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NATIONAL WETLAND INVENTORY

NOTES TO USERS

HAWAIIAN ISLANDS

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INTRODUCTION

The U.S. Fish and Wildlife Service, Office of Habitat Resources is conducting an inventory of the wetlands of the United States. The National Wetlands Inventory (NWI) is establishing a wetland data base in both map and computer forms for the entire country. The NWI information will serve to identify the current status of U.S. wetlands and can be used as a reference point from which future changes in wetlands can be evaluated.

1. PURPOSE

The purpose of Notes to Users is to provide general information regarding the production of NWI maps and wetlands found within a relatively similar geographic area. Notes to Users are not intended to include complete descriptions of all wetlands found in the area nor provide complete plant species information.

2. AREA COVERED

The area covered includes the Islands of Oahu, Maui, Molokai, Kauai and Hawaii (see attached Index Maps). According to Baileys Ecoregions (1978), the Hawaii Islands are within the Humid Tropical Domain, Rainforest Division, Hawaiian Islands Province. The humid tropical domain is controlled by equatorial and tropical air masses. The average temperature of every month is warmer than 65°F (18°C) and there is no winter season. Tropical rainforest average annual rainfall is heavy and exceeds annual expectation; however, it varies in amount and in season and areal distribution.

Land-surface form - Hawaii occupies a tropical oceanic position just south of the Tropic of Cancer (23½°N.). The five principal islands and four smaller ones are all valcanoes in various stages of erosion. The islands are hilly and mountainous, especially toward the east. Coastlines are mostly rocky and rough. Only Oahu and Niihau have much coastal plain. Surface streams are not abundant, because the ground, being composed of lavas, is highly porous.

Climate - Hawaii has a tropical climate. The surrounding ocean and the highly persistent northeast tradewinds maintain almost uniform climate throughout the year. At any given location, temperature and precipitation remain nearly constant, but both vary greatly with altitude and exposure. At sea level, average January temperature is about 70°F. (21°C.); average July temperature is about 75°F. (24°C.). Frost is rare below 4,000 ft. (1,200 m.) and has never been recorded below 2,500 ft. (760 m.). Precipitation is heaviest on the windward side of all the islands; lee slopes are semiarid. For example, the trade winds, blowing from the northeast, first reach the peaks on the northeast side of Oahu and annual rainfall there averages more than 200 in. (5,000 mm.). Leeward is the rain shadow. Annual rainfall at Honolulu averages about 20 in. (500 mm.).

Vegetation - Because the Hawaiian Islands are isolated, their flora are unique; before man's arrival, many species were endemic. Stands of native plants on the islands include shrub, forest, bog, and moss-lichen.

Most of the shrub land is along the coastal lowlands, on the lee sides of the mountains; but it extends to considerable altitudes where rainfall is slight. Forests grow above the shrub land on the lee sides of mountains but extend to sea level on the windward sides.

Shrubs mixed with scattered trees grow on the upper slopes of the high mountains. Bogs are common in areas of heavy rainfall. Mosses and lichens grow above timberline, where rainfall is low and frost is frequent.

Soils - Soils of the islands are a complex pattern of leached Ultisols and Oxisols, Inceptisols, and rocky highlands and coastlines. Deep Ultisols are widespread on old lavas that form the older islands; young lavas on the younger islands are still rock.

3. MAP PREPARATION

All wetlands are classified according to the Service's system "Classification of Wetlands and Deepwater Habitats of the United States" (Cowardin, et al. 1979). The aerial photo interpretation of wetlands/deepwater habitats are in accordance with NWI established mapping procedures (NWI 1982). Wetlands/deepwater habitats were identified on the aerial photographs based on vegetation, visible hydrology, and geography using the Service's wetland definition and classification system.

Field reconnaissance was conducted March 11-22, 1983, covering areas on Oahu, Maui, Kauai, and Hawaii. Field sites were based on initial review of the aerial photography and potential photo interpretation problems.

Most of the aerial photography used was 1:48,000 scale black and white taken in February and December 1977 and January 1978. The overall quality, resolution, and contrast of the photography was good. A limited number of photos had scattered cloud cover, but did not significantly interfere with photo interpretation.

Primary collateral data included Corps of Engineer's true-color aerial photography of the coastal areas, Soil Conservation Service soil surveys (USDA 1972 & 1973), an existing wetland survey (Elliott and Hall, 1977) and wetland plant guide (Stemmermann, 1981).

The NWI effort in Hawaii began in early 1983 and was completed in early 1984. Wetland maps are now available for the Islands of Oahu, Maui, Molokai, Kauai, and Hawaii at a 1:24,000 scale (7½ quad sheet) and for Lanai, Niihau, and Kahoolawe at a 1:62,500 scale. 125 wetland maps have been produced for the State of Hawaii: 11 for Kauai, 15 for Oahu, 5 for Molokai, 17 for Maui, and 74 for Hawaii at 1:24,000 scale and one each for Lanai, Kahoolawe, and Niihau at 1:62,500 scale. These large-scale maps are composite maps which show the location, shape, and classification of the wetlands/deepwater habitats on USGS base maps.

The project officer for production of the wetland maps is Dennis Peters, Regional Wetlands Coordinator, U.S. Fish and Wildlife Service, Region 1 Lloyd 500 Building, Suite 1692, 500 N.E. Multnomah Street, Portland, Oregon 97232, (503-231-6150).

Aerial photo interpretation was completed by Martel Laboratories, Inc., St. Petersburg, Florida. Maps were prepared by Martel Laboratories, Inc., and the NWI National Team in St. Petersburg, Florida.

4. USER CAUTION

The map documents were prepared primarily by stereoscopic analysis of high altitude aerial photographs. Wetlands were identified on the photographs based on vegetation, visible hydrology, and geography. The aerial photographs typically reflected conditions during the specific year and season when they were taken. In addition, there is a margin of error inherent in the use of aerial photographs. Thus a detailed on-the-ground and historical analysis of a single site may result in revision of the wetland boundaries established through photographic interpretation. In addition, some small wetlands and those obscured by dense forest cover may not be included in the map document.

Federal, State, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, State, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, State, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

5. WETLAND COMMUNITIES AND DEEPWATER HABITATS

This discussion is a general overview of wetlands/deepwater habitats ir Hawaii as mapped by the NWI. It is not a complete list of NWI mapping codes nor does it contain a complete vegetation list, but rather reflects general wetland plant communities observed during the field work.

All five systems of the Service's wetland classification system (Marine, Estuarine, Riverine, Lacustrine, and Palustrine) occur in Hawaii.

Marine - Commonly occurring wetlands/deepwater habitats in the Marine System include the classes coral reef, rocky shore, and unconsolidated shore. The coral reefs are classified Marine (M), subtidal (1), reef (RF), coral (1), subtidal water regime (L). Rocky shore and unconsolidated shore classes were classified as Marine, intertidal, rocky shore, bedrock, regularily flooded water regime (M2RSIN) or unconsolidated shore, sand (M2US2N). These shoreline wetlands, for the most part, are mapped as linear features.

Estuarine - The major wetlands and deepwater habitats in the Estuarine System include the classes open water (OW), forested (FO), scrub/shrub (SS), and emergent (EM).

The open water/unknown bottom class is characterized by water on the aerial photography and is classified Estuarine, subtidal, open water with a subtidal water regime modifier (E1OWL).

The Estuarine forested and scrub/shrub wetlands are within the intertidal subsystem and characterized by red mangrove (Rhizophora mangle) and the less common oriental mangrove (Bruguiera gymnorhiza). Depending on height (greater or less than 6m), these areas are classified Estuarine, intertidal, forested, or scrub/shrub, broad-leaved evergreen (E2FO3 or E2SS3) with a regularly flooded (N) or irregularily flooded (P) water regime modifier depending on tidal range and seaward limit of the mangroves.

The Estuarine, intertidal, emergent wetlands are relatively small with limited tidal influence. The vegetation is persistent commonly consisting of pickleweed (Batis moritima), sea purslane (Sesuvium portulacastrum), Indian pluchea (Pluchea indica), and salt grass (Sporobolus virginius). The water regime modifiers are either regularily or irregularily flooded. Thus, the NWI codes E2EM1N or E2EM1P.

Riverine - Riverine wetlands/deepwater habitats are present throughout the eight Hawaiian Islands. However, many were not mapped because they are obscured on the aerial photography by a tree canopy which is classified in the Palustrine System.

The permanent rivers include both upper and lower perennial subsystems of the Riverine System with the predominate class open water. The lower perennials (R1OWH) are found in the coastal plains with the upper perennials (R3OWH) found in the higher elevations, both with a permanently flooded water regime modifier.

There are many dry streambeds generally found on the leeward side of the islands. These streams do not flow year round and are classified as Riverine intermittent streambed (R4SB) with a temporarily (A), seasonally (C), or intermittently (J) flooded water regime.

Lacustrine - Natural or artificial basins greater than 20 acres are in the Lacustrine System; these wetlands/deepwater habitats are not overly common on the Hawaiian Islands. As classified and mapped on the NWI maps, the Lacustrine System generally includes the class open water with the special modifier impounded--Lacustrine (L), limnetic (1), open water (OW), permanently flooded (H), impounded special modifier (h).

Palustrine - The majority of the wetlands/deepwater habitats mapped by the NWI are within the Palustrine System. These habitats consist primarily of those dominated by woody vegetation (forested or scrub/shrub), by herbaceous vegetation (emergent wetland) or by open water.

The Palustrine, open water/unknown bottom classification, for the most part, describes farm ponds or small impoundments. The water regime modifiers may be permanently flooded, intermittently exposed, or semi-permanently flooded and generally with an excavated (x) or a diked/impounded (h) special modifier.

Palustrine emergent wetlands, are characterized by persistent vegetation and by a wide range of water regime modifiers from temporarily to semi-permanently flooded (PEMIA, B, C or F). There wetlands are characterized by various plant species; the most common species noted during the NWI field checks was California grass (*Brachiaria mutica*). Other species include, but are not limited to, bulrish (*Scripus* spp), spreading dayflower (*Commelina diffusa*), barnyard grass (*Eschinochloa crusgalli*), sedge (*Cyperus* spp), torpedo grass (*Panicum repens*), native sawgrass (*Cladium leptostachyum*) and shrubby water primrose (*Ludwigia octovalvis*).

Taro fields are classified on the NWI maps as Palustrine emergent wetlands, persistent, with a mixed artifically/semi-permanently flooded (KF) water regime modifier and a diked/impounded (h) special modifier. Thus the NWI code PEM1KFh.

Palustrine wetlands characterized by woody vegetation are classified as either forested or scrub/shrub (depending on height) and all are broad-leaved evergreen at the subclass level (PF03 or PSS3). These wetlands

are found in the coast plains, along river flood plains or as linear bands along rivers. Water regime modifiers range from intermittently flooded to seasonally flooded. A common species is Hau (Hibiscus tiliaceus); associated species include java plum (Eugenia cumini), brazilian pepper (Schinus terebinthifolius) and guava (Psidium guajava). These forested wetlands are often in association with emergent wetlands.

Large areas of forested wetlands occur in the higher elevation on Kauai, Hawaii, Maui, and Molokai. However, limited field checking to determine the classification and boundaries of these forested wetlands was done only on Kauai and Hawaii. The predominate water regime modifier applied to these forested wetlands was semi-permanently flooded or saturated (PFO3F or B). Interspersed throughout these forested wetlands are saturated emergent wetlands (PEM1B). Some noted species include ohia (Metrosideros collina polymorpha), olapalapa (Cheirodendion trigynum), blue berry (Vaccinium calycinum), false staghorn (Dicranopteris spp), sedges (Carex spp, Cyperus spp), painiu (Astelia spp) and beakrush (Rhynchospora lavarum).

Several forested and scrub/shrub wetlands were classified as a wetland/upland mix (PFOB/v). These are areas of upland forested plant communities with forested or scrub/shrub wetlands, saturated water regime, scattered throughout.

6. SOURCES OF ADDITIONAL INFORMATION

Since the purpose of the Notes to Users is to provide a general overview of a relatively large geographic area, it is important to be aware of sources of additional information. The following is a list of reports providing information about the area of concern.

Bailey, Robert G. 1978. Description of the ecoregions of the United States. U.S. Forest Service/USDA, Ogden, Utah.

Cowardin, Lewis M., Virginia Carter, Francis C. Golet, and Edward T. La Roe. 1979. Classificaiton of wetlands and deepwater habitats of the United States. FWS/OBS 79/31.

Elliott, Margaret E. and Erin Marie Hall. 1977. Wetlands and wetland vegetation of Hawaii. U.S. Army Corps of Engineers, Pacific Ocean Division, Contract Number DACW 84/77-C-0014.

NWI. 1981. Mapping conventions for the National Wetlands Inventory. Unpublished mimeograph.

NWI. 1984. Fiscal year 1984 first quarter, report of progress. U.S. Fish and Wildlife Service.

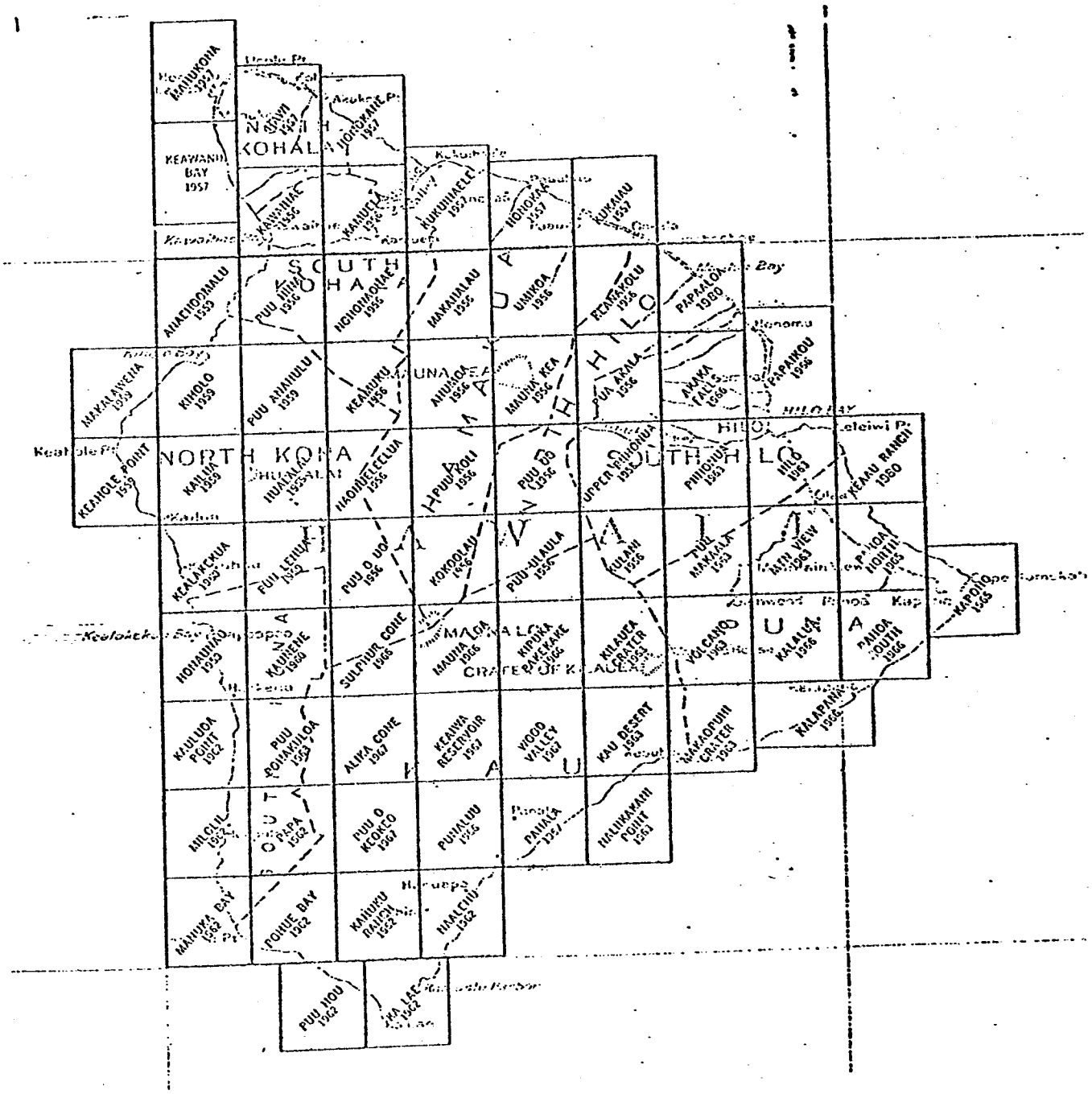
Peters, Dennis D. 1984. National Wetlands Inventory for the Hawaiin Islands. Unpublished mineograph. Presented at the 24th Annual Forestry and Wildlife Conference. Honolulu, Hawaii. May 1984.

Stemmermann, Lani. et al. 1981. A guide to Pacific wetland plants. U.S. Army Corps of Engineers. Honolulu District.

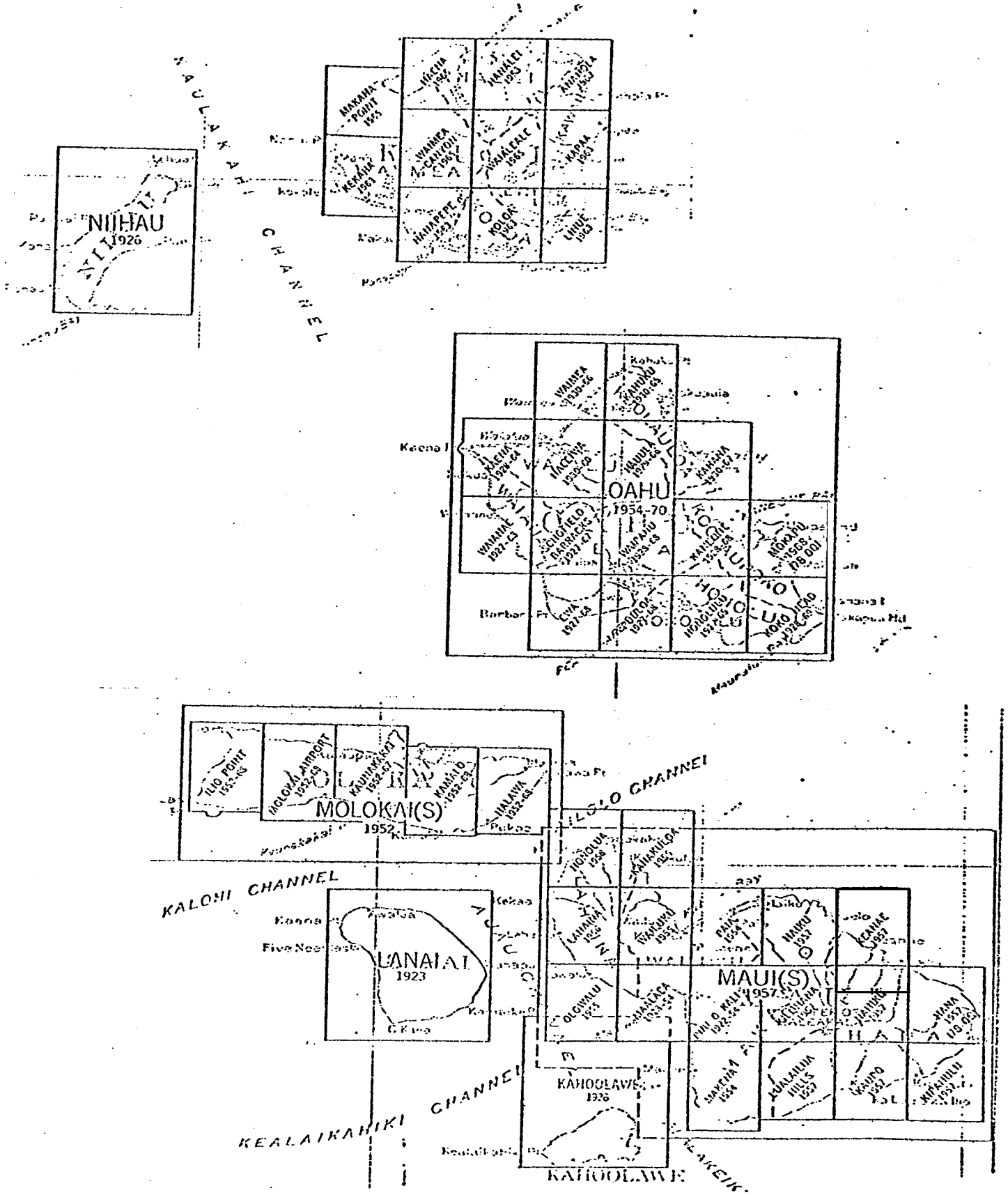
U.S. Department of Agriculture. 1972. Soil survey of islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. USDA, Soil Conservation Service.

U.S. Department of Agriculture. 1973. Soil survey of island of Hawaii, State of Hawaii. USDA, Soil Conservation Service.

Wilen, Bill O. and Ross Pywell. 1981. The National Wetlands Inventory. Paper presented at In-Place Resource Inventories: Principles and Practices--A National Workshop, Orono, Maine, August 9-14, 1981.



Index of NWI wetland maps for Hawaii (from USGS topo. maps of Hawaii, American Samoa, and Guam, April 1981).



Index of NWI wetland maps for Kauai, Oahu, Molokai, Maui, Lanai, Kahoolawe, and Niihau (from USGS index to topo. maps of Hawaii, American Samoa, and Guam, April 1981).