

COOPERATIVE NATIONAL PARK RESOURCES STUDIES UNIT

UNIVERSITY OF HAWAII AT MANOA

Department: of Botany

Honolulu, Hawaii 96822

(808) 948-8218

Clifford W. Smith, Unit Director
Associate Professor of Botany

BIANNUAL REPORT #16

June 1981

October 1, 1980 to June 30, 1981

NATIONAL PARK SERVICE

CONTRACT NUMBERS

CX 8000 7 0005

CX 8000 7 0006

CX 8000 7 0007

CX 8000 7 0008

CX 8000 8 0011

CX 8000 8 0012

CX 8000 0 0020

CX 8000 10004

TABLE OF CONTENTS

Coordinating Committee	1
Hawaii Volcanoes and Haleakala National Parks	
Bird Survey. <i>S. Conant</i>	2
Hawaii Volcanoes National Park	
Role of Fire in the Natural Ecosystem. <i>C. W. Smith</i> ..	3
Vegetation Recovery Following Goat Removal.	
<i>D. Mueller-Dombois</i>	4
History of Endemic Hawaiian Birds. <i>W. E. Banko</i>	5
Studies on Banana Poka, <i>A. E. LaRosa</i>	6
Haleakala National Park	
Kīpahulu District Resources Management Studies.	
<i>C. W. Smith</i>	7
Mammal Enclosure Studies, <i>J. D. Jacobi</i>	9
Kīpahulu Valley Feral Pig Study, <i>C. H. Diong</i>	11
Other Unit Activities	13
Publications	14
CPSU/UH Past Reports Status	16

COORDINATING COMMITTEE

Dr. John W. Beardsley
Professor of Entomology
University of Hawaii at Manoa

Dr. Charles H. Lamoureux
Professor of Botany
University of Hawaii at Manoa

Dr. Andrew J. Berger
Professor of Zoology
University of Hawaii at Manoa

Dr. Lloyd Loope
Research Biologist
Haleakala National Park

Dr. Hampton L. Carson
Professor of Genetics
University of Hawaii at Manoa

Dr. Dieter Mueller-Dombois
Professor of Botany
University of Hawaii at Manoa

Dr. Donald E. Gardner
Research Biologist
CPSU/UH
University of Hawaii at Manoa

Dr. Clifford W. Smith
Associate Professor of Botany
University of Hawaii at Manoa

Dr. Elmo Hardy
Senior Professor of Entomology
University of Hawaii at Manoa

Dr. Charles Stone
Research Biologist
Hawaii Volcanoes National Park

HAWAII VOLCANOES AND HALEAKALA NATIONAL PARKS

BIRD SURVEY

Project Leader: Dr. Sheila Conant
Assistant Professor of General Science
University of Hawaii at Manoa

Contract Number: CX 8000 7 0007
Started on January 1, 1976
Terminated

- Objectives: 1. To provide an updated checklist of birds in ~~Hawaii~~ Volcanoes National Park and Haleakala National Park Crater District.
2. To provide population density figures for each species, in each park.
3. To provide provisional distribution maps for each species, in each park.

Progress: Due to a misunderstanding that occurred during the ~~absence~~ of the Unit Director this year, no real progress has been made on this project. The project leader submitted a draft of her paper "Spatial Distribution of Birds Along an Altitudinal Gradient on Mauna Loa, Hawaii" for initial comments from the resource managers. There was a concern that the manuscript was too technical, and not very applicable to management. Unfortunately, that message was not passed on to the reviewers who were confused, resulting in some lengthy delays in responding. In the meantime, the project leader had taken advantage of a rare opportunity to do some extended studies on the breeding biology of the Nihoa Millerbird. On her return, it is hoped that the final report can be completed rapidly.

Submitted by: C. W. Smith

HAWAII VOLCANOES NATIONAL PARK
ROLE OF FIRE IN THE NATURAL ECOSYSTEM

Project Leader: Dr. Clifford W. Smith
Director, CPSU/UH
University of Hawaii at Manoa

Contract Number: CX 8000 7 0008
Started in January 1976
Terminated on 30 September 1980

- Objectives: 1. To evaluate the recovery of six ecosystems ~~within~~ Hawaii Volcanoes National Park after fire.
2. To measure the effect of fire on the survival, reproduction, and growth of plants.
3. To determine whether or not the damage by fire to a particular ecosystem would merit intervention by the National Park Service.

Progress: The Hilina Pali Exercise Fireburn Study has been continued. It is intended to publish the results of this study in a scientific journal in the near future. After six years, there are only minor changes in the vegetation in the burned area. *Andropogon* continues to dominate the area and its cover is decreasing slightly.

Study transects were established in two large areas burned since the last report--Hilina Pali Lookout and Naulu Forest.

The Ainahou burn area was also remonitored. The responses of the vegetation to cover are very similar to those in the Hilina Pali Exercise Fireburn area except that molasses grass (*Melinis minutifloris*) is much more abundant in the Ainahou area. The abundance of this exotic weed is probably due to the deep ash layer, providing a better substrata.

Submitted by: C. W. Smith

HAWAII VOLCANOES NATIONAL PARK
VEGETATION RECOVERY FOLLOWING GOAT REMOVAL

Project Leader: Dr. Dieter Mueller-Dombois
Professor of Botany
University of Hawaii at Manoa

Contract Numbers: CX 8000 7 0006
Started on November 1, 1975
Terminated on 30 September 1980

Objectives: 1. To monitor the changes in vegetation in previously established sites.

2. To produce a new vegetation map for the coastal lowland.

3. To project the probable path of recovery and identify potential problems in the new ecosystem.

Progress: The final report for this project was recently submitted to Western Region and Hawaii Volcanoes National Park for review.

Submitted by: C. W. Smith

HAWAII VOLCANOES NATIONAL PARK

A HISTORICAL SYNTHESIS OF ENDEMIC HAWAIIAN BIRDS WITH SPECIAL
EMPHASIS ON SPECIES FOUND WITHIN HAWAII'S NATIONAL PARKS

Project Leader: Winston E. Banko
Research Associate
Hawaii Volcanoes National Park

Contract Number: CX 8000 8 0012
Started on January 1, 1978
Anticipated termination on September 30, 1982

Objectives: 1.. To produce six manuscripts analysing the role of food depletion, competition by foreign organisms, predation, disease, and habitat alteration and destruction in the decline and extinction of recent Hawaiian avifauna.

2. To produce eleven manuscripts describing in detail the known history of endemic Hawaiian birds.

Progress: Report #7 "Population History--Species Accounts: Forest Birds - Muscapidae, Meliphagidae" is in the final stages of preparation for publication. Report #8 "Population History--Species Accounts: Forest Birds - Drepanididae (*Loxops*, *Melamprosops*)" has completed the reviewing process except for #8B. Report #9 "Population History--Species Accounts: Forest Birds - Drepanididae (*Hemignathus*)" is about to be returned to the author for proofing before being sent to WRO and HAVO for review. Report #10 "Population History--Species Accounts: Forest Birds - Drepanididae (*Pseudonestor*, *Psittirostra*)" has been reviewed internally by CPSU/UH and has been returned by the author.

Other papers in the series are in preparation.

Submitted by: C. W. Smith

HAWAII VOLCANOES NATIONAL PARK

STUDIES ON BANANA (POKA

Project Leader: Anne M. LaRosa
Graduate Student
Botany Department
University of Hawaii at Manoa

Not under contract
Started in January 1980
Anticipated termination in August 1981

- Objectives:** 1. To evaluate the role of the feral pig in the dispersal and establishment of banana poka.
2. To determine the requirements for seed germination.
3. To determine seedling growth rates and light requirements.

Progress: The fieldwork for this project will be completed this summer.

It is hoped that a first draft of the final report (a M.S. degree thesis) will be ready by December 1981. The review of the literature has been completed.

Submitted by: C. W. Smith
A. M. LaRosa

HALEAKALA NATIONAL PARK

KĪPAHULU DISTRICT RESOURCES MANAGEMENT STUDIES

Project Leader: Dr. Clifford W. Smith
Director, CPSU/UH
University of Hawaii at Manoa

Contract Number: CX 8000 0 0020

Started on June 15, 1981

Anticipated termination on June 15, 1983

- Objectives:**
1. To provide vegetation maps of the upper and lower management areas of the valley.
 2. To provide descriptions of the vegetation mapped in both areas.
 3. To define buffer zone for resource management activity to minimize the invasion of exotic species from the lower valley into the upper valley.
 4. To recommend priorities for the management of exotic species.
 5. To update the checklist of the flowering plants in the valley.
 6. To identify and provide population distribution and densities of all small mammals in the valley.
 7. To evaluate the impact of each small mammal species on the natural resources in the valley.
 8. To locate all feral goat populations and to map the extent of their activity in the valley.
 9. To locate all feral goat bedding areas inside and adjacent to the Park.

Progress: The vegetation map has been prepared and will be transferred to a Mylar overlay soon. The accompanying vegetation description is in progress. Some difficulties have been experienced in deriving meaningful aggregations of vegetation types in the exotic woodlands in the area. It is hoped that by utilizing some clustering data analysis programs trends will become more obvious.

The goat distribution research program has not progressed significantly since the last report. Data on goat distribution

in more remote areas is being collated from the casual observations of hunters and researchers. One unconfirmed report locates goats in mid-elevations of the upper floor of Kīpahulu Valley close to the cliffs.

The vegetation mapping of the upper valley of Kīpahulu Valley is being co-ordinated by the U. S. Fish and Wildlife Service's Forest Bird Project. Using this approach, the extensive disturbance from ground data collection, proofing, etc. can be minimized.

The rat population estimation program has met some difficulties in methodology and technique. Quite frankly, we are back at square one in trying to find a method which is reliable yet practical in the extremely difficult working conditions in the valley.

Submitted by: C. W. Smith

HALEAKALA NATIONAL PARK

MAMMAL ENCLOSURE STUDIES:
COMPETITION BETWEEN NATIVE AND EXOTIC PLANT SPECIES

Project Leader: James D. Jacobi
Graduate Student in Botany
~~University of Hawaii, and~~
U. S. Fish and Wildlife Service, Hawaii

Contract Number: CX 8000 7 0005
Started in August 1973
Terminated

Objectives: 1. To assess the competitive effects of *Holcus lanatus* (velvet grass or Yorkshire fog) in *Deschampsia* grassland and *Sophora* scrub.

2. To monitor the effect of excluding exotic mammals from the above communities.

Progress: The final report has been completed and is about to be printed. The abstract and recommendations follow:

Changes in the vegetation following disturbance by feral pigs were studied to determine if the native plants could maintain dominance over introduced species. Results of vegetation sampling along transects established through a 120 ha study area showed that native species dominated the grassland, however, 23.2% of the ground had been uprooted by pigs. After the vegetation inside a small fenced exclosure was monitored for 5 years, it was found that native and introduced species competed equally for areas uprooted by pigs. It was concluded that if feral pigs continue to forage in the grassland, introduced plant species will increase in both cover and abundance.

Recommendations:

1. Eliminate pigs from the Kalapawili grasslands. The results of this study have shown that continued rooting of the area by feral pigs will lead to an increase in the cover and abundance of introduced plant species in the grassland. If the pigs are eliminated, the native species will at least maintain their present dominance of the vegetation.

A pig-proof fence should be constructed at the lower edge of the grassland where it merges into the native scrub vegetation, starting from the edge of Kipahulu Valley and running around the grassland and up to the area of Lau'ulu peak.

A preferable solution would be to construct, where feasible, a pig-proof fence along the vicinity of the National Park boundary, on the outer north slope from Kipahulu Valley to Ko'olau Gap, deviating from the actual boundary line only where the terrain will not allow for a secure fence. This fence would additionally serve as a barrier to pig movements in the native scrubland on this slope.

2. Eliminate the blackberry plants which have become established in the lower portions of the grassland and scrubs. Blackberry has the potential for increasing in both distribution and abundance from the plants presently established in this area. It could form impenetrable thickets within a few years. This control program should be coordinated with the Hawaii State Department of Land and Natural **Resources** to additionally remove the blackberry plants established in the upper portions of the native forest in the Ko'olau Forest Reserve.

3. Continue monitoring the vegetation inside and determine long-term changes in the grassland community following removal of the pigs.

Submitted by: J. D. Jacobi

HALEAKALA NATIONAL PARK
KĪPAHULU VALLEY FERAL PIG STUDY

Project Leader: C. H. Diong
Research Assistant in Zoology
University of Hawaii at Manoa

Contract Number: CX 8000 8 0011
Started on October 1, 1977
Anticipated termination on September 30, 1981

- Objectives:** 1. To determine the distribution, abundance, and biology of feral pigs in Kīpahulu Valley, Maui.
2. To determine the ecological impact of feral pigs in that area.
3. To provide management recommendations relating to these exotic animals.

Progress: Field work for this study has concluded. Traps have been deactivated and major equipment has been taken out of the field. Two fixed-site radiotracking stations have been dismantled, but their components are still in the field. Since the conclusion of field activities, most of the time has been devoted to data analysis and writing. Manuscripts summarizing and synthesizing the major aspects of the study will be submitted to the Unit by September.

Comparisons of the Hana Rain Forest vegetation in 1973, 1978, and 1980 showed that from 1973 to 1980 more species decreased in frequency than increased. Most of the decrease occurred between 1973 and 1978, at the same time feral pigs invaded the area. Of the species showing the most striking decreases, most were woody shrubs. The species that increased were mostly ferns and small herbs. Permanent transects were established in a pig-damaged *Oreobolus* bog which the Park later fenced. Restudy of an *Oreobolus* bog severely damaged in 1978 showed much recovery of cover by 1980, but several species, all native, failed to recover, and a few, including exotic Velvet Grass (*Holcus Zanatus*) were more abundant than before disturbance.

Comparisons of the earliest and most recent inventories of the Kīpahulu 2150' pig enclosure showed few measurable changes in vegetation over a two year period. Protection from disturbance alone has so far led to little suppression of exotics. An inventory of *Cibotium* spp. between 700-1400m (2300-4600') showed small individuals were disproportionately rare. Feral pigs apparently selectively attack individuals smaller than 15 cm. trunk diameter.

The following papers are to be presented at the forth-NPS sponsored Conference on the Feral Pig in Hawaii at Hawaii

Volcanoes National Park:

1. Population description, Home ranges and Movement patterns of feral pigs in Kīpahulu Valley.
2. Live-trapping as a resource management tool.
3. The impact of pigs on the vegetation of Kīpahulu Valley and Hana Rainforest.

Submitted by: C. H. Diong
A. Y. Yoshinaga

OTHER UNIT ACTIVITIES

13

- | | |
|-------------------------|---|
| Western Regional Office | <ol style="list-style-type: none">1. Met with Regional Chief Scientist in San Francisco to discuss Unit progress and future.2. Responded to a number of Region requests for ideas and suggestions. |
| Hawaii Regional Office | <ol style="list-style-type: none">1. Discussed Lower Kīpahulu problems and identified important biological resources and scientific concerns in the area. |
| Hawaii Volcanoes N.P. | <ol style="list-style-type: none">1. Met with Superintendent on several occasions to discuss resource management problems and possible research input.2. Continued assisting resource management specialist in the reorganization of the resource management program and related research needs.3. Continued monitoring of Ainahou Burn.4. Participated in the planning of the Conference on feral pigs in Hawaii to be held in Hawaii Volcanoes National Park.5. Discussed exotic plant eradication programs and efforts with the Superintendent and the Chief, Resources Management on several occasions. |
| Haleakala N.P. | <ol style="list-style-type: none">1. Met with Superintendent on several occasions to discuss resource management.2. Continued development of Kīpahulu Valley research program.3. Met with Nature Conservancy on several occasions identifying important biological resources in lower valley and scope of resource management problems in the area. Completed Nature Conservancy sponsored Resources Basic Inventory of Lower Kīpahulu Valley.4. Discussed exotic plant control efforts in the Kīpahulu area with NPS personnel |

- Caldwell, M. M., R. Robberecht and W. D. Billings. 1981. A Steep Latitudinal Gradient of Solar Ultraviolet-B Radiation in the Arctic-Alpine Life Zone. *Ecology* 61:600-611.
- Canfield, J. E. and L. R. Stemmermann. 1981. Vascular Plants of Kīpahulu Valley below 2000 feet in C. W. Smith edit. Resources Basic Inventory of Kīpahulu Valley below 2000 feet.
- Conant, S. 1980. -Birds of the Kalapana Extension. CPSU/UH Tech. Rep. #36.
- Conant, S. 1981. Recent observations of endangered birds in Hawaii's National Parks. *Elepaio* 41:55-61.
- Daida, G. Y. and C. W. Smith. 1981. Lichens of Lower Kīpahulu Valley below 2000 feet in C. W. Smith edit. Resources Basic Inventory of Kīpahulu Valley below 2000 feet.
- Diong, C. H. 1981. A Portable Metal Box Trap for Live-Capture of Feral Pigs. CPSU/UH Tech. Rep. #37.
- Gagne, W. O. 1981. Insects and Myriapods of Kīpahulu Valley below 2000 feet in C. W. Smith edit. Resources Basic Inventory of Kīpahulu Valley below 2000 feet.
- Gardner, D. E. 1981. An Evaluation of Herbicidal Methods of Strawberry Guava Control in Kīpahulu Valley in C. W. Smith edit. Resources Basic Inventory of Kīpahulu Valley below 2000 feet.
- Gardner, D. E. 1981. Nuclear behavior and clarification of the spore stages of *Uromyces koeae*. *Can. J. Bot.* 59:939-946.
- Gardner, D. E. 1981. Rust on *Commelina diffusa* in Hawaii. *Plant Disease*. (in press).
- Gon, S. M. III and L. W. Pinter. 1981. Annotated List of the Arachnid Fauna of Kīpahulu Valley below 2000 feet in C. W. Smith edit. Resources Basic Inventory of Kīpahulu Valley below 2000 feet.
- Hoe, W. J. 1980. *Andraea* in Hawaii. *The Bryologist* 83:212-214.
- Hoe, W. J. and C. W. Smith. 1981. Bryophytes (Mosses, Liverworts and Hornworts) of Kīpahulu Valley below 2000 feet in C. W. Smith edit. Resources Basic Inventory of Kīpahulu Valley below 2000 feet.
- Krauss, B. H. 1981. Ethnobotanical Resources in Kīpahulu Valley below 2000 feet in C. W. Smith edit. Resources Basic Inventory of Kīpahulu Valley below 2000 feet.

- Robberecht, R., M. M. Caldwell and W. D. Billings. 1980. Leaf Ultraviolet Optical Properties Along a Latitudinal Gradient in the Arctic-Alpine Life Zone. Ecology 61:612-619.
- Severns, R. M. 1981. Land Molluscs of Kipahulu Valley below 2000 feet in C. W. Smith edit. Resources Basic Inventory of Kipahulu Valley below 2000 feet.
- Smith, C. W., **A. Y. Yoshinaga and C. H. Diong. 1981.** Vertebrates (excluding Birds) in Kipahulu Valley below 2000 feet in C. W. Smith edit. Resources Basic Inventory of Kipahulu Valley below 2000 feet.
- Stemmermann, M. 1981. Birds of Kipahulu Valley below 2000 feet in C. W. Smith edit. Resources Basic Inventory of Kipahulu Valley below 2000 feet.
- Whiteaker, L. D. 1980. The Vegetation and Environment in the Crater District of Haleakala National Park. CPSU/UH Tech. Rep. 1/35.

Technical Reports

- | | | |
|-----|--|----------------------------|
| 1. | 01-Year First Progress Report | Available |
| 2. | Proposal for the Study of Rare and
Endangered Birds in Hawaii's National
Parks. | No longer available |
| 3. | The Ohia Dieback Problem in Hawaii | No longer available |
| 4. | Vegetation Map, HAVO | No longer available |
| 5. | Revised Checklist of Vascular Plants,
HAVO | Available |
| 6. | 01-Year Final Report | Available |
| 7. | 02-Year First Progress Report | Available |
| 8. | HAVO Fern Checklist | No longer available |
| 9. | HALE 1975 RBI Narrative | No longer available |
| 10. | Halapē Marine Survey | Available |
| 11. | Kīpahulu Expedition 1976 | No longer available |
| 12. | Ohia Decline: The role of
<i>Phytophthora cinnamomi</i> | No longer available |
| 13. | PUHE Marine Fauna | No longer available |
| 14. | Hawaiian Bird Bibliography | No longer available |
| 15. | PUHE Plant Survey | Available |
| 16. | PUHE Marine Flora | Available |
| 17. | Limnological Survey of Lower Palikea
and Pipīwai Streams, Kīpahulu, Maui | No longer available |
| 18. | The Hilina Pali Fire: A Controlled
Burn Exercise | No longer available |
| 19. | Kīpahulu Valley Pig Proposal | No longer available |
| 20. | Ohia Rain Forest Study | No longer available |
| 21. | Hawaiian Bird Bibliography | No longer available |
| | Part 1 -- The Bibliography | No longer available |
| | Part 2 -- Keyword Index | No longer available |
| | Part 2 -- Author/Source Index | No longer available |
| 22. | Kīpahulu Valley Research Plan | No longer available |
| 23. | Evaluation of Rare and Endangered
Bird Research Programs for
Hawaii's National Parks | No longer available |
| 24. | Haleakala National Park Crater District
Resources Basic Inventory: 1976-77 | Available |
| 25. | Haleakala National Park Crater District
Resources Basic Inventory: Mosses | No longer available |
| 26. | Haleakala National Park Crater District
Resources Basic Inventory: Birds | No longer available |

- | | | |
|-----|---|---------------------|
| 27. | An Ecological Survey of Pua'alu'u Stream | No longer available |
| 28. | Proposed Native Ecosystem Restoration
Program for Halapē, Kiauhou, and Apua
Point Hawaii Volcanoes National Park | No longer available |
| 29. | Mites (Chelicerata: Acari) Parasitic on
Birds in Hawaii Volcanoes National Park | No longer available |
| 30. | Distribution of Mosquitoes (Diptera:
Culcidae) on the East Flank of Mauna
Loa Volcano, Hawai'i | No longer available |
| 31. | Haleakala National Park Crater District
Resources Basic Inventory: Insects | Available |
| 32. | Summer Census of the Reef-fish Community
of Waters Adjacent to Pu'uhonua o
Hōnaunau National Historical Park,
Summers 1974 - 1978. | Available |
| 33. | Upper Kīpahulu Valley Weed Survey | Available |
| 34. | The Plant Genus <i>Hibiscadelphus</i> in Hawaii | Available |
| 35. | Vegetation Map - HALE | Available |
| 36. | Birds of Kalapana Extension | Available |
| 37. | A Portable Metal Box Pig Trap-Feral Pigs | Available |

Avian History Reports

HISTORY OF ENDEMIC HAWAIIAN BIRDS

- | | | |
|------|--|---------------------|
| 1. | Introduction | No longer available |
| 2. | Specimens in Museum Collections | No longer available |
| 3. | - To be prepared after species accounts
completed | |
| 4. | Species Accounts. Introduction | No longer available |
| 5A. | Newell Shearwater ('A'o) | No longer available |
| 5B. | Hawaiian Dark-Rumped Petrel ('Ua'u) | No longer available |
| 6A. | Hawaiian Hawk ('Io) | No longer available |
| 6B. | Hawaiian Raven /Crow ('Alalā) | No longer available |
| 6C/D | Hawaiian Thrushes | No longer available |

Other Reports

Resources Basic Inventory of Kīpahulu Valley below 2000 feet.