HAWAII AUDUBON SOCIETY

'ELEPAIO

Journal of the Hawaii Audubon Society

For the Protection of Hawaii's Native Wildlife

VOLUME 58, NUMBER 6 AUGUST/SEPTEMBER 1998

Watershed Evolution in the Hawaiian Islands

By Dieter Mueller-Dombois[1]

The following non-peer reviewed article, edited from the author's testimony in the Waiahole Ditch contested case, is presented to provide background for 'Elepaio readers as they consider watershed management issues.

Stream Ecosystem Development

Stream ecosystems are naturally integrated with other Hawaiian ecosystems, if they are considered as geographically defined by their watersheds. Most streams in Hawaii originate in the native 'ohi'a lehua (*Metrosideros polymorpha*) dominated rain forest in the mountainous uplands. From here, the streams flow downwards to the coastal areas, usually in greater numbers and mostly perennially on the windward slopes and in lesser numbers and more seasonally on the leeward slopes. In their downward flow, the streams traverse through several ecological zones and vegetation types, and become enlarged through lateral springs and tributaries. The conditions in these ecological zones and vegetation types, together with their associated organisms, soils, topographies and microclimates, influence the streams wherever these terrestrial components form parts of a stream's watershed. From an ecological perspective, therefore, a stream ecosystem can be functionally defined as a stream together with its watershed, because the two form an interactive terrestrial/aquatic system Figure 1.

Stream patterns are reflective of the ages, rainfall and topography of each island. O'ahu shows many streams on both sides of its eastern mountain range (the Ko'olau mountains), and a much sparser stream pattern on both sides of its western leeward mountain range (the Waianae mountains). An advanced stage of geomorphological aging of a shield volcano can be observed on O'ahu. It relates to the Ko'olau volcano on east O'ahu, which formed over 2 million years ago.

The geologically built surface of the former Ko'olau volcanic shield could have been located at about 1500 m elevation, (Gill 1994) on account of a huge geological landslide, the remnants of which have only recently been discovered northeast of Kane'ohe Bay and Kailua Bay, where they rest on the flank of the submarine Hawaiian ridge, occupying an area in outline much larger than O'ahu itself (Moore et al. 1989). This huge landslide (perhaps consisting of more than one slide) must have removed a large chunk of land from the east slope of the volcanic shield, probably causing a retraction of the windward shore line. Moreover, the submarine slide must have emanated from a fault line (or a combination of fault lines) east of the caldera, because today's spectacular slopes forming the near vertical cliffs, or palis on the windward side are considered to be from 1-3 km west of the original caldera wall.

The slope regression by stream erosion on the windward side has been going on for a very long time. The process began with the formation of am phitheater-headed or U-shaped valleys, when viewed from the air. Amphitheater-headed valleys have been cut by relentless stream activity from near the surface of the shield downwards, often by stepped waterfalls. These can eventually change into single, very long and steep waterfalls. Initially, the U-shaped or amphi-theater-headed valleys may be quite far apart with larger, more resistant, interfluves in between. In the course of time the interfluves are cut by secondary streams, which either develop on the

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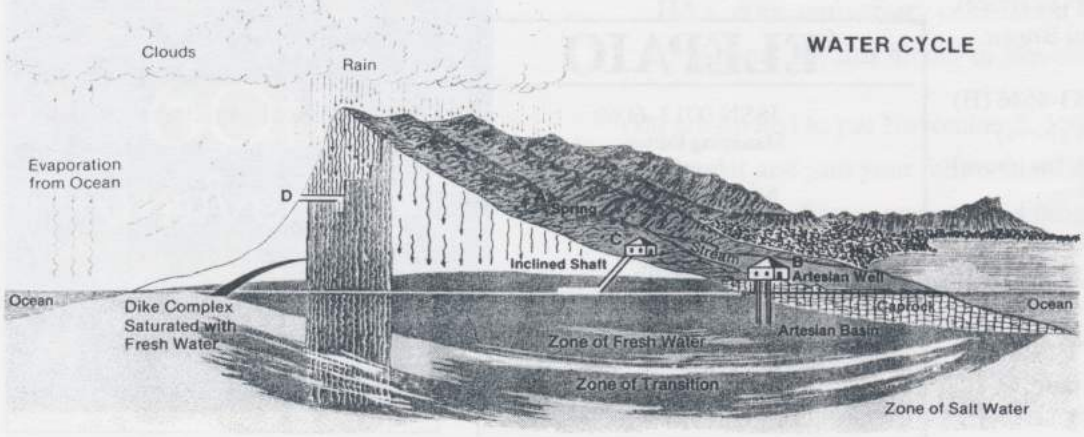

Fig. 1 The water cycle of a typical island water system such as O'ahu. Source: City and County of Honolulu, Board of Water Supply.

MEMO To Ornithological Journal Collectors:

The Society has received word from Janet Hinshaw, Librarian for The Wilson Ornithological Society, that they are making their overstock of back issues of The Wilson Bulletin available for the cost of postage! Publication years listed in the notice are 1902 through 1989, although not all years nor all issues in a given year are available. If you would like to get a copy of the combined list/order form, please send a self-addressed envelope with 32 cents postage to Susan Miller at the HAS office or contact Ms. Hinshaw at jhinshaw@umich.edu.

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'ELEPAIO

ISSN 0013–6069
Managing Editor:
(vacant)
Scientific Editor
Ronald Walker, 235–1681 (H)
Reporters:
Distribution:
Robert Pyle

The *'Elepaio* is printed on recycled paper and published nine times per year: February, March, April, May, June/July, August/September, October, November, and December/January.

IN MEMORIAM

The Board of Directors and members of the Society extend their condolences to the family of Brooks Harper. As Robert P. Smith, Pacific Islands Ecoregion Manager, said "The Pacific Islands lost a true friend with the unexpected death of Brooks Harper, Field Supervisor for the U. S. Fish and Wildlife Service's Pacific Islands Office in Honolulu. A strong supporter of protecting wildlife and their habitat for future generations, Brooks also clearly understood the role of people in conservation efforts. His sensitivity to the role of local communities in planning and carrying out such efforts, and his respect for the various cultures of the Pacific Basin, became trademarks of his work. We have all been enriched by the life of Brooks Harper, and his accomplishments will serve as an enduring legacy."

Reginald David, HAS Treasurer, who worked with Brooks professionally both in Hawaii and elsewhere in the Pacific, noted that Brooks always did the best job he could within the constraints of bureaucracy and funding.

Brooks is survived by wife Joan and two sons: Bret, age 15, and Blaise, age 5. A memorial fund has been established for the future education of the boys. Contributions should be in the form of checks made out to "Bret and Blaise Harper" and sent to Robert P. Smith, U.S. Fish and Wildlife Service, P. O. Box 50088, Honolulu, HI 96850. The credit union in the Federal Building will be accepting these contributions in a special account.

interfluves or may emanate from ground water (Macdonald et al. 1983).

Ground water originates from the percolation of rain water into the soil substrate, including the interfluves, and may be diverted into laterally flowing seepage water. The diversion to lateral seepage is a function of soil parent material inconformities. In either case, with continued lateral water flow, the interfluves are cut back from both sides until they form ridges, while bogs may be formed in intermittent depressions. Thereafter, the ridges erode slowly, filling the now broadened valley with sediments until landforms, such as the row of windward cliffs from Waimanalo to north of Kane'ohe, are formed. An illustration of this development can be seen in Figure 2, which shows a cross-section through east O'ahu's Ko'olau mountain range. The peaks and ridges represent erosion resistant stacks of former lava flows and/or dike complexes.

Forest Ecosystem Dynamics

In the Hawaiian rain forest, community and population dynamics are superimposed on ecosystem dynamics. It takes only 1000 to 3000 years for volcanic substrate to attain optimum nutrient availability associated with maximum plant biomass. Thereafter both biomass and nutrient availability decline gradually due to occlusion of phosphorus (Crews et al. 1994) and soil acidification associated with leaching of cations and in many cases, increasingly poor drainage. Superimposed on long-term soil changes and ecosystem development are cycles of forest dieback and recovery, which are among the most significant expressions of community dynamics in the 'ohi'a dominated rain forest. The dieback stage in the o'hi'a forest offers an opportunity for alien plant invasion. However, areas gone into dieback should not be dismissed as less worthy of conservation simply because they may have lost some rare and endangered species. Dieback areas must be protected and monitored as natural forest recovery areas that are essential for the self-perpetuation of Hawai'i's native rain forest system.

Landscape Aging, Forest Dynamics and Watershed Management

Any form of slope regression will cause a dynamic response in the vegetation in terms of mortality followed by recovery . Wherever it occurs as landslides, the forest cover on such slides will usually be destroyed and most trees will suffer a catastrophic death. Thereafter, the remaining landscars offer a new surface for plant invasion and the development of a new vegetation cover. Wherever slope regression occurs as a gradual process, it is associated with a degradation or deterioration of the soil substrate and a corresponding deterioration of the existing forest stand. Such gradual soil deterioration can contribute to forest dieback.

Forestry in Hawai'i has always been and continues to be primarily for the production and sustainability of high yields of a clean freshwater supply. This implies that watershed management continues to be of high priority and as such should be based on the currently best information from available research. This clearly would also be the most appropriate approach to the management of Hawaiian stream ecosystems under the ahupua'a concept. The history of this forest policy has been summarized by Cuddihy and Stone (1990). Despite natural dieback due to changing soil conditions, native forests continue to survive in the montane environments of the older islands. If left alone, a forest will come back on soils rejuvenated by slope regression provided the native species are not displaced by alien species. Unfortunately , the past policy of planting alien species to protect the Hawaiian watersheds has brought new problems in vegetation dynamics. The planting of such species as paperbark (*Melaleuca*

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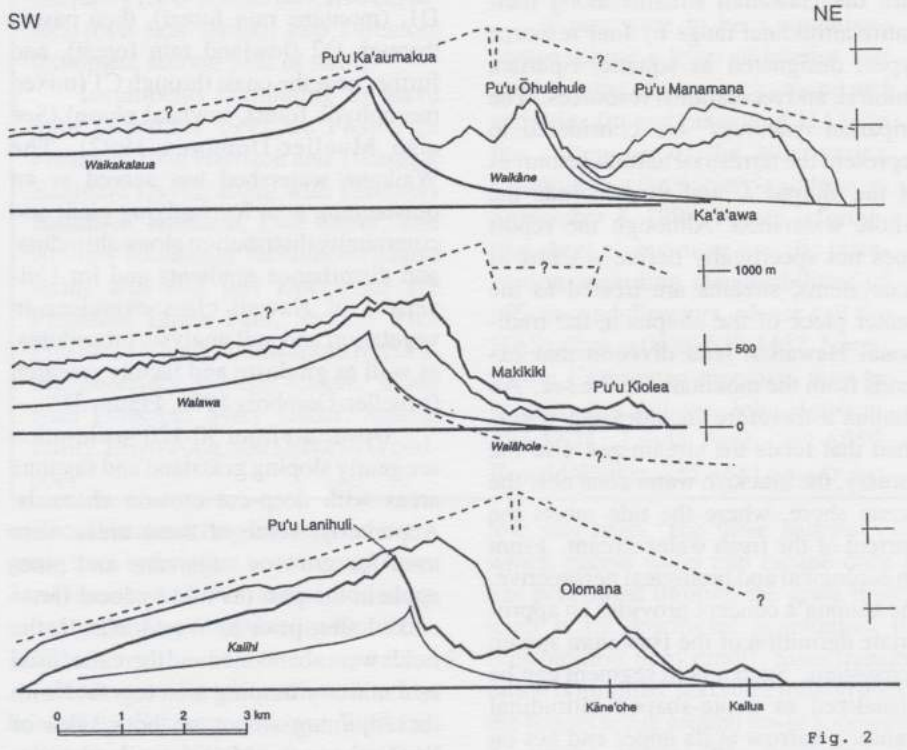

Figure 2 *Three windward-leeward profiles through O'ahu indicating the reduction of the former volcanic shield by several mechanisms, among which slope regression and erosion from stream cutting dominates from NE to SW in accordance with prevailing tradewinds on the rainier side. Highest peaks belong to Ko'olau mountain range, which is on left of former caldera. Resistent shield remnants remain as submountains nearer the windward coastline, such as Olomana, Pu'u Manumanu, etc. (From Wirthmann and Huser 1987 with minor modifications).*

quinquenervia) will prevent native species such as o'hi'a from evolving into successional races. Planting of swamp mahogany (*Eucalyptus robusta)* may dry the soil, prevent the re-establishment of a protective undergrowth cover, and therefore fail to protect the watershed from accelerated soil erosion. Furthermore, most uniform stands of non-native forest species will not be self reproducing in the long run and will have to be restored artificially. As a consequence, the services supplied by a self-reproducing forest are lost, and watershed protection will require major additional expenses in the future.

An Impaired Watershed on Windward O'ahu

The Hawai'i Stream Assessment (HSA) team (Smith et al. 1993) has published a very informative and well illustrated report on the current status of Hawai'i's streams. The HSA report evaluates the Hawaiian streams along their entire altitudinal range by four resource types, designated as aquatic, riparian, cultural, and recreational resources. The "riparian resources" are considered to represent the terrestrial natural resources of the ahupua'a, and they include the whole watershed. Although the report does not specifically define streams as ecosystems, streams are treated as the center piece of the ahupua'a, the traditional Hawaiian land division that extends from the mountains to the sea. An ahupua'a therefore includes the watershed that feeds the stream and also the estuary, the brackish water zone near the ocean shore, where the tide meets the current of the fresh water stream. From an ecological and biological perspective, the ahupua'a concept provides an appropriate definition of the Hawaiian stream ecosystem. Such a land segment can be visualized as a pie-shaped altitudinal transect, narrow at its upper end but on older islands often widened there by tributaries and broadened occasionally into fan-shaped configurations at its lower end in the coastal zone.

The Waikane Watershed

Waikane stream originates in the Ko'olau Mountain Range on east O'ahu and runs into the northern part of Kane'ohe Bay. According to the vegetation zone map of Ripperton and Hosaka (in Cline 1955), the Waikane stream begins in zone D1, (montane rain forest), then passes through D2 (lowland rain forest), and further near the coast through C1 (mixed mesophytic forest, lowland phase) (See also Mueller-Dombois 1992). The Waikane watershed has served as an outstanding area for studying plant and community distribution along altitudinal and disturbance gradients and for University of Hawaii class exercises in vegetation and soil analysis procedures, as well as graduate and faculty research (Mueller-Dombois 1996, Figure 3).

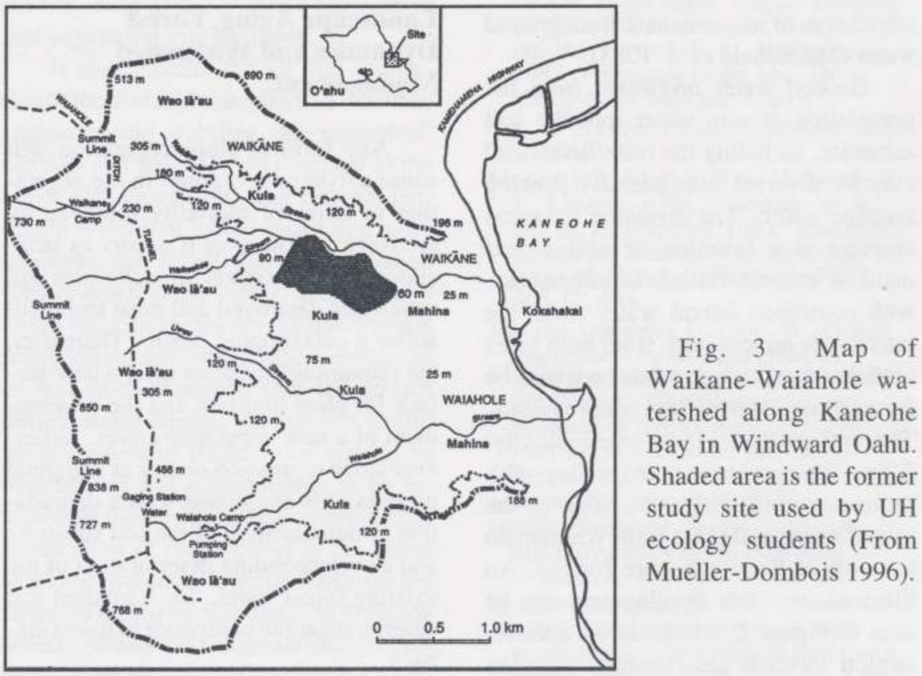

Fig. 3 Map of Waikane-Waiahole watershed along Kaneohe Bay in Windward Oahu. Shaded area is the former study site used by UH ecology students (From Mueller-Dombois 1996).

Upstream from 50-120 m elevation are gently sloping grassland and savanna areas with deep-cut erosion channels. Apparently, some of these areas were used for growing sugarcane and pineapple in the past (as told by local farmers). Later, prior to World War II, the fields were abandoned and thereafter used as a military training area together with the adjoining slopes on both sides of Waikane stream. More recently, the gently sloping terrain has been opened up for sale of house lots.

From 150-200 m, the area becomes more densely wooded and above 250 m less disturbed and more natural, except for the stream diversion in the upper rain forest at 245 m elevation where the Waiahole Ditch cuts across the Waikane stream. Here several tunnels (including Waikane 1, Waikane 2) were dug between 1925 and 1929, which since that time divert the bulk of Waikane's stream and ground water from the watershed above 245 m elevation, including the internal mountain springs and seepage. This water was diverted to the leeward side for sugarcane, formerly an important agricultural industry that now has become obsolete. It is also likely the Uwao tunnel diverts some water from the Waikane watershed.

Above the tunnel area, from 250-550 m elevation, the slopes and ridges are covered mostly by native vegetation in form of low-statured 'ohi'a dominated rain forest. In the lower middle section, from about 50 to 150 m elevation, the vegetation is severely disturbed. Here an alien grass, the broom sedge (Andropogon virginicus), has spread, forming extensive grass patches on the gently sloping ground, and the northern slopes above Waikane stream.

The broom sedge is native to eastern North America and was inadvertently introduced and first collected in 1924 (Wagner et al. 1990). This grass displays a temperate-zone phenology, whereby it undergoes partial dormancy in the winter months from December through March, after which it re-greens by formation of new grass blades or culms reaching a peak in September/October during its flowering season (Sorenson 1980). With

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aging, the grass bunches accumulate dried-up and dead foliage on vegetative propagules, which remain standing and attached to the individual grass plants. This habit prompted us (Kartawinata and Mueller-Dombois 1972) to classify this grass as forming a "dry grass cover", even though it is well developed in former rain forest areas and on moist to water-soaked soils.

If periodically burned, broom sedge individuals stay alive indefinitely, resprouting each time from their roots, which extend downward to 25-40 cm depth depending on soil conditions. Below 38 cm soil depth (15 inches), their roots are very sparse to non-existent, while above they are very soil-volume intensive. These patterns result in erosion damage and prompted studies on the soil-water relations of the alien grass cover in the early 1970s.

Climate, Vegetation, and Soil Water Characteristics of Windward O'ahu

Waikane Valley can be classified as representative of a mesic tropical rain forest environment. For rain forest climates such as the Ko'olau watershed area above Kane'ohe Bay, high rainfall throughout the year is typical. Throughout a monitoring year, May 1967 through May 1968, the rain forest environments on O'ahu invaded by broom sedge grass cover on account of human disturbances showed soil water in excess of field capacity. Rainfall during this period did not deviate substantially from the norm as shown by comparing the current year's rainfall with the 25-year record.

With several student groups in the physiological plant ecology course during the early 1970s, we measured and compared transpiration rates from broom sedge grass blades with those of tree leaves of Java plum (*Syzygium cumini syn. Eugenia cumini*) and other tree species such as mango (*Mangifera indica*), which grew in small groves on the gently sloping interfluve in lower Waikane valley. We also measured potential evaporation rates as well as air temperature, relative humidity and saturation deficit. Measurements were done on an overcast, windy February day and a sunny, calm February day in 1972. The results indicate that on a square meter basis of ground surface the transpiring leaf mass of evergreen trees in the grass savanna was from 3 to 4 times greater than that of the broom sedge ground cover (Mueller-Dombois 1973).

If one considers the median monthly rainfall for February in lower Waikane valley as about 200 mm, it can be concluded that the partially dormant and dried-up grass cover of broom sedge is capable of recirculating only one fourth of the incoming rainfall from its root zone in the surface soil. Here the grass cover is acting like a mulch overlying the mineral soil. The mulch allows the water to penetrate onto the soil during showers, but it also locks the water into the shallow root mass. The three pathways by which excess water can escape once it has penetrated through the grass mulch itself is by downward penetration, by transpiration, or by runoff. Since transpiration is minimal, and since the soil under the broom sedge ground cover appears to be always moister than field capacity, most of the rain water will be diverted as runoff once it reaches the soil surface.

In addition, the grass sod down to 30-40 cm soil depth may become waterlogged even after a short, heavy shower of 15-25 mm rainfall. Under the sod, downward penetration is severely slowed due to the denser soil consistency below

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Your Chance To Be Involved In How Your Society is Run – Nominating Committee Seeks Candidates For Board

by Susan Elliott Miller

It is August - and the Nominating Committee (Linda Paul, John Harrison, and Ronald Walker) are looking for Society members who are willing to serve on the Board. The bylaws call for fifteen directors to serve two-year terms; five of the fifteen directors are elected by the membership to officer positions. Normally eight directors are elected in even years and seven elected in odd years.

However, as a result of resignations and Board members being elected or appointed to fill unexpired officer terms, the following positions are now open for nomination: President, Second Vice President, and Recording Secretary (two-year terms); five Directors (two-year terms); two Directors (complete second year of term).

Incumbents continuing to serve until December 1999 are First Vice President John Harrison and Treasurer Reginald David, along with Directors Elizabeth Kumabe, Dan Sailer, and Andrew Tomlinson. Incumbents whose terms will end this December are President Linda Paul, Second Vice President Wendy Johnson and Recording Secretary Deetsie Chave, along with Directors Mary Gaber, Sharon Reilly, Ellyn Tong, and Deborah Woodcock.

The HAS Board is a dynamic group of committed individuals whose energy and expertise involve many aspects of environmental protection in Hawaii from fund raising to education, and from birding to habitat cleanup.

All members of the Board are expected to attend two-hour monthly meetings and a Leaders Retreat in January. Directors are also expected to be active on one of the Society's two standing committees: Conservation and Education. Persons interested in serving on the Board are encouraged to attend a Board meeting; the next one will be August 10th at 6:30 p.m. at the HAS office.

If you want to be a candidate, please submit a letter of interest and brief resume of your background and activities (in and outside of HAS) to the attention of the Nominating Committee at the Society's address by September 4, 1998. For an information sheet giving more specific information regarding responsibilities of officers and directors, please call the HAS office at (808) 528-1432. Nominating Committee members may be contacted as follows: John Harrison, 595-8621; Linda Paul, 262-6859; Ronald Walker, 235-1681 (all on O'ahu).

the root zone. On slopes, this can result in the loosening and lubrication of the sod from below. Large sod segments often get torn off, aided by the weight of being waterlogged, and slide downslope. On the more gently sloping interfluves, runoff in the grass cover is equally strong and frequent. Any slight depression, such as a foot path, may readily develop into an erosion channel, dissecting the interfluve surface and transporting top soil into Waikane Stream and then further into Kane'ohe Bay.

In contrast, the foliated tree crowns are capable of recycling much more water by transpiration, potentially more than twice as much as the amount of February rainfall. The trees act like wicks, transferring soil water back into the atmosphere during sunny and windy periods. The water storage capacity of the soil is restored by the actively transpiring trees soon after any prolonged rain shower. Moreover, the trees can effectively remove water from their deeper reaching root zone, which extends to more than twice the depth of the grass roots in the soils of Waikane Valley. Also, water penetration is facilitated under tree cover because of their deeper root zones, which increases the water storage capacity of the soil.

In an earlier study (Kartawinata and Mueller-Dombois 1972) we observed that without fire, the broom sedge community will become reforested naturally on windward O'ahu. We suggested that in the lower Waikane Valley natural succession would potentially revert the grass cover back to koa forest and at higher elevation into 'ohi'a forest. However, such self-restoration process could take several decades both because of the presence of alien tree species and because of the depletion of springs and seeps due to water diversion. Therefore active forest and vegetation management is required for an appropriate restoration of the Waikane watershed. A planting program would be necessary to restore native koa forest in parts of the Waikane watershed. If and when the "Hawai'i Tropical Forest Recovery Act" and its Action Plan (1994) become policy, and then result in real action, Waikane Valley and the whole watershed inland of Kane'ohe Bay should be considered a priority land area for forest restoration and vegetation management.

It also appears certain that restoration of the diverted water back to Waikane stream would stabilize the watershed. Springs and seeps would reappear at the upper elevations providing internal irrigation water that would result in a more vigorous rain forest that would extend further down in the valley. Rejuvenated kukui trees and ferns would stabilize the soil along stream banks and prevent blocks of soil from slumping into the stream during storm surges. Sediments would be continuously flushed out instead of building up and accumulating to be released all at once during heavy rain storms. Restoration of forest cover in the lower Waikane watershed, particularly on the slopes of the tributaries that feed Waikane Stream would also regulate the surface water flow and would reduce the sediment load going into Kane'ohe Bay, thereby improving the estuary, which is important as spawning ground and for the development of juvenile cohorts of the native freshwater fishes, the 'o'opu species.

References Cited

Action Plan. 1994. Hawai'i Tropical Forest Recovery Task Force. Published by Hawai'i State Dept. of Land and Natural Resources (DLNR). Honolulu. 78 pp. and 4 appendices.

Cline, M. G. ed. 1955. Soil Survey of the Territory of Hawaii: Islands of Hawaii, Kauai, Lanai, Maui, Molokai, and Oahu. U.S. Dept. of Agric. in Coop. with Hawaii Agric. Expt. Sta. Soil Survey Ser. 1939. No. 25, 644 p.

Crews, T., Fownes, J., Herbert, D., Kitayama, K., Mueller-Dombois, D., Riley, R., Scowcroft, P., and P. M. Vitousek. 1994. Changes in soil phosphorus and ecosystem dynamics across a long soil chronosequence in Hawai'i. Ecol. Monographs.

Cuddihy, L. W. and C. P. Stone. 1990. Alteration of Native Hawaiian Vegetation: Effects of Humans, their Activities and Introductions. University of Hawaii Press, Honolulu. 138 p.

Gill, L. 1994 Submarine landslides in the Hawaiian islands. A two page article in Na Makani o Moanalua, The Newsletter of Moanalua Gardens Foundation. Vol. 11 No. 3. Fall 1994.

Kartawinata, K. D. Mueller-Dombois. 1972. Phytosociology and ecology of the natural dry-grass communities on Oahu, Hawaii. Reinwardtia (Herbarium Bogoriense, Bogor, Indonesi) 8: 369-494. Macdonald, G. A., Ab ott, A. T., and F. L. Peterson. 1983. Volcanoes in the Sea: Th Geology of Hawaii. Unive

sity of Hawaii Press, Honolulu. 2nd ed., 517 p.

Moore, J.G., Clague, D.A., Holcomb, R. T., Lipman, P. W., Normark, W. R., and M. E. Torresan. 1989. Prodigious submarine landslides on the Hawaiian ridge. J. Geophys. Research 94:17, 465-17, 484.

Mueller-Dombois, D. 1996. Watershed impairment by an alien grass on windward Oahu. In Proceedings of the October, 1994 Hawaii Stream Restoration Symposium. 237-259. Hawaii Dept. of Land & Natural Resources, Division of Aquatic Resources Tech. Rep. 96-01.

Mueller-Dombois, D. 1992. Distributional dynamics in the Hawaiian vegetation. Pac. Sci. 46: 221-231.

Mueller-Dombois, D. 1973. A non-adapted vegetation interferes with water removal in a tropical rain forest area in Hawaii. Trop. Ecol. 14: 1-16.

Sorenson, J. C. 1980. Phenology of Andropogon virginicus in Hawaii. MS Thesis. Dept. of Botany, University of Hawaii at Manoa, Honolulu. 196 p.

Smith, C., Wilcox, C., Edmunds, S., Crusius, M., Huddleston, J., and D. Parkin (HSA team). 1993 Hawai'i Streams - Na Kahawai o Hawai'i. A Coop. Project of State of Hawai'i Commission on Water Resource Management and the Rivers, Trails and Conservation Assistance Program of the National Park Service. Report and data base available from: State of Hawai'i DLNR Commission on Water Resource Mgt. P.O. Box 621, Honolulu, HI 96809. 40 p.

Wagner, W. L. Herbst, D. R., and S. H. Sohmer. 1990. Manual of the Flowering Plants of Hawai'i. B. P. Bishop Museum Spec. Publ. Bishop Museum Press. 2 vols.

Wirthmann, A. and K. Huser. 1987. Vulkaninseln als Modelle Tropischer Reliefgenese. Georgr. Rundschau (Westermann) 39:22-31.

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Apply by October 1 for Research Grants in Hawaiian or Pacific Natural History

The Hawaii Audubon Society offers grants for research in Hawaiian or Pacific natural history. Awards are oriented toward small-scale projects and generally do not exceed $500. Special considerations are given to those applicants studying dryland forests or aeolian systems in Hawai'i. Applicants are encouraged to solicit grants from other organizations to fund research which cannot be funded entirely by the Society.

Grant recipients are expected to submit a 2-3 paragraph progress report, suitable for publication in the Society's journal *'Elepaio*, within 6 months of the termination date specified. The recipients are also encouraged to draft a more detailed 2-3 page report which would be considered for publication in *'Elepaio*.

Grants are reviewed semiannually. Deadline is October 1 for winter/spring grants. Call, write, or FAX the HAS office (see page 2) for application guidelines.

Pictured here are James Mejeure of the Honolulu Zoo explaining one of the bird exhibits to one of our youngest, but most devoted birders, Marke Jenkins. The picture was taken on Marke's ninth birthday. He has attended almost every HAS field trip for the past two years. His mother, Florence, writes:

" Marke's interest in bird watching started when Dr. Barbara Bateman visited Hawaii to observe Marke at Assets School. Barbara goes birding in Central America as often as she can, and was at Ho'omaluhia Botanical Gardens with Mary Gaber as our guide. Marke was hooked on birding thereafter and has spent his last two birthdays on Audubon field trips. He truly enjoys studying birds and the company of fellow birders. I'd like to thank everyone associated with Hawaii Audubon, because the field trips have made a tremendous impact on Marke. "

Hawaii Audubon Society's 60th Anniversary!

A Celebration is Coming Up - and YOU are invited!

November 1999 will be the 60th anniversary of the first issue of the *'Elepaio*; that month was also taken as the HAS' founding month when the 50th anniversary of the Society was celebrated in 1989. The Board has decided to kick off HAS' 60th anniversary celebration by having the Annual Awards dinner in November 1998.

You are invited to put November 5, 1998 from 6 to 9 p.m. on your calendar and join your fellow members at McCoy Pavilion for dinner, awards, and program.

Susan Miller is looking for people who enjoy parties to help her plan this one—please call her at 528-1432.

'ELEPAIO
AUGUST/SEPTEMBER 1998

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Calendar of Events

Thursday, September 3
Education Committee monthly meeting, 7 p.m. at BaLe Sandwich Shop in Manoa Marketplace (near Safeway). For more information, call chairperson Wendy Johnson, 261-5957.

Monday, August 10 and September 14
Conservation Committee monthly meeting at the HAS office at 5:45 p.m. For more information, call chairperson Dan Sailer, 455-2311.

Monday, August 10 and September 14
HAS Board meeting, always open to all members. 6:30 - 8:30 p.m. at the office.

Sunday, August 16
Adam Asquith and Ron Englund will lead a **field trip** to Kahana State Park to observe native Hawaiian damselflies and learn about their biology, habitats, and conservation needs. Meet at 9:00 a.m. by the State Library along Punchbowl to carpool or at 10:00 a.m. at the entrance to Kahana Valley State Park (next to restrooms). Trip will be 2-3 hours; bring hat, sunscreen, mosquito repellent, water, lunch or snack, and tabis; wear boots. Suggested donation is $2.00/person. Please register by calling the HAS office (528-1432, voice mail box 4) before August 15th.

Monday, August 17
Adam Asquith of the U.S. Fish and Wildlife Service will speak on "Damsels in Distress: Biology and Conservation of Hawaiian Damselflies" at the HAS **membership meeting and program.** The meeting is from 7:30-9:30 p.m. at Bishop Museum, Paki Hall Conference Room. Refreshments provided; HAS publications, tapes, and T-shirts available for purchase.

Saturday, August 29
Service trip to Mt. Ka'ala has been scheduled. This is a real work trip, so wear sturdy boots, tough, long pants, and bring work gloves. You will also need sunscreen, hat, drinking water and lunch; tools will be provided. Our main objective will be removing blackberry and other noxious plants from the area. Limited to 10 people, so call Florence Jenkins at 671-3154 to reserve a spot and for information about the meeting place.

Saturday, September 19
Field trip to the Ki'i Unit of James Campbell National Wildlife Refuge. We should see four of our endangered Hawaiian water birds plus several others. Limited to 20 people. Call Mary Gaber at 247-0104 or Florence Jenkins at 671-3154 to register and for details on time and place to meet for carpooling. Suggested donation, $2.00.

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