

SUBJECT INDEX

- Adaptation
 - to altered habitat, 78, 88;
 - to inbreeding, 478; to novel perturbations, 439; to selective pressures vs inbreeding depression, 450-451
- Adaptive radiation, 4, 499; in invertebrates, 107, 108
- Aeolian ecosystems, 119, 166.
 - See also Vegetation types
- Agriculture, 39, 153, 156; effects on native plants, 43; effects on native species, 78; impacts on forests, 76; relation to aliens, 169, 225. See also Polynesian man, effects of
- Agronomy, 153, 182
- 'Aha Kuka (Gathering of Councils), 515
- Ahupua'a, as economic/cultural /ecological land unit, 497
- Air pollution, role in causing 'ohi'a dieback, 408
- Alien replacement communities, 412
- Alien species
 - as competitors with native birds, 76; as modifiers of native habitats, 76; as obstacles to preservation of Hawaiian biota, 468-469, 472; as reservoirs of bird diseases, 76; as threats to native birds, 76, 271; effects of, on native species, 78; impacts of, 150; removal of, from bird habitat, 92; roles of agencies, idealism, and politics in management of, 373; severity of threats by, in Hawai'i, 460, 468-469, 472; terminology, 182. See also species groups
- Allelic diversity, 437
- Allelopathy, 183-204, 225, 273. See also Plants, alien
- Alpine scrub, 159, 170. See Vegetation types; Vegetation zones
- Altitude, as factor in diversity, 114
- Amaranthaceae, Fabaceae, Malvaceae, status of (as representatives of Hawaiian flora)
 - distribution by island, 46-53; effects of insects on, 54-55; effects of ungulates on, 54; extinction of pollinators of, 54; possible reasons for degradation, 46-53; reactions to disturbance, 54; research needs, alien and native plant interactions, 55; small populations of, 54; status, 45, 46-53, 54; threats to, 55
- Animal Species Advisory Commission, 234, 503, 519
- Aquatic Life and Wildlife Advisory Committee, 503, 519
- Archeology
 - evidence for Polynesian impacts, 111; in vegetation reconstruction, 44
- Avian diseases. See Diseases, Bird
- Avian malaria. See Diseases, Bird
- Avian pox. See Diseases, Bird
- Biocontrol, 170-173; as management tool, 471; guidelines for, 166; in extinction of native invertebrates, 113, 118; need for review, research, caution, 118, 172; of alien plants, 96, 172, 183-204, 237-238; of insects, 160, 165, 172; of mollusks, 112-113, 160, 161; risks of, 158, 160, 165, 171, 173
- Biological control. See Biocontrol
- Biological experimentation, 390. See also Enclosures, as research technique; Hawaiian forests, as experimental controls; Research methods
- Biotic regions, 4
- Birds
 - as agricultural pests, 283; assessment of status by vegetative assessment, 9; endemicity of, 4; extinction of, 4, 75-76, 77, 109, 266, 267, 299, 444; factors limiting populations of, 77, 88, 92; habitat of, 78, 272; management for, 77, 92, 93-94, 95; parasites of, 161; population resistance to stresses, 84; role in alien plant dispersal (see individual plant species);

- species associations, 269-270 (see also Guilds, bird); status of various species, 78-89, 92, 93-94; threats to, 78, 82, 266-267, 268-272; vulnerability to predation, 267. See Taxonomic Index for specific groups and species. See also Research needs
- Birds, alien, exotic, introduced
 - control of, 520; effects on native birds, 76, 272, 283
- Birds, diseases of. See Diseases, bird
- Birds, endangered, rare, threatened, 77, 78, 79, 81, 82, 83, 84, 85, 86, 87, 271; percentages recorded on Hawai'i Forest Bird Survey, 16; relation to elevation and habitat, 16
- Birds, endemic, indigenous, native, 75-97; recovery of, 96, 425; management of, 80, 92, 96; causes of declines of, 268; displacement by alien birds, 268; distribution of, 78-89; population declines of, 78, 79, 82, 83, 86, 88; population dynamics of, 79, 84, 89, 283-284; reforestation for, 83, 85; threats by alien species, 271
- Birds, extinct, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 425
- Bishop Estate, 381
- Bishop Museum, 62, 136, 490
- Board of Agriculture, 234
- Board of Land and Natural Resources, 234, 503, 506, 509, 519, 525
- Bogs, 154; as areas for endemic plants, 39, 396; resistance to alien plants, 226. See also Vegetation types
- "Bottlenecks," role in tolerance to inbreeding, 445. See also Colonization; Genetics
- Boundaries, natural, vs political, for natural areas, 409, 463
- Buffer zones, 286, 464
- Captive propagation, 78, 81, 92, 95, 471, 524
- Caves, 119, 152, 166
- Cave Species Specialist Group, 119
- Chemical control
 - advantages, 280; around ports of entry, 167; disadvantages, 78, 165, 280; of invertebrates, 165; of plants, 236-237, 471; of predators, 281-282; of ungulates, 278, 279-280. See also individual species groups
- Chemicals, registration procedures, 280
- Climate
 - as factor in 'ohi'a dieback, 407-408; in colonization, 151, 159; in disease transmission, 331; influence of ecosystems on, 394, 499, 500; in species diversity, 114
- Climatic regimes, 388-389
- Climax forest, characteristics of, 410
- Coevolution, 108, 110, 157, 166
- Cohort 'ohi'a stands, 409
- Cohorts, 393. See also Dieback, 'ohi'a
- Colonization
 - alien species, 150; before Polynesian man, 181; birds, 86, 276, 283; "bottlenecks" in selfing and polyploid species, 449; diversification, of plants, 181; genetics, 438; invertebrates, 107, 151, 157; mammals, 276; mechanisms of, 299; plants, 425; requirements for success, 151, 152, 443
- Communication, 488, 489. See also Conservation; Cooperative efforts; Land use; Scientific roles in Hawai'i
- Compartmentalized management, need for, 510
- Competition, 150, 153, 252, 521; among birds, 268-270, 282-284; among birds and rats, 270; among birds and invertebrates, 268; among insects, 159, 160, 172; among invertebrates, 151, 154, 165; among plants, 26, 394, 395, 396, 405, 412, 501; among pollinators, 155, 156, 157

- Competitive exclusion, example in alien plant success, 225
- Conflicts in Hawai'i conservation, sources of, 504, 506
- Conservation
 legal and planning mandates, 518-526; need for cooperative efforts, 485-486, 487, 490;
 objectives, priorities, and strategy, 118, 424, 468, 478, 486-487, 502-503, 511;
 problems, 489, 512, 513;
 statewide implementation, 502; types of activities and evaluation of, 487-488
- Conservation District, 79, 117, 505, 506
- Conservation ethic, 117, 467-468, 491, 501-502, 513-514, 515, 518, 527, 528
- Conservation Subzones, 128, 505, 508, 510, 525. See also Protective Subzone
- Conservation triage, 137, 469-470
- Constitution of the State of Hawai'i, 502, 518
- Control, of vertebrate damage, 275, 277-278, 281; through habitat management, 171. See also Management; Plants, alien; Predators, control of; Ungulates; Vertebrates, alien
- Cooperative efforts, needs and examples, 172, 466, 490-491, 516, 529
- Coordination Plan (Hawai'i Department of Land and Natural Resources), 522
- Critical habitat, 504
- Cultural Plan (Office of Hawaiian Affairs), 497
- Data base, Hawaiian species. See Natural Heritage Program
- Defense mechanisms, 157, 159
- Degradation
 by alien vertebrates, 252, 256, 260-265; of native vegetation, 17. See also individual species; Ecosystem alteration
- Depredation
 by invertebrates, 152-155;
 by rodents, 164-165, 394; by ungulates, 256, 260, 261, 262-264. See also species groups
- Development, effects on native plants. See Ecosystem alteration
- Dieback, as developmental stage in forest succession, 406, 408, 410
- Dieback, causes of, 404, 406-408
- Dieback, 'ohi'a, 10, 403-416; as disease, 415; bog-formation form, 405; causal hypotheses, 406; characteristics of, 404, 405; cohort senescence theory of, 410; displacement form, 405; distribution of dieback stands, 408; dryland form, 405; forms of, 405-406; gap-formation form, 405, 406; implications for forest bird distribution, extinction, 274, 412; implications for management, 410-412, 413, 414, 476; implications for preserve design, 411, 412 (see also Preserve design; Succession); research needs, 476 (see also Research needs, 'ohi'a dieback); role of rainfall, 407; role of ungulates, 408; soil characteristics, 405-406, 407, 408, 409, 414; wetland form, 405
- Dieback areas, susceptibility to invasion by alien species, 44, 412
- Diseases
 causative agents in 'ohi'a dieback, 404, 408; in agriculture, 162; larval dermatitis, 321; of mollusks, 162-163; of native invertebrates, 162; of plants, 153, 161-162; resistance to, in invertebrates, 162; transmission by alien vertebrates, 253; vectors and reservoirs, 161, 162. See also Diseases, bird
- Diseases, bird, 76, 77, 86, 87, 88, 161, 172, 299-336, 338-356; acute, 310; arboviruses, 323, 330, 336; Aspergillosis, 306, 332-333; Avian enteritis, 331; Avian influenza, 336; Avian malaria, 76, 79, 80, 82, 83, 172, 273, 299, 309, 328, 335, 469; Avian pox, 80, 273, 306, 329-330, 339, 348, 349, 350, 351, 352, 353,

- 354, 355-336; Avian toxoplasmosis, 308; bacterial, 331-332, 336, 352; botulism, 331, 332, 339, 340, 344, 345; Blackhead, 306, 312; Candidiasis, 306; chronic, 308, 310; Coccidiosis, 307-308, 313; Eastern equine encephalomyelitis, 324, 326, 330; effects of nutrition on, 318-319; effects of ungulates on, 273; Encephalomyelitis, 328; epidemics, 334; Equine encephalitis viruses, 299; Fowl pox, 328; fungal, 332-333; generalized, 334; host-specific, 334; importance in population dynamics, 299, 335-336; Infectious bronchitis, 313, 334; introduction and management of, 373; Japanese B encephalitis, 330; limiting factors in populations, 309, 334-336; Mycobacteriosis, 336; Newcastle disease, 330, 336; Pigeon malaria, 310; Pneumonia, 331; resistance to, 80, 89; respiratory, 331; St. Louis encephalitis, 330; Scaly face, 326; Scaly leg, 325-326; susceptibility, 229, 334; synergistic effects of, 313, 319, 331; togaviruses, 330; transmission agents of, 161, 299 (see also specific taxa, 306-333); transmission from captive birds, 299; Trichomoniasis, 306-307; viral, 329-331, 336; Western equine encephalitis, 330
- Disharmonic species, of parasites, 333
- Dispersal
of alien plants, 164, 183-204, 253, 263, 265, 274, 284, 396; of alien plants, need for vectors, 397; of alien vertebrates, 253; of invertebrates, 107, 151, 170; of plants, 155
- Dispersal agents
alien invertebrates, 163; alien vertebrates, 469. See also Pigs
- Distribution
endemic birds, related to disturbance, 86, 87, 92; mollusks, in relation to elevation and disturbance, 114-115; plants, modification by pigs, 263
- Disturbance
by alien animals as benefit for alien plants, 26, 231; catastrophic, 411; in preserve design, 462, 463, 466-467, 472; role of, in diversity, 462; simulation, as management action, 471; of vegetation, in relation to endangered species, 14-15, 79
- Disturbed areas, as habitat for aliens, 158, 169, 235, 273
- Diversity
importance of, 137; in determination of preserve size, 463, 468; in relation to vegetation zones, 114; plant, in relation to climate and geology, 25, 42. See also Genetic diversity; Species diversity
- Dogs (wild), effects on pigs, 262
- Drives, as management tool for ungulates, 279
- Earthworms, agent in soil formation, 150. See also Soils, invertebrate relationships
- Ecological zones, 34, 35-36, 139-140. See also Vegetation zones
- Economics
conflict with native ecosystem preservation, 181, 507, 509, 511; of conservation and preservation, 522, 523, 528, 529
- Economy, effects of quarantine on, 166
- Ecosystem alteration, 14-15, 26, 78, 79, 468, 469; by man, 4, 44, 45, 75, 76, 79, 86, 108, 111, 112, 118, 153, 253-254, 509; naturally occurring, 108, 110; role in establishment of aliens, 152; role of, in formation of cohort 'ohi'a stands, 409. See also 'Ewa Plains
- Ecosystem classification, need for, 133, 510. See also Research needs

- Ecosystem conservation, 479, 480. See also Conservation; Native ecosystems; Natural areas; Preserves
- Ecosystem management, 144, 165, 412, 521. See also Native ecosystems, management of
- Ecosystem restoration, 18, 92, 422-428, 480; cost-benefit studies lacking, 477; difficulties of, 424, 477; goals of, 424-425, 428, 477; management recommendations, 427-428, 477-478; through ungulate exclusion, 263
- Ecosystem recovery, 18, 378, 398, 425-426
- Ecosystem types, based on role of man, 423. See also Ecological zones; Vegetation types; Vegetation zones
- Ectoparasites, bird, 323-328. See Taxonomic Index for specific groups and species
- Education, 89, 120, 144-145, 510, 514-516, 521, 523-524; about alien species control, 166, 173, 234-235, 287; about conservation of plants, 62, 487, 515; methods and motivations, 'Elepaio (Hawai'i Audubon Society newsletter), 487-488
- Endangered Forest Bird Project (The Nature Conservancy), 490
- Endangered, rare, and threatened species as source of conflict, 504, 506; as U.S. Fish and Wildlife Service focus in Hawai'i, 484; candidate taxa, 5, 116, 117, 119; definition of "use", 9; designation of, 4, 115, 116, 117, 118, 520; establishment of habitat for, 524; management of, 520-521; research needs, 116, 427, 484. See also species groups; Preserve design
- Endangered Species Act, 4, 5, 28, 117, 491, 502, 504, 505
- Endangered Species Preservation Plan (Hawai'i Department of Land and Natural Resources), 524
- Endemics, Hawaiian species, 25, 142, 444, 452. See also species groups, endemic, indigenous, native
- Endoparasites, bird, 306-323. See Taxonomic Index for specific groups and species
- Environmental Impact Statements (EIS), needed for introductions, 173
- Environmental Protection Agency, 280
- Erosion, caused by ungulates, 83, 96, 260
- "Essential" habitat, 504
- Evolution as natural process, 499; of Hawaiian species, 25, 110, 150, 158, 166, 299; of native plants, effects of cattle, 260
- 'Ewa Plains (as case study in ecosystem alteration) agriculture, effects on native plants, 60; comparisons of original and present flora, 59-60; European man, effects on flora, 56-57; geography and climate, 56; Polynesian man, effects on flora, 56, 57, 59; reconstruction of flora, 57; vegetation types and species, 58
- Exclosures agencies responsible for, 378, 379-387; ages, locations, and sizes, 377, 378, 379-387; as management tool, 18, 377, 390, 398, 475; as research technique, 377, 378, 379-387, 398; natural, 378, 397, 413; purposes of establishing, 378, 379-387, 476; use in ecosystem restoration, 425; vegetation responses within, 378, 379-386, 393-397
- Exotic Animal/Native Wildlife Conflicts Plan (Hawai'i Department of Land and Natural Resources), 524
- Experimental Use Permits, 280
- Extinction bird, by avian pox, 335-336; bird, by predation, 266, 267; causes of, 109, 110, 119; coevolved species, 157; ecosystem, 416, 469; Hawaiian rain forest, 416; invertebrate, by biocontrol and chemical control, 158; invertebrate, due to loss of host plants, 113; mollusk, 108, 109, 110, 111, 159, 160; natural and man-induced

- compared, 434; 'ohi'a, 404;
 percentages of major taxa,
 142; pollinators, 155;
 pre-European contact, 109,
 111, 497; predisposing
 factors, 434. See also
 species groups; Biocontrol
Federal Register, 28, 504
Federal Research Study Areas,
 463, 465
 Fencing, as control for
 ungulates, 97, 278, 279,
 398, 471. See also
 Management techniques;
 Ungulates
 Fire
 as management tool, 471;
 cause of 'ohi'a dieback,
 408; disturbance of native
 vegetation, 17; human-
 caused, 153; invasion of
 alien plants after, 40;
 naturally occurring, 17,
 228; response of alien
 plants to, 183-204, 207-216
 Food
 birds as, 75; invertebrates
 as, 163, 266, 267, 268, 270,
 272; plants as, 263, 264;
 use by insects, 159, 160.
See also Competition
 Forest removal, effects of,
 41, 500
 Forest fragmentation, 274, 284
 Forest Reserves, 522
 Forest types
 dryland, 133; koa-'ohi'a, 3,
 9, 10, 11, 12, 16, 17, 19,
 76, 79, 266, 271, 394, 398;
 mixed mesophytic, 34, 39,
 41, 42, 133. See also
 Vegetation types; Vegetation
 zones
 Forests
 alien, problems with, 501;
 disturbed, in relation to
 native and alien birds, 84,
 269
 Fossils
 bird, 78, 80, 83, 109;
 invertebrate, 109, 110;
 mollusk, 110-111, 112
 Foster Botanic Garden, 235
 Game Management Areas (Hawai'i
 Department of Land and
 Natural Resources), 520
 Gene pools, in Hawai'i, 499
See also Genetic Management;
 Genetics
 Genetic conservation, 498
 Genetic diversity
 management limitations, 478;
 manifestations and sources
 of, 436, 439; 498; methods
 to determine, 442-443
 Genetic drift, definition and
 effects, 437
 Genetic load, definition, 437
 Genetic management, 433, 440,
 446-449, 450-451, 452-453,
 479
 Genetics
 effects in small
 populations, 435; importance
 in preserve design, 433-434,
 460, 468; inbreeding
 species, 438; invertebrate,
 159, 165; management by
 zoos, 440-441; management
 for diversity, 441;
 outbreeding species,
 437-438; plant, 29, 155,
 156. See also Genetic
 management
 Grazing, 153. See also Land
 use
 Growth forms, of alien plants,
 183-204
 Guilds
 bird, 269-270; invertebrate,
 106, 158
 Habitat degradation
 definition, 252. See also
 Ecosystem alteration;
 Ecosystem degradation
 Habitat range, of alien
 plants, 183-204
 Hawai'i Audubon Society, 487
Hawai'i County General Plan,
 518
 Hawai'i Department of
 Agriculture (DOA), 275
 Hawai'i Department of
 Education (DOE), 515
 Hawai'i Department of Land and
 Natural Resources (DLNR),
 96, 275, 279, 282, 378, 379,
 380, 381, 382, 383, 385,
 386, 415, 416, 486, 487,
 490, 491, 503, 511, 519,
 520, 521, 523
Hawai'i Department of Land and
 Natural Resources Regulation
 No. 4, 502, 505, 525
 Hawai'i Department of Planning
 and Economic Development
 (DPED), 505, 516, 523
 Hawai'i Department of
 Taxation, 505

- Hawai'i Division of Forestry and Wildlife (DOFAW), 6, 136, 282
- Hawai'i Forest Bird Survey, 6, 7, 9, 10, 13, 16, 77, 81, 82, 85, 86, 271, 397, 469, 487, 490, 491, 510
- Hawai'i Land Use Commission, 505
- Hawai'i Revised Statutes (HRS), 275, 502, 503, 519
- Hawai'i's Renewable Resources Research Plan for the 80's (Hawai'i Department of Land and Natural Resources), 502, 503-504, 521
- Hawai'i State Plan, 501, 502, 518
- Hawai'i Wildlife Plan (Hawai'i Department of Land and Natural Resources), 279, 282, 503, 521, 522, 523, 524
- Hawaiian culture, 57, 497. See also Ecosystem alteration; Man; Polynesian man
- Hawaiian forests, as experimental controls, 414, 500. See also Biological experimentation; Research methods
- Hawaiian Islands, geologic description of, 25, 298-299
- Hawaiian species, characteristics of, 4, 150. See also Island ecosystems
- Heritage Program (The Nature Conservancy), 484, 510
- Honolulu Quarantine Station, 324. See also Quarantine
- Honolulu Zoo, 331, 348
- Horticulture, 167, 172, 182, 234
- Horticulturists, need to interact with, 63
- Hosts
- invertebrate, 108 (see also Insects); plant, 108 (see also Plants). See also Diseases, bird
- Hunting
- as conflicting use of native forests, 508; as management tool, 278-279, 471; as recreation, 508. See also Management; Ungulates; Vertebrates, alien
- Hybridization, 155, 156, 165
- Hydrology. See Watersheds, management of
- Importation
- birds, 330, 333, 336; plants, 181, 234
- Inbreeding, 441, 446-449, 449-450; small populations, 444-445. See also Colonization; Small populations
- Inbreeding coefficients, in colonizing populations, 445
- Inbreeding depression, 443, 437-438
- Index of Rarity, 116. See also Endangered, rare, and threatened species; Invertebrates; Plants
- Indicator species, 470
- Infections, bird, 306-333. See also Diseases
- Insects, 270, 273; affected by host plants, 154; alien, 149-173; alien, impact on native predators, 160; as disease vectors, 161-162; colonial/social, 153, 156, 157, 158-159, 160, 166, 169; dominant group on oceanic islands, 151; endemic, indigenous, native (see Invertebrates, endemic, indigenous, native). See Food; Pollinators. See Taxonomic Index for specific groups and species
- Integrated Pest Management, 285
- International Biological Program (IBP), 6, 62, 114, 151
- International Union for the Conservation of Nature and Natural Resources (IUCN), 117, 119
- Introductions
- accidental, 4, 150, 152, 167; bird, 283; insect, 160; plant, 181; adverse effects of, 118, 252; alien, 524-525; Polynesian, 108, 111, 112, 181, 252, 253, 425, 497; post-European contact, 181, 255, 425
 - control of, 167, 168; effects on invertebrates, 108; intentional, 112, 118, 150, 152, 156, 161, 163, 166, 167, 173, 519; bird, 283; for biocontrol, 158, 165, 170 (see Biocontrol); for horticulture, 167, 172 (see also 183-204); insect, 160; plant, 39,

- 181; pollinators, 164, 372; reasons for, 152; regulations for, 519
- of plants and their pollinators, 164; rate of plant, 181; vertebrate, restrictions on, 275; invertebrates, alien, effects on native species, 150, 152, 160, 469
- Invasions. See Dispersal
- Invertebrate Red Data Book (IUCN), 117
- Invertebrates
 - alien, exotic, and introduced, effects of, 112, 372; as food, 266, 268; conservation of, 166; diversity of, 106-107, 113-114, 115; endemic, 106, 107, 115, 117; endangered, rare, and threatened, 106; extinction of, 109, 111, 113, 154, 162, 165; management of, 115, 119-120, 136, 163, 166, 169, 170, 372; population declines, 154, 160, 161; predation by invertebrates, 112-113, 114, 115-120, 157-158; recovery of, 425; survival requirements of, 106-107; threats to, 111, 112-113, 115, 155-161. See Taxonomic Index for specific groups and species
- Island ecosystems, characteristics of, 25, 142, 158, 239
- Isolation
 - as quarantine aid, 167; influence on species composition and evolution, 4, 150, 333. See also Colonization; Genetics
- Land acquisition, for preservation of Hawaiian ecosystems, 470. See also Land use; Native ecosystems; Natural areas; Preserves
- Land ownership issues, as factor in preserve design, 470, 472
- Landscaping. See Horticulture
- Land use
 - compatible, 414, 518; conflicting, 39, 117, 137, 169, 411, 472, 506-508, 509-510, 522, 525-526
- Land use legislation, 510; in planning, 511; recommendations for, 509-519; in relation to endangered plants, 43-45
- Laysan Island, as restoration project case study, 425. See also Ecosystem restoration; Ecosystem recovery
- Legal mandates
 - conflicts, 508; native ecosystems, 502-506. See also specific legal documents; Native ecosystems; Natural areas
- Legal protection, of birds and habitat, 81, 85, 89, 92, 95. See also specific legislation; Birds; Endangered Species Act; Endangered species
- Leopold Committee, 424
- Logging, as disturbance to native species, 17, 79, 85, 86. See also Forest fragmentation; Forest removal; Silviculture
- Lowlands, 152, 157; as alien plant habitat, 41, 42, 206, 217; as native species habitat, 34, 84, 158; coastal, as endangered plant habitat, 34; coastal, as fossil sites, 110; land development in, 40, 41. See also Agriculture; Ecological zones; Ecosystem alteration;
- Makiki Environmental Education Center, 515
- Man, roles in alien plant dispersal, 183-204. See also Polynesian man, effects of
- Management
 - community vs species approach to, 5, 19, 95; endangered, rare, threatened species, 5, 6, 18; guidelines and priorities for, 410, 486; Preserve design; Native ecosystems; Natural areas; endemic, indigenous, native species and ecosystems, 18, 19, 89, 137, 144, 469, 471, 475, 486, 507, 510; necessary for preservation, 520; preserves and natural areas, 117, 137, 464-465, 480; training needs, 513. See also species groups; Dieback; Ecosystems management; Native

- ecosystems; Natural areas; Preserves
- Manual of the Flowering Plants of Hawai'i (book), 24, 61, 143
- Maui Forest Trouble, 413
- Mauna Kea Ranch, 381
- Mechanical control, plants, 237, 471
- Minimum population size, definition, 436
- Moanalua Gardens Foundation, 515
- Mollusks
- alien, exotic, introduced, 150, 154, 273; as disease vectors, 113; distribution of, 114-115; endangered, rare, and threatened, 106, 108, 109, 110, 111, 112, 114, 115, 117, 119, 160, 168; extinction of, 159, 160; predation on, 267, 270, 272. See Taxonomic Index for specific groups and species
- Mongoose. See Predation;
- Predators; Vertebrates, alien
- Monotypic stands, of alien plants, 227-228. See also Allelopathy
- Mosaic forests, 410, 416. See also Dieback, 'ohi'a; Native ecosystems; Preserve design; Succession
- Motivation, 528-529
- mt-DNA analysis. See Genetic diversity, methods to determine
- Multiple use, difficulties in, 509. See also Land use, conflicting
- Mutation rates, response to disturbances. See Genetic diversity, manifestations and sources of
- Mutualism, 155, 163, 262, 272-273
- National Park Service, 6, 96, 113, 117, 282, 378, 381, 382, 383, 384, 385, 406, 415, 424, 485, 487, 490, 491
- National Science Foundation, 415
- National Wildlife Refuges, 128
- Native ecosystems
- conflicts, 506-508 (see also Land use, conflicting); importance of, 510, 517 (see also Native ecosystems, uses of); legal and planning mandates, 503, 518; management of, 475, 483, 509-516; reasons for preservation, 495-496 (see also Native ecosystems, uses of); succession in, 426; uses of, 495-496, 497, 500, 518. See also Ecosystem management; Natural areas; Preserves
- Natural Area Reserve Commission, 503
- Natural Area Reserves, 89, 97, 128, 136, 137, 235, 279, 286, 486, 491, 510, 520, 522
- See also Native ecosystems; Natural areas; Preserves; Sanctuaries; Wildlife Sanctuaries
- Natural Area Reserve System, State, 117
- Natural areas
- adequacy of protection of Hawaiian taxa, 133, 135, 136, 144; benefits of, 500; definition of, 128; examples in Hawai'i, 129, 483-484; legal aspects, 128, 129, 137, 503, 521; management of, 128, 129, 136, 169, 237; need for, 63, 128; statistics on, 129, 130-133. See also Native ecosystems; Natural Area Reserves; Preserves; Sanctuaries; Wildlife Sanctuaries
- Natural Heritage Program, 118.
- Natural processes, need to preserve, 499. See also individual processes, e.g.
- Nutrient cycling; Native ecosystems, uses of
- Natural Resources:
- Bureaucratic Myths and Environmental Management (book), 528-529
- Natural resource managers, training for. See Education
- Nene restoration project, 426-427. See also Ecosystem restoration; Species restoration programs
- Nutrient cycling, 152, 153, 164, 274-275, 499; alteration, 230, 253, 263, 273
- Nutrient requirements, alien vs native plants, 274, 408, 413
- Nutrition, affecting disease susceptibility. See Diseases, bird, effects of nutrition

- Office of Endangered Species, 116
- Office of Hawaiian Affairs, 490, 497
- Offshore islets, 131, 134; as locations for relict populations, 110, 119. See also Exclosures, natural; Relict populations
- 'Ohi'a
 polymorphism in, 406; life stages of, 409. See also Dieback, 'ohi'a; Vegetation types
- 'Ohi'a Rain Forest Study, 6
- "Optimum" habitat, definition, 270-271
- Organizational Roles and Responsibilities Plan
 (Hawai'i Department of Land and Natural Resources), 522
- Pacific Science Association Inter-Congress, 527
- Parasites, bird, 298-328, 333, 334, 335, 336, 338-356; arrival with colonizers, 299, 333; as threats to native species, 334; importance in population dynamics, 299, 335-336; endemic, 299, 333; introduced, 299, 333. See Taxonomic Index for specific groups and species. See also Diseases, bird
- Parasites, mollusk, 113
- Pastures, 163. See also Land use; Ranching
- Pest, definition of, 181
- Pigs
 as dispersal agent of alien plants, 396, 397; effects on dieback area, 412; effects on ecosystems, 39, 275, 395, 426; effects on native plants, 111-112, 263-264, 272, 378, 382, 383, 384, 385, 395, 396-397; effects on nutrient cycling, 274 (see also Nutrient cycling, alteration of); importance in pre-European ecosystems, 254-255; threats to native birds, 272. See also Depredation; Ungulates
- Planning mandates, for native ecosystems, 502-506, 508. See also specific documents
- Plants, research techniques for, 390-393, 398 (see also Research needs; Research methods, plant). See Taxonomic Index for specific groups and species
- Plants, alien, exotic, introduced
 allelopathic, 207-216 (see also Allelopathy); distribution in Hawai'i, 183-204, 206-217, 217-227; effects of, 44, 227-231, 273, 372; effects on non-Hawaiian Islands, 231-233; effects of ungulates on, 229, 253 (see also Dispersal, of alien plants); establishment, favorable conditions for, 217 (see also Disturbance; disturbed areas); fire susceptibility (see Fire, response of alien plants to); individual growth forms of, 207-216; management of, 181, 205, 233-239, 240, 372, 398; nitrogen fixers, 207-216; noxious, 207-216; numbers naturalized, 181; origins, 111, 207-216; reasons introduced, 207-216; summary of characteristics for Hawai'i, 240-242; threats to native ecosystems, 18, 82, 96; ungulates, as control of, 229, 394
- Plants, endangered, rare, threatened, 16, 26, 28, 29; distribution by ecological zone, 34, 37-38; distribution by island, 30-33, 34, 37-38, 39-43; threats to, 30-33, 153, 154 (see also Land use; Vertebrates, alien)
- Plants, endemic, indigenous, native
 as hosts of invertebrates, 108; recovery of, 393, 396-397, 425 (see also Exclosures); regeneration in relation to environment, 395-396; taxonomy, classification, and status, 4, 27, 28, 29, 40; threats to, 29, 39, 40, 394 (see also Vertebrates, alien); uses, 498-499
- Plants, extinction of, 4, 28, 43, 47-53, 54, 155, 260, 261, 262, 425, 512

- Pollinators, 155, 156, 157, 159, 163, 164, 394. See also Extinction; Insects; Plants
- Polynesian man, effects of, 17, 26, 45, 75-76, 111, 245, 253, 254. See also Agriculture; Ecosystem alteration; Extinction; Introductions
- Population size, as factor in susceptibility to stresses, 299. See also Small populations
- Predation, 252, 263-268; by vertebrates, 76, 78, 111, 266, 267, 469. See also species groups
- Predators, control of, 281, 520. See also Control
- Preserve design
 considerations of, 92, 278, 284, 433, 459, 462, 463; biology of populations within preserve, 460, 465; definition of preserve's objectives, 460-461; determination of minimal area, 461-464; diversity, 463, 468; ecological content and setting, 459; edge effects, 463; life expectancies of, 461, 467-468; manageability, 464-465; shape and size, 459, 462, 463; succession, 462, 466-467; threats, 462, 468
- ecosystem knowledge
 critical, 460, 461
- endangered, rare, and threatened species, 460 (see also species groups)
- island biogeographic theory
 as basis for, 459, 461
- problems, 434, 465, 466, 479
- selection and management, 118, 119-120, 464
- steps in, 460-465
- suggestions, 480
- to encompass 'ohi'a dieback, 476-477
- Preserves
 establishment of, 524; goals for native vegetation system, 18; need for representative vegetation types, 60. See also Native Ecosystems; Natural Area Reserves; Natural area; Sanctuaries
- Private landowners
 need for in conservation movement, 514; problems of and with, 488, 489, 511
- Protective Subzone, purpose, extent, uses, 505-506. See also Conservation Subzones
- Public Hunting Areas (Hawai'i Department of Land and Natural Resources), 520
- Public Hunting Opportunities Plan (Hawai'i Department of Land and Natural Resources), 524
- Puppets on the Path
 (environmental education/entertainment group), 515. See also Education, methods and motivation
- Quarantine, 172; need for enforcement, 235; need for improvement, 166, 167; regulations, 118, 167. See also Honolulu Quarantine Station; Introductions, control of; Introductions, intentional, regulations for; Introductions, restrictions on; Isolation. See also individual species groups
- Radiotelemetry, for ungulate management, 280
- Rain forest
 as irreplaceable resource, 50; disappearance of, 498; endangered plants in, 40, 42 (see also Plants, endangered, distribution of); genetic diversity of, 498. See also Vegetation types
- Ranching
 effects on alien and native plants, 217, 226; effects on birds, 79, 85, 86, 217; effects on ecosystems, 256, 260. See also Conservation; Land use
- Rare and Endangered Species of Hawaiian Vascular Plants, 24
- "Rare species richness," use in analysis of status of groups, 10. See also Endangered and threatened species; Endangered species
- Recovery Plans
 for Hawaiian birds, 6, 89, 90-91, 96; purpose of, 504

- Recovery teams, for endangered and threatened species, 6, 504
- Reforestation. *See* Birds
- Regional planning, role of native ecosystems in. *See* Native ecosystems, uses of
- Relict populations, 29, 76, 83, 88, 80, 110, 113, 119. *See also* Offshore islets
- Research applications to management, 27, 118, 171, 284-285, 393, 410, 415, 423-424, 461, 462, 514, 523, 528. *See also* Ecosystem restoration; Education; Preserve design; Vegetation mapping; Vertebrates, alien
- Research methods
for vegetation changes, 390-393; sampling frequency, in plant studies, 392; statistical analysis problems, 392, 393. *See also* Biological experimentation; Exclosures; Hawaiian forests, as experimental controls; Native ecosystems
- Research methods, for plant cover and density, 390-392
basal area measures, 391; Braun-Blanquet releve, 391; Line-intercept, 391; measure-tag-remeasure, 392; point-frequency sampling, 390-391; transects, 391. *See also* Research methods
- Research needs
alien-native interactions, 373; alien vertebrate control, 253, 280, 286, 397; autecological studies, 168; biological surveys, 168; bird diseases, 169, 299, 333, 336; birds, 77, 78, 89, 283-284, 412, 427; distribution and reporting of results, 512, 514; invertebrates, 109, 114, 119-120, 168, 169, 170, 424; native ecosystems, 509; native species, 142-144; natural areas, 135, 136; natural resource inventory, 497; 'ohi'a dieback, 404, 476; permanent plot studies, 411; plant ecology, 62, 63; plant groups, 26-27, 54-57, 62-63, 377-386, 390, 392-399, 424; plant nutrition, 414; preserve design, 411; species competition, 270, 282, 284; vegetation mapping, 411, 413; watersheds, 413-414, 416
- Rodents
depredation, 264-265, 394; effects on native species, 253; predation on invertebrates, 111, 112, 113, 264, 267, 268; role in alien plant dispersal, 183-204; role in pollination, 264. *See also* Invertebrates; Plants; Vertebrates, alien
- Sanctuaries, State of Hawai'i, 128, 137. *See also* Natural Area Reserves; Natural areas; Preserves
- Scientific roles in Hawai'i, 489-490, 513, 514. *See also* Communication; Private landowners
- Selection pressures, natural and man-influenced, 439, 443. *See also* Genetic management; Inbreeding; Small populations
- Sierra Club, 487, 488
- Silviculture, effects on native plants, 43-44. *See also* Logging
- Small populations
colonization and extinction of, 433, 443, 479; definitions, 435, 478; genetic consequences of, 437, 438; in agriculture, sports, and zoos, 439-440; of native species, 26, 29, 80, 81, 82, 252; reasons for, 434. *See also* Colonization; Genetic management
- Soil Conservation Service, 514
- Soils
boundaries of, 409; invertebrate relationships, 163, 164 (*see also* Earthworms); plant relationships, 229-230, 274, 405-406, 407, 408, 409
- Speciation, 40, 107, 151, 499. *See also* Adaptive radiation; Evolution; Genetics; Isolation
- Species, diversity of, 114. *See also* Diversity; Genetic diversity

Species packing, 151
 Species restoration. See
 Genetics; Genetic
 management; Nene Restoration
 project
 State Conservation District.
 See Conservation District
 State Forest Reserves, 501
 See also Forest Reserves
 Subalpine grassland, 396. See
 also Vegetation types;
 Vegetation zones
 Succession, 462, 466-467; as
 natural process, 414, 419.
 See also Dieback; Preserve
 design, considerations
 Synergism, 163-164. See also
 Diseases, synergistic
 effects of

The Nature Conservancy (of
 Hawai'i), 42, 80, 86, 88,
 96, 97, 117, 118, 128, 136,
 286, 383, 385, 393, 461,
 463, 464, 471, 484, 487,
 490, 491, 497, 510, 513,
 514, 515. See also
 Geographic Index
 Tourism, 496
 Translocation
 as restoration technique,
 92, 95; restrictions on, 275
 Transplantation, as management
 tool, 471, 524-525
 Trapping, as management tool,
 279, 281, 471. See also
 Control; Predators;
 Ungulates

Ungulates
 as cause of extinction of
 mollusks, 112; as control
 agents for alien plants,
 394; effects on native
 ecosystems, 96, 97, 142,
 260, 271, 408, 426;
 management of, 97, 236, 278,
 279, 377, 378; roles in
 alien plant dispersal,
 183-204; threats to native
 birds, 75-76, 80, 82, 83,
 87, 88, 89, 92, 271; threats
 to native plants, 26, 34,
 42, 378, 379-386, 393, 394,
 395, 396, 397, 398, 426. See
 also species groups, threats
 to; Control; Enclosures;
 Management; Native
 ecosystems; Pigs
 University of Hawai'i, 490,
 505, 515

U.S. Department of
 Agriculture, 96
 U.S. Fish and Wildlife
 Service, 4, 5, 6, 26, 28,
 77, 89, 116, 117, 127, 136,
 282, 397, 404, 415, 463,
 483, 487, 490, 491, 504, 510
 U.S. Forest Service, 6, 379,
 380, 381, 385, 386, 406,
 407, 414, 415, 463
 U.S. National Park Service.
 See National Park Service
 U.S. Navy, 385, 386
 U.S. Soil Conservation
 Service, 379

Vectors. See Diseases;
 Invertebrates; Vertebrates,
 alien. See also Taxonomic
 Index for specific groups
 and species
 Vegetation associations,
 388-389. See also Vegetation
 types; Vegetation zones
 Vegetation classes, 388-389.
 See also Vegetation types;
 Vegetation zones
 Vegetation mapping, 8-9, 407,
 409, 413. See also Research
 applications
 Vegetation recovery, in
 vegetation classes/zones,
 393-397
 Vegetation types, 133; effects
 of ungulates on, 256, 260,
 261, 262; Hawai'i Island,
 descriptions and sizes of,
 11-12; status and
 distribution, 10, 13, 16.
 See also Ecosystem types;
 Forest types; Vegetation
 zones
 Vegetation zones, 34, 133,
 217-227, 378, 388-389;
 statistics on protected
 examples of, 134. See also
 Ecosystem types; Forest
 types; Vegetation types
 Vertebrates, alien
 distribution of, 256,
 260-266; effects of, 253,
 254, 256, 257, 258-259,
 260-272, 272-275, 372-373,
 469 (see also Disturbance;
 Plants, endemic, indigenous,
 native, effects on);
 management of, 286, 373;
 research applications to
 management, 252, 285, 286,
 485, 497. See also Birds,
 alien; Mongooses; Pigs;
 Research needs

Watersheds

management of, native
Hawaiian group interest in,
490; management in relation
to alien plants, 225;
importance of native forests
as, 500, 501, 517;
protection of, 96, 153, 399,
407, 413-414, 416, 464, 521;

suitability as preserves,
463, 466

Wildlife Data Base Plan
(Hawaii Department of Land
and Natural Resources), 523
Wildlife Sanctuaries, 520. See
also Natural Area Reserves;
Natural areas; Preserves