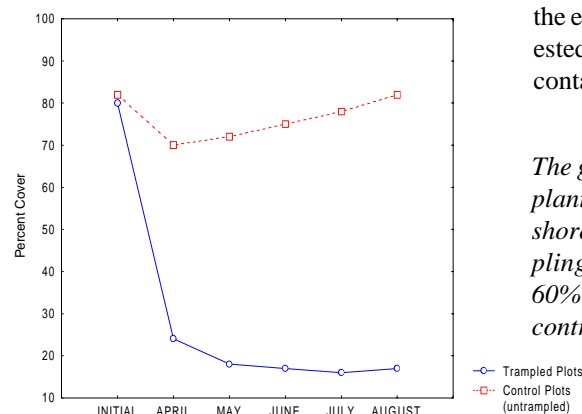
- “ Seaweeds, a characteristic feature of rocky shores are removed by trampling. These seaweeds are food for herbivores, including crabs and snails, and they provide a refuge from predators and from desiccation for many organisms during low tide. When the plants disappear so do the snails and crabs. Seaweeds generally recover within a year after trampling stops.
- “ Mussels, a key component of rocky shores throughout the world are susceptible to trampling. On the west coast, mussel beds provide a habitat for over 300 other species that live within the dense beds. This diversity is lost when mussels are removed by trampling. Recovery is slow and may take decades.
- “ Even after trampling stops, the impacts continue. A year after experimental trampling stopped in Oregon, mussel beds continued to be lost from experimentally trampled areas. By contrast, mussels were not lost from control (untrampled) plots.
- “ Trampling weakens the attachment of plants and animals to the rock substrate and makes them more suscep-

“ Recently, Tim Grubba found that succession, the orderly process by which ecosystems recover from disturbances, is altered or even halted by trampling. This is because trampling removes a species of barnacle that is central to the recovery process.

The results of these studies have been used extensively in management of rocky shores and the coastal zone. They formed the basis of the State of Oregon's Territorial Sea Plan which was designed to conserve marine life from the intertidal to 3 nautical miles offshore. They led to innovative management strategies in Yaquina Head, Haystack Rock, and elsewhere. The newly designed wheelchair accessible tidepools in Oregon are based on our recommendations to minimize human impacts. In Washington, the study has been used in formulating management and monitoring plans for marine parks.

The impact of human traffic on one of the most diverse and fragile coastal communities is just being explored. By carrying out the crucial experiments, we have learned much about the nature and extent of human impacts. Consequently we can implement some simple strategies that conserve this unique ecosystem on the edge of land and sea. If you are interested in getting more information please contact SEI headquarters in Portland. 

table



The graph at the left shows the decline of plant life on an experimentally trampled shore in Oregon. One year after trampling stopped, cover had increased to 60% in trampled plots, and was 70% in control plots.

SEI WHO?


Chris Becker, a graduate of the University of New Hampshire (Masters in Zoology) and Smith College (AB in Biology) started working at SEI in April as a staff biologist. Originally from West Union, Ohio, Chris has worked in many different environments from salt marshes in Rhode Island to fishing boats on the Bering Sea. In New Hampshire she studied the natural diet of lobsters in the Great Bay Estuary. More recently, in Oregon, she tracked salmon predators (squawfish) in the Columbia River using radio telemetry and completed visual surveys of spawning salmon in the Sandy River basin. Along with her boating skills, SCUBA training, and diverse field research experiences, Chris brings to SEI her energy and enthusiasm for each project that comes her way. Outside of work, and every day life, Chris can be found at the fencing salle practicing sabre.



Board Member: Dr. Bill Murdoch, a professor in the Biological Sciences Department, University of California at Santa Barbara is a member of the science board of directors for SEI. Dr. Murdoch is a transplanted Scot who completed his undergraduate and graduate studies in U.K. A Professor of Ecology, he studies population dynamics, especially predator-prey interactions and population regulation. Among his long list of publications, Dr. Murdoch is the author of *Poverty of Nations: the Political Economy of World Hunger, Food and Population* (1980). He has long been interested in the connection between pure research and applied problems. For 10 years he directed one of the largest studies ever carried out on the environmental impacts of a coastal nuclear power plant, and for the past 10 years much of his research has focused on understanding the dynamics of a successful biological control agent of an insect pest. The recipient of many awards including, Guggenheim Fellowship, President's Award of the American Society of Naturalists, and the Robert H. MacArthur Award, Dr. Murdoch is also a former director of the National Center for Ecological Analysis and Synthesis.

Tim Grubba Alert! Tim completed his M.S. and he got married - all in June. Congratulations to Tim and Camille!

Habitat Change

You may have noticed our address change in the last issue of *SEI NOW*. With expanding project and personnel needs, we found our old space no longer adequate; we've relocated the Portland office across town to S.W. Taylors Ferry Road. Our new habitat overlooks the Willamette River and has a view of Mt. St. Helens so we can keep an eye on local volcanic conditions! As you can see in the photograph, our new building is a unique architectural design, resembling a water tower, and provides creative, open working spaces. Stop by to visit next time you come through town! 



SEI Thanks....

SEI has a strong species and forest ecosystem program. Thanks to the following for support and assistance with this program:

Rayonier
U.S. Forest Service
Weyerhaeuser Company
Boise Cascade
Champion International
Port Blakely Tree Farms
Washington Department of Fish and Wildlife
Boise Cascade Corporation
National Fish & Wildlife Foundation
Menasha
Plum Creek Timber Company
National Fish and Wildlife Foundation

SEI thanks the following groups and individuals for their support both of the organization and specific endeavors.

Oregon Community Foundation
Rose E. Tucker Charitable Trust
American Bird Conservancy
Theresa Ivimey
Miriam Chun
Henie Francis
Elizabeth Stark
Sandy Sundquist
Neal Maine - Pacific Educational Resources
6th Graders at Milton Somers Middle School in La Plata, Maryland

Sustaining natural environments needs your support. SEI is a non-profit institute, and all donations are tax-deductible as allowed by law. Thank you for your support.

Volunteer opportunities are available at SEI. If you are interested please call SEI headquarters.

Sustainable Ecosystems Institute

SEI works to sustain ecosystems and the people who depend on them. We focus on areas of current or potential conflict and bring about science-based cooperative solutions.

SEI Moment : The Marbled Murrelet Field Team on board the R/V Murrelet.
Picture taken in May, 1997 at Friday Harbor Labs, Washington. Pictured in photo:
Joe Evenson, Ruth Milner, Deborah Brosnan, Dan Varojean, Chris Becker, Paul Brewster ,
Frank Bacik, Steve Courtney, Ann & Bill Lansing, Diane Evans, Rick Merizon, and Bud
McCrary.



*You can't be suspicious of a tree,
or accuse a bird or a squirrel of
subversion or challenge the ideology
of a violet.*

Hal Borland
(1900-1978)
American Writer

The Headwaters Project - Science and old-
growth Redwood. Page 4.



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