# Wetland Management in the Hawaiian Islands Workshop Proceedings
October 31, November 1, 2002

Sponsored by The Wildlife Society – Hawaii Chapter and the Hawaii Department of Land and Natural Resources. A special thanks to Ducks Unlimited and Pacific Coast Joint Venture for providing funding to help make this workshop possible.

## Adam Asquith

**Title:** Wetland Management in Hawaii: Low Tech from the High Ground.

**Abstract:** Pre-historically, most coastal wetlands in Hawaii were forested swamps, not marshes. Remaining native vegetation is predominately perennial sedges. Presently most coastal wetlands, and certainly those that are managed, do not have original soils, original hydrology, or original vegetation. Arguably, they are not natural Hawaiian systems, but surrogate water bird habitats that have management life expectancies. It is argued that we should be embracing low tech, appropriate, sustainable water bird management efforts that include 1) stream protection and management, 2) restoration of coastal brackish wetlands, and 3) expansion and support of wetland taro farming.

**Contact Information:**
Adam Asquith
University of Hawaii
Sea Grant College Program
4654 Hauaala Rd.
Kapaa, HI 96746
Phone:808-635-8290

## Sheila Conant

**Title:** Managing Wetlands in Hawaii: Bringing Science, Culture and Community Together.

Working Together
- Your research agendas should be more than just what your biologists want - managers also need to be involved in planning.
- Managers have different questions than land mangers.
- Different people have different land use needs; research needs to address all stakeholders' questions.
- All the stakeholders in wetland management need to have some say in what type of research is being performed.
- What are the best ways to maximize survival and recovery of water birds in different types of wetlands.

Communication

- Everyone has different views on wetland management.
- Resource managers need to encourage stakeholders questions.
- Respect all opinions on management plans.

Planning
- Get all possible interest groups involved in strategic planning.
- A lot of controversy about the best way to manage wetlands; difficult opinions.
- Everyone needs to respect various opinions.
- Be honest about information available.
- Go into mediation in "good faith".
- If you don't want to play the game then you should not be on the field.
- Public meetings are necessary to involve all stakeholders.
- Make every effort to tell the public about what you are doing and why.

Messages
- Open communication and collaboration among stakeholders will facilitate cost-effective management.
- Community based management is the best way to involve the public.
- Hamakua Marsh is a good example of a successful community-based restoration.
- As far as taro cultivation for water bird conservation, various wetland management approaches can work together in a complementary fashion. Making the various wetland management scenarios work together is a challenge for everybody.
- There are a lot of resources at stake - cultural issues, economic issues, and biological issues - and they need to be dealt with in a very careful way.

**Contact Information:**

Sheila Conant, Ph. D.
Professor and Chair, Department of Zoology
Professor, Graduate Specialization in Ecology,
Evolution and Conservation Biology
University of Hawaii at Manoa
2538 McCarthy Mall
Honolulu, HI 96822
Phone: 808-956-8617
FAX: 808-956-9812

**Carlos Andrade**

**Title:** Significance of Taro to the Hawaiian Culture.

Managed wetlands have always existed in Hawaii
- Fish ponds
- Turtle ponds
- Taro fields.

Background
- Taro is the staple food of the Hawaiian people.
- Make poi by pounding taro root.
- Historically taro was first thought to be cultivated in Japan in 100 A.D.
- Rice was a weed in early taro patches and was domesticated as people moved into the area.
- Christian belief - humans are created in the image of god and given dominion over the land of animals.
- Hawaiian belief - mating of the Sky father and Earth mother, Molokai and Oahu; after successful mating a daughter is born. This is very different than the belief that we have dominion over the earth.

Nutrition
- Taro is rich in calcium, iron and riboflavin, no cholesterol and no fat.
- Taro is fed to babies because of its high vitamin content, and fed to the elderly because it is easily digestible.
- After much discussion by aboriginal people, taro was approved in the 1980's as part of the approved food groups for schools and other programs.
- Soviet astronauts ate poi while in space.
- Taro also has medicinal qualities, helping to sooth burns and bug bites.
- The entire plant can be eaten; the leaves have a spinach quality once cooked.

Spiritual
- Hawaiian belief says that the people are related to the land, when they take care of the land they are taking care of their family.
- Taro plant is not just a physical thing that grows in a wetland - it is a spiritual entity that binds all life forms together and acknowledges their junior status in the genealogical order when they eat the taro.
- The transformation of taro into poi is still relatively sacred in many Hawaiian families.
- Hawaiians eat out of a common poi bowl - providing a time for pleasant social gathering and interaction.
- Taro acts as a sacrament - taro is consumed as a celebration of life and it serves as a metaphor for the celebration of our connectedness - of kinship and inclusiveness of family.
- The taro not only nourishes the body, it also nourishes the Hawaiian sense of family and connection with each other, and it establishes identity as an aboriginal people.

- Taro is a semi-aquatic plant, which was planted in streams and wetlands. Taro cannot grow in stagnant water.
- Taro represents the relationship between marine and land forms of life.
- Only a few hundred acres of Hawaiian taro wetlands exist today as opposed to the thousands of acres that existed before European contact.

**Contact Information:**
Carlos Andrade
Acting Assistant Professor of Hawaiian Studies
University of Hawaii at Manoa
Hawaiian Studies Building Room 209A
2645 Dole St
Honolulu HI 96822, USA
Telephone: (808) 973-0976
Fax: (808) 973-0988

## Michael D. Silbernagle

**Title:** Management Actions on the Oahu National Wildlife Refuge Complex Wetland Refuges.

**Abstract:** Wetlands require long-term investments of time, effort, and funding to maintain their productivity. A variety of tools are used to accomplish this. On the Oahu National Wildlife Refuge Complex (Oahu NWRC) wetland refuges, a variety of management tools are being used with success. Some of these tools, their uses, and effectiveness on the Oahu NWRC will be described. A case in point of how some of these tools and techniques were used to improve plant and animal populations on one of our refuges will be covered. Finally, where are we going from here with our wetland management program on the Oahu NWRC.

Where are these Refuges?
James Campbell NWR
Kii Unit
- North Shore
- 117 ac. Total/70 ac. Wetlands
Punamano Unit
- North Shore
- 37 ac. Total/20 ac. Wetlands
Pearl Harbor NWR
Honouliuli Unit
- West Loch
- 37 ac. Total/18 ac. Wetlands
Waiawa Unit
- Middle Loch

- 24 ac. Total/21 ac. Wetlands

Water Management
Foundation for wetland management
Without it options are limited
Variety of components

Water Distribution
Buried pipelines
Manually operated valves
Convey water
Permit flow to individual ponds

Water Level Monitoring
Manual
- Staff gauge
Automated
- Logger
Provide time/water-level continuum
- Seasonal
- Weather events

Water Use Monitoring
Quantity used
Reported to State
Help evaluate conservation measures
Help determine seasonal needs

Habitat Management
Water as a Tool: Wet or Dry?
Timing
Drying
- Helps germinate some wetland plant species
Flooding
- Helps control upland species

Combination
Increase diversity
Habitat
Species
Shorebird habitat
Plant germination

Mechanical Methods
Refuge staff
Volunteers

- Individuals
- Schools
- Organizations

Manual

Power tools

Mowing

Mowers
- Push
- Riding

Tractors with mowers
- Boom-mount flail
- Rear-mount flail and brush-hogs

Mowing: Pro and Cons

Pros
- Quicker than some other methods
- Reduces height of vegetation
- Equipment readily available

Cons
- Results don't last long
- Effects only above ground parts of plant

Tilling

Recently used

Shallow till (3")

Improved vegetation control over mowing

Subsurface disturbance

Tilling: What's the difference?

Used successfully to slow the growth of:
- Batis
- Bulrush
- Cattail
- Bacopa

Big advantage: root disturbance

Longer lasting results: Tilling vs. Mowing

Mowed & tilled at the same time

2-month duration between work and photo

Results may vary

Prescribed Burning: Why Burn?

Thorough biomass removal

Rapid nutrient return to soil

Quicker than some other techniques

Prescribed Burn Issues
Planning & preparation
Risk
Smoke consideration
Proximity to development

Herbicide Application
Applied prior to burning
Spot treatment
Control undesirable vegetation

GIS to Document Habitat
Habitat manipulation
- Pre-treatment conditions
- Post-treatment conditions
Plant species
- Presence
- Distribution
- Acreage

GIS Results
Graphic representation
- Plant species
- Distribution
- Acreage
- Associations
Graphic comparison
- Between years
- Mgt. Technique used
Flexibility

Outreach: Why?
Get the word out about wetlands:
- Develop an appreciation
- Understand the importance
- Learn about wetland species
- Gain an understanding of wetland management
- Provide opportunity to experience wild places

Outreach: What's available
James Campbell National Wildlife Refuge
- Weekly tours during stilt non-breeding season
- 2 days a week presently
Pearl Harbor National Wildlife Refuge
Honouliuli Unit

- Environmental education program in cooperation with Hawaii Nature Center
- Public Overlook (coming soon)

Honouliuli Unit

A Case In Point: In the Beginning (1996) there was no comprehensive habitat manipulation for more than 7 years.
Poor overall wetland conditions.
Low water bird use.

Vegetation conditions

Excessive plant cover
- High density
- Woody
- Tall

Poor species composition
- *Pluchea*, *Batis*

Wildlife Conditions

Low numbers
Low species diversity
Low productivity

What Did We Do?

Dried wetland impoundments
Removed rank vegetation
Aerated soil via exposure to air
Refilled impoundment

Wildlife Response: A Cycle

Temporal changes
- Plant species
- Wildlife Numbers
- Water quality
- Varies with site

Honouliuli
- ~18-24 months

Native Plant Response

Four species of native plants present
Some used by endangered water birds
Some are aggressive (*Bacopa sp.*)

Research/Studies

University of Hawaii
- Native wetland plant out-planting research

Refuge Staff
- Water quality trends

What's in the Future for the Oahu NWR Complex?
* Continued mechanical experimentation
* Improved water impoundment configuration
* Improved water distribution
* Improved water quantity

**Contact Information:**
Michael D. Silbernagle
Wildlife Biologist
US Fish and Wildlife Service
Oahu National Wildlife Refuge Complex
66-590 Kamehameha Hwy., Room. 2C
Haleiwa, HI 96712
Phone:(808) 637-6330 x23
FAX: (808) 637-3578

## Glynnis Nakai

**Title:** Kealia Pond National Wildlife Refuge, Maui, Hawaii

**Abstract:** Kealia Pond National Wildlife Refuge is a naturally formed coastal wetland on the south shore of Maui. The refuge encompasses 700 acres of open water, mudflats, and upland habitats between the towns of Kihei and Ma'alaea. Established to protect Hawaii's endangered water birds (Hawaiian stilt and Hawaiian coot), the refuge has a great potential for hosting a diverse assemblage of water bird species, yet is subjected to upper watershed changes and urbanization at its boundaries. A comprehensive understanding of the wetland dynamics should be gained in order to plan, implement, and monitor management and restoration actions in efforts to enhance habitat for endangered and migratory bird species.

Rely on Nature for management
High water in winter.
Low water in spring.
Low water causes 98% die back of tilapia (fish) in pond, resulting in problems with foul smells associated with the refuge.
High nutrient levels may be causing outbreaks of spotted-wing midges.

Projects
Comprehensive water quality monitoring.
Invertebrate study.
Fish studies, including experimental control methods for invasive fish species.
Study to look at water bird ecology, biology.

Goals

Gain information about wetland ecology.
Use information gathered to make management decisions.

Stumbling blocks
Limited water control.
Invasive species (primarily *Batis maritima*) cover most of the pond's northern shore.
Beware not to infringe upon stilt nesting.
Mangrove tree removal.

Conclusions
Hawaiian water bird management is more than just putting water in a pond- managers need to know the wetland ecology.
Trial and error work needs to be done in order to develop new, more effective methods.
Cultivation of native wetland plants should be part of a wetland management program.

**Contact Information:**
Glynnis L. Nakai, Refuge Manager
Maui NWR Complex
P.O. Box 1042 (Milepost 6 Mokulele Hwy.)
Kihei, HI 96753
Phone: 808-875-1582
Fax: 808-875-2945

**Carey Smith**

**Title:** The Pacific Coast Joint Venture and Wetland Project Funding Opportunities.

**Abstract:** The Pacific Coast Joint Venture (PCJV) is a partnership among federal, state and local governments, private conservation organization, corporations and individuals working toward the preservation and restoration of wetland habitats. PCJV boundaries included coastal northern California, Oregon, Washington, British Columbia, Alaska, and most recently, Hawaii. Since its start in 1991, PCJV partners have acquired 150,000 acres of wetlands and watershed areas, and restored 50,000 acres of coastal wetlands, through partner contributions of more than $400 million. The three major funding sources for this partnership include the North American Waterfowl Conservation Act funds and the National Coastal Wetland Conservation Act fund. During the past year, Hawaiian partners competed successfully for four wetland projects under these grant programs. Total funds acquired for these projects came to more than $2 million. This presentation will discuss the differences among these three funding mechanisms, and provide insight on how to pursue funding.

North American Wetland Conservation Act:

Purpose:

Signed into public Law on December 13, 1989

- To protect, enhance, restore, and manage an appropriate distribution and diversity of wetland ecosystems and other habitats for migratory birds and other fish and wildlife in North America;
- To maintain current or improved distributions of migratory bird populations; and
- To sustain an abundance of waterfowl and other migratory birds consistent with the goals of the North American Waterfowl Management Plan and the international obligations contained in the migratory bird treaties and conventions and other agreements with Canada, Mexico, and other countries.

North American Wetland Conservation Act Accomplishments since 1989:

| Type | # Projects | NAWCA Grant | Partner Funding | Total |
|---|---|---|---|---|
| Non-Coastal | 301 | $142,488,130 | $488,733,140 | $631,221,280 |
| Coastal | 186 | $102,232,230 | $391,022,900 | $493,355,130 |
| Total | 487 | $244,820,370 | $879,756,040 | $1,124,576,420 |

*Total Acres Affected is 2.5 million, of which 600,000 are coastal acres.

Standard Grant Program

What does this Act fund?

- Acquisition, restoration, or enhancement of wetlands and associated uplands.

Who is eligible for funding?

- Everyone.

Program Funds Available

- For 2002 it was $45 million.

How much is available for a project?

- $1 million.

What is the required match?

- 2 to 1, non-federal to grant (1 to 2 to be competitive).

What constitutes a match?

- Cash, prior acquisitions or restorations, surveys, appraisals, etc. (2 year envelope).

What is the ranking criterion?Seven criteria totaling 100 points: 1. Waterfowl Resource Value (15)

2. Wetland-dependant Migratory Bird Resource Value (15)
3. NAWCA and Specially Recognized Sites (15)
4. Wetland Status Trends (10)
5. Long-term Conservation (15)
6. Endangered Species and Other Species Listing (10)
7. Partnerships (20)

What are the application dates?

Last week of March and first week of July.

Web site: http://birdhabitat.fws.gov.

Phased Approach to NAWCA Projects
Lower Columbia River Eco-Region Restoration Project (Phase I, II, III)

| Date | Grant Funds | Partner Funds | Acres Protected | Acres Restored |
|---|---|---|---|---|
| Phase I: 1997 | $708,100 | $751,800 | 229 | 3,455 |
| Phase II: 1998 | $994,000 | $6,909,000 | 812 | 3,863 |
| Phase III: 1999 | $999,014 | $6,119,574 | 1,963 | 4,697 |
| Total | $2,701,114 | $13,780,374 | 3,004 | 12,015 |

NAWCA Funded Estuarine Projects in Washington State

Two Examples:
Sequim Bay Acquisition and Restoration
Grantee: Jamestown S'Klallam Tribe
Project:125 Acres Acquired and 14 Acres restored.
Act Funds: $400,000
Matching Funds: $1,564,750

Willapa Bay
Grantee: Columbia Land Trust
Project: 4,245 acres acquired and 337 acres restored.
Act Funds: $999,855
Matching Funds: $19,930,814

North American Wetland Conservation Act Small Grants

Purpose: To promote long-term wetlands conservation activities through encouraging participation of new grantees.
Differences from the standard grant
1) Total program funds are $2 million
2) Project funding limited to $50,000
3) Application period is the last week of November

National Coastal Wetland Conservation Acts Grants

Purpose: National Coastal Wetlands grants are available for:
1) the acquisition of interests in coastal lands or waters;
2) the restoration, management or enhancement of coastal wetland ecosystems;
3) projects must provide for long-term conservation of such lands and waters and the hydrology, water-quality, and fish and wildlife dependent thereon
- Eligible participants: State agencies in states bordering on the oceans, gulf, or great lakes, with the exception of Louisiana.
Funding: Up to$15 million is annually made available through the Sport Fish Restoration Account, which has four sources:

1) a manufacture's excise tax paid on fishing equipment;
2) import duties on fishing tackle, pleasure boats, and yachts;
3) federal fuel tax revenues from motorboat fuels;
4) accrual of interest on the trust fund in which deposits are held.- Funds available by project: A maximum of $1 million per proposal.

Matching requirements: Most states qualify for a 75% to 25% match (grant funds to non-federal match).
Eligible match: The match can be any non-federal cash or in-kind contributions including, past acquisitions or restorations or other services, provided that the action is necessary and reasonable for completing the project.

Project ranking criteria: The following are the thirteen criterion totaling 64 points used to rank projects:

1) Wetlands Conservation (7)
2) Maritime forest on coastal barriers (7)
3) Long-term conservation (7)
4) Further ecosystem/watershed management planning (3)
5) Conservation of threatened and endangered species (5)
6) Benefits to anadromous or inter-jurisdictional fish (5)
7) Benefits to coastal-dependent migratory birds (5)
8) Prevent of reduce contamination (5)
9) Catalyst for future conservation (4)
10) Partners in conservation (4)
11) Federal share reduced (5)
12) Education/outreach program or wildlife-oriented recreation (3)
13) Other factors (i.e. threat, expense, cultural resources, invasive species control)

National Coastal Wetland Conservation Acts Grants

- Application deadline: Middle of June
- Web site: www.fws.gov.cep/cwgcover.html

Coastal Wetlands Conservation Act Grant Projects in Washington State:

Tarboo Bay
Ellsworth Creek
Chinook River
Point Hannon
Dabob Bay
Snohomish River Delta
Niawuakum River
Grays Harbor
Chehalis Floodplain
Elk RiverKennedy Creek
Bone River
Woodard Bay
Duckabush River
Union River
Third Lagoon
Nooksack River
Nemah River
Whatcom Creek
Hoko River Estuary

Bringing Together the Pieces

Step 1: Acquired a 1080-acre conservation easement through the Wetland Reserve Program $1.8 million.Step 2: The Columbia Land Trust acquired fee title ownership of the 1080-acre tracts and an additional 200 acres through a NAWCA grant $200,000.Step 3:Received a $375,000 Salmon Recovery Board grant for estuarine restoration. Step 4:Columbia Land Trust donates the land to the Washington Department of Fish and Wildlife.Step 5: Washington Department of Fish and Wildlife receives a $960,000 National Coastal Wetlands Conservation grant for restoration.Step 6: Received $400,000 from the Wetland Reserve Program for restoration.Step 7: Ducks

Unlimited donated $20,000 in engineering for restoration. Step 8: U.S. Forest Service contributed $20,000 toward restoration.

**Contact Information:**
Carey Smith
Pacific Coast Joint Venture Coordinator
9317 NE Hwy 99, Suite D
Vancouver, WA 98665
Phone: 360-696-7630

## Fern Duvall

**Title:** Kanaha Pond Wildlife Sanctuary, Maui - Issues, Programs and Management in 2002

**Abstract:** Kanaha Pond Wildlife Sanctuary - Habitat Restoration and Management. Kanaha Pond Wildlife Sanctuary (KPWS) is not only a primary wetland which is managed as habitat for Hawaii's three endangered water birds, the Hawaiian Stilt, Hawaiian Coot and Hawaiian Duck, but it is also site of intense ongoing ecosystem restoration. Its location, description and its history, provide a background for the current largely volunteer driven projects which are converting the alien plant dominated landscape back to the original plant communities. The efforts, value, and outcomes of the last four years of the habitat and dune restoration by the many volunteers are highlighted.

Kanaha Pond Wildlife Sanctuary
• 235 acres, with 85-90 acres of open water.
• Depth is 1.7' on average, with deepest areas approximately seven feet deep.
•Located on the north (windward) Coast of Maui.
• The "pond" is a lagoon surrounded by sand dunes and a *Prosopis* forest/shrub-land.
• Spring fed at 155 million gallons per day, it stores 50 million gallons.
• The pond receives only 18" rain per year; it loses 1.5 million gallons per day in evaporation.
• A 164 foot deep well provides water level control.

250 years ago Kapi'i-o-ho'okalani creates two fishponds from wetlands.
In the 1940's the Navy creates Naval Air Station Kahului [NASKA], filling and segmenting the wetland.1951 - The Territorial Board of Agriculture designates Kanaha Pond a "Waterfowl Sanctuary".
1962 - DLNR given permit to "manage" 143 acres as a Wildlife Sanctuary by HDOT – Airports Division with FAA approval.
1971 – The National Park Service designates Kanaha as a "National Natural Landmark".
1973 – HDOT/Airports transfers management of the area to DLNR. 1994 - More area is added to DLNR management (currently 235 acres).The Water at Kanaha Pond:
Brackish to hyper-saline depending on location.

Chlorinates is 3,927 mgcl/l to 20,000 mgcl/l (drinking water is: 30 – 150 mgcl/l).
Most of the pond is impacted by sewage injection nutrients.
Clear RED to BLACK peripheral waters – the historic pre-1974 condition.
The Waterbird Recovery Plan designates Kanaha as "Primary Recovery Habitat"
Hawaiian Stilt: 20% - 40% of birds in State bi-annual counts.Hawaiian Coot: 20% - 60% of birds in State bi-annual counts.Hawaiian Duck: (since 1996) - 43 birds in most recent counts.
TOTAL of 86 species – native and alien, resident and migratory.
Plants at Kanaha Pond Wildlife Sanctuary:
Total Species – 170 (All categories).
Percentage composition:
62 % Alien species
21 % endemic Hawaiian species
15 % Non-endemic native species
2 % Polynesian introductions

Habitat Management - Whole Ecosystem Restoration:
(Slide showing typical viewing condition of the Sanctuary only 5 years ago).
Most of the non-submerged lands dominated by *Pluchea* shrublands and *ProsopisPluchea indica and P. carolinens* causes declines in: Water bird habitat
Lowered water table
Restricted views of pond and water
Trial case for habitat restoration of a highly altered site:
The two acre "test site" – starting condition in November.
Rodeo drizzle followed.Habitat continues to shift vegetation type, more wet.
February endangered water birds colonize and breed in areas not previously available.
Kanaha's famous Makaloa (*Cyperus laevigatus* ) explodes.
15 months after restoration water "appears", coots move in.
Habitat Restoration applied as Ecosystem Restoration concept at entire sanctuary in 1999.
Restoration TenantsRestore with pre-contact native plants.
Utilize interested volunteers:
Native Hawaiian Plant Society
Maui Police Department
In last four years volunteers have:
Removed 326 tons of *Pluchea* by hand.
Performed >2400 hours of work per year [9631 hours total].
Provided >$36,000 match monies/year for $144,465 total.

Kanaha Pond Sand Dunes Restoration Project
Four year project.12 Species of T & E plants (1096 individuals) and 15 other common native species.
Biggest Problems: rats & drought.

Species are naturalizing:
Offering genetic safety net populations in a protected area.
In a restored community/ecosystem complex.

Known from Pollen - now common following re-establishment through out-planting.
We are off to a successful start in a *long* process.

**Contact Information:**
Dr. Fern Duvall II
Wildlife Biologist - Maui District
Department of Land & Natural Resources
54 S. High Street, Room 101
Wailuku, Hawaii 96793
Phone: 808-873-3502
Fax: 808-873-3505

## Eric Guinther

**Title:** Community Efforts and Studies to Restore Habitat in Kawai Nui Marsh: `Ahahui Mälama I Ka Lökahi

**Abstract:** A community project utilizing volunteers is attempting to restore wetland habitats to a small part of Kawai Nui Marsh at Na Pohaku o Hauwahine. Restoration involves removing, by hand, the thick vegetation cover and underlying peaty soils to expose the water of the marsh and create ponds. Replanting with mostly native wetland plant species completes the process of habitat restoration. However, problems arise in keeping the ponds open against a tendency for organic sediments to refill the ponds and alien wetland plants, such as cattail, to re-establish. To better understand the dynamics of this marsh system, a Kailua Bay Advisory Council (KBAC) grant was obtained to study sediment properties, water quality, and biological interactions. The study has the broader purpose of describing how this largest of marsh systems in the Hawaiian Islands functions. This progress report mostly describes results obtained to date looking at the water/solids relationships in selected, representative parts of the marsh.

Science at the Marsh:
Trying to replant shore area with native plants including *Bacopa* and a native hibiscus.
Few native birds have been attracted to the wetlands thus far.
Ponds are being dug by hand.
Have no control over the water level.
Water levels go down in the summer and gives rise to blue green algae.
A hydrologist from HPU has been studying the marsh.
Kawai Nui marsh was once a large valley.
The marsh went through cycles of fresh water and brackish water; today is a fresh water marsh.
Many different types of sediments are present in the marsh including a coral reef sand layer.
Fresh water enters the system through two ways: groundwater and stream water.
Placed wells through out the marsh to access the water below.

Two transects through the marsh represent two areas of the marsh: a floating mat of vegetation and a anchored matt of vegetation.
Data from test-wells show a general lowering of water between August and October
In October water input begins again.
When it rains the entire vegetation rises up.
The middle of the marsh is not losing water as quickly as the rest of the marsh.
When the wells were first installed no water was found under the vegetation mat.
Now after three years of drought on Oahu we are finding water.
Hypothesis: When you add seasonal water into the system most of the water enters into ground water system, but as you add water, pressures cause water to be moved up through the water table and forces the bottom sediments up against the bottom of the vegetation mat.
When water is under the vegetation mat it is anaerobic and doesn't support life, except for bacteria.
Now taking water quality and temperature samples around the marsh.

**Contact Information:**
Eric Guinther
AECOS Inc. / AECOS Consultants
Phone: 808-247-3424
FAX: 808-236-1782

**Lauren Apiki**

**Title:** Hamakua Marsh Educational Website

**Abstract:** Hamakua Marsh in Kailua has long been dry as the result of water diversion. Discover how elementary students in the windward community of Oahu, Hawaii created a virtual wetland in their efforts to help restore this ecosystem as a sanctuary for endangered native Hawaiian water birds.

Navigated though website: hamakuamarsh.com.
Gave students a voice to speak on community issues.
Kids were allowed to act on their ideas.
Looked at Hamakua Marsh and how the kids could restore it for native water birds.
350 students worked on the website.
Illustrations, photographs and writing for website was all done by students.
Used sound, animation, and voice to help communicate issues.
Alex Handler helped project by providing professional scientists to talk to students.
This project allowed us to work with a diversity of students and provide various input opportunities based on aptitude.
Took information and targeted different age groups.
Students worked together and assisted each other to complete tasks.
Hamakuamarsh.com is one of the most comprehensive sites about water birds created by students.

Website was created in both English and Hawaiian languages.
These students had never worked on a website before.
Students visited Hamakua marsh and helped to plant native plants and remove debris.
Trying to engage all different types of visitors giving them a science perspective and a historical perspective.
One of the more difficult sections was trying to identify insects in the marsh.
Animation is used to support content information.
Students from Kailua Elementary School, Ke Kula O Samual M. Kamakau, and Lanikai School participated in the creation of the website.
Students decided that the best way to bring water back to the marsh was to pipe water in from Kawai Nui marsh.

**Contact Information:**
Lauren Apiki
Executive Director, LET Academy
Phone: 808-988-1952

## Dan Dorfman

**Title:** GIS Applications for Conservation

**Abstract:** Disseminating Information for Ecological Understanding:
The Hawaii Natural Heritage Program tracks the location of rare, threatened, and endangered species and natural communities. It provides information on the composition, distribution, and functional requirements of native Hawaiian ecosystems. HINHP partners with academic researchers and conservation management agencies to support decision-making and biodiversity conservation related research. The program collaborates on watershed monitoring and invasive species tracking and eradication efforts. HINHP is also the home of the Hawaii Gap Analysis Program, which includes terrestrial, freshwater and marine gap analysis efforts in an integrated project to review Hawaiian biodiversity conservation status. This program also participates in the National Biological Information Infrastructure through PBIN, the Pacific Basin Information Node.

Hawaii's Natural Heritage Program:
Tracking the Status of Hawaii's Native Species and Ecosystems in Support of Conservation.

Hawaiian Islands
• Approximately 6,750 species found only in Hawaii.
• 90% of the endangered species of the United States.
• 2% of the land mass of the United States.
• More endangered species per square mile than anywhere else on the planet. Primary causes:
• Habitat modification by humans.
• Introduction of alien species.

The Natural Heritage Mission:
The Hawaii Heritage Program mission is to gather, synthesize, and disseminate comprehensive information on the status and location of Hawaii's biological resources in order to assist others towards making a positive impact on biodiversity. As part of Center for Conservation Research and Training (CCRT), our mission has expanded to include training and mentoring programs that strive to integrate scientific research and technology with applied natural resource management to enhance problem solving and decision-making.
At every step of the way we have incorporated technological advances in computerized mapping, satellite navigation, and remote sensing so that we can provide better, more usable information to our users.

Hawaii Natural Heritage Program:
Over the last 2 years, Heritage has diversified expanding our databases and GIS to include:
• The tracking of alien species such as ungulates and weeds.
• The tracking of aquatic species and habitats.
• The tracking of marine species and habitats.
• The tracking of propagules, seed storage, and out-plantings.
• The development of a watershed monitoring database.
• Dissemination of data over the web.

Heritage Natural Diversity DB & GIS
Services include:
Biological Surveys and assessments.
Forestry.
GIS and database development.
GIS/GPS integration.
GPS surveys and training.
Image processing and classification.
Monitoring.
Spatial analysis and modeling.
Technical support in GIS and GPS.
Urban Planning.
Watershed monitoring.
Database and Geographical Information System
Using Overlay Analysis Areas of Ecological Significance Add Endangered Species Overlay Owners: Create Partnerships.

Objective FunctionSSM attempts to minimize the total cost of a portfolio:
Or in plain language, Total Portfolio Cost = (cost of selected sites) + (penalty cost for not meeting the stated conservation goals for each element) + (cost of spatial dispersion of the selected sites as measured by the total boundary length of the portfolio).
Pacific Basin Information Node (PBIN)
PBIN (a part of NBII) is a regional clearinghouse of biological and ecological data in the Pacific.

HINHP is responsible for the compilation and dissemination of geo-spatial and database information for PBIN, through the use of ArcIMS. The first task is to gather and disseminate information on the location of priority weeds and pests in Hawaii.

**Contact Information:**
Dan Dorfman, HI-GAP Coordinator
Hawaii Natural Heritage Program (HINHP)
Center for Conservation Research and Training (CCRT)
University of Hawaii
3050 Maile Way, Gilmore 409
Honolulu, HI 96822
Phone:(808) 956-6616

## Ati Jeffers-Fabro

**Title:** Hawaii's Nature Center's Wetland Education Program at Honouliuli and Pouhala Marshes.

**Abstract:** The Hawaii Nature Center has been conducting programs in Wetland Education for over 10 years providing an educational experience for over 30,000 third graders, their teachers and parent chaperones. Although intensely managed, the U.S. Fish and Wildlife Service has allowed the exclusive use of the Pearl Harbor National Wildlife Refuge, Honouliuli Unit for educational purposes. Out of seven grade level programs, this one in particular currently has the longest waiting list of schools wanting to attend. Consequently, the Hawaii Nature Center began working with the State DLNR Division of Forestry and Wildlife to extend our programs into the Pouhala Marsh Wildlife Sanctuary located in Waipahu, Oahu. This partnership has extended out into the Waipahu Community and with a potential grant from the State Department of Health will also address the issue of Polluted Runoff Control and the wetland habitat.

Mission Statement
Fostering awareness, appreciation and understanding of the environment of Hawaii to encourage wise stewardship of the Islands in the future.

The Need for Wetland Education
Over 30% of Hawaii's lowland wetlands have been filled or converted.
Long-term protection of remaining wetlands is essential.
Wetlands' role in watershed education.
Education is a valuable tool for community outreach.
Students are taken to USFWS Pearl Harbor National Wildlife Refuge, Honouliuli Unit.
Students also participate in programs at Pouhala Marsh, Waipahu, Oahu.
Hamakua Marsh is also a site for students to learn about water birds.

Agency Involvement
U.S. Fish & Wildlife Service.

Department of Land and Natural Resources, Division of Forestry and Wildlife.
Department of Health.
Ducks Unlimited.

Community Involvement
Volunteers help to remove debris from the marsh area.
People see other people working to implement change.
Average one service project a month at Hamakua Marsh.
Piles of Debris are gathered by hand and taken out by machines.
Police academy cadets help with service projects.
EPA supplied funds to test education curriculum..

**Contact Information:**
Ati Jeffers-Fabro
Educational Director, Hawaii Nature Center
2131 Makiki Heights Drive
Honolulu, HI. 96822
Phone: 808-955-0100 ext. 16
Fax: 808-955-0116

## Sharon Reilly

**Title:** Ducks Unlimited Hawaii – Program Overview and Strategies for Wetlands Conservation

**Abstract:** Hawaii historically supported a diverse array of water birds in its wetlands and forests. Over the past 2000 years of human presence, Hawaii's endemic rails, flightless geese and ibis species have become extinct. Six endemic water birds still persist but all are listed as endangered. In 1989 Ducks Unlimited started a program in Hawaii to assist in the recovery of Hawaii's water birds, focusing on wetland habitat conservation restoration and management. Since then and in partnership with many federal, state and local agencies and private land owners, DU has initiated 38 projects to assist in the protection and restoration of an estimated 300 acres of wetlands and approximately 1700 acres of associated habitat, e.g. upland watershed, riparian habitats.

DU contributes to wetland conservation and the recovery of Hawaii's endangered water birds by focusing on three major objectives: 1) wetland habitat restoration and management; 2) wetlands and water bird research; and 3) wetland education and information management. These objectives are being accomplished by leveraging private and public funding and developing coalitions between public and private organizations.

This presentation is an overview and discussion of DU's *Wetlands Hawaii Initiative*, current projects in progress, projects in development, future goals and strategies for accomplishing water bird recovery and DU's own program objectives.

**Contact Information:**
Sharon Reilly
1151 Punchbowl Street Room 323
Honolulu, Hawaii 96813
Phone: 808-522-8230 X 122

**Eric Gillman**

**Title:** The Convention on Wetlands of International Importance

**Abstract:** Hawaii's Thousand Friends, the Hawaii Division of Forestry and Wildlife, and the National Audubon Society are collaborating to pursue designating Hawaii's Kawainui and Hamakua marshes to the Convention on Wetlands Ramsar List.

The Convention on Wetlands of International Importance, an intergovernmental treaty adopted in 1971 in the Iranian city of Ramsar, came into force in 1975, and has come to be known as the Ramsar Convention. As of September 2002, 133 States have become Contracting Parties to the Convention, including the United States where the Convention came into force in 1987, and these Contracting Parties have designated 1198 sites to the Ramsar List covering over 103 million hectares. The U.S. has designated 18 wetlands to the Ramsar List, with one site in Alaska, and the others in the contiguous 48 states.

The Ramsar Convention recognizes the importance of wetlands as key elements of inland waterways and coastal systems. The Convention espouses the "wise use" of wetlands, managing these areas to retain their ability to provide valued services for future generations. The Ramsar Convention created the List of Wetlands of International Importance, or the "Ramsar List," which includes sites identified by the Contracting Parties as meeting Convention criteria. The Conference of the Contracting Parties has developed eight Criteria for Identifying Wetlands of International Importance, which help contracting parties identify sites containing representative, rare, or unique wetland types; and sites that are critical for conserving biodiversity. The Ramsar Convention is available to assist member countries to develop and implement national policy and legislative frameworks, education and outreach programs, inventory projects, research efforts, and training projects. The Ramsar Convention also provides a vehicle for regional and international collaboration between countries for the management of shared wetland systems and species.

Sacred to Hawaiians, Kawainui Marsh, the largest remaining emergent wetland in Hawaii and Hawaii's largest ancient freshwater fishpond, is located in what was once the center of a caldera of the Koolau shield volcano. The marsh provides primary habitat for four of Hawaii's endemic and endangered water birds, and contains archaeological and cultural resources, including ancient walled taro water gardens (lo`i) where fish were also cultivated. Kawainui Marsh stores surface water, providing flood protection for adjacent Kailua town, one of the largest towns on the windward side of Oahu. Hamakua Marsh is a smaller wetland historically connected to and immediately downstream of Kawainui Marsh, which also provides significant habitat for several of Hawaii's endemic and endangered water birds.

There are several benefits of designating a Hawaiian wetland to the Ramsar List. The designation provides an opportunity to tap the technical expertise from the Ramsar Bureau and Ramsar's International Partners. Designation could be a catalyst to develop better regional collaboration between Hawaii and other Contracting Parties of the Pacific Islands region. The U.S. Government would formally recognize the existence of an internationally valuable wetland in Hawaii, which might justify providing more technical and financial federal assistance to augment management of these wetlands. International recognition of a Hawaii wetland provides publicity and a tourist attraction. And international recognition of the importance of the wetland can provide an added level of protection.

List of Wetlands of International Importance ("Ramsar List") Definition of "Wetlands"

"...wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters. The boundaries of each wetland…may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands."

Criteria for Identifying Wetlands of International Importance

1. Representative, rare, or unique example of a wetland type;
2. Supports vulnerable, endangered, or critically endangered species or threatened ecological communities;
3. Supports populations important for maintaining biological diversity of a bio-geographic region;
4. Supports plant or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions;
5. Supports 20,000 or more water birds;
6. Supports 1% of the individuals in a population of one species or subspecies of water bird;
7. Supports a significant proportion of indigenous fish subspecies, species, or families, life-history stages, species interactions, or populations;
8. An important source of food for fishes, spawning ground, nursery, or migration path on which fish stocks depend.

Ramsar List Designation for Kawainui and Hamakua Marsh Complex, Hawaii

**Contact Information:**

Eric Gilman, Pacific Representative
National Audubon Society's Living Oceans Program
Chair, Society of Wetland Scientists International Chapter
2718 Napua`a Place
Honolulu, HI 96822
Phone: 808-977-1976
Fax: 808-988-1440

**Herb Lee, Jr.**

**Title:** Waikalua Loko Fishpond Preservation Society & Kahea Loko Project

**Abstract:** Kahea Loko is a three year grant received from the US Department of Education in October 2000 under the Native Hawaiian Education program to develop curriculum, grades 4 to 12 in the area of science, social studies and language arts utilizing the fishpond as a resource for learning.
The presentation will include:
1. Brief history of fishponds in Hawaii.
2. Mission of Waikalua Loko FPS.
3. Progress of Kahea Loko.
4. Strategic Importance of Hawaiian fishponds in both ancient and modern times
5. How Hawaiian fishponds relate to the management of the Ahupua'a including wetlands.

Different types of fishponds
Fishponds date back to the 14th century in Hawaii.
Fishponds and wetlands are all part of the Hawaiian Ahupua'a concept.
Kaneohe & Pearl Harbor are the 2 areas on Oahu that historically contain fishponds.
The Hawaiians built 488 fishponds statewide.
Only about 60 fishponds remain recognizable today.
Fishponds are a very critical part of Hawaiian culture.
There are six different types of Hawaiian fishponds.
It took a tremendous amount of effort to construct a fishpond.
Hawaiian fishponds were constructed with gates, these gates allowed for water to be moved in and out of the fishponds.
Fishponds were usually built at the point where a stream meets the ocean
Gates were made from wood from the area.
Wetlands are great areas to grow fish.
Waikiki used to be all fishponds.

Mission
1995 Waikalua Fishpond Preservation Society was formed.
The mission of the society was to educate the community about fishponds.
Invasive species were removed around the fishpond, mostly mangrove.
Dr. Clyde Tumara started a program working with school students to teach about fishponds.
October 2002 received a grant to develop a curriculum in three areas: science, social studies, and language arts to help teach public school children grades 4th-12th utilizing the Hawaiian fishpond to teach these subjects.
Today more curriculum involves cultural aspects.
Waikalua Fishpond Preservation Society is working with University of Hawaii and Sea grant in order to develop the curriculum.

Located fishponds sites all around the islands that are accessible for school children so that they can go out and learn about fishponds.
In developing the curriculum there are many challenges, but have made many partnerships.
Designing curriculum to meet and exceed performance standards.
Goal is in 2003 to take curriculum all over islands and train 300 teachers to use it correctly as to begin implementation.
To teach students about stewardship is critical in order to save these cultural resources.

**Contact Information:**
Herb Lee Jr.
Founder of the Waikalua Loko Fishpond Preservation Society
Project director of Kahea Loko with the Pacific American Foundation.
PO Box 1917
Kailua, HI 96734
Phone: 808-262-3261
Cell: 927-5646

## Paul Rappun

**Title:** Taro Cultivation

**Abstract:** Discuss how taro ponds are managed, the cycle of taro growth, and how to efficiently manage shallow water ponds.

How do you grow taro & its importance to the land:
It takes 9-18 months until you can harvest taro once it is put into the ground. It takes a lot of work to cultivate taro. Taro is viewed as a non–consumptive use of water; one of the many uses of water in the Ahupua'a (traditional Hawaiian land division). Rivers connect the mountains and the ocean - they provide natural pathways for fish and birds to travel along.

Taro is a political subject here in Hawaii. At one time there were 200,000 acres of taro land in the state, now there are only about 400 acres. The US Fish and Wildlife Service owns most of the taro-land left in the state and feels that taro growth is an unproductive way to manage wetlands. Without the taro there would be no birds in Hanalei Bay.
In our river we have a rock dam. The rocks are placed loosely. A rock dam is loosely built in the taro patch to control water flow and retention. The rock dam is placed there and native fish can climb up over the dam but exotic species cannot.

Flooding is important. One problem with taro cultivation is that farmers like to situate their crops in areas that are prone to flooding. Respect the river and the flooding of the rivers. Taro is best planted in the middle of the river bed, not along the banks in the riparian areas. Along the edge of the river is the riparian zone.

Floodwaters carry a lot of nutrients and minerals that are important to build up soils. Taro farmers in Waipio never have to fertilize their crops because of all the floods. It's said that the first year after a flood the taro crop will be good and decline every year thereafter, until the next flood. Taro patches act as a sediment trap - this is very important to the river system. Sometimes when the rivers flood the farmers let the waters go into their fields, it is especially good for the younger taro.

The taro lo`i is something that needs to be managed not "kept after". My brother and myself try to run our taro patches organically. There is very little nutrient loss off of taro patches. We use a fine ground powder made of fish and cattle bones to put over soil and use as fertilizer. It's made here in Hawaii and shipped out to the mainland - it's a shame that not more people in the islands use it. This mixture of organic matter is put on the fields dry. We've been using it on taro and it's been working very well - put a couple pounds per thousand square feet - it lasts the entire life of the crop.

First eight months or so the taro grows very quickly, then it starts to shrink down. The important thing about growing taro is to control nitrogen inputs. If you give the plant nitrogen too late in the crop cycle, you ruin the crop. If you use organic fertilizers, you are using traditional means of growing taro.

The second use of water is using it for growing taro. The water is returned back to the stream after being used in the field and it's a little bit warmer. Small amounts of water are lost but that is because of transpiration & evaporation and is part of the water cycle. In my opinion when the water is returned to the stream from the taro fields, that is when it should be used for wetlands - that's when you create a wetland. The water should then be used in fishponds and eventually makes it way back into the ocean.

The Nation Marine Fisheries Service says that the biggest reason for the decline in wetlands is the loss of near-shore wetlands. Wetlands are where fish spawn and without them, fish stocks decline.

I don't feel that birds and taro are competing species. Our farm is a small taro farm, only about four acres. When the farm was broken up the birds had to disperse. Once community taro growing was started the birds came back and started breeding. The small areas of taro are very important. The future of taro farming is not in giant commercial farms but small individually owned farms.

It's better to have the water flowing through the Ahupua'a and the taro patches than to have it being used for building houses.

Taro patches are important for our heritage and our future.

**Contact Information:**
Paul Rappun
47-410 Lulani Street

Kaneohe, HI 96744

**Nan Greer**

**Title**: Kalo Farming: Lessons in Cultural Survival, Wetlands Management, and Traditional Environmental Knowledge

**Abstract:** Conflicts over natural resources and land allocation issues are intensifying worldwide. Such conflicts present obstacles to both environmental conservation efforts and to political stability. In the Hawaiian Archipelago, conflicts over the use and management of wetland areas have reached an all-time high. While decades of agricultural, commercial, and residential development have threatened critical wetlands, some biologists have found that endangered water birds are attracted to wetland areas that have traditionally been farmed for *kalo*. Research is being conducted with 60 *kalo* farmers on the Hawaiian Island of Kauaʻi, investigating the connection between *kalo* farming and endangered water birds. The research focuses specifically on the economics of *kalo* farming, the value of *kalo* farming as a wetlands management alternative, the value of environmental knowledge developed over generations by *kalo* farmers, and the cultural aspects of *kalo* farming. The research involves household interviews, weekly data collection on farm statistics and water bird counts, a Traditional Environmental Knowledge survey, focus group discussions, and participant observation. These research methods are designed to document traditional environmental knowledge employed in watershed management, and the economic profitability of *kalo* farming. This will provide an estimate of the per-unit cost for *kalo* farmers managing wetlands for a specific number of endangered water birds. If *kalo* farming is indeed as environmentally valuable as is claimed, it may provide the State of Hawaii and other regions throughout the moist tropics, with a means of promoting both human and environmental well-being. Initial research experiences have shown that *kalo* farmers are very enthusiastic about discussing their knowledge of the endangered water birds. Thus far they have participated in the design of a water bird monitoring system (among other things), increasing the data accuracy by recording more details of the *loʻi kalo* environment than merely the water bird populations.

**Contact Information:**
Nan Marie Greer
National Science Foundation Fellow
Ph.D. Candidate, Environmental Anthropology
University of Washington
Home Address:
P.O. Box 671
Kilauea, Hawaii 96754
Phone: 808-828-1096

**Terrell Kelly & Clyde Imada**

**Title:** The Wetland Plant List, Wetland Indicator Status List Use, Status of Updates, and Need for Wetland Plant Publications.

Origin and Use of the Wetland Plant List:
The "National List of Plant Species that Occur in Wetlands", also known as the "Green Book", was put out in 1988 by the US Fish and Wildlife Service. The plant list is used in both regulatory and non-regulatory frameworks. The U.S. Army Corps of Engineers, under the Clean Water Act, uses the list to help determine wetland delineation. USDA also uses the 1988 list to determine wetland areas. The list is also used in documents such as Environmental Impact Statements.

The "Green Book" lists plants by scientific names and classifies them by obligate or facultative status. When used in wetland delineation, the dominance of different vegetative species is determined, and then whether the species is obligate or facultative. This helps to identify and classify wetland areas. If a plant is not on the list, then the plant in question is considered an upland species, and not a wetland plant.

In order to delineate a wetland area, all three parameters must be met: soils, hydrology and plants. The list was created in 1988 by scientists who came from Florida to Hawaii and met with botanists across the state. Much of the information is anecdotal. Not a lot of field tests were done in the creation of this list. A revised list was put together in 1998, but unfortunately the revisions were not approved for political reasons.

Specific examples of plants that are not in the "Green Book" that are obligate plants here in Hawaii include:
- Many new plant species introduced since the 1988 list was put together that need to be evaluated.
- At least 200 new plants that have naturalized in Hawaii since 1988.
- *Sylvania molesta* a problem water fern is not in the listing of obligate plants.
- Other plants not included on the list are *Syzygium cumini* and *Nymphea* sp. water lilies.
- Name changes have been made since 1988 that need to be recognized
- A recently introduced sedge *Fimbristylis ferruginea* needs to be added to the list.
- *Nephroiepic multiflora*, a species that was deleted from the list and needs to be put back.
- *Scripus* (the genus) no longer exists in Hawaii and should be removed from the list.

Many publications are needed so that field identifications can be made more easily.
The green-book should be updated as soon as possible.

**Contact Information:**
Clyde Imada
Bishop Museum
1525 Bernice Street
Honolulu, HI 96817

**Christopher Puttock**

**Title: Database of Hawaiian Flora**

- 10,000 species of plants inhabit Hawaii.
- New tools are needed to identify Hawaiian flora.
- The Bishop Museum has a database of over 2,000 plants vouchers dating back to 1775.
- All these species will have been logged in a data-base by the end of 2003.
- Geo-referencing will be included in the species descriptions within the database.
- Suggestion that the latitude and longitude should be given with species description.
- Everyone should have a GPS unit - satellite technologies have been updated and are available here in the islands.
- Anytime you bring a specimen to the Bishop Museum you should also give us the GPS coordinates of where it was found.
- DNA fingerprinting of plant species is needed.
- Amy Greenwell Botanical Garden located on the Big Island contains the largest collection of taro plants in the islands.
- The facility accepts requests for plant propagation, just need 3 months lead-time and they can grow out about 10,000 specimens.
- All the resources offered at the Bishop museum should be used by anyone who needs them.

**Contact Information:**
Christopher Puttock
Bishop Museum
1525 Bernice Street
Honolulu, HI 96817
Phone: 808-848-4177
Fax: 808-847-8252

**Colleen Henson**
**Hawaiian Water bird Recovery Plan: Overview and Status of the Second Revision**

Species covered by Plan
There are four endangered species covered by this plan:Hawaiian duck or koloa maoli (*Anas wyvillianana*);
Hawaiian coot or `alae ke`oke`o (*Fulica alai*);
Hawaiian moorhen or `alae `ula (*Gallinula chloropus sandvicensis*);

Hawaiian stilt or ae`o (*Himantopus mexicanus knudseni*).
- Historically, all four species were found on all of the main Hawaiian Islands except for Lanai and Kahoolawe. - Accurate population estimates are not readily available – none of these species are thought to number more than 2500 individuals with the exception of coots (2000-4000 statewide).

Hawaiian Water bird Recovery Plan Development
1975 – FWS established the Hawaiian Water bird Recovery Team to evaluate data and develop a plan for water bird recovery. This team created the original recovery plan in 1977 - The plan covered the Hawaiian coot, moorhen, and stilt.1985 – plan revised and updated to include the koloa maoli.1999 - Second Revision – Builds on previous efforts. Parts I and II of plan drafted by Andy Engilis & Dr. Frederic Reid of Ducks Unlimited with modifications by FWS. The plan was published for public review in 1999 but has not yet been finalized. Additional comments are currently being sought from the State biologists.
2002 – Draft Second Revision.

Recovery Plan Contents
I – Introduction:
Overview
Reasons for Decline and Current Threats
Conservation Measures
General Recovery Strategy
II – Species Accounts
III – Recovery
Objectives
Step-down Outline and Narrative (Recovery Tasks)
IV – Implementation Schedule

Factors Affecting Recovery
Habitat loss.
Predation by alien species.
Invasion of wetlands by non-native plants.
Hybridization.
Avian Disease.
Possible environmental contaminants.

Recovery Objective
Restore and maintain self-sustaining water bird populations on the main Hawaiian Islands. Additionally, sufficient suitable habitat must be protected and managed in perpetuity on each of these islands such that these species no longer require protection under the Endangered Species Act.

General Recovery Strategy
- Protect and actively manage wetland habitats.
- Conduct research.

- Establish new koloa and moorhen populations.
- Plan and implement an Information and Education Program.
- Reevaluate recovery objectives.
- Protect and actively manage wetland habitat areas to maximize water bird productivity and survival to better define limiting factors, refine recovery objectives, and improve management techniques.
- Establish a koloa population on one additional island and moorhen populations on two additional islands.
- Plan and implement an Information and Education Program to increase land manager knowledge of water bird needs and increase public support for water bird recovery.
- Public support will be critical in addressing koloa hybridization with mallards.
- Re-evaluate recovery objectives as additional information becomes available.

Wetland Protection and Management

The recovery plan focuses on the protection and management of wetlands needed to support the population numbers and species distribution strategies established in the recovery plan. These wetlands have been broken down into three groups:

1. Protected Wetlands
2. Primary Wetlands
3. Secondary Wetlands

Protected Wetlands - Wetlands currently under Federal, State, County, or private protection but not necessarily managed for water birds.

Primary Wetlands - Core wetlands needed for recovery that are currently unprotected. Protection and management of these wetlands provides the highest likelihood that the four water bird species can be recovered.

Secondary Wetlands – other wetland habitats utilized for nesting, dispersal, foraging, and loafing that may include habitats such as taro ponds, aquaculture ponds or some other less productive wetland areas. Some of these areas may be quite important, such as Cyanotech wetlands for stilts. For the most part, we have limited information on the role of these secondary wetlands in the life cycle of endangered water birds. We need to identify those habitats necessary for maintenance or distribution of the species and evaluate the need for protection and/or management of these habitats.

Protected Wetlands

List of protected wetlands identified in the plan. These wetlands should remain protected and management plans emphasizing water birds developed and implemented for each wetland.

**Kauai**
Hanalei NWR
Huleia NWR
Kawaiele
Mana Base Ponds
Maui/Molokai
Kakahaia NWR
Kanaha Pond
Kealia Pond NWR
Ohiapilo
**Hawaii**
Aimakapa Kaloko Pond
Parker Ranch Ponds
**Oahu**
Hamakua Marsh
Heeia Marsh
James Campbell NWR
Kawainui Marsh
Niulii Ponds
Nuupia Ponds
Paiko Lagoon
Pearl Harbor NWR
Pouhala Marsh

Primary Wetlands
Primary wetlands identified in the recovery plan. Recommend protection and management of these wetlands in order to recover endangered water birds. The loss of any of these wetlands could potentially be offset by gains in productivity in other wetlands or by creation or protection of additional wetlands. For example, the Waipio Peninsula Ponds have largely been converted to soccer fields although some remnant ponds could potentially be restored for water birds.
Niihau
-- Playa Lakes
-- Kauai
-- Lumahai Wetlands
-- Mana Wetlands
-- Opaekaa Marsh
Molokai
-- Ooia-Kaluaapuhi Fishponds
-- Paialoa
Hawaii
-- Montane Stock Ponds
-- Opaeula Pond
-- Waiakea-Loka Waka Ponds
Oahu
-- Kahuku Area Wetlands

-- Laie Wetlands
-- Punahoolapa Marsh
-- Ukoa Marsh
-- Waialua Lotus Fields
-- Waihee Marsh
-- Waipio Peninsula Pond

Recovery Criteria:
Down-listing Criteria Koloa maoli.
- Remove hybridization threat with mallards.
- Protected wetlands managed for water birds.
- Multiple, viable breeding populations on Kauai/Niihau, Oahu, and Hawaii.
- Stable or increasing population of >2,000 birds for 5+ consecutive years.

Down-listing Criteria Hawaiian Coot
- Protected wetlands managed for water birds.
- Multiple, viable breeding populations on Kauai/Niihau, Oahu, Maui/Molokai, and Hawaii.
- Stable or increasing population of >1,800 birds for 5+ consecutive years.

Down-listing Criteria Hawaiian Moorhen
- Protected wetlands managed for water birds.
- Multiple, viable breeding populations on Kauai/Niihau and Oahu, and occupied historical range on Maui/Molokai and/or Hawaii.
- Stable or increasing population of >1,500 birds for 5+ consecutive years.

Down-listing Criteria Hawaiian Stilt
- Protected wetlands managed for water birds.
- Multiple, viable breeding populations on Kauai/Niihau, Oahu, Maui/Molokai, and Hawaii.
- Stable or increasing population; >1,500 birds for 5+ consecutive years.

De-listing Criteria All Species
- Protected wetlands managed.
- Primary wetlands protected and managed.
- Population numbers stable or increasing for 10+ years.
Koloa maoli.
- Viable breeding population on Maui/Molokai.

Assistance Needed
Water bird count data – data is entered only through 1997 or 1998; some of data may be missing and needs to be located.
State Biologists – some may not have had an opportunity to review the current revision. The FWS would like comments by November 25 2002, but failing that, the project will be taken over by a new ornithologist at the FWS for editing and publication.
Status of Second Revision

Public review in Summer 1999.
Comments incorporated and provided to Regional Office in Summer 2000.
Additional comments received.
Additional review by State biologists – comments due by November 25, 2002.
Comments incorporated by Field Office.
Plan reviewed by Regional Office.
Plan finalized and published in Federal Register – Spring or Summer 2003.

**Contact Information:**
Colleen M. Henson
Fish & Wildlife Biologist
U.S. Fish & Wildlife Service
Pacific Islands Ecoregion
300 Ala Moana Blvd., Rm 3-122
P.O. Box 50088
Honolulu, HI 96850
Phone: 808-541-3441
Fax:(808) 541-3470

**Donna Stoval**

**Title:** Wetland Protection and Restoration Partnerships**.**

**Abstract:** This presentation will identify how private, county, state and federal agencies are working together to make a momentous effort in restoring Oahu's wetlands and shorelines for endangered water birds, migratory shorebirds, native fisheries, and for the residents and visitors of Hawaii. There have been multiple incentives to this project but all have shared a common goal.

**Contact Information:**
Donna Stovall, Refuge Manager
U.S. Fish and Wildlife Service
Oahu National Wildlife Refuge Complex
66-590 Kamehameha Hwy., Rm 2C
Haleiwa, Hawaii 96712
Phone: 808/637-6330 x 26
Fax: 808/637-3578

**Dr. Diane Drigot**

**Title:** Enhancing Wetland, Water bird, and Military Training Habitats at Marine Corps Base Hawaii (MCBH): Progress Made, Lessons Learned, and Challenges Ahead.

**Abstract:** Over the past twenty years, Marine Corps Base Hawaii (MCBH) has made significant progress to inventory, enhance, and restore its wetlands to improve their value as habitat for Hawaii's endangered water birds, a variety of migratory waterfowl, and native aquatic life. MCBH's natural and constructed wetlands are also managed to support healthy hydrological functioning, aesthetic, recreational, educational, and in some instances, military training values. This presentation will review progress made, lessons learned, and challenges ahead to ensure "no net loss" of either wetland or military training habitat as MCBH shifts more efforts toward an ecosystem-based, regional, collaborative watershed approach to wetland management.

Marine Corp Base Hawaii (MCBH)
- Department of Defense lands have a disproportionate number of federally-listed endangered species.
- MCBH owns 4,000 acres in Hawaii and sits atop biologically diverse areas.

Wetlands on base
- The Nu'upia Ponds are located on base.
- 130 stilts utilize the property. This accounts for 10% of the state population.
- 30 ancient fish-ponds occupied the peninsula prior to base construction.
- MCBH has several man-made wetlands – due to topographical changes.
- MCBH recently acquired lands at Bellows AFB, including streams and a wetland area

Stewardship
- Wetlands are a critical part of the watershed.
- MCBH uses a regional approach to environmental protection.
- Strong pollution prevention plan on base.

"Swords into Plowshares"
- Invasive plants crowd native birds out of shallow water and mud-flat nesting and feeding habitat: mangrove, *Pluchea*, pickle weed.
- Amphibious assault vehicles are used to combat invasive species and create stilt nesting habitat.
- Controlled destruction leads to new creation.
- Media recognition nurtures Marine's sense of pride, doing what's right and being protectors.
- Hand removal of invasive plant species improves endangered species habitat.
- Collaborative community involvement fosters community relations.
- 2 million dollars has helped to eradicate 22 acres of mangrove.

Urbanization impacts on windward watersheds
- Accelerated siltation and polluted storm water runoff impairs watershed function.
- Bellows AFB gets a lot of upstream pollution due to agriculture. This causes algal blooms in Waimanalo Bay.

How de we improve the situation?
Public Awareness

- Walk the Watershed event- biotic monitoring of watershed quality.
- State of Hawaii teachers help to implement the project.
- Education Foundation 686- Environmental education class at UH outreach college.
- Community riparian native plant gardens on Marine Corp Base.
- Nu'upia ponds web site designed by kids at school with implemented watershed lesson plans.

Present vs. Potential – wetlands at MCBH
Restore pocket wetlands.
Return fill back to wetlands to create shallow-water feeding habitat.

**Waimanalo Watershed**
- Agriculture has degraded the watershed.
- In concept design process of restoring stream and wetland ecosystems to create additional water bird habitat.
- Keep combat-ready military and steward of the environment.
- Move towards more sustainable development plans.

Get public interested in process:
- Kaneohe Klipper ponds.
- Try to broaden public thinking.
- Use an ecosystem approach – beyond your fence lines.

Ko'olaupoko Sustainable Communities Plan:
- Preserve/ restore existing wetlands and fishponds.
- Create new wetlands and infiltration basins.
- Create streamside (riparian) management or buffer zones.

**Contact Information:**
Dr. Diane Drigot
Senior Natural Resources Management Specialist
Commanding Officer
Box 63062 (ENVIRONMENTAL)
MCBH KANEOHE BAY HI 96863-3062
Phone: 808-257-6920 x224
Fax: 808-257-2794

**Peter Galloway**

**Title:** U.S. Army Corps of Engineers Regulatory Permit Program

**Abstract:** The U.S. Congress has directed the U.S. Army Corps of Engineers to protect the waters of the United States, including wetlands, by regulating certain activities within those waters. An overview of the regulatory process will be presented, with emphasis on permit requirements for activities in wetlands. To request jurisdictional determinations or to obtain pre-application consultations for proposed projects, telephone Regulatory Branch at (808)438-9258 or fax (808)438-4060. Regulatory program information, an application form, and current Honolulu District public notices are posted on the Honolulu District home page (www.poh.usace.army.mil).

**Contact Information:**
Peter Galloway
Ecologist
Regulatory Branch (CEPOH-EC-R)
U.S. Army Engineer District Honolulu
Bldg. 230
Fort Shafter, HI 96858-5440
Phone: 808-438-8416
Fax: 808-438-4060

**Wendy Wiltse:**
**Title:** EPA'S Wetlands Program

**Abstract:** EPA has an active role in wetlands regulation under the Clean Water Act Section 404. The Army Corps is responsible for issuing Section 404 permits. The Corps and EPA jointly develop program guidance, determine jurisdiction, and undertake enforcement. EPA reviews and comments on Section 404 permits and has authority to elevate or veto permits. EPA also offers grants for wetlands management, restoration, and monitoring. EPA's 404(b)(1) Guidelines are a critical tool for minimizing impacts because the Guidelines require the least environmentally damaging practicable alternative. EPA's priorities for protecting wetlands in Hawaii are to take timely enforcement actions for unauthorized discharges, review alternatives analyses for large federally funded projects, improve compensatory mitigation, integrate wetlands protection with other tools for watershed protection, improve protection and compensatory mitigation for coral reefs, and provide training.

**Contact Information:**
Wendy Wiltse, Ph.D.
Environmental Scientist
US Environmental Protection Agency
300 Ala Moana Blvd.
Honolulu HI 96850
Phone: (808) 541-2752

**Terrell Kelley:**

**Title:** Learning from Compensatory Mitigation: Kihei, Maui.

Background
- Urbanization effects on created wetland systems.
- Presented aerial photographs to show decline of wetland area in Kihei.
- In 1965 there were about 200 acres of wetlands in Kihei.
- In 1976 it had declined to 163 acres.

- In 1991 it had declined to about 111 acres.
- Today it stands about 80 acres left. 10 of them are mitigation.
- There was a cumulative effect to the area, due to development and urbanization.
- Individual permits to degrade wetlands were not significant on their own but over time created a significant cumulative effect.
- Between 1991 and 2000 there were 28 more acres of wetland filled.
- A 3:1 ratio of mitigation has been performed.
- The mitigated ponds have small islands in the centers for wildlife use.
- The design of the mitigated areas for wildlife habitat is not very good - the water is to deep in the ponds - stilts have drowned after hatching due to overly high water levels.
- These ponds are filled with *Tilapia*, which compete with stilts for habitat.
- The mitigated areas are not functioning as viable wetland areas.
- There was a flood event a couple of weeks ago and the ponds filled with sediment and overflowed.

Summary
- More attention needs to be paid to cumulative impacts of wetland loss.
- Cumulative effects continue to have an impact in Kihei.
- Some restoration is occurring now with better designs that could be used as a model in the future.
- Existing wetland protection should be the primary objective. Mitigation is not currently a viable alternative to natural wetland habitat and should only be considered as a last resort.

**Contact Information:**
Terrell Kelley
United States Department of Agriculture
PO Box 50004
Honolulu, HI 96850
Phone: 808-541-2600 ext. 109

**Mark Ono:**

**Title:** Mediated Discussion on Predator Control.

1. Avian predator control versus mammalian predator control - On what species should predator control be focused on? Are we spending too much time focusing on cats, mongooses and rats rather than cattle egrets and auku'u? At what level do avian predators impact endangered water bird populations?
2. Animal Rights - How should predator control agencies deal with animal rights activists when speaking of predator control to save endangered water birds? What is the appropriate forum for this type of debate?
3. Trapping Devices - What traps work for what situation? What kinds of traps are considered politically correct and which ones aren't?

4. Trap Baits - Is there an "ultimate bait" that works in any environment? Labor intensive baits (food scraps, paste lures, oils, etc.) versus basic baits (cat food, wax baits, etc.), which one is best? How Section 7 consultations can be the limiting factor on how successful trap-lines can be.
5. Perimeter trap-lines versus "active" trap-lines - What type of trap-line is more appropriate - perimeter trap-lines or actively moving traps within the perimeter?
6. Data Collection versus field-work - What is more important to a wetland manager - the actual predator control field work or data collection for historical comparative purposes. Is there a predator control database available?

**Contact Information:**

Mark Ono
District Supervisor,
Hawaii USDA-APHIS-Wildlife Services
3375 Koapaka Street, Suite H-420
Honolulu, HI 96819
Phone: 808-861-8575
Cell: 808-479-7383
Fax: 808-861-8570