Welcome to the annual Hawai‘i Conservation Conference: the largest gathering of people actively involved in the protection and management of Hawai‘i’s native species and ecosystems. The purpose of the conference is to facilitate interaction among resource managers and the scientific community. It is an opportunity to discuss and obtain up-to-date information on a variety of conservation activities in Hawai‘i. It is also a time to see old friends, meet new colleagues and form new partnerships. We all have something to gain when we gather together to share experiences and ideas.

Terrorists transformed our world in 2001, leaving us with immediate feelings of powerlessness, desperation, and isolation. However, the healing process has brought us closer together and given us a new sense of patriotism, of belonging, and a greater dedication to those things precious to us. And so, we move through 2002 with a new awareness, or possibly a renewed awareness, of the uniqueness and value of our islands and the living things they support. It is with this new awareness, new vigor, new commitment, that we formulated the 2002 conference.

Key to the organization of this conference was an event called the Forum, which was sponsored by The Secretariat for Conservation Biology in February of this year. The Forum was attended by scientists and resource managers from throughout the state, and they gathered for the purpose of reassessing Hawai‘i’s conservation priorities. Out of this gathering came a list of issues, tasks, and activities that this group hoped to have facilitated by the Secretariat. This list coalesced into 4 areas:

1. Educate and/or influence public thought – of our school children, of the public, of the decision makers. It is hoped that through education we can have greater recruitment within the local communities to the conservation workforce, greater support for previously unpopular conservation strategies, and the approval of effective, financed laws and programs to control invasive species and promote native habitat.

2. Acknowledge the economics of conservation through workshops on the benefits of ecotourism, facilitating the creation of an economic value index for native resources, and/or facilitating the understanding of the costs of alterations by invasive species.

3. Model and map invasive species, risk/invasiveness assessment model – promoting a coordinated, comprehensive knowledge base of the effects and significance of invasive species.

4. Provide workshops or form task forces on topics/actions that would benefit various parts of the conservation community –
   - Form a working group to develop a draft statewide invertebrate conservation action plan
   - Convene an invertebrate conservation workshop with emphasis on monitoring and standardized methods
   - Form a task force to examine conservation laws and regulations
• Assist in the development of certificate programs in monitoring, land management, and techniques for professionals
• Develop a Hawaii Biodiversity Strategy (Plan) modeled on New Zealand’s
• Sponsor a workshop to bring scientists together with educators to include non-traditional educators

This Conference is designed to welcome the marine community and open new avenues of communication. The panels are devoted to methods of influencing people and the economic and ecological sustainability of nature tourism.

Reflecting the Secretariat’s work in communication within the marine community, we have specifically invited the submission of abstracts concerning marine conservation. In celebration of the merging of terrestrial and marine conservation we have invited ‘Ōhi’a Productions to present, “In the Clear Blue Sea.” ‘Ōhi’a Productions is a non-profit, §501(c)(3) organization founded in March of 1995, by Lisa Matsumoto and Michael Furuya to provide creative, educational and inspiring theatrical experiences to Hawai’i’s children and families. They seek to develop creativity and self expression in Hawai’i’s school children while promoting cultural and environmental awareness and education.

‘Ōhi’a’s Educational Road Shows’ entertaining and informative presentation of its environmental themes receives highly positive evaluations from attending students, faculty and environmental organizations. The shows proved to be such a powerful vehicle in educating students and the public about environmental concerns that the Department of Land and Natural Resources (DLNR) began to sponsor video productions of the shows. The DLNR donates two copies of the videos to every elementary school and library in the State of Hawai’i, making these educational shows available to every student in Hawai’i. We are pleased and proud to have them participate in our Conference this year.

We hope the conference provides you with opportunities to share your work with colleagues, provides greater depth of understanding of your chosen area of conservation, and inspires you to seek new areas of conservation exploration. Toward providing a consistently high caliber experience for you, please remember to fill out the evaluation form in the conference booklet. Turn it in at the registration desk or to an Organizing Committee member before you leave. Mahalo for your support and participation.

**Conference Organizing Committee:**

Shahin Ansari, University of Hawai‘i at Mānoa, Department of Botany
Jane Beachy, Hawai‘i Army National Guard
Tonnie Casey, Kamehameha Schools
Coleen Cory, The Nature Conservancy
Curt Daehler, University of Hawai‘i at Mānoa, Department of Botany
Betsy Gagné, Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife
Claudia Hamblin-Katnik, Secretariat for Conservation Biology
Carol Terry, Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife
Kristie Trousdale, Secretariat for Conservation Biology
Ron Walker, US Fish and Wildlife Service
Registration: Palace Lounge

Job Board: Palace Lounge

All Sessions: Tapa Ballroom II and III

Lunch: Tapa Ballroom I

Poster Sessions: ‘Iolani Suites I – VII
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Thursday, July 18, 2002

7:30 a.m.  Registration

8:00 a.m.  Oli, Nathan Napoka

8:05 a.m.  Welcome: Claudia Hamblin-Katnik, Secretariat for Conservation Biology

8:15 a.m.  Keynote address: Human Populations and Island Ecosystems over 40,000 Years: Lessons from the Archaeological Record
Dr. Patrick Kirch, University of California at Berkeley, Department of Anthropology

Invasive Plants

Moderator: Mike Leech, O'ahu Invasive Species Coordinator

9:00 a.m.  Towards a Weed Risk Assessment Program for Hawai‘i and the Western Pacific Islands. Julie S. Denslow¹ and Curt Daehler². ¹Institute of Pacific Islands Forestry, USDA Forest Service; ²Department of Botany, University of Hawai‘i at Mānoa.

9:20 a.m.  Ecosystem-Scale Impacts of the Invasion of Albizia (Falcataria moluccana) into Native Wet Lowland Forests of Hawai‘i. R. Flint Hughes, Julie S. Denslow, and Susan Cordell. Institute of Pacific Islands Forestry, USDA Forest Service.

9:40 a.m.  Biological Control as a Tool for Managing Strawberry Guava (Psidium cattleianum). Tracy Johnson¹, Wendell Sato¹, Jose Pedrosa-Macedo², Marcelo Vitorino³, Charles Wikler⁴ and Cliff Smith.⁵ ¹USDA Forest Service, Institute of Pacific Islands Forestry; ²Universidade Federal do Parana, Brazil; ³Universidade Regional de Blumenau, Brazil; ⁴Universidade Estadual do Centro-Oeste, Brazil; ⁵Botany Department, University of Hawai‘i at Mānoa.

10:00 a.m.  BREAK

Native Plants and Restoration Strategies

Moderator: Rick Warshauer, Pacific Island Ecosystems Research Center, USGS-BRD.

10:40 a.m.  Demography of the Threatened Haleakalā Silversword (Argyroxyphium sandwicense ssp. macrocephalum): Implications for Conservation and Restoration. Stacey Forsyth¹, Lloyd Loope² and Robert Robichaux.¹ ¹Department of Ecology and Evolutionary Biology, University of Arizona; ²Haleakalā National Park, USGS-BRD.

11:00 a.m.  Conservation Aspects of Very Low Elevation Hawai‘i Vegetation Remnants.
Jonathan P. Price¹ and Frederick R. Warshauer.² ¹Graduate Group in Geography, University of California at Davis; ²Pacific Island Ecosystems Research Center, USGS-BRD.


11:40 a.m. Rehabilitation of Native Plant Communities Affected by the Broomsedge Fire. Rhonda Loh¹, Tim Tunison¹, Alison Ainsworth², David Benitez¹, Jon Maikaie¹, Bobby Mattos¹, Jack Minassian², David Palumbo², Sierra Peterson² and Matthew Schultz.² ¹Division of Resources Management, Hawai‘i Volcanoes National Park; ²Fire Management Office, Hawai‘i Volcanoes National Park, NPS.

12:00 LUNCH and Distinguished Speaker Award

Marine

Moderator: Mark Heckman, Waikiki Aquarium

1:20 p.m. ‘Ōhi‘a Productions: “In the Clear Blue Sea”

2:05 p.m. Mitigation of Coral Reef Impacts in the Pacific Islands from Federal Projects. Antonio Bentivoglio. US Fish and Wildlife Service, Honolulu, HI.

2:25 Nesting Hawksbill Turtles (Eretmochelys imbricata) on the Island of Hawai‘i. Lawrence K. Katakahira and William A. Seitz. Hawai‘i Volcanoes National Park, NPS.

2:45 BREAK

Birds and Bees

Moderator: Betsy Gagné, Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife

3:20 p.m. The Po‘ouli (Melamprosops phaeosoma): Progress Towards Recovery Through Hands-on Management. Jim Groombridge¹, Greg Massey², James Bruch¹, Marcy Okada¹, Trent Malcolm¹, Chris Brosius¹ and Bill Sparklin¹. ¹Maui Forest Bird Recovery Project, HI, ²Maui Veterinary Services Office, Hawai‘i Department of Land and Natural Resources.

3:40 p.m. Developing A Helicopter Translocation Model for Hawaiian Forest Birds. J. Gregory Massey¹, J.J. Groombridge², James Bruch², and Marcy Okada.² ¹Maui Veterinary Services Office, Hawai‘i Department of Land and Natural Resources; ²Maui Forest Bird Recovery Project, HI.

4:00 p.m. Foraging and Habitat Use by the Endangered Laysan Teal: Implications for Translocation. Michelle Reynolds. Pacific Island Ecosystems Research Center, USGS-BRD.

4:20 p.m. Introduced Pathogens and Persistent Bird Populations in Hawai‘i: Biocomplexity of an Evolving Disease System. Patrick Hart et al. Pacific Island Ecosystems Research Center, USGS-BRD.

4:40 p.m. Pollen Usage by Hawaiian Yellow-faced Bees (Hylaeus [Nesoprosopis]) and the Role of Endemic Bees in Perpetuating Native Ecosystems. Karl Magnacca. Department of Entomology, Cornell University, NY.
PROGRAM

Friday, July 19, 2002

7:30 a.m.  Registration

8:00 a.m.  Reminders, Announcements

Nature Tourism

Moderator: Carol Terry, Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife

8:05 a.m.  The Symbiosis of Conservation, Economics and Nature Tourism

Rob Pacheco, Hawai‘i Forest & Trail, “Ecotourism: the Hawai‘i Experience”
Curt Cotrell, Na Ala Hele, DLNR, “Managing Ecotourism: the Government Perspective”

10:20 a.m. BREAK

Education, Ecological Effects of Field Education, and Economic Effects of Conservation

Moderator: Maile Sakamoto, Environmental Planning Office, Hawai‘i Department of Health

11:00 a.m.  Mania for Wasmannia: Involving K-12 Educators and Students in Conservation Research.
Daniel S. Gruner1, Patrick Conant2, Lloyd L. Loope3, Kenneth Y. Kaneshiro4, Neil Reimer5, Ellen VanGelder3, and Donald B. Young6. 1Department of Zoology and Graduate Program in Ecology, Evolution and Conservation Biology (EECB), University of Hawai‘i at Mānoa; 2Hawai‘i Department of Agriculture; 3 Pacific Island Ecosystems Research Center USGS-BRD; 4Center for Conservation Research and Training, University of Hawai‘i at Mānoa; 5Hawai‘i Department of Agriculture, Plant Quarantine Branch; 6Curriculum Research and Development Group, College of Education, University of Hawai‘i at Mānoa

11:20 a.m.  Impacts of Educational Groups on Hawaiian Tidepools and Reef Flats.
Mark B. Heckman. Waikiki Aquarium, University of Hawai‘i at Mānoa.

11:40 a.m.  Effects of Watershed Conservation on Hawai‘i’s Environomy.
Basharat A. Pitaﬁ1, Brooks Kaiser2 and Jim Roumasset1. 1Department of Economics, University of Hawai‘i at Mānoa; 2Department of Economics, Gettysburg College, PA.

12:00 p.m.  LUNCH (Reception style)

12:20 p.m.  Poster Presentations (‘Iolani Suites)
A Little Bit of Everything

Moderator: Mike Kido, Stream Research Center, University of Hawai‘i at Mānoa

2:00 p.m. Biodiversity of Macroalgae from Hawai‘i’s Stream Resources. Alison R. Sherwood¹, Michael H. Kido² and Clifford W. Morden.¹,³ ¹Department of Botany, University of Hawai‘i at Mānoa; ²Hawai‘i Stream Research Center, University of Hawai‘i at Mānoa; ³Center for Conservation Research and Training, University of Hawai‘i at Mānoa.

2:20 p.m. Effectiveness of Broadcast Application of Palletized Baits Containing 50 PPM Diphacinone in Reducing Rat Populations in Hawaiian Forests. Eric B. Spurr¹, Gerald D. Lindsay², Charlotte Forbes Perry³, and David Foote.³ ¹Landcare Research, New Zealand; ²Deceased; ³Pacific Island Ecosystems Research Center, USGS-BRD.

2:40 p.m. Control of Invasive Vertebrates on Guam for Protection of Native Flora and Fauna. Daniel Vice¹, Diane Vice², Craig Clark¹, Celestino Aguon², and Suzanne Medina.² ¹Animal and Plant Health Inspection Service, USDA-Guam; ²Division of Aquatic and Wildlife Resources, Guam Department of Agriculture.


3:20 p.m. BREAK

Influencing People

Moderator: Claudia Hamblin-Katnik, Secretariat for Conservation Biology

3:55 p.m. Approaches to Influencing People

Art Medeiros, Biologist, Pacific Island Ecosystems Research Center, USGS-BRD.
Cathleen Natividad, Biologist, National Parks Service, Haleakalā National Park
Jeff Mikulina, Lobbyist, Sierra Club-Hawai‘i Chapter
Patricia Tummons, Journalist, Environment Hawai‘i

5:00 p.m. Presentation of Student Award

Closing: “Hawai‘i Aloha”
**KEYNOTE SPEAKER and PANEL PARTICIPANTS**

**Keynote Speaker:**

**Dr. Patrick Kirch,** originally from Hawai‘i, graduated from Yale University in 1975. He joined the Anthropology faculty at University of California at Berkeley at the beginning of 1989 and has held the Class of 1954 Chair since 1994. Geographically, his field of research encompasses the Pacific Islands, with particular concentrations in Melanesia and Polynesia. Substantively and theoretically, he is interested in the origins and diversification of the cultures and peoples of the Pacific, in the evolution of complex sociopolitical formations (especially "chiefdoms"), in prehistoric as well as ethnographic subsistence systems (especially those involving some form of intensification), and in the impact of indigenous peoples on the island ecosystems of the Pacific.

During his eleven years at Berkeley, he has actively pursued research in all of these areas. A continuing focus has been on the Lapita Cultural Complex of the Western Pacific, which is widely regarded as the "foundation" culture underlying the later diversity of island Melanesian and Polynesian cultures. In 1989 and 1991, he led an interdisciplinary team on two expeditions to Mangaia Island in the Southern Cooks, to investigate the Holocene record of paleoecological change and the role that colonizing humans have had in this record. That research has led to some ten publications and also spawned a graduate student dissertation project. Theoretical work on agricultural intensification, combined with an ethnoarchaeological test case at Futuna in Western Polynesia is frequently cited in the theoretical literature on intensification. Long-term and continuing research on the evolution of Polynesian sociopolitical structures has been another facet of his research that has continued at Berkeley. Since 1994 he has directed a substantial field program on the island of Maui, again involving both graduate and undergraduate student participation, which focuses on protohistoric transformations in environmentally marginal landscapes.

Ongoing research projects in oceanic archaeology and pre-history are coordinated through his Oceanic Archaeology Laboratory and include a major survey and excavation project in Kahikinui, Maui, a study of household archaeology in the Society Islands, and continuing research on human impacts on island ecology.

His research program at Berkeley has been supported by major grants from the National Science Foundation, the National Geographic Society, and the Pacific Rim Grant Program of the UC Office of the President. His research has been recognized in several ways, including election to the National Academy of Sciences and the American Academy of Arts and Sciences. He has also been elected an Honorary (life) Member of the Prehistoric Society of Great Britain and Ireland, and a Fellow of the California Academy of Sciences. He has been a Miller Institute Professor at Berkeley, and a Fellow at the Center for Advanced Study in the Behavioral Sciences, Palo Alto. In 1997, his research accomplishments were honored with the awarding of the John J. Carty Award for the Advancement of Science by the National Academy of Sciences.

**The Symbiosis of Conservation, Economics and Nature Tourism**

**Panelists:**

**Ted Lee Eubanks,** currently residing in Austin, Texas, is involved in studying and promoting experiential tourism as a sustainable economic approach for communities. Former Texas Governor Ann Richards
named Eubanks to the Governor's Task Force on Texas Nature Tourism that developed a nature tourism plan for Texas, and he represented Texas in October 1995 at the White House Tourism Summit. In addition, Eubanks is a founding member of the board of directors of the Texas Nature Tourism Association. Eubanks serves as a member of the Texas Parks and Wildlife Landowner Incentive Program Steering Committee, a program to help support landowners who wish to enhance their properties for endangered or threatened species.

Nationally, Eubanks serves as a founding board member of Watchable Wildlife Inc. In addition, Eubanks has served as a member of the board of directors of the National Audubon Society and is a former president of the Texas Ornithological Society.

He has spoken and published widely on environmental, natural history, and nature tourism issues, and has been the recipient of the Roger T. Peterson Excellence in Birding Award, the Take Pride in America Certificate of Merit (US Department of the Interior), the Steve Thompson Award for Special Achievement on Behalf of Wildlife (Rio Grande Birding Festival in Harlingen, Texas), and is the first recipient of the Chandler Robbins Conservation/Education Award from the American Birding Association. In order to expand beyond research and development to actual application of nature tourism "best practices," Eubanks recently formed a new corporation –World Nature Trails. In future months this new company will begin to offer a variety of goods and services to support the development of nature tourism initiatives and projects.

Rob Pacheco arrived in Hawai‘i in 1990. It didn’t take him long to realize that a real need existed for environmentally sensitive outings to uniquely natural Hawaiian places led by knowledgeable and enthusiastic guides – hence the creation of Hawai‘i Forest & Trail. His trips seek to expose the visitor to the best examples of Hawaiian natural history. He helps to conserve Hawai‘i’s endangered environment by educating others about it. One of the integral ideas Pacheco instituted was to establish partnerships with private landowners that would allow tours to places with wild and remote native ecosystems that had been previously inaccessible. Hawai‘i Forest & Trail is one of the few tour companies allowed access to private lands and controlled access wildlife refuges.

Hawai‘i Forest & Trail’s adventure tours have attracted attention from major national and international media and have been featured in Town & Country, National Geographic Traveler, E-Entertainment, the New York Times, the Robb Report, CNN’s Travel Guide, NBC’s Evening Magazine, Fox TV’s No Boundaries and The Travel Channel. The Pachecos and Hawai‘i Forest & Trail were named as Entrepreneur of the Year for the Big Island in 1998. The company continues to work for conservation with students in the schools, sponsoring free field trips, participating in tree planting and other community service projects and practicing their credo that "conservation begins with education."

Curt Cotrell, Program Manager, Outdoor Recreation Section, Na Ala Hele Trail and Access Program, Department of Forestry and Wildlife (DOFAW), Hawai‘i Division of Land and Natural Resources, graduated from California State University at Chico in 1983 (Geography) and came to Hawai‘i to backpack Mauna Loa and the Kalalau Trail. Once here, he had the opportunity to live and work in Hana, Maui. His work was varied and included ranch caretaker, orchard and export nursery management, coaching cross country at Hana High School, and cement walkway and stone wall construction. He moved to Honolulu in 1987 and worked at the Legislature for former State Representative and Committee Chair Mark Andrews as his office manager and Committee Clerk for the Committee on Planning, Energy and Environmental Protection.

In 1991, he started working for DOFAW as the O‘ahu Trails and Access Specialist for what was then a new program - Na Ala Hele. In 1995 he became the Na Ala Hele Program Manager, servicing the program statewide. In this capacity guided the program as it evolved from primarily a trail development and restoration function into an emerging management and regulatory function. In April of 2002, Na Ala Hele
received a National Award under the category of education and communication from the Coalition of Recreational Trails, based in Washington DC. The CRT selected Na Ala Hele's website (www.hawaiitrails.org), the "Hiking Safely" brochure, and the Hawai‘i Trail Analysis - a report produced with the support of University of Hawai‘i graduate students. These projects were initiated to enhance public safety and to provide an automated, online method for permitted commercial tour operators to reserve a limited amount of tour capacity for a select group of Na Ala Hele trails and access roads.

**Approaches to Influencing People**

**Panelists:**

**Art Medeiros** has worked on Maui as a biologist, first with Haleakalā National Park and now with the U.S. Geological Survey for the past 21 years. He is in the final year of his doctoral program in botany at the University of Hawai‘i at Mānoa. He is spearheading several ongoing restoration projects in leeward forests on Haleakalā, most notably Auwahi diverse dryland forest on ‘Ulupalakua Ranch and the Pu‘uokali Wiliwili Forest Reserve on Department of Hawaiian Home Lands. He believes the involvement of the community in environmental work, especially restoration, is critical to the long-term successes of most environmental efforts. A public which has only heard or read about Hawaiian plants and animals is unlikely to become their spirited and involved protectors. When the public begins to understand the reality of what the "loss of biodiversity" really means to Hawai‘i, her people, and our shared culture, and participates in its restoration, the ranks of heartfelt defenders grows until what seemed a hopeless situation becomes suddenly hopeful. For more information on Art’s work go to [http://gamma.mhpcc.edu/ulupalakua/auwahi/mainmenu.htm](http://gamma.mhpcc.edu/ulupalakua/auwahi/mainmenu.htm)

**Cathleen Natividad** has been a Wildlife Biologist running the Endangered Species Management at Haleakalā National Park since 1992. She was born and raised on Oahu and moved to Maui to work at Haleakalā after graduating from high school. She has a Bachelor's degree in Wildlife Sciences from Oregon State University, and a Master's degree in Wildlife Biology from the University of Washington. Her involvement with community began when she volunteered to build fences at Haleakalā National Park through the High School hiker's program. She also works with the Friend's of Haleakalā National Park to promote the Adopt-A-Nene and other programs.

**Patricia Tummons** is a career journalists. After 13 years at a large daily newspaper on the mainland, she moved to Hawai‘i, where she co-founded the monthly newsletter *Environment Hawai‘i* in 1990. Since that time, she has continued to serve as its editor and chief writer. The newsletter has won many awards, including most recently second place in the category of investigative reporting and second place in the category of best overall newsletter from the Newsletter and Electronic Publishers Association. The newsletter, which now has two staff writers and two regular columnists, covers topics ranging from Hawai‘i’s summits to its deepest waters, and everything in between. It is independent, non-partisan, and strives for science-based coverage of some of the state's most controversial issues.

**Jeffrey Mikulina** is the Director of the Sierra Club, Hawai‘i Chapter. He serves as the lobbyist for the organization and oversees the activities of the four Sierra Club groups in Hawai‘i that have a combined membership of over 5,000. He returned to Hawai‘i after graduate study in engineering at the University of Illinois at Urbana-Champaign, where he researched decision theory and environmentally conscious design. Jeffrey has written on environmental issues for *The Boston Globe*, *Backpacker Magazine*, *Honolulu Weekly* and other publications. He was featured in *Details Magazine* and in *Honolulu Magazine’s* “Best of 2000.” His recent accomplishments with the Sierra Club include passing legislation that requires returnable deposits on all beverage containers, increases the funding of natural resources through tourism taxes, and increases renewable energy use in the state.
POSTER SESSION

‘IOLANI SUITES I – IV

1. CGAPS: FILLING THE GAPS IN BIOSECURITY FROM INVASIVE SPECIES.
   Steve Lohse¹, and Christy Martin.² ¹Coordinating Group on Alien Pest Species; ²Maui Invasive Species Committee.

2. THE O‘AHU INVASIVE SPECIES COMMITTEE (OISC): FIGHTING THE INVASIVES BATTLE ON O‘AHU.
   Mike Leech¹, Melissa Dumaran², Jordan Jokiel², Christina Crooker³, and Coleen Cory.⁴ ¹O‘ahu Invasive Species Committee; ²Hawai‘i Army National Guard; ³US Fish and Wildlife Service; ⁴The Nature Conservancy of Hawai‘i.

3. PROTECTING KAUA‘I’S BIODIVERSITY FROM INVASIVE SPECIES: A COOPERATIVE APPROACH.
   Arti Michelle Clark¹ and Meghan A. Halabisky.² ¹USDA Natural Resources Conservation Service; ²Kaua‘i Invasive Species Committee.

4. THE BIG ISLAND INVASIVE SPECIES COMMITTEE’S PURPOSE, STRATEGY AND ACCOMPLISHMENTS.
   Laura Hillis. Big Island Invasive Species Committee.

5. FILLING THE GAP: MAUI INVASIVE SPECIES COMMITTEE, AN ISLAND-BASED PARTNERSHIP TO ADDRESS INCipient INVASIVE SPECIES.
   Christy Martin, Jack Peterson and Mike Walker. Maui Invasive Species Committee.

6. STEMMING THE TIDE: HISTORY AND STATUS OF MICONIA (Miconia calvescens) MANAGEMENT ON MAUI AFTER 14 YEARS OF DEVELOPING PARTNERSHIPS AND ESCALATING ACTION.
   Jeremy Gooding¹, Mike Walker², Steven J. Anderson¹, and Aaron Kogan.³ ¹National Park Service, Pacific Islands Exotic Plant Management Team; ²Maui Invasive Species Committee; ³Haleakalā National Park, Resources Management.

7. CONSERVATION PARTNERSHIP PROGRAMS.

8. THE HAWAI‘I GAP ANALYSIS PROGRAM UTILIZES GIS AND REMOTE SENSING TO REFINE STEWARDSHIP DELINEATIONS AND IMPROVE LAND COVER AND SPECIES DISTRIBUTION LAYERS FOR MODELING AND ANALYSES.
   Dan Dorfman¹, Steven Hochart¹, Shannon McElvaney¹, Rick Camp¹, and Marcos Gorresen.² ¹Hawai‘i Natural Heritage Program; ²Pacific Island Ecosystems Research Center, USGS-BRD.

9. STATISTICAL CONSIDERATIONS FOR DEVELOPING EFFICIENT, ADEQUATE, AND DEFENSIBLE MONITORING PROGRAMS.
   Jim Baldwin. USDA Forest Service, Pacific Southwest Research Station.

10. REHABILITATION OF KOA (Acacia koa) FOREST ON LOWER MAUNA LOA, HAWAI‘I VOLCANOES NATIONAL PARK.
    Alison Ainsworth¹, Rhonda Loh², Matthew Schultz¹, and Tim Tunison.² ¹National Park Service, Fire Management Office; ²National Park Service, Division of Resources Management.

11. RESTORATION AND MANAGEMENT IN KALUAA GULCH, HONOULIULI PRESERVE, O‘AHU.
    Trae Menard, Dan Sailer, and Nat Pak. The Nature Conservancy of Hawai‘i.
12. DROUGHT, NITROGEN AMENDMENTS, AND RUSSIAN THISTLE (Salsola Kali) INVASION AT POHAKULOA TRAINING AREA.
   Sean M. Gleason¹ and David T. Faucett.² ¹Environmental Division, United States Army; ²Pacific Cooperative Studies Unit at University of Hawai‘i.

13. EFFECTS OF VARIOUS FIELD-TESTED HERBICIDE/APPLICATION TREATMENT COMBINATIONS ON ESTABLISHED AND INCipient WEED SPECIES IN KÔKE‘E STATE PARK.
   Ellen Coulombe, Katie Cassel, David Alexander, Laura Arnold, Sarah Newton, Kerri Fay, Alison Koepfgen, and Aurora Kagawa. Kōke‘e Resource Conservation Program.

14. SEED COLLECTION MANAGEMENT IN HAWAIIAN PLANT CONSERVATION.
   Alvin Y. Yoshinaga. University of Hawai‘i at Mānoa.

15. UNDERSTORY INVASION OF EUCALYPTUS PLANTATIONS.
   Rebecca Ostertag¹, Christian P. Giardina² and Susan Cordell.³ ¹University of Hawai‘i at Hilo; ²USDA Forest Service, MI; ³Institute of Pacific Islands Forestry, USDA Forest Service.

16. THE ‘ÖPAE‘ULA WATERSHED PROTECTION PROJECT.
   H. Kapua Kawelo¹, Matthew D. Burt¹, Alvin L. Char¹, Vincent J. Costello³, Jordan Jokeil¹, Matthew J. Keir¹, Brent R. Liesemeyer², Jobriath L. Rohrer¹, Craig Rowland³, and Manabu Tagomori.⁴ ¹Department of the Army, Environmental Division; ²Makiki DOFAW Baseyard; ³US Fish and Wildlife Service; ⁴Kamehameha Schools.

17. RARE PLANT REINTRODUCTION: LESSONS LEARNED BY O‘AHU ARMY NATURAL RESOURCE PROGRAM.

   Kim Starr, Forest Starr, and Lloyd Loope. Pacific Island Ecosystems Research Center, USGS-BRD.

19. POPULATION GENETICS OF THE ENDANGERED HAWAIIAN PLANT GENUS HESPEROMANNIA AND IMPLICATIONS FOR CONSERVATION EFFORTS.
   Susan N. Ching Harbin¹, and Clifford W. Morden². ¹Department of Botany, University of Hawai‘i at Mānoa; ²Center for Conservation Research and Training, University of Hawai‘i at Mānoa.

20. BIOLOGICAL INVENTORY AND MONITORING IN THE NATIONAL PARKS OF THE PACIFIC ISLANDS.
   Darcy Hu¹, Sandy Margritér¹, Bryan Harry², and Mashury Waite³. ¹National Park Service, Pacific Islands Support Office at Hawai‘i Volcanoes National Park; ²National Park Service, Pacific Islands Support Office, Honolulu; ³Pacific Cooperative Studies Unit

21. HOME RANGE PATTERNS OF PALILA (Loxioides bailleui) IN A NARROW STRIP OF FOREST ON THE EASTERN SLOPE OF MAUNA KEA.
   T. Colleen Murray, Steve Dougill, and Paul Banko. Pacific Island Ecosystems Research Center, USGS-BRD.

22. METHODS OF CAPTURING KALIJ PHEASANTS (Lophura leucomelanos) IN HAWAI‘I VOLCANOES NATIONAL PARK.
   Samuel N. Aruch, Thane K. Pratt, and John P. Vetter. Pacific Island Ecosystems Research Center, USGS-BRD.
POSTER SESSION

‘IOLANI SUITES V – VII

23. NON-NATIVE FOREST BIRDS: ARE THEY IMPORTANT RESERVOIR HOSTS FOR AVIAN MALARIA?
   **Kelly Kozar**¹, Carter T. Atkinson¹, Eben Gearing¹, Peggy Farias² and Susan I. Jarvi.²
   ¹Pacific Island Ecosystems Research Center, USGS-BRD; ²University of Hawai‘i at Hilo.

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   **Eric VanderWerf.** US Fish and Wildlife Service.

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   **Matthew E. Reiter,** Dennis A. LaPointe, and A. Dan Lease. Pacific Island Ecosystems Research Center,
   USGS-BRD.

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    **Julie K. Lease**¹, Carter T. Atkinson¹, Susan I. Jarvi², Dennis A. LaPointe¹, Peggy Farias³, Helen Baker³,
    Paul Baker⁴, Gregory Massey⁵, Ellen vanGelder⁶ and Holly Freifeld.⁴ ¹Pacific Island Ecosystems Research Center,
    USGS-BRD; ²University of Hawai‘i at Hilo; ³State of Hawai‘i, Division of Forestry and Wildlife; ⁴US Fish and
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   **J. Kiyoko McMurry**¹ and David Foote.² ¹Pacific Cooperative Studies Unit, University of Hawai‘i; ²Pacific
    Island Ecosystems Research Center, USGS-BRD.

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   **William Haines**¹, Lloyd Loope¹, Ellen VanGelder¹, Paul Krushelnický², and Stephanie Joe.³ ¹Pacific Island
    Ecosystems Research Center, USGS-BRD; ²University of California at Berkeley; ³University of Hawai‘i at Mānoa.

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    **Ellen VanGelder**¹ and Mikhail Korzukhin.² ¹Pacific Island Ecosystems Research Center, USGS-BRD; ²
    Institute of Plant Physiology, Russian Academy of Sciences.

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   **John Gutrich**¹, Ellen VanGelder² and Lloyd Loope.² ¹Hawai‘i Pacific University; ²Pacific Islands Ecosystem
   Research Center, USGS-BRD.

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   **Mike Hamnett.** Social Science Research Institute, University of Hawai‘i at Mānoa

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   Samantha Whitcraft¹, Lisa Pytka.² ¹Kaho‘olawe Island Reserve Commission; ²New College of Florida, Sarasota

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   Lianne Mailloux¹, Yonat Swimmer¹, Richard Brill², and Mike Musyl.¹ ¹Joint Institute for Marine and Atmospheric Research, University of Hawai‘i at Mānoa; ²National Marine Fisheries Service, NOAA.

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   David Penn, June Harrigan and Maile Sakamoto. Hawai‘i Department of Health.

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   Reuben H. Wolff¹, Anne M. Brasher² and Jill A. Jenkins.³ ¹Contract Biologist, U.S. Geological Survey; ²US Geological Survey; ³National Wetlands Research Center, USGS-Biological Resources Division, LA.

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41. TREE FROGS (*Eleuthrodatylus coqui* and *Eleuthrodactylus planirostris*) IN HAWAI‘I.

42. BUILDING HAWAI‘I’S FUTURE CONSERVATION WORKFORCE.
   Fred D. Stone¹ and Sharon Ziegler-Chong.² ¹Forest TEAM Program, Hawai‘i Community College at Hilo; ²University of Hawai‘i Hawaiian Internship Program (UH-HIP).
ABSTRACTS

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REHABILITATION OF KOA (Acacia koa) FOREST ON LOWER MAUNA LOA, HAWAI‘I VOLCANOES NATIONAL PARK. Park resource managers are successfully developing techniques to reforest old cattle pastures and to establish native understory species displaced by alien grasses beneath koa forest. Koa-dominated forest communities were reduced to pastures by cattle grazing during the nineteenth and early twentieth centuries. Koa overstory regenerated to a closed canopy forest with the removal of feral cattle in some areas on Mauna Loa; however, pasture grasses: Meadow ricegrass (Ehrharta stipoides), Dallis grass (Paspalum dilatatum), and Kikuyu grass (Pennisetum clandestinum) continued to dominate preventing the development of native understory and continued regeneration of koa. Since 1998, efforts have focused on developing techniques to restore native plants to a pasture and two closed canopy koa forest sites totaling twelve acres. The goal is to create model communities across the full extent of dry to mesic montane koa forest types. Experimental alien grass control efforts in the 1990s determined that direct seeding of native trees is required where the seed bank has been depleted and to augment species diversity. Supplemental outplanting is used for species that are unable to establish through natural or artificial seed banks. Approximately 6,000 plants and over 300,000 seeds representing 13 native species have been planted in koa forest restoration efforts thus far, with over 70% survivorship. Future monitoring will determine if species additions create an environment unfavorable to alien grasses, and allow natural native species regeneration.

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THE CONSERVATION AND MANAGEMENT IMPLICATIONS OF AXIS DEER (Axis axis) DIET AND HOME RANGE. Partial results of a three-year field study of axis deer (A. axis) on Maui are presented. Radio-telemetry data document home ranges during drought conditions that are nearly ten-fold larger then those of other studies. Annual home ranges were similar for both sexes. Minimum convex polygon (MCP) home ranges for bucks (n=3) averaged 1385 +/- 473 hectares. Doe MCP home ranges (n=9) averaged 1345 +/- 555 Ha. These ranges exceed those documented in Nepal (male/female, 183 Ha/135 Ha). Drought was an important factor behind these differences, with entire herds moving several kilometers to find forage. The conservation implications of axis deer foraging preferences for Maui are severe. Worldwide, A. axis has been documented to consume 428 plants species, representing 84 plant families. As grazers, they eat broadly within the poaceae (>104 species), but also eat widely within other families: fabaceae (>50), asteraceae (>24), cyperaceae (>23), rubiaceae (>22), euphorbiaceae (>21) and malvaceae (>14). In Hawai‘i, they are documented eating rare species and several genera (Panicum, Cenchrus, Hibiscus, Sida, Diospyros, Waltheria, Santalum) containing threatened species on Maui. Deer foraging also likely spreads grasses and other plants into pristine areas. These foraging data document the deer’s potential threat to Maui’s native species. Home range data helps identify the spatial scale over which management should act to protect native species and watersheds.

Timmy Paulokaleioku Bailey, Gale Plana, and Cathleen Natividad

Haleakala National Park, PO Box 369, Makawao, HI 96768
NEW METHODS AND INSIGHTS FOR CONTROLLING FERAL CATS (*Felis catus*) IN ENDANGERED BIRD HABITATS. Conservation managers throughout Hawai‘i know that feral cats (*Felis catus*) are notoriously difficult to control. Feral cats often avoid cage-type live capture traps and may be few in numbers, making for labor-intensive control. Managers are also posed with the problem possibly of capturing endangered birds in traps. Intensive trapping for feral cats in Haleakalā Crater occurred from October 2001 through May 2002. New, successful control techniques were developed to capture cats and avoid capturing endangered Nēnē (*Branta sandvicensis*) and endangered ‘Ua‘u (*Pterodroma phaeopygia sanwichensis*). Trapping was successful not only because of trapping methods, but by understanding different feral cat behaviors. Categories for behaviors include varying degrees of "domestic", "wild" and "feral" cats. We experimented with a variety of baits including, scents, lures, and calamari. Scents and lures were marginally successful at luring cats to traps. Dangling pieces of calamari were most successful. Information in this project is useful for managers attempting to control low numbers of feral cats in remote areas. "Soft catch" leg-hold and cage-type live traps were placed strategically so as not to capture endangered birds. Leg-hold traps were more successful than live traps for wild and feral cats.

**Jim Baldwin**

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STATISTICAL CONSIDERATIONS FOR DEVELOPING EFFICIENT, ADEQUATE, AND DEFENSIBLE MONITORING PROGRAMS. When developing monitoring programs there are several statistical issues that when appropriately addressed can enhance the probability of success. Those issues are summarized as follows: (1) Specify a set of objectives, (2) Define the spatial and temporal statistical population, (3) State the population parameters of interest, (4) Define a sampling frame, (5) Stratify (if necessary), (6) Select a sampling protocol, (7) Decide on a measurement protocol, (8) State a specific estimation procedure, and (9) State reporting units. Going through these issues is an iterative process and the end result should be a monitoring program with the proposed analyses actually capable of addressing the objectives with the proposed data to be collected with respect to both the type and amount of data. An example about monitoring the status of an endangered bird will illustrate the process.

**Antonio Bentivoglio**

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MITIGATION OF CORAL REEF IMPACTS IN THE PACIFIC ISLANDS FROM FEDERAL PROJECTS. Executive Order 13089 on Coral Reef Protection (EO, signed on July 11, 1998) created the Coral Reef Task Force which wrote the National Action Plan to Conserve Coral Reefs. The Action Plan lays out a science-based road map to achieve healthy coral reefs. This report surveys completed Federally funded or permitted projects in the Pacific with unavoidable impacts to coral reef ecosystems and assessed compliance and effectiveness of compensatory mitigation for these losses. This report found 39 projects where there was some measurable loss to the coral reef ecosystems. Compensatory mitigation was recommended for 20 of the projects (51%) and there was 50 percent compliance (10 projects) with these recommendations. For eight projects (80%), where compensatory mitigation was implemented, monitoring or follow-up surveys were conducted. Only five of these projects were effective in compensating for some loss of coral reef resources. These five projects mitigated 15 acres from the total acres of coral reef habitat lost. Current forms of compensatory mitigation are all marine based. Land-based activities affecting nearshore water quality such as runoff, offshore sewage disposal, and injection wells for desalination plants can have large impacts on coral reefs. The future Interagency Coral Reef Mitigation Policy will need to be inclusive and therefore address increasing watershed health as a potential form of compensatory mitigation for losses to the coral reef ecosystem.

**Naomi D. Bentivoglio** and **Joy M. Hiromasa**

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CONSERVATION PARTNERSHIP PROGRAMS. Hawai‘i is home to a large number of species listed as threatened or endangered under the Endangered Species Act, relatively few of which are located on Federal lands. Therefore, to reach out to non-Federal partners, the Fish and Wildlife Service uses a variety of voluntary habitat restoration...
provides non-Federal landowners with assurances that their efforts will not encumber their lands in the future. A sample of projects includes partnering with the State's Environmental Workforce, reintroducing Nēnē (Branta sandvicensis) to Moloka‘i after it has been absent from the island for more than 100 years, participating in the ‘Ōla‘a-Kilauea Partnership on the Island of Hawai‘i, and protecting the Kaua‘i cave wolf spider (Adelocosa anops) and the Kaua‘i cave amphipod (Spelaeorchestia koloana) in the Koloa Caves on Kauai, among others. These efforts help willing non-Federal landowners to dedicate portions of their land to recover threatened and endangered species in Hawai‘i and to protect Hawai‘i’s natural heritage.

Carl Berg, Jan M. Surface, and Maka‘ala Ka‘umoana

Hanalei Heritage River, P.O. Box 1285, Hanalei, HI 96714

HANALEI RIVER HUI: VOLUNTEER WATER QUALITY MONITORING GUIDES FURTHER STUDY BY STATE DEPARTMENT OF HEALTH. The Hanalei Heritage River Program (HHRP) has concerns that cesspools and septic systems for the entire town of Hanalei may be contaminating the ground water that eventually finds its way into Hanalei Bay and River. Community volunteers with HHRP sample water at the Hanalei Pier four times a week for Enterococcus as an indicator of wastewater pollution. The Hawai‘i State Department of Health (DOH) also samples weekly at the Hanalei Pier. In response to HHRP water quality data, the County closed the restrooms at Black Pot Park on February 7, 2002. Fifteen samples for the four weekends prior to the restroom closure had a mean Enterococcus value of 124.7/100 ml (federal standard is 35/100ml). Fifteen samples for the four weekends after the closure had a mean Enterococcus value of 27.7/100 ml. DOH felt that Black Pot Park facilities may contribute to groundwater pollution and ordered a fluorescence dye study to determine if wastewater goes directly into the Hanalei River or Bay. Preliminary results showed no dye in the bay. DOH and an assigned county engineer overseeing the project are working on ways to improve the wastewater facility at Black Pot Park, including the addition of chlorine tablets to kill bacteria as the water enters the leach field. HHRP is continuing to sample the waters of Hanalei River and Bay, but it is time to start considering a centralized sewage treatment plant for Hanalei.

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PROTECTING KAUA‘I’S BIODIVERSITY FROM INVASIVE SPECIES: A COOPERATIVE APPROACH. The Kaua‘i Invasive Species Committee (KISC) is a voluntary partnership of government, private and nonprofit organizations, and concerned individuals working to exclude, contain and manage the most threatening invasive plant and animal species on Kaua‘i. KISC was established in the fall of 2001 as part of a combined state-wide effort to conserve Kaua‘i’s native biodiversity and minimize adverse impacts caused by alien species within the context of economic, social and ecological values. Kaua‘i’s high rate of endemism (highest in the Hawaiian archipelago and quite possibly the world, with a total of 224 endemic plants) make it a biodiversity hotspot of global magnitude. Kaua‘i has over 95 threatened and endangered species federally listed by the US Fish and Wildlife Service. Invasive species pose the largest threat to Kaua‘i’s biodiversity as well as to Kaua‘i’s watersheds and water resources, tourism-based economy, agriculture, health, and the general quality of life. This poster presentation will display information concerning Kaua‘i’s unique biodiversity and KISC’s top-priority noxious species: PLANTS- Miconia (Miconia calvescens), Long Thorn Kiawe (Prosopis juliflora), Fireweed (Senecio madagascariensis); ANIMALS-Little Red Fire Ant (Wasmannia auropunctata), Coqui Frog (Eleutherodactyl coqui), Greenhouse Tree Frog (Eleutherodactylus planirostris).

Ellen Coulombe, Katie Cassel, David Alexander, Laura Arnold, Sarah Newton, Kerri Fay, Alison Koepfgen, and Aurora Kagawa

Kōke‘e Resource Conservation Program, P.O. Box 100, Kekaha, HI 96752
EFFECTS OF VARIOUS FIELD-TESTED HERBICIDE/APPLICATION TREATMENT COMBINATIONS ON ESTABLISHED AND INCipient WEED SPECIES IN KÔKE’E STATE PARK. One of the greatest threats to the beautiful and rare montane ecosystems of Kaua’i is displacement by non-native species. The Kôke’e Resource Conservation Program (KRCP) is a volunteer based alien species control program that involves the public in protecting these valuable resources through hands-on service learning projects in weed removal. In the four years the program has been in operation, over 10,000 volunteer hours have contributed towards the removal of 4,026,182 invasive weeds from 1,100 acres in Kôke’e State Park, Kaua’i, Hawai’i. This poster qualitatively describes a variety of field-tested herbicide/application combinations which generates adequate mortality among our problematic incipients. Examples include: Privet (Ligustrum sinense): Frill, Garlon (20% in Forest Crop Oil (FCO), Cup of Gold (Solandra maxima): drizzle, Garlon (20% in FCO) or Escort (4 grams per gallon of water), Honeysuckle (Lonicera japonica): notch or basal bark with Garlon (20% in FCO), Firethorn (Pyracantha angustifolia & crenatoserrata): cut stump or frill, Garlon (20% in FCO), Butterfly Bush (Buddleia madagascarensis): foliar spray, Escort (4 grams per gallon of water) or notch, Garlon (20% in FCO). KRCP is sponsored by Hui o Laka/Kôke’e Museum and the Hawai’i Department of Land & Natural Resources (DLNR), State Parks Division and is funded by the Hawai’i Community Foundation, the US Fish & Wildlife Service, the US Forest Service, The Nature Conservancy, and private donations.

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TOWARDS A WEED RISK ASSESSMENT PROGRAM FOR HAWAI’I AND THE WESTERN PACIFIC ISLANDS. A statewide program to limit the impact and spread of invasive exotic plants should include an easily applied, objective, reliable mechanism for assessing the likelihood that a species will become invasive in native or managed ecosystems. Recent evaluation by Daehler and his students suggested that of the weed risk assessment programs currently in use, an adaptation of the system developed by the Australian Quarantine and Inspection Service (AQIS) gave the most reliable assessments for plants introduced to Hawai’i. The program relies on a variety of species attributes, including behavior where introduced elsewhere, environmental requirements, and reproduction and dispersal characteristics. We used a modified AQIS program adapted for Pacific Island climates to screen 200 species of trees, shrubs, herbs, and vines. Species were selected from lists of plants recommended for use in Hawai’i or the high islands of the Western Pacific. This list of species also was evaluated independently by more than 20 professionals with taxonomic and field expertise in the region. We asked them to use their experience to evaluate the current and future impact of these species on native and managed ecosystems. We will compare the results of both evaluation processes and discuss their use for developing plant importation and use protocols for island environments.

Jan Dierking

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A SOCIO-ECONOMIC STUDY OF THE AQUARIUM FISH INDUSTRY IN HAWAI’I. The trade in marine aquarium fishes is a global industry of $200 million in retail annually, driven by the demand of hobbyist aquarium owners. The US represents 60% of the worldwide market. It is also a supplier of over 650,000 fishes annually. Of this harvest, 70% comes from Hawai’i, where concern about over-collecting arose as early as 1973. The state harvest increased from 90,000 fishes in 1974 to over 460,000 in 1997. This study focuses on the Kona coast of Hawai’i where about 50 collectors own commercial licenses. It is estimated to be the most important catch area of Hawai’i. Resource conflicts with the tourism industry, especially dive and snorkel tour operators, and public conservation efforts resulted in the establishment of 35% of the coastline as aquarium no-catch areas (so called Fish Replenishment Areas, FRAs) in 2000. Future sustainable management taking into account interests of different user groups will require accurate data. However, due to non-enforcement of filing of catch reports, in theory required by law, information on the aquarium fish industry is scarce. This study will increase our understanding of the aquarium fish trade in Hawai’i by conducting interviews and surveys of aquarium fish collectors in Kona. Entering a dialogue with collectors will enhance knowledge about their perceptions and the economic value and structure of the industry, and estimates of collection volumes necessary for an effective management of this resource.
THE HAWAI’I GAP ANALYSIS PROGRAM UTILIZES GIS AND REMOTE SENSING TO REFINE STEWARDSHIP DELINEATIONS AND IMPROVE LAND COVER AND SPECIES DISTRIBUTION LAYERS FOR MODELING AND ANALYSES. The Hawai‘i Gap Analysis Program (HIGAP) is part of a nationwide USGS effort to assess the extent to which native animal and plant species are being protected. The fundamental concepts of GAP were exemplified by the USFWS Forest Bird Surveys of the late 1970’s and early 80’s which assessed the distribution of a key vertebrate species against the distribution of protected areas. These surveys were conducted in order to identify gaps in protection and thus make strong recommendations for future conservation management. Advances in technology, remote sensing, and geographic information systems (GIS) have made it possible to improve and refine our techniques for conducting GAP analysis. This year alone HIGAP has created the first statewide stewardship layer delineating the boundaries, degree of management, ownership, and watershed partnership affiliations of all public lands at the parcel level. It has also finished the mapping of the Hawai‘i Stream Assessment’s aquatic species data based upon the biophysical attributes of the streams (e.g., degree of slope, presence of water falls, etc.). In addition, new techniques have been developed for land cover mapping and bird species density and distribution models using Landsat TM multispectral satellite imagery. GIS layers produced by HIGAP will assist land managers, researchers, and planners in making scientifically sound recommendations for future conservation management.

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DROUGHT, NITROGEN AMENDMENTS, AND RUSSIAN THISTLE (Salsola Kali) INVASION AT PŌHAKU-LOA TRAINING AREA. Russian thistle, an introduced tumbleweed, is invading native lovegrass (Eragrostis atropioides) and oweoweo (Chenopodium oahuense) shrublands at Pōhaku-loa Training Area, U.S. Army. We compared gas exchange and tissue-water relationships among Russian thistle, lovegrass, and oweoweo to determine if Russian thistle invasion may be influenced by drought or soil N availability. Russian thistle produced 47% and 49% more aboveground biomass than did lovegrass or ‘oweoweo, respectively. Amax and stomatal conductance were similar among all species subjected to leaf-to-air vapor pressure differences. Root:shoot ratios were significantly lower for Russian thistle than for either of the two native species. Estimates of bulk modulus of elasticity and the relative water content at the turgor loss point revealed that Russian thistle possessed more elastic leaf and stem tissue than lovegrass. Osmotic pressure measurements at full turgor indicated that Russian thistle is able to maintain higher turgor pressures at most relative water contents than either of the native species during periods of drought stress. RGR of all species responded similarly to N treatments. The results of this experiment suggest that Russian thistle invasion may be exacerbated by periods of low soil-water availability.

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STEMMING THE TIDE: HISTORY AND STATUS OF MICONIA (Miconia calvescens) MANAGEMENT ON MAUI AFTER 14 YEARS OF DEVELOPING PARTNERSHIPS AND ESCALATING ACTION. From discovery of miconia (Miconia calvescens) in a botanical garden in 1988, knowledge of miconia distribution and resources devoted to control on Maui have steadily increased. Early control efforts lagged due to insufficient resources chasing a rapidly expanding problem. Recent partnership developments and increases in support from federal, state, county...
and private entities have dramatically increased the level of miconia invasion knowledge and the scope of control work. Major escalation in the miconia war began in 1999 with systematic reconnaissance and control by the Maui Invasive Species Committee (MISC). In 2000, the National Park Service Exotic Plant Management Team (EPMT) was organized as a rapid response weed assessment and control force. In 2002, Haleakalā National Park initiated several new measures supporting miconia operations. Other programs such as the Emergency Environmental Workforce (EEWF) have also contributed significantly. Currently, knowledge of miconia distribution and density on Maui has stabilized, suggesting adequate problem assessment. As we enter the next stage of management, we will see if additional resources, added to the long-time effort from entities such as the Division of Forestry and Wildlife (DOFAW) and The Nature Conservancy (TNC), will stem the tide of miconia. With an estimated 30,000 acres of potentially infected forest requiring at least aerial reconnaissance, we are on the cusp of witnessing either growing success controlling miconia, or a continuation of the theme: too few resources too late.

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MANIA FOR Wasmannia: INVOLVING K-12 EDUCATORS AND STUDENTS IN CONSERVATION RESEARCH. The GK-12 program of the National Science Foundation, funded through the Ecology, Evolution and Conservation Biology Program at the University of Hawai‘i, establishes learning partnerships between graduate students and K-12 teachers. Fellows are mentors and incorporate their own research, emphasizing perspectives of evolutionary and conservation biology, into school curricula to assist teaching standards-based lessons. We describe one fellowship project that developed a curriculum in intermediate and high school classrooms on east Hawai‘i Island aimed at a newly introduced species of fire ant. The “little fire ant” (Wasmannia auropunctata) was discovered on the Big Island in 1999, and is known from other introduced localities to be a severe threat to agriculture, human health, and biodiversity. Students participate in conservation action, with schoolyard and homework collections of this ant contributing to a distribution map. Students have discovered one new population of the little fire ant, and two new ant species never recorded from the Hawaiian Islands. Student collections, however, cannot replace systematic surveys but do act as complementary random sampling with significant educational potential. Greater public sensitivity to the problem of alien species in general may prevent future introductions and create early warning networks of informed citizens. Continuing challenges include installing data quality control measures, development of free-standing curricula, interactive ant identification keys, and web-based GIS with remote data entry. The curriculum may “boilerplate” into curricula targeted at other noxious potential pests, including the dreaded red imported fire ant (Solenopsis invicta).

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POTENTIAL ECOLOGICAL AND ECONOMIC IMPACTS OF INTRODUCED RED IMPORTED FIRE ANTS (Solenopsis invicta) IN HAWAI‘I. The Red Imported Fire Ant (RIFA), Solenopsis invicta, has become a major pest throughout the southern United States. RIFA as an invasive nuisance species has created health problems for humans and animals, and caused substantial damage to irrigation systems, electrical circuits, and machinery. In Texas alone, fire ant damages and expenditures are estimated to exceed $1 billion dollars annually. RIFA has invaded California with damages forecasted to exceed $3 billion over the next 15 years if left unchecked. Invasion of RIFA into
Hawai‘i could have significant adverse impacts on the Hawaiian economy and people. Minimizing economic costs of RIFA involves addressing the tradeoff between abatement costs (efforts to stop RIFA) and damages to economic sectors caused by RIFA. In this study, an ecological-economic simulation model is utilized to estimate the dynamic effects of RIFA spread over time in consideration of RIFA biology (i.e., reproduction and rates of spread), different levels of expenditures and control efforts, and potential economic damages. Analyses are conducted to: 1) highlight the potential economic damages and economic sectors at risk from a RIFA invasion in Hawai‘i and 2) address policy options for decision-makers attempting to minimize the economic costs from a RIFA invasion.

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DEMOGRAPHY OF THE THREATENED HALEAKALĀ SILVERSWORD (Argyroxyphium sandwicense ssp. macrocephalum): IMPLICATIONS FOR CONSERVATION AND RESTORATION. Matrix population models are useful tools for analyzing the structure and dynamics of natural populations. These models use average transition rates among age or stage classes to assess population viability and to project future population size and structure. We used nearly 20 years of demographic data to develop a stage-based population model for the threatened Haleakalā silversword (Argyroxyphium sandwicense ssp. macrocephalum), a long-lived, monocarpic plant endemic to Maui, Hawai‘i. Individuals were classified into one of five stage classes, based on size and reproductive status. Fifteen year-pairs of data, collected from eleven permanent plots between 1982 and 2001, were analyzed. Silversword recruitment and flowering varied greatly among years. Stasis was the most likely fate for all non-reproductive stage classes, averaging 80-90% of all transitions. The probability of death sharply declined as plants increased in size, although all stages were more susceptible in drier years. Between 1997 and 2001, the number of plants in the permanent plots declined markedly, the result of both decreased survivorship and reduced recruitment, possibly due in part to a prolonged drought on Maui. Sensitivity and elasticity analyses, which determine the relative contribution of each stage class to the population growth rate, suggest that survivorship has a greater impact on population growth rate than does fecundity. We discuss the potential consequences of various threats and management options for the future of the Haleakalā silversword population.

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THE PO‘OULI (Melamprosops phaeosoma): PROGRESS TOWARDS RECOVERY THROUGH HANDS-ON MANAGEMENT. The Maui Forest Bird Recovery Project has successfully conducted a recovery initiative for the Po‘ouli (Melamprosops phaeosoma), widely considered to be one of the World’s rarest birds – with only three known individuals. Ongoing monitoring has confirmed the absence of breeding activity due to geographical separation. An Environmental Assessment in 1999 recommended a translocation, in an attempt to form a breeding pair in the wild. Following two years of required experimental trials, the Maui Forest Bird Recovery Project recently led a multi-agency translocation attempt that successfully moved a female Po‘ouli into the male’s home range. The female was held briefly in captivity, fitted with a radio transmitter, and then released in the known vicinity of the male, where her movements were monitored by radio telemetry. The female roosted overnight near the male, but eventually flew back to her own home range. Despite her return, a wealth of new biological information was gained from this field initiative. Observations of her feeding behavior when held in field-captivity, an account of the hiked translocation, and her post-release movements in Hanawāi obtained from 10 days of radio-tracking data will be presented. Field observations of the radio-tracked female confirmed her close association with several Maui Parrotbill individuals. The overall translocation result suggests that a more extensive form of field-captivity may be needed to bring about a wild breeding pair. This recovery technique is currently the only alternative strategy to captive propagation for the Po‘ouli.

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EVALUATION OF A CONTAINMENT STRATEGY FOR THE ARGENTINE ANT AT HALEAKALĀ NATIONAL PARK – THE FIRST FOUR YEARS. The Argentine ant (*Linepithema humile*) was first documented from Haleakalā National Park in 1967. Its range has since expanded to include two distinct populations covering more than 485 hectares (1200 acres) in the Park and adjacent private lands. Hawaiian biota evolved in the absence of ants and are highly vulnerable to ant predation. This is the only harmful ant species currently in Hawai‘i that can occupy high-elevation areas, where it exerts strong negative effects on endemic invertebrate populations, including essential pollinators. We have therefore implemented an experimental containment strategy to prevent ant spread. Beginning in 1997, a granular, protein-based bait has been applied annually by helicopter to a 120m-wide band along ant population margins. Here, we evaluate the effectiveness of the first four years of boundary treatments, 1997-2001. By comparing rates of population expansion since 1997 to earlier rates, we estimate that the treatments have protected 145 hectares (360 acres) from ant invasion, as of the year 2001. Although the treatments have nearly halted ant spread in some locations, ant spread has continued in others, though at a slower rate than would have been expected without treatments. The boundary treatments are worthwhile, but to be ultimately successful, we must completely contain the Argentine ant within the Park, and preferably reduce its range. Since our current methods fall short of this goal, we must continue to improve them by exploring alternative products and techniques.

Mike Hamnett

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) COASTAL OCEAN PROGRAM FUNDS HAWAIIAN INITIATIVE. The Hawai‘i Coral Reef Initiative Research Program was established in 1998 to support research and monitoring of coral, algae, fish, and other marine species to ascertain what changes result from human activity. From this, resource managers can determine if regulations and other management measures are needed to preserve our coral reef ecosystems. The Program is currently in its fourth year of operation and has grown to fund 10 research projects aimed at managing and protecting Hawai‘i’s coral reefs. The program is managed by a dynamic partnership between the University of Hawai‘i and the State’s Department of Land and Natural Resources’ Division of Aquatic Resources. The Program works with county, state, and federal agencies and private organizations to achieve three primary goals: 1) Assess major threats to coral reef ecosystems, 2) Build resource management capacity, 3) Conduct public awareness programs. Projects currently funded include an investigation of new technologies to determine algal health (relevant for grading permit and water quality violations) and land-coastal interactions, amongst others. For more information, call 956-7479 or go to our website: www.Hawaii.edu/ssri/hcri.

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POPULATION GENETICS OF THE ENDANGERED HAWAIIAN PLANT GENUS HESPEROMANNIA AND IMPLICATIONS FOR CONSERVATION EFFORTS. The purpose of this study was to conduct basic genetic and biological research on the Hawaiian hesperomannia (*Hesperomannia spp.*) for use in the conservation of the genus. This endemic genus contains three species (*H. arborescens, H. arbuscula*, and *H. lydgatei*), all of which are federally listed as endangered. The degree of genetic variation within and among species and populations was analyzed using RAPD molecular data. Initial results indicate that within the genus there is overall low genetic variation. Among the three species, varying degrees of rarity are associated with different degrees of genetic diversity. For instance, *H. arborescens*, the most broadly distributed species, appears to contain the least amount of genetic variation. In contrast, some *H. arbuscula* populations on O‘ahu have smaller, more geographically restricted populations with higher genetic diversity. Knowledge regarding the level of inbreeding and genetic drift for each species and population will be beneficial in determining conservation strategies for these species.
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INTRODUCED PATHOGENS AND PERSISTENT BIRD POPULATIONS IN HAWAI’I: BIOCOMPLEXITY OF AN EVOLVING DISEASE SYSTEM. Avian malaria and pox are known to have severe detrimental impacts on native bird populations in Hawai’i, leading to the near-absence of native birds from most low-elevation habitats, where mosquito vectors are abundant. The "Biocomplexity of Introduced Avian Disease" project is investigating host species, vectors, and parasitic infections in 9 ‘ōhi’a-dominated forests from sea level to 1800 m on eastern Mauna Loa. We have detected year-round presence of the southern house mosquito (Culex quinquefasciatus), the vector of avian malaria, in 3 low-elevation forests. Mosquitoes infected with malaria have been found at all 3 sites, demonstrating that local disease transmission is occurring. Nonetheless, the forests continue to harbor high densities of the native Hawai’i ‘Amakihi (Hemignathus virens). ‘Amakihi are resident and breeding at low elevations in densities approximately 2-3 times those found at high elevations (16.2 birds captured/100 net-hrs and 5.7 birds/count period at low elevations, compared with 5.7 birds/100 net-hrs and 2.1 birds/count period at high elevations). ‘Amakihi persist despite extremely high prevalence rates of malaria (60-90% of birds infected). Laboratory challenge experiments lend support to the idea that the primary reservoir of avian malaria at low elevations on Hawai’i is the Hawai’i ‘Amakihi. The genetic, epidemiological, immunological, and demographic basis for persistence of these populations is the subject of ongoing research. In the face of expanding mosquito populations and continued threat of disease, understanding how these populations persist may hold the key to preservation of other native bird species in Hawai’i.

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IMPACTS OF EDUCATIONAL GROUPS ON HAWAIIAN TIDEPOOLS AND REEF FLATS. The Waikiki Aquarium, a unit of the University of Hawai’i at Mānoa, has offered reef flat and tidepool exploration classes for school groups and the general public for over 20 years. These programs emphasize awareness, appreciation and conservation of shoreline habitats and marine life. The Aquarium also offers yearly training for educators on reef ecology and on how to conduct low impact marine fieldtrips. Studies by the Aquarium have looked at trampling impacts of our programs on reef flats, types and numbers of organisms touched or picked up by students on school led outings, as well as numbers of students and sites most popularly used by school groups. Results show that over 2000 students and teachers (grades K-12) visit less than 10 nearshore sites each year, with 3-4 highly favored sites used most frequently. Students tend to touch or collect the visible/ mobile invertebrates and turn approximately one rock per participant. On one algal dominated reef flat, trampling at very low levels (30 people/event, 8 events/4 months) had minimal impact on macroalgal populations, but studies at moderate and higher levels are needed. Overall, given the very small number of locations used by school groups, monitoring of the most popular sites is recommended. Impacts from all groups (educational and local users) and natural fluctuations need to be understood to maintain resource integrity in these high use areas.

Laura Hillis
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THE BIG ISLAND INVASIVE SPECIES COMMITTEE’S PURPOSE, STRATEGY AND ACCOMPLISHMENTS. Since 1999 the Big Island Invasive Species Committee (BIISC) has been working to prevent new invasive pest infestations on the island of Hawai’i, to stop newly established pests from spreading and to support efforts to control, contain or eradicate established pests. BIISC, a voluntary partnership of private, government and non-profit organizations and individuals, is concerned about all non-native invasive pests threatening native ecosystems, agriculture, industry, human health, or the quality of life within Hawai’i County. This year a Rapid Response Team has been established to survey, map and initiate control of incipient populations of priority non-native invasive plants. In addition to completing detailed mapping of target species, a survey of invasive plants along the Belt Highway is being conducted as part of an early detection strategy. As new information is gathered in these surveys BIISC’s list of target species and courses of action are continually redefined. With both the Rapid Response Team and Operation Miconia (established in 1996) in place, BIISC was in an excellent position to oversee the Emergency Environmental Work Force whose efforts vastly augmented invasive species control work on the Big Island.

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GAP ANALYSIS AND ITS ROLE IN HAWAIIAN STREAM CONSERVATION AND RESTORATION. Hawai’i’s one and only statewide assessment of the physical and biological condition of its streams was completed in 1978 and even then, indications were that the overall biological integrity of streams was declining at an alarming rate. Nearly a quarter century later, little progress has been made toward the development of a comprehensive stream assessment framework or implementation of a much needed systematic island-wide stream survey effort. To establish a foundation for such an endeavor, the Hawai’i GAP Analysis Program is developing an aquatic data management framework utilizing the organizing power of the Geographical Information System (GIS) beginning with a statewide stream classification module which will serve as an engine for testing predictive models related to aquatic species distribution and stream habitat condition. Stream surveys of habitat and biological integrity using the Hawai’i Stream Bioassessment Protocol will provide the robust sampling methodology needed to determine the current status of streams as well as test the validity of species and habitat models generated. GIS coverages produced in Aquatic GAP and accessible via the Internet will improve the quality, level, and usability of information necessary to jump start future stream assessment, conservation, and restoration programs in Hawai’i.

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BIOLOGICAL INVENTORY AND MONITORING IN THE NATIONAL PARKS OF THE PACIFIC ISLANDS. To better care for park resources, Congress has directed the National Park Service to conduct biological inventories, and to plan and implement long-term monitoring. Nationwide, parks have been grouped into 32 inventory and monitoring networks to economize on effort and expertise. The Pacific Islands Network consists of six parks in Hawai’i and three parks in the western and central Pacific. Our biological inventory goal is to document 90% of the vascular plants and vertebrates in each park. Reflecting gaps in our knowledge, common inventory themes across Hawai’i parks include herptofauna, bats, and marine surveys. Targeted field inventories are now underway. This year, our network received funding to plan long-term ecological monitoring. Our monitoring goals are to document the status and trends of park ecosystems, detect adverse changes in a timely manner, and determine if management actions are improving or sustaining ecosystem health. Presently, we are assembling information on existing and past monitoring and present and potential threats. Over the next year, we will construct conceptual models to articulate key processes, components, and/or threats. This information will help us identify park “Vital Signs,” or indicators of ecosystem health, for monitoring. We will be asking our colleagues in agencies, institutions, and organizations to
participate in this identification process. Our monitoring planning represents the opportunity to collaborate with others to increase the scale of our work and the power of our conclusions for the benefit of shared resources.

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ECOSYSTEM-SCALE IMPACTS OF THE INVASION OF ALBIZIA (*Falcataria moluccana*) INTO NATIVE WET LOWLAND FORESTS OF HAWAI’I. Invasive species pose major threats to the integrity and functioning of ecosystems in Hawai’i. Previous studies have shown that when particular invasive species introduce a new biological process into an ecosystem, they have the potential to substantially alter the functioning of that ecosystem. In effect, such species change the fundamental rules by which other species must survive and reproduce. Here we present results regarding the degree to which albizia (*Falcataria moluccana*) - an alien nitrogen-fixing tree native to Indonesia - substantially increases nitrogen inputs into wet forests growing on young lava substrates in the Puna District of Hawai’i. We demonstrate that albizia is capable of facilitating the invasion of other alien species (e.g. strawberry guava, *Psidium cattleianum*) that would otherwise be prohibited from invading such young, nitrogen-limited systems. Results indicate that monthly rates of litterfall and nitrogen inputs were 4 to 8 times higher under albizia canopies compared to those away from albizia canopies. Nitrogen availability was also substantially higher in soils sampled under, compared to away from, albizia canopies. Further, while ‘ōhi’a (*Metrosideros polymorpha*) individuals dominated study sites away from albizia canopies, the presence of closed canopies of albizia resulted in nearly 100% mortality of this native tree. In contrast, strawberry guava was virtually absent from sites away from albizia canopies but reached densities as high as 14,000 stems/ha at sites under those canopies.

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BIOLOGICAL CONTROL AS A TOOL FOR MANAGING STRAWBERRY GUAVA (*Psidium cattleianum*). A decade of biological studies of insects attacking strawberry guava (*Psidium cattleianum*) in its native Brazil have identified several potential biological control agents that are highly specific and damaging to their host plant, one of Hawai’i’s worst invasive weeds. The most promising of these agents is *Tectococcus ovatus*, a leaf-galling scale insect capable of severely restricting plant growth and reproduction. Studies completed to date indicate that *T. ovatus* poses no threat to related plants such as common guava (*Psidium guajava*) and ‘ōhi’a lehua (*Metrosideros polymorpha*). Plants growing in association with *P. cattleianum* were examined at field sites in southern Brazil, and only *P. cattleianum* and its close relative, *P. spathulatum*, were found attacked by *T. ovatus*. Members of the family Myrtaceae in Brazil not attacked by *T. ovatus* include *P. guajava, Eugenia spp., Callistemon salignus, Eucalyptus grandis, and Pimenta acuminatus*. Hawaiian plants exposed to *T. ovatus* in the laboratory include the natives *M. polymorpha* and *Wikstroemia* sp., and the non-natives *P. guajava, Eucalyptus citriodora, Eucalyptus globulus, Melaleuca quinquenervia, Syzygium jambos, Syzygium malaccense, Lythrum maritimum, Cuphea ignea, and Cuphea hyssopifolia*. None of these species were damaged by *T. ovatus* or permitted gall development. Ongoing research is designed to quantify the impact of *T. ovatus* on varieties of strawberry guava targeted in Hawai’i. Although this impact is expected to be substantial, additional efforts are needed to integrate biocontrol with other strategies for controlling strawberry guava and restoring invaded forests.

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DRIYLAND RESTORATION AND ENDANGERED SPECIES MANAGEMENT AT KANAIO TRAINING AREA, MAUI. Kanaio Training Area (KNTA), Maui is the Hawai’i Army National Guard’s largest training area and the focus of a long-term restoration project. The arid 4,707 training area located on the south slope of Haleakalā extends from 200 – 1800 feet above sea level. Comprised mostly of ‘a‘ā lava flows, KNTA contains several remnant
vegetation types (seasonal and perennial dryland forest), and habitat for numerous significant native species, including Blackburn’s moth (*Manduca blackburnii*) and tree-form ‘ohai (*Sesbania tomentosa f. arborea*). These resources have been severely impacted by drought, competition with non-native species and ungulate pressure. In March 2000, a 21-acre ungulate-proof exclosure was constructed to protect an ‘a‘ali‘i (*Dodonaea viscosa*) kipuka. Although low in diversity, this site is a relatively weed-free, isolated safe haven for experimental restoration of native flora and out-planted rare, threatened and endangered species. We compared vegetation changes over time in response to the exclusion of ungulates and supplemental scattering of 135,000 seeds from 18 Maui species. Preliminary results are extremely encouraging. Germination of seed-scattered species and natural recruitment of lianas, shrubs and trees has been observed. Protected dryland trees such as hao (*Rauvolfia*), ‘ohe makai (*Reynoldsia*), and lama (*Diospyros*) are flushing with new growth. To protect the integrity of the kipuka, we conduct annual surveys for fountain grass (*Pennisetum setaceum*) and other cooperative projects with Ulupalakua Ranch, Maui Invasive Species Committee, Haleakalā National Park, Department of Land and Natural Resources and the Emergency Environmental Work Force.

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NESTING HAWKSBILL TURTLES (*Eretmochelys imbricata*) ON THE ISLAND OF HAWAI‘I. The hawksbill turtle is indigenous to Hawai‘i and is the rarest of sea turtles in the Pacific Ocean. In the United States, recent hawksbill nesting has been documented only in southern Florida and in the Hawaiian Islands. In the Hawaiian Islands, regular nesting has been documented on Moloka‘i, Maui and Hawai‘i with nearly 90% of nesting turtles occurring on Hawai‘i. From 1989 to 2001, we located ten nesting beaches and regularly monitored the principal sites. The nesting season, from egg laying to hatching emergence, began in late May and extended to January with the peak egg laying period from late July to mid September. A total of 52 turtles were tagged and 438 nests were documented, most occurring at two principal sites, Kamehame and ‘Äpua. Individual turtles laid between one and six clutches per season. Mean nest success was 74.2%. The mean interval from nesting to renesting within a season was 20.7 days, the mean clutch size was 178.3 eggs, and the mean incubation period was 64.2 days. Following the nesting season, hawksbill turtles migrated to their resident foraging habitat, primarily along the Hämäkua coast of Hawai‘i. After two to five years, these turtles returned to their same nesting beach, demonstrating a high degree of nest site fidelity. The primary limiting factors affecting nesting and hatching success were predation by mongooses, alien plants, artificial lights, hatching strandings, vehicular traffic, and recreational use of nesting beaches.

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THE ‘ŌPAE‘ULA WATERSHED PROTECTION PROJECT. The ‘Ōpae‘ula Watershed Partnership was formed in 1999 to discuss conservation and watershed protection options for the Northern Ko‘olau Mountains on O‘ahu. Since then the group has become a sub-group of the Ko‘olau Mountains Watershed Partnership. Partners include Kamehameha Schools, the State of Hawai‘i, O‘ahu Division of Forestry and Wildlife, the US Fish and Wildlife Service, and the U.S. Army. Pigs heavily impacted the native plants and the watershed. In May of 2001, the partnership completed the first ecosystem scale ungulate exclosure ever constructed in the Ko‘olau Mountains. The project encompasses approximately 250 acres of the upper limits of the ‘Ōpaeula watershed. This area receives over 200 inches of rain each year. Vegetation types include wind swept summit crest vegetation and wet montane forest. There are seven rare plant species within the fenced unit including more than 80% of the known individuals of an endangered haiwale (*Cyrtandre viridiflora*). There are also two species of endangered tree snail (*Achatinella sowerbyana* and *Achatinella lila*). Invasive plant species threats are few and the partners are optimistic that little alien plant control will be necessary. More than 80% of the State of Hawai‘i’s human population resides on O‘ahu. In addition, most of the fresh water utilized by this population is drawn from the Ko‘olau Watershed. It is the partners' hope that this project is the first of many aimed at protecting and preserving the beautiful and precious resources of the Ko‘olau Mountains, O‘ahu.
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AN UNCONVENTIONAL APPROACH TO CONSERVING HAWAI’I’S VANISHING FLORA. In 1993, I attended a conference where the rules and regulations regarding Act 73, were discussed. As landscape architects, the requirement of this Act to use native flora in public landscapes, would have greatly impacted our designs. I listened to the presenters, saw beautiful pictures and was told of the virtues of using native plants. However, I left as most did, with mixed emotions and was not inspired. The conference did, however, awaken my lingering interest in preserving our flora. Years passed and there were very few instances of native plants being used. In 1998, I decided to dedicate my efforts to propagation and cultivation of native plants. If the plants were available, and possessed ornamental characteristics I was confident that they would be used. Data on propagation was minimal, and stock material was practically non-existent, thus propagation initially was very difficult. However, since beginning, I have succeeded in propagating, testing and evaluating over 300 different natives, forty of which are endangered. I am now growing or have released a total of over 50,000 natives. Throughout my struggle to propagate native plants I have drawn several conclusions. Many native plants may be difficult to propagate, but are no more difficult to cultivate than non-native ornamentals. I firmly believe that endangered species can be saved through cultivation and ornamental use. It is important for the landscaping industry to recognize their critical role in educating and encouraging the public use of native plants.

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METHODOLOGY USED IN DETERMINING PROPOSED CRITICAL HABITAT FOR 255 PLANTS. Under a time frame mandated by court ordered deadlines, the USFWS devised a methodology to determine critical habitat for 255 plant species in Hawai’i based on the best available scientific and commercial data. Data sources on plant locations and conditions included the Hawai’i Natural Heritage Program, the Center for Plant Conservation monitoring database, field data from local experts and in-house rare plant databases and resources. Initial primary constituent elements were determined for each species from field records and databases. Field experts were contacted and meetings held to discuss suitable habitat areas for each species. Historical range of each species was determined based on historical and current plant locations and published references. The field experts then pointed out on quad maps (using a computer-aided mapping program) areas of the islands where suitable habitat still exists for each species. USFWS staff then evaluated this suitable habitat and delineated a subset of the area that is needed for the conservation of each species, as defined by published recovery plans and by the general guidelines established by the Hawai’i and Pacific Plant Recovery Coordinating Committee (i.e., 8 to 10 populations of 100, 300 or 500 mature reproducing individuals). These areas believed to be necessary for the conservation of the species were proposed as critical habitat for each species. Before finalizing the critical habitats, public comments and other information (e.g., economic and other impacts) are factored into the final designations.

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NON-NATIVE FOREST BIRDS: ARE THEY IMPORTANT RESERVOIR HOSTS FOR AVIAN MALARIA? Avian malaria (Plasmodium relictum) continues to be a major factor limiting the recovery of native Hawaiian forest birds. Most disease transmission occurs at elevations below 5,000 ft. because of thermal constraints on both the mosquito vector and parasite. Transmission can occur at higher elevations in warmer months, however. The role non-native birds play as reservoir hosts for initiating these outbreaks has been controversial, with some suggesting that their removal from native forest bird habitats might be an effective strategy for preventing epidemics. We tested susceptibility of Japanese White-Eyes (Zosterops japonicus), Red-Billed Leiothrix (Leiothrix lutea), and House Sparrows (Passer domesticus) to malaria and measured their infectiousness to mosquitoes over time. House sparrows were the most susceptible of these species and capable of infecting mosquitoes up to 200 days post infection (PI). Japanese White-Eyes and Red-Billed Leiothrix were difficult to infect by mosquito bite and were infectious to mosquitoes for only a brief time. Removal of these two species from recovery habitats will probably
have little impact on disease transmission. House Sparrows, however, could serve as focal sources for infection. Their association with human infrastructure and water sources at higher elevations should be a concern for resource managers.


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**AVIAN MALARIA IN AMERICAN SÄMOA: INDIGENOUS PARASITE OR EMERGING DISEASE?** High susceptibility of endemic Hawaiian forest birds to introduced avian malaria (*Plasmodium relictum*) suggests that this parasite might have similar impacts on other insular avifaunas. We surveyed forest birds in American Sämoa in 1996 and 2000 by blood smear, serology, and PCR to establish whether this parasite is present and whether it is a potential threat to the indigenous avifauna. We failed to detect parasites by blood smears or serology from 191 forest birds belonging to 8 species in 1996, but 58% of the samples were positive by nested PCR for rRNA and/or TRAP genes with DNA sequences suggesting presence of a *Plasmodium spp*.. Samples collected on Tutuila in September 2000, were positive by blood smear for malarial parasites consistent in morphology with *P. circumflexum*, a cosmopolitan parasite of passerines. High prevalence of chronic infections suggests that this parasite is indigenous to the central Pacific and not a threat to the Sämoan avifauna.

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**THE O`AHU INVASIVE SPECIES COMMITTEE (OISC): FIGHTING THE INVASIVES BATTLE ON O`AHU.** The O`ahu Invasive Species Committee (OISC) is a voluntary partnership of private, governmental and non-profit organizations and individuals united to prevent new invasive species infestations on the island of O`ahu, to eradicate incipient invasive species, and to stop established invasive species from spreading. Formed in 2000 out of the Fountain Grass Working Group (FGWG), OISC has improved efforts for prevention, control and monitoring of incipient invasive species threatening agriculture, watersheds, native ecosystems, tourism, industry, human health, and the quality of life on O`ahu. OISC’s top five targets include: miconia (*Miconia calvescens*), fountain grass (*Pennisetum setaceum*), Caribbean frogs (genus *Eleutherodactylus*), thorny kiawe (*Prosopis juliflora*), and Himalayan blackberry (*Rubus discolor*). To date, staff from OISC and member organizations, along with dedicated volunteers, have eradicated over 700 miconia plants, treated other incipient, habitat-modifying weeds on approximately 200 acres, and created a GIS-linked database to map the progress of these efforts. In addition, OISC benefited from the State Legislature’s Emergency Environmental Workforce crew dedicated to pest eradication. Goals for 2003 include 10,000 acres of aerial survey, 1,500 acres for treatment, 1,200 acres for post-treatment evaluation and monitoring. OISC also aims to fund additional personnel to educate policy-makers, industry and the public. The group’s unique position near the state capitol provides the opportunity to influence alien species policy, funding and decision-making in order to benefit other ISCs in preventing the spread of pests statewide. With it’s multi-faceted program, OISC welcomes new members to become involved in invasive species work on O`ahu.

**Rhonda Loh**, Tim Tunison, Alison Ainsworth, David Benitez, Jon Makaike, Bobby Mattos, Jack Minassian, David Palumbo, Sierra Peterson and Matthew Schultz

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2National Park Service, Fire Management Office, PO Box 52, Hawai`i Volcanoes National Park, HI 96718
REHABILITATION OF NATIVE PLANT COMMUNITIES AFFECTED BY THE BROOMSEDGE FIRE.

Rehabilitation of native plant communities damaged by a recent 1,003 acre wildfire began July 2000. Two strategies are used to re-vegetate burned communities. The goal in fire-damaged ʻōhiʻa (*Metrosideros polymorpha*) woodland is to establish a modified community of fire-tolerant native species able to self-perpetuate, accepting that alien grasses and wildfire remain important ecosystem components. Species are identified as fire-tolerant based on their response to past wildfires and direct seeding experiments in research burns conducted between 1993-1999. The goal in fire-damaged koa (*Acacia koa*) forest is to establish vegetated fuel barriers that reduce the risk of wildfire spreading into key areas. A dense native understory is planted under naturally recovering koa. Twenty thousand plants composed of 31 native species are targeted for establishment in 828 plots scattered across the burn. By eighteen months, 1,436 volunteer and paid-worker days had been spent collecting seed, propagating and outplanting 9,000 individuals and sowing 2.5 million seeds of 15 species in the burn. Planting continues to Summer 2003. Outplant survivorship is 80-95% for most species. Successful seedling establishment of ʻaʻaliʻi (*Dodonea viscosa*), māmane (*Sophora chrysophylla*), koʻo koʻolau (*Bidens Hawaïiensis*), and koa is achieved by directly seeding plots. Widespread community participation in the rehabilitation effort increases public awareness and support of conservation issues in the park. The project also allows managers to apply methodologies developed from small research burns across a large management area. Further monitoring will determine the long-term success of the rehabilitation project.

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CGAPS: FILLING THE GAPS IN BIOSECURITY FROM INVASIVE SPECIES. Alien pest invasions are a constant and costly threat to Hawai‘i’s native ecosystems, biodiversity, watersheds, economy, public health, and quality of life. State and federal programs have arisen piecemeal to address specific pest concerns, resulting today in an array of official programs of limited scope lacking comprehensive coordination and with numerous gaps between agencies, jurisdictions, and existing laws. The Coordinating Group on Alien Pest Species (CGAPS) was formed in 1995 in response to the need for statewide coordination to close the “gaps” in Hawai‘i’s biosecurity. CGAPS is a voluntary, multi-agency partnership that coordinates high-level communication and decision-making to improve statewide alien pest prevention, early detection and rapid response, long-term control, and funding for invasive species work. CGAPS’ partners number over two dozen local, state, and federal agencies and private organizations, including Hawai‘i’s Invasive Species Committees (ISCs). The Maui Invasive Species Committee (MISC), Moloka‘i subcommittee of MISC (MoMISC), Big Island Invasive Species Committee (BIISC), the O‘ahu Invasive Species Committee (OISC), and the Kaua‘i Invasive Species Committee (KISC) work on several levels: through partnerships on each island to combat the worst invasive pests facing that island; among each other on common goals to prevent the spread of species from island to island; and with the statewide Coordinating Group on Alien Pest Species (CGAPS) in an effort to prevent new pests from entering the state by changing or enacting more effective policies, procedures, and legislation.

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POLLEN USAGE BY HAWAIIAN YELLOW-FACED BEES (*Hylaeus [Nesoprosopis]*) AND THE ROLE OF ENDEMIC BEES IN PERPETUATING NATIVE ECOSYSTEMS. Studies of pollination in Hawai‘i have primarily focused on rare plants or pollination by birds. The 60 species of yellow-faced bees (*Hylaeus*) are the only native bees, but have never been examined for pollen usage, in part due to their habit of carrying it internally. Pollen loads were dissected from the crops of female *Hylaeus* and grains identified and counted. Nearly 70% came from seven community-dominant plants: ʻōhiʻa (*Metrosideros polymorpha*), ʻūlala (*Cheirodendron trigynum*), pūkiawe (*Styphelia tameiameiae*), ʻaʻaliʻi (*Dodonea viscosa*), naupaka (*Scaevola* spp.), naio (*Myoporum sandwicense*), and māmane (*Sophora chrysophylla*). Very frequently the pollen in the crop was not that of the plant the bee was caught on, indicating the unreliability of collection records for pollen usage. The potential dependence of important forest trees on bee pollination makes the decline of several once-common species of bees a particular cause for concern.
USE OF POP-UP SATELLITE ARCHIVAL TAGS TO QUANTIFY MORTALITY OF MARINE TURTLES INCIDENTALLY CAPTURED IN LONGLINE FISHING GEAR. Interactions between marine turtles and longline fishing gear have reached unacceptable levels in the Pacific Ocean. As a result, Hawai‘i-based courts have severely restricted longline fishing in the central Pacific. Our current research aims to reduce hooking of threatened and endangered sea turtles so that time-area fishery closures can be most effective. Our objective is to provide reliable estimates of delayed mortality and morbidity following longline-turtle interactions. To estimate delayed mortality, we deploy pop-up satellite archival tags (PSAT) on incidentally-caught pelagic hard-shelled marine turtles. PSATs have a link that corrodes at a pre-set pop-up date thereby releasing the tag from the base-plate mounted on the carapace. The transmitter floats to the surface and transmits data (e.g. depth, temperature, geolocation) to an overhead satellite. The tags also have a fail-safe/ mortality sensor, whereby the link can be set to corrode if the tag is stationary for extended periods or, if it exceeds a specified depth. Post-hooking mortality and morbidity (PSAT data) will be correlated with a standardized set of scored observations, such as hook location, severity of injury, and turtles’ general health assessment.

Trent R. Malcolm, Jim J. Groombridge, Chris N. Brosius, Bill D. Sparklin, Jamie C. Bruch, and Marcy M. Okada

Maui Forest Bird Recovery Project, 2465 Olinda Road, Makawao, HI 96768

THE EFFECTIVENESS OF GROUND-BASED RODENTICIDE APPLICATION IN A MONTANE CLOUD FOREST ON MAUI. The Maui Forest Bird Recovery Project is a multidisciplinary project dedicated to the conservation of Maui’s endangered forest birds and their habitat. Since 1997, the project has aggressively controlled rat populations within the home ranges of the three remaining Po‘ouli, a critically endangered Hawaiian honeycreeper. Rats are primarily controlled using rodenticide (0.005% diphacinone) distributed inside of tamper-resistant bait stations. In 2001, a study was initiated to measure the effectiveness of the project’s ground-based rat control efforts. Relative rat abundances are monitored in each of 5 snap-trapping grids (3 treatment, 2 non-treatment) 3-4 times per year. Results indicated that rat densities were significantly lower inside of the poison treatment areas than in the non-treatment areas, but this picture varied between sessions and areas. Our findings alert managers to the need for more consistent rat control and highlight the importance of monitoring rat densities on a fine temporal scale. This type of adaptive management is critical to efficiently maintain suitable habitat for Maui’s remaining forest birds. Our long-term rat density monitoring will be useful in pre- and post-monitoring of aerial applications of rodenticide that are planned for Hanawi Natural Area Reserve.

Christy Martin, Jack Peterson and Mike Walker

Maui Invasive Species Committee, PO Box 790360, Pa‘ia, Maui, HI 96779.

FILLING THE GAP: MAUI INVASIVE SPECIES COMMITTEE, AN ISLAND-BASED PARTNERSHIP TO ADDRESS INCipient INVASIVE SPECIES. The Maui Invasive Species Committee (MISC) is a voluntary federal-state-county-private partnership working together to prevent, contain, or eradicate the most serious incipient plant and animal invasions. MISC works to enhance the effectiveness of pest prevention and control through communication, coordinated planning, direct fieldwork, and education. Partners in MISC started working together as the Melastome Action Committee (MAC) in August 1991 to address the threats posed by miconia (Miconia calvexcens), Tibouchina herbacea, and Koster’s curse (Clidemia hirta). MISC evolved from MAC in December 1997 with the recognition of increasing threats posed by species beyond Melastomes, and became a fully funded field operation in November 1999. A subcommittee of MISC, MoMISC, formed on Moloka‘i in October 2000 to address invasive species concerns specific to Moloka‘i. Since November 1999 MISC has been able to continue to secure funding for public outreach, mapping, and control objectives for priority species: Miconia (Miconia calvexcens), pampas grass (Cortaderia jubata and C. selloana), fountain grass (Pennisetum setaceum), ivy gourd (Coccinia grandis), giant reed (Arundo donax), rubber vine (Cryptostegia spp.), Jerusalem thorn (Parkinsonia aculeate), downy rose myrtle (Rhodomyrtus tomentosa, Melastoma candidum), Eleutherodactylus frogs (Eleutherodactylus coqui and E. planirostris), parrots and parrot-like birds (Psittacidae). MISC will continue efforts to control or eradicate
invasive species that threaten native ecosystems, watersheds, the economy and human health, and will also continue to work with the other ISCs and CGAPS to prevent new pest species from entering the state.

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DEVELOPING A HELICOPTER TRANSLOCATION MODEL FOR HAWAIIAN FOREST BIRDS. Future translocations of Hawaiian avifauna will require the use of helicopters to reach remote locations both within and between islands. This study tested a novel method of translocating birds via helicopter and also evaluated the site fidelity and survivorship of birds that were released using both “hard” and “soft” methods. In June 2001, 18 ‘I‘iwi (Vestiaria coccinea) were translocated via helicopter from east to west Maui. For logistical purposes, birds were acclimated to a captive diet at the capture site and held in individual cages overnight before being transported the following morning. Blood samples were collected at the beginning of the acclimation process and screened for avian malaria. All translocation candidates successfully acclimated to captivity without incident. Birds were randomly assigned to either hard (n = 9) or soft (n = 9) release groups prior to transport. Individuals in the hard group were released immediately upon arrival at the release site. Individuals in the soft group were held in captivity at the release site for seven days. Birds were fitted with radio transmitters and tracked post release. All birds survived the helicopter flight suggesting that future helicopter translocations may be used in the management of endangered species such as the ‘Ākohekohe (Palmeria dolei). There appeared to be no difference in long-term survivorship or site fidelity (both groups remained in the vicinity of the release site for the duration of transmitter life), but these results may be affected by the transmitter’s short battery life and our small sample size.

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SENSITIVITY OF DROSOPHILA ENGYOCHRACEA TO PESTICIDES IN HAWAI‘I VOLCANOES NATIONAL PARK. Drosophila engyochracea is a rare endemic Hawaiian picture-wing fly, whose range is restricted to two ca. 50 ha. mesic forest kīpukas in Hawai‘i Volcanoes National Park. This study compares the survival of wild-caught D. engyochracea exposed to three separate pesticides currently used or under study for controlling both rats (Rattus rattus, R. exulans and R. norvegicus) and the western yellowjacket wasp (Vespula pensylvanica) in mesic kīpukas in the Park. The three pesticides evaluated were: 1) Ramik Green (0.005% diphacinone) a rodenticide currently being studied for the control of rats; 2) Fipronil, a new yellowjacket insecticide recently evaluated as a replacement for 3) Knox Out 2FM, a microencapsulated formulation of diazinon, an organophosphate insecticide that was discontinued in December 2000. Fourteen-day survival of D. engyochracea cohorts exposed to the rodenticide was high and did not differ from separate controls employing commercial Drosophila diet or a placebo of Ramik Green (pellets formulated without diphacinone). In contrast, the insecticides resulted in substantially decreased survival of flies exposed to either fipronil or diazinon. These results are in agreement with previous observations of dead picture-wing flies at bait stations containing Knox Out 2FM. The sensitivity of native arthropods to pesticides used in alien species control programs in Hawai‘i has not been previously evaluated. Alien species control strategies need to be designed so as to minimize or eliminate non-target hazards to rare endemic Hawaiian arthropods, such as Drosophila engyochracea.

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RESTORATION AND MANAGEMENT IN KALUAA GULCH, HONOLULU PRESERVE, O‘AHU. The recently completed 108-acre Kaluua Gulch fence enclosure in The Nature Conservancy’s Honolululi preserve will enhance the management of populations of 1 endangered bird, 24 endangered plants or plant species of concern, 10 rare snails and insects, and the rapidly declining O‘ahu Diverse Mesic Forest vegetation community. In addition to
protecting the existing biological resources, the enclosure provides an ideal setting for restoring native vegetation communities and reintroducing rare plants due to its accessibility to relatively intact native forest. After conducting staff and volunteer hunts to remove the last of the remaining pigs, The Conservancy initiated a volunteer-based restoration program called the Habitat Restoration Team, which consists of volunteers trained to collect seeds, propagate native plants, and manage and restore specific sites within the enclosure. The restoration sites, initially located in intact native forest remnants, represent the full spectrum of vegetation communities within the enclosure. As restoration progresses within the intact portions of the sites, actions will expand into more degraded areas surrounding the native forest remnants with the intention of learning how to restore both native and alien dominated communities at the landscape scale. All aspects of the restoration process, such as labor and material inputs are tracked and entered into a database, and photo points will document progress at each site. The Nature Conservancy hopes this project will provide valuable information regarding project planning, cost projection and methods for restoration projects associated with statewide watershed partnerships.

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TREE FROGS (Eleuthrodactylus coqui & Eleuthrodactylus planirostris) IN HAWAI‘I. Coqui (Eleuthrodactylus coqui) and Greenhouse frog (Eleuthrodactylus planirostris) are two species of tree frogs that have raised quite a concern in Hawai‘i. Two experimental surveys were conducted. Various local nurseries and plant marketing businesses were contacted by phone and asked some questions regarding the frogs. It was hypothesized, that the tree frogs are still present in local nurseries, and is suspected that nurseries are the primary distribution source of these frogs to private and public landscaping on the Big Island. Results acquired from the survey showed that out of 42 nurseries which responded, 14% had the frogs but do not currently have them, 3% were not sure, 21% currently have the frogs, and 62% had no frogs at all, showing that frogs are presently populating in nurseries and other plant marketing businesses. In addition, another experimental survey was undertaken to find the opinions of residents of the eastern side of the Big Island (with greatest populations of frogs). A total of 66 Big Island residents were randomly selected from the phone book and surveyed. Ninety-four percent were aware of the frogs and 81% disliked the frogs, 8% liked them, and the remaining 11% were not sure. About the same proportions of people think that the frogs are a bad thing for Hawai‘i (82%), and people were asked to give comments, and either liked or disliked the frogs. Ninety percent of those surveyed favored eradication, if the process was not too costly and environmentally safe.

T. Colleen Murray, Steve Dougill, and Paul Banko

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HOME RANGE PATTERNS OF PALILA (Loxioides bailleui) IN A NARROW STRIP OF FOREST ON THE EASTERN SLOPE OF MAUNA KEA. The palila (Loxioides bailleui) is an endangered, endemic honeycreeper limited to sub-alpine dry forests on Mauna Kea, Hawai‘i. Most of the wild population (>90%) is found near Pu‘u Lā‘au, on the western slope of the mountain. However, there are declining, remnant populations on the southern and eastern slopes of the mountain. In the spring of 2000, we radio-tagged three adult palila on the eastern slope of Mauna Kea and followed their movements until transmitters dropped. Results of home range analyses show the mean area of the radio-tagged eastern slope palila were much larger (7.0±5.8 km²) than adults we had radio-tagged on the western slope in 1999 and 2000 (0.5±0.33 km², n=3). Palila are dependent on māmane (Sophora chrysophylla) for food and need a sufficient elevational gradient of forest to forage year-round. Birds on the western slope inhabit a forest with a wider elevational gradient and a higher density of trees, resulting in shorter excursions from the center of their home range in order to forage. Subsequently, we believe the narrow forest on the eastern slope forces palila to range much farther for food than their western slope counterparts. Results from this study suggest there is a single, small population utilizing a larger area. The eastern slope dry forest continues to shrink as a result of cattle grazing in pastures below the forest, driving palila populations in that area further along the road to extinction.

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2002 Hawai‘i Conservation Conference
UNDERSTORY INVASION OF EUCALYPTUS PLANTATIONS. Plantations may facilitate the regeneration of native species on degraded lands but they also support non-native species. We measured species composition and biomass of understory plants in stands of 7-yr-old *Eucalyptus saligna* on the Island of Hawai‘i that were arranged in a replicated 2 x 2 factorial of planting density (1 x 1 m or 3 x 3 m) and fertility (regular and no fertilization). From yr 1 to 6, understory vegetation was eliminated with herbicides, after which applications ended to permit the return of understory vegetation. At the end of yr 7, understories were dominated by 28 species of herbaceous and woody plants, of which only moa (*Psilotum nudum*) and sumac (*Rhus sandwicensis*) were native. Biomass and species richness were lowest in plots that were densely planted and fertilized. Fiddlewood (*Citharexylum caudatum*), African tulip tree (*Spathodea campanulata*) and sumac were the most common woody species. Fiddlewood had a light compensation point more than five times lower than the other species, but a high light saturation point, allowing for growth and survival under both full sun and shade conditions. These findings suggest that tree plantations in Hawai‘i may not be useful for facilitating native species recruitment or for preventing the spread of invasive plants.

David Penn, June Harrigan, and Maile Sakamoto

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THE TOTAL MAXIMUM DAILY LOAD (TMDL) PROGRAM. State of Hawai‘i Water Quality Standards require protection of various inland and coastal water uses, including protection of native breeding stock (Class 1.a. and 1.b.), support the propagation of aquatic and marine life (Class 1.b., AA, A, and II), conservation of coral reefs (Class AA), and perpetuation of the marine bottom in a most natural state (Class I). Through the federally-regulated Total Maximum Daily Load (TMDL) process, the State of Hawai‘i Department of Health (DOH) determines where these water uses are not adequately protected (“impaired waters”) and identifies the source and magnitude of pollutant loads that are causing water quality problems. We then estimate how much these loads must be reduced in order to clean the water body so that it meets the State water quality standards, and work throughout the watershed to plan and promote actions that can be taken to achieve these pollutant load reductions, improve water quality, and protect and enhance our aquatic and marine ecosystems. The current list of impaired waters covers 11 pollutant categories in 58 coastal waters, 52 streams, and 1 lake across 5 main islands. The most common pollutants/indicators of concern are nutrients and turbidity/sediments, followed by enterococci, chlorophyll a, and trash. Our current focus on developing TMDLs for impaired streams includes visual assessment of stream habitat and biotic integrity. Coupling this information with physical and chemical analysis of the stream water column helps us to assess relationships between water quality and stream biological indicators.

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EFFECTS OF WATERSHED CONSERVATION ON HAWAI‘I’S ENVIRONMENT. Department of Business, Economic Development and Tourism’s recent interest in sustainable tourism and carrying capacity of Hawai‘i’s natural resources demands an expansion of economic policy analysis and planning to an integrated representation of the economy and the environmental systems that sustain it. As a start to this ambitious undertaking, we show the effects of resource conservation on other resources and the economy can be quantified and can provide an essential component of economic growth with environmental stewardship. Our example concerns watershed conservation in the Ko‘olau’s and its effect on groundwater recharge, reef sedimentation, marine pollution, and the economy. After illustrating the pertinent internal environmental interactions and those involving the economy, we provide a methodology for estimating the effects of watershed conservation. A risk matrix is prepared, consisting of watershed locations v. risk factors (such as fires, feral animals, invasive species etc.). To obtain the probability of damage at each watershed location due the risk factors operating there, estimates are elicited from a panel of experts. The effect of this damage on the water balance (runoff, recharge) on each location is determined using a system of regressions relating water balance to site characteristics such as slope and vegetative cover. This permits estimating the
economic value of the increased groundwater recharge and the benefits of avoiding reef sedimentation associated with surface runoff. The quantified "environomic" system is then used to compare three policy scenarios representing untrammelled growth, environmental preservation, and growth with stewardship. Needs for improved measurement techniques are assessed.

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CONSERVATION ASPECTS OF VERY LOW ELEVATION HAWAI‘I VEGETATION REMNANTS. Examination of plant species richness (angiosperms) at varying elevation indicates a sharp decline in richness below 700 meters. While this is largely due to intense human impact in these areas, sampling has likely been inadequate, since these areas are perceived by biologists to be degraded. Non-coastal low elevation (<200m) habitats contain a reported 263 species: 26% of the flowering flora, 79% endemic. Coastal habitats include 136 species: 13% of the flora, 55% endemic. Recent fieldwork has identified locations where the interface between coastal and inland vegetation still retains a significant native component. Recent inventory of these sites has extended the recorded lower elevation limit of several plant species to less than 200 meters (within the coastal interface): hala pepe (Pleomele auwahiensis), ‘āwikuwiki (Canavalia molokaiensis), kōlea lau nui (Myrsine lessertiana), pāwale (Rumex skottsbergii), neleau (Rhus sandwicensis), pāpala kēpau (Pisonia brunoniana), ‘uki (Machaerina angustifolia, M. marisoides), ‘ie‘ie (Freycinietia arborea), and he‘upueo (Agrostis avenacea). Species composition can be surprisingly rich, especially at wetter sites. The growing list of relict sites represents all that is left of an originally rich portion of the Hawaiian flora. These areas include distinct, often surprisingly resilient, native communities. Analysis of these communities yields valuable information such as site and species characteristics that may help guide the identification, protection and potential restoration of some of the better sites.

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PRELIMINARY DATA IN SUPPORT OF COMMUNITY-BASED MOSQUITO (Culex quinquefaciatus) CONTROL FOR MANAGEMENT OF AVIAN DISEASE. In an effort to curtail the impact of avian malaria (Plasmodium relictum) on Hawaiian native forest birds, an effective mosquito control strategy must be developed. The Southern House Mosquito (Culex quinquefaciatus), the vector for avian malaria, prefers to lay its eggs in nutrient-rich, standing water that can be found throughout residential communities, agricultural operations and forest reserves. To assess the importance of residential areas in the production of mosquito vectors, we have monitored adult mosquito populations both within the Volcano Village residential community and in an adjacent, native forest tract (Cooper Center). CO₂ baited CDC traps were used to capture mosquitoes and the samples were dissected to determine infection status. Mosquitoes were present year-round in the Village and Cooper with a mean capture rate (mosquitoes/ trap night) of 2.4 and 1.16 respectively. Peak capture rates of 8.4 in November for the Village and 2.7 in September for Coopers were recorded. Mean infection rates were found to be 10.1% in the Village and 15% at Cooper. Any proposed mosquito control strategy must be effective in both the forest reserves and in surrounding residential communities. Continued monitoring of mosquito populations, public education and community based mosquito control will be necessary for landscape level disease management.

Michelle Reynolds

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FORAGING AND HABITAT USE BY THE ENDANGERED LAYSAN TEAL: IMPLICATIONS FOR TRANSLOCATION. Habitat use and the relationship between food habits and the prey abundance of a Hawaiian endemic dabbling duck, Anas laysanensis, was studied on Laysan Island. The species was previously widespread across the Hawaiian archipelago, but is now restricted to a single isolated population. Fecal analysis and behavioral observations indicate that Laysan teal are not 100% macro-insectivores as previously reported. Seeds occurred in 31% of fecal samples analyzed (N=118). Habitat use was not correlated with prey abundance except for use of the
camp, which increased, with moth abundance (r=0.71 p<0.01). The terrestrial zone was used for nesting, cover, and nocturnal foraging. Within the terrestrial habitat, prey selection closely matched prey abundance. Bunch grass (*Eragrostis variablis*) was preferred for cover, mixed and viney vegetation (*Sicyos, Ipomoea spp.*) were preferred for foraging. Brood-rearing and foraging at the lake were concentrated at fresh water. Brine fly (*Ephyridae: Scatella sexnotata*) abundance was highly seasonal and so was the proportion of birds foraging on brine flies. When brine fly density is very high (>6 flies/cm²), Laysan teal prefer brine flies to other wetland prey. Habitat use varied among adults (N=53; 1562 telemetry locations). Nine percent used camp, 18% used the coast, 96% used the lake, and all used the terrestrial zone. Details of the plasticity in diet and range of habitat use improve our understanding of the species ecology on Laysan, and enable managers to choose suitable sites for establishing additional populations for conservation.


Department of the Army, Environmental Division, Directorate of Public Works, Schofield Barracks HI 96857-5013

RARE PLANT REINTRODUCTION: LESSONS LEARNED BY O‘AHU ARMY NATURAL RESOURCE PROGRAM. The Army's O'ahu Natural Resource Program is charged with managing threatened and endangered species and the ecosystems that support these resources. One component of this management includes the reintroduction of rare and endangered plant taxa back into the wild. The Army's Natural Resource Program has reintroduced hundreds of individuals of endangered plant taxa. Species have ranged from grasses to large trees and target habitat from wet summit to dry forest environments. Many lessons have been learned in the process. Techniques have been experimented with and refined with regard to pre-planting preparation of plant stock, site selection and preparation, transportation and planting, post planting care, and monitoring. Issues associated with pre-planting preparation of stock included determining the best size class for reintroduction. Also explored were adequate quarantine methods to ensure clean stock, thus minimizing risks to the natural environment. Site selection has been based on the best available information regarding both biotic and abiotic factors. Site preparation has included invasive species control and production of out-planting holes dug with a gas auger. Plants were typically transported via helicopter sling in a custom-designed transport container. Post planting care was kept to a minimum with six months of at least bi-quarterly visits to investigate for signs of water stress or pathogen problems. A reintroduction monitoring form has been developed which facilitates the collection and organization of data for analysis and feedback into adaptive management.

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THE USE OF GIS IN HABITAT MANAGEMENT AND CONSERVATION OF MAUI’S ENDANGERED FOREST BIRDS. GIS is a valuable tool for scientists and natural resource managers who wish to examine spatial patterns of biological processes. The Maui Forest Bird Recovery Project applies this technology to field conservation in Hanawi Natural Area Reserve, a remote region of high conservation importance. We use GIS primarily for habitat management and avian conservation, to develop adaptive management strategies within Hanawi, with techniques being tailored specifically to each area of concern. For habitat management, GIS has enabled us to identify gaps in our ground-based diphacinone application, and to identify patterns in bait take. This has enabled us to develop a more effective bait application strategy. For avian conservation, it is an important tool in translocation and telemetry efforts. We demonstrate how avian radio-telemetry data can be integrated with ArcView using LOAS software. During the Po’ouli (*melamprosops phaeosoma*) translocation, maps were created using historic sightings of each Po’ouli (*melamprosops phaeosoma*) and Kernel Analysis to help define areas where mist netting and searching should be focused to optimize successful capture. Radio-tracking data from the Po’ouli translocation was integrated with geo-referenced field observations to maximize our interpretation of the females post-release behavior. On a larger scale, probability ellipses were created for locations of translocated ‘I’iwi (*vestiaria coccinea*) that were translocated by helicopter from Hanawi to West Maui.

Kim Starr, Forest Starr, and Lloyd Loope

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COASTAL RESTORATION OF KANAHA BEACH, MAUI: EFFORTS OF THE EMERGENCY ENVIRONMENTAL WORKFORCE (EEW). Lowland areas of Hawai‘i have been severely modified by humans, resulting in near total conversion of the native landscape to an assemblage of common pantropical weeds. However, native vegetation of coastal areas has shown resistance to invasion, probably due to the dominance of mostly indigenous (vs. endemic) species and the fact that salt spray selects against most potential lowland invaders. Kanaha Beach, located along the north central shore of Maui just east of Kahului, still harbors native flora and fauna, including several endemic species of plants and insects. Small scale restoration of the site had been initiated several years ago and showed promise. These efforts were stepped up by bringing on a full-time crew from the EEW, a program established to improve Hawai‘i’s economy and environment by providing jobs for workers made jobless in the wake of the abrupt downturn in tourism last fall. A 6-person crew went to work starting in early-December and continued into April. The crew concentrated on mechanical removal of non-native Pluchea (*Pluchea* spp.), thickets of kiawe (*Prosopis pallida*), Bermuda grass (*Cynodon dactylon*), pickleweed (*Batis maritima*), and buffel grass (*Cenchus ciliaris*). To date, a mile of coastline encompassing about 30 acres has been cleared and maintained. The persisting native vegetation is expanding, and additional coastal species native to Maui Nui have been planted to add diversity. The Kanaha Beach site can serve as a potential model for restoration and alien species control in coastal areas throughout the state.

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BUILDING HAWAI‘I’S FUTURE CONSERVATION WORKFORCE. Hawai‘i has large areas of federal, state and private land with native ecosystems requiring management. In addition to filling current employer needs, the need for trained workers will increase as more areas are brought under active management. In the past, Hawai‘i has relied on specialists trained outside the State to serve much of its employment needs, but programs are being implemented within the State that focus on mentoring more “local” students into careers related to the environment. Justifications for such efforts range from the role local employees can play in community-based management initiatives to the important economic role conservation and sustainable resource use play in our state. Several efforts started in the last decade are starting to address these work force development efforts, including career explorations in secondary school, service learning opportunities, field exploration programs, internship programs, and technical training programs. Two such programs are the University of Hawai‘i Hawaiian Internship Program (UH-HIP) at UH-Hilo and the Tropical Forest Ecosystem and Agroforestry Management Program (Forest TEAM) at Hawai‘i Community College. UH-HIP links Native Hawaiian undergraduates to resource organizations for summer internships. Sixty percent of graduated participants are working in conservation in Hawai‘i while 15% are pursuing higher degrees. Forest TEAM is a 2-year technical training program in agroforestry and forest ecosystem management leading to an A.S. degree. Upon completion of the degree students may work with ecosystem management programs or continue their studies in a 4-year university. This poster will also provide space for other conservation training programs to display their information.

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A NEW INVASIVE PLANT SPECIES INFORMATION SOURCE DATABASE ONLINE. In February-April 2002, two of us (PT and RR) worked together to translate information from a (RR’s) one million record flat file plant name database into a correctly-structured normalized relational database. The database specializes in weed information, citing bibliographic sources for each record. A soon-to-be-published book entitled “A Global Compendium of Weeds” is based on the 21,000 weed species in the database and includes origin, weediness/naturalization information by locality, information on toxicity, and “environmental weed” and legal “noxious weed” designations. Having all this information online in a proper format will enormously expedite worldwide efforts (but especially efforts in the Pacific Basin) for the prediction of those species likely to be invasive based on their behavior elsewhere.
in the world. Additionally, this will facilitate efforts at risk assessment by countries and states who wish to emulate biosecurity measures successfully implemented by Australia and New Zealand.

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BIODIVERSITY OF MACROALGAE FROM HAWAI‘I’S STREAM RESOURCES. Assessment of the quality of Hawai‘i’s freshwater resources is contingent on understanding data from a variety of abiotic and biotic factors. The algae is an understudied component of Hawaiian stream ecosystems, and increased knowledge of this group could provide information about the conditions of the water body in which they are found. In addition, since they are at the base of food webs in these stream systems, many other stream organisms utilize them for food and/or habitat. Scattered previous studies have reported algae from streams and other freshwater habitats in Hawai‘i, but here we present the results of the first 14 months of a comprehensive survey of stream macroalgae in the state. Habitats surveyed ranged from degraded urban sites to nearly pristine streams. Representatives of the Chlorophyta, Cyanophyta, Rhodophyta, Bacillariophyta and Tribophyta were identified, with approximately 20 of them new state records. Overall, the average number of macroalgal taxa identified from each stream region sampled (4.8) was higher than reported for streams in North America and the Caribbean (3.1), as well as previous estimates for Hawaiian streams (3.4). Correlations between algal biodiversity and stream conditions will help researchers and managers understand the effects of alterations (such as diversion and channelization) on natural communities, and will also indicate floristic changes that are most likely a result of human impact. Such data are necessary to understand the effects of human intervention in watersheds that may be used for drinking water, irrigation, or recreational activities.

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DISTRIBUTION, ABUNDANCE, AND BREEDING BIOLOGY OF WHITE TERNS (Gygis alba) ON O‘AHU. White terns (Gygis alba) are common in the northwestern Hawaiian Islands, but in the main islands they are found only on O‘ahu, where they were first observed nesting in 1961. The O‘ahu population is listed as endangered by the State of Hawai‘i. The population has expanded since then, but no systematic surveys have been conducted to determine the distribution and abundance. Beginning in October 2001, an attempt to census white terns on O‘ahu was initiated. Nesting and roosting sites were located by observing flying birds and by characteristic clusters of droppings under habitual perches. The population of white terns on O‘ahu is at least 400 adults, including over 100 breeding pairs. White terns often occurred in loose aggregations. All terns were found in urban and suburban areas, with the largest concentrations in downtown Honolulu. Nests and roosting birds were found in 21 different tree species, but kukui (Aleurites moluccana) and mahogany (Swietenia mahagoni) were preferred, and monkeypod (Samanea saman) and figs (Ficus spp.) also were used frequently. Previous studies of the breeding biology on O‘ahu found that most eggs were laid from February-June with a peak in March; results of this study agree thus far. White terns are tolerant of people and noise, but construction and tree-trimming projects should be conducted when fewer white terns are nesting and in a way that minimizes disturbance to nesting birds. Landscaping with kukui and mahogany might provide more nesting habitat for white terns.

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PREDICTING RANGE LIMITS FOR THE RED IMPORTED FIRE ANT (Solenopsis invicta) IN HAWAI‘I. Recent establishment of the red imported fire ant (S.invicta;RIFA) in California puts Hawai‘i at high risk of invasion by this pest due to the huge quantities of goods shipped here from California. S.invicta, arguably the world’s worst
ant pest, poses a huge risk to Hawaiʻi’s native biota. In order to allow resource managers to determine which areas are at high risk of *S. invicta* invasion, future potential range of *S. invicta* in Hawaiʻi was predicted following a modeling method developed by Dr. M. Korzukhin and others. The model simulates colony growth and calculates subsequent production of reproductive females (alates) based on soil temperature, the key ecological factor determining *S. invicta* colony growth and metabolism. Results were compared to those at calibration sites located at the extreme northern limits of the current RIFA range on the U.S. mainland. Average alate production at these calibration sites was used to define zones of probable *S. invicta* proliferation. Hawaiʻi results were mapped according to these colony proliferation definitions. A precipitation threshold was used to indicate regions where arid conditions may prohibit colony growth in areas without supplemental water sources such as irrigation, stock ponds, and streams. Results predict *S. invicta* colonization will be temperature-restricted primarily in areas above 2500m on Hawaiʻi, and in some areas above 1900m on Maui and 1000m on Kauaʻi. Results also show that lack of precipitation in some leeward locations may also restrict RIFA colonization.

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CONTROL OF INVASIVE VERTEBRATES ON GUAM FOR PROTECTION OF NATIVE FLORA AND FAUNA. The introduction of numerous vertebrate species, including the brown tree snake (*Boiga irregularis*; BTS), rat (*Rattus spp.*), feral pig (*Sus scrofa*), sambar deer (*Cervus marinus*) and feral cat (*Felis catus*), has led to the extinction, extirpation, or suppression of numerous native plants and animals on Guam. The long term viability of extant species is dependent upon the implementation of integrated wildlife damage management programs that target detrimental species. Current projects on Guam include: the removal of over 3,000 BTS, using snake traps and oral toxicants, from a 550 hectare forest block on the northern end of the island, in support of Mariana crow (*Corvus kubaryi*) recovery and re-introduction; BTS control around nesting caves used by island grey swiftlets (*Aerodramus vanikorensis bartschi*), which has produced substantial swiftlet population increases, and the establishment of a 22 hectare predator and ungulate exclosure which protects native vegetation and supported F2 generation reproduction of released Guam rails (*Gallirallus owstoni*). These initial successes have provided managers with opportunities to create plans for landscape scale species restoration. Proposed future projects include predator control and the installation of multiple species exclusionary barriers across large forest blocks on northern Guam, and the subsequent re-introduction of additional native avifauna.

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METHODS OF MONITORING HAWAIIAN MONK SEALS (*Monachus schauinslandi*) IN THE KAH'OOLAWE ISLAND RESERVE FOR MANAGEMENT PURPOSES. The Kaho'olawe Island Reserve offers a number of unique management opportunities and challenges due to its history and cultural importance to the Hawaiian people as the kino lau (sacred body form) of Kanaloa (god of the ocean). Seized by the U.S. Navy in 1941 and used as a live-fire range for 50 years, the Kaho'olawe Island Reserve (KIR) today is managed by the state of Hawai’i and held in trust for a future, recognized, sovereign Hawaiian nation. Due to the long break in human habitation, Kaho‘olawe’s coastal areas are relatively pristine and may provide important refuges in the Main Hawaiian Islands for rare ‘ilio-holo-i-ka-uaua (*Monachus schauinslandi*). Due to the Navy’s continuing cleanup of ordnance, access to the KIR’s coastal areas is limited. However, regular access to some areas is provided for cultural use by the Protect Kaho'olawe ‘Ohana (PKO) and for restoration and monitoring projects, as well as for the Navy’s contractor – ParsonsUXB. Effective partnerships between the KIRC and these groups have yielded significant monk seal sighting information. The KIRC is compiling and analyzing 5 years of information tracking location, habitat type, behavior, scar patterns, and sex of sighted ‘ilio-holo-i-ka-uaua to generate minimum population estimates and determine habitat use patterns. These data will serve to provide the Hawaiian peoples and resources managers with methods to collect and utilize incidental sighting data and apply them to habitat mapping and a protected species management plan.
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HYDROPHOBIC ORGANIC COMPOUNDS IN O‘AHU STREAMS AND POSSIBLE SUB-LETHAL EFFECTS ON STREAM FAUNA. As part of the U.S. Geological Survey’s National Water Quality Assessment (NAWQA) program, streambed sediment and fish tissue were collected from 26 streams on the island of O‘ahu to assess the occurrence and distribution of hydrophobic organic compounds. Bed sediment was analyzed for organochlorine compounds and semi-volatile organic compounds, and fish tissue was analyzed for organochlorine compounds. Organochlorine pesticides were used on O‘ahu in urban as well as agricultural settings until the mid-1980s when their use was restricted or halted in the U.S. because of their harmful effects on wildlife and their tendency to accumulate and persist in soil, sediment, and biota. These compounds are transported into streams and eventually discharge into the near-shore environment. These compounds can enter the food chain and bio-accumulate. Organochlorine compound concentrations in bed sediment and fish tissue were correlated. Concentrations of these compounds in fish at all the urban sites were high and at times exceeded national criteria for the protection of fish and fish-eating birds. Many organochlorine compounds have also been correlated with sub-lethal effects in fish and other vertebrates; including endocrine disruption, reduced reproductive output, and lower resistance to disease. A pilot study was conducted using green swordtails (Xiphophorus helleri) along a gradient of concentrations of organochlorine compounds. Results indicate that fish from contaminated streams have significantly reduced sperm and egg counts, shorter gonopodia, and lower gonadosomatic indices (GSI). Sperm viability was related to contaminant levels and influenced by GSI.

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SEED COLLECTION MANAGEMENT IN HAWAIIAN PLANT CONSERVATION. Recent research at the USDA National Seed Storage Laboratory and the University of Hawai‘i Center for Conservation and Training shows seeds of many, probably most, species of native Hawaiian plants are readily storable for years. Practical seed storage guidelines for seed users are available in the on-line seed storage manual at (http://www2.Hawaii.edu/scb/seed/seedmanual.html). The University of Hawai‘i Center for Conservation Research and Training (CCRT) is working to establish a comprehensive seed conservation system for native Hawaiian plants. When fully developed, the system will include central facilities for seed storage research and long-term storage of back-up seed collections (“Noah’s Ark”), local medium-term storage facilities for seeds used in ongoing programs (“passbook savings account”), and support for on-site storage facilities at the end-users’ locations. The CCRT seed storage facility at Lyon Arboretum now provides these services. Seed users interested in making use of the facility’s services or developing their own seed storage programs can contact CCRT for assistance.
The Secretariat for Conservation Biology (SCB) is an innovative partnership guided and funded by ten organizations involved in natural resource management, research and education programs in Hawai‘i. The SCB is a small unit within the UH Center for Conservation Research and Training, with an advisory group representing the partner organizations that meet quarterly to design and guide the SCB agenda and activities.

**SCB Partner Organizations and Advisory Group Members**

- University of Hawai‘i - Center for Conservation Research and Training  
  Ken Kaneshiro
- The Nature Conservancy of Hawai‘i  
  Sam Gon
- DLNR Division of Forestry and Wildlife  
  Michael Buck
- U.S. Fish and Wildlife Service  
  Paul Henson
- U.S. Forest Service  
  Kathy Ewel
- USGS Biological Resources Division  
  Bill Steiner
- U.S. National Park Service  
  Bryan Harry
- Bishop Museum  
  Allen Allison
- East West Center - Program on Environment  
  Nancy Lewis
- Kamehameha Schools  
  Peter Simmons
- Ducks Unlimited  
  Tom Dwyer

**Mission**

To promote effective, long-term management of Hawai‘i’s native ecosystems through a collaborative research, training and outreach effort among land managers, scientists, educators and the general public.

**Goals**

- Foster communication between researchers and managers to promote management-oriented research.
- Increase and sustain support for high-priority management-oriented conservation research in Hawai‘i.
- Communicate the results of conservation science to natural resource managers.
- Increase public awareness as to the importance of conserving and managing Hawai‘i’s biological diversity.
- Facilitate and coordinate cooperative projects and sharing of resources that support the SCB mission.

**Activities**

- Hawai‘i Conservation Conference
- Hawai‘i Conservation Forum
- Hawai‘i-New Zealand Conservation Biology Exchange Program
- Applied Conservation Research Grants Program
- Practical Management Guides for Natural Resource Managers
- Training Workshops for Natural Resource Managers
- Conservation Science Information on the Internet
- Natural Resource Economic Valuation Initiative
- Public Awareness Partnership and Campaign Strategy
- Workshops Illustrating Marine Issues and Strategies for Positive Resolution
HAWAI‘I ALOHA (Ku‘u One Hanau)

Composed by Reverend Lorenzo Lyons (Makua Laiana)

E Hawai‘i, e ku‘u one hänau e
Ku‘u home kulaiwi nei
‘Oli nō au i nā pono lani ou
E Hawai‘i, aloha e!

E Hawai‘i, the sands of my birth
My native home
I rejoice in the goodness you confer
O Hawai‘i, such aloha!

E hau‘oli e nā ‘ōpio Hawai‘i nei
‘Oli e! ‘Oli e!
Mai nā aheahe makani e pā mai nei
Mau ke aloha no Hawai‘i

So be glad, young ones of Hawai‘i
Sing out! Sing out!
Gentle breezes approach, blow hither
Love for Hawai‘i endures

E hau‘oli e nā ‘ōpio Hawai‘i nei
‘Oli e! ‘Oli e!
Mai nā aheahe makani e pā mai nei
Mau ke aloha no Hawai‘i
E Hawai‘i, aloha e!

So be glad, young ones of Hawai‘i
Sing out! Sing out!
Gentle breezes approach, blow hither
Love for Hawai‘i endures
O Hawai‘i, such aloha!