

# Riparian Composition and Function in a Small Watershed in Hanalei, Hawaii



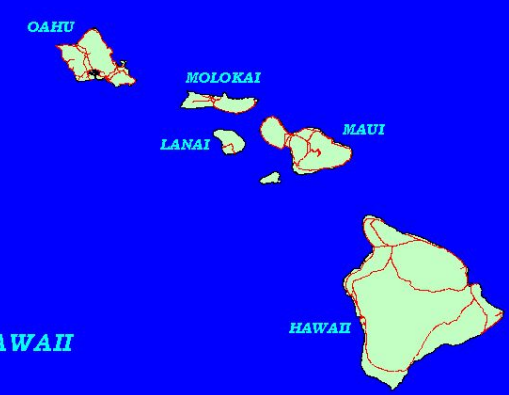
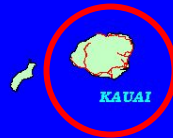
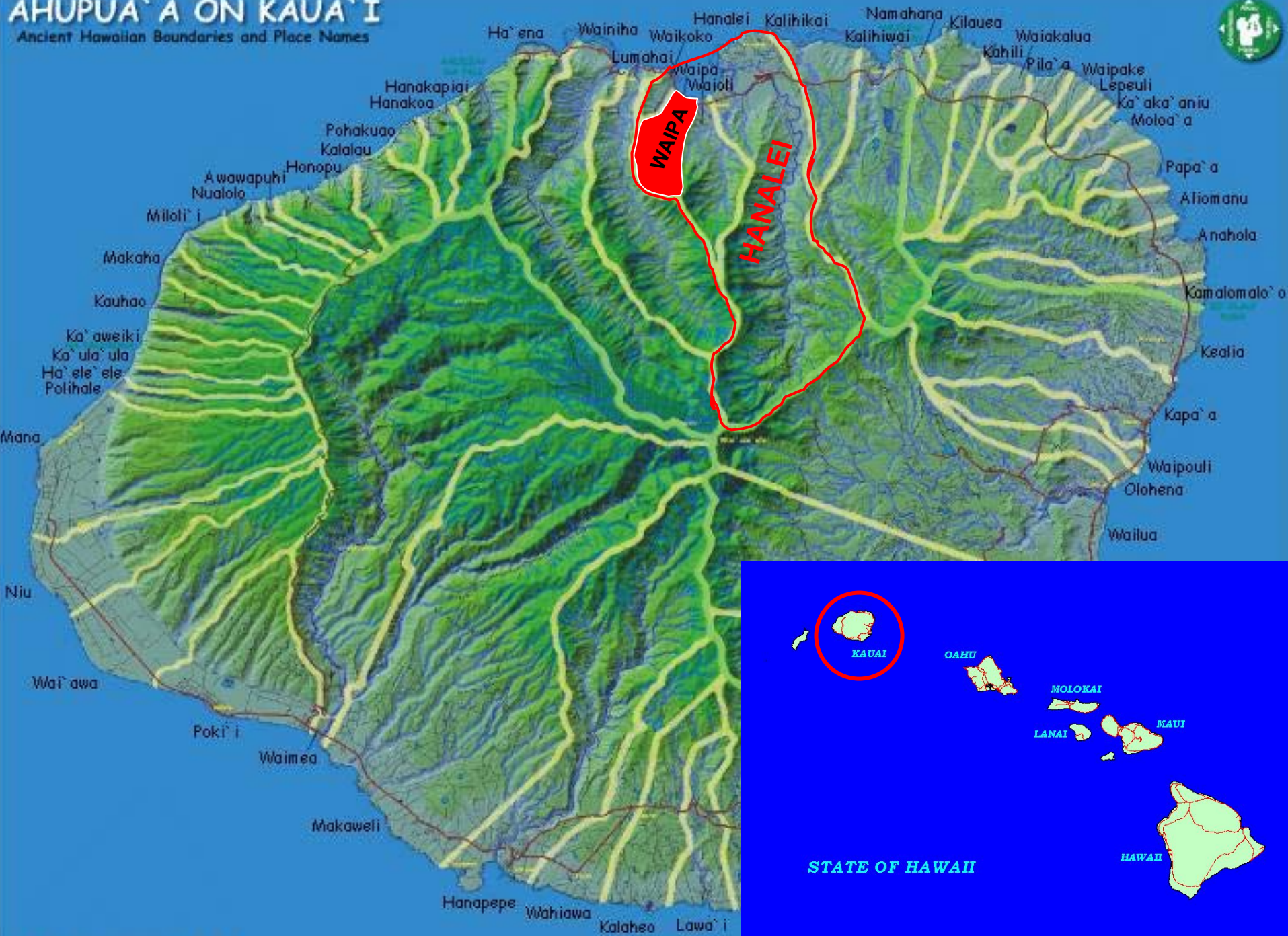
**Carl Evensen and Guy Ragosta**



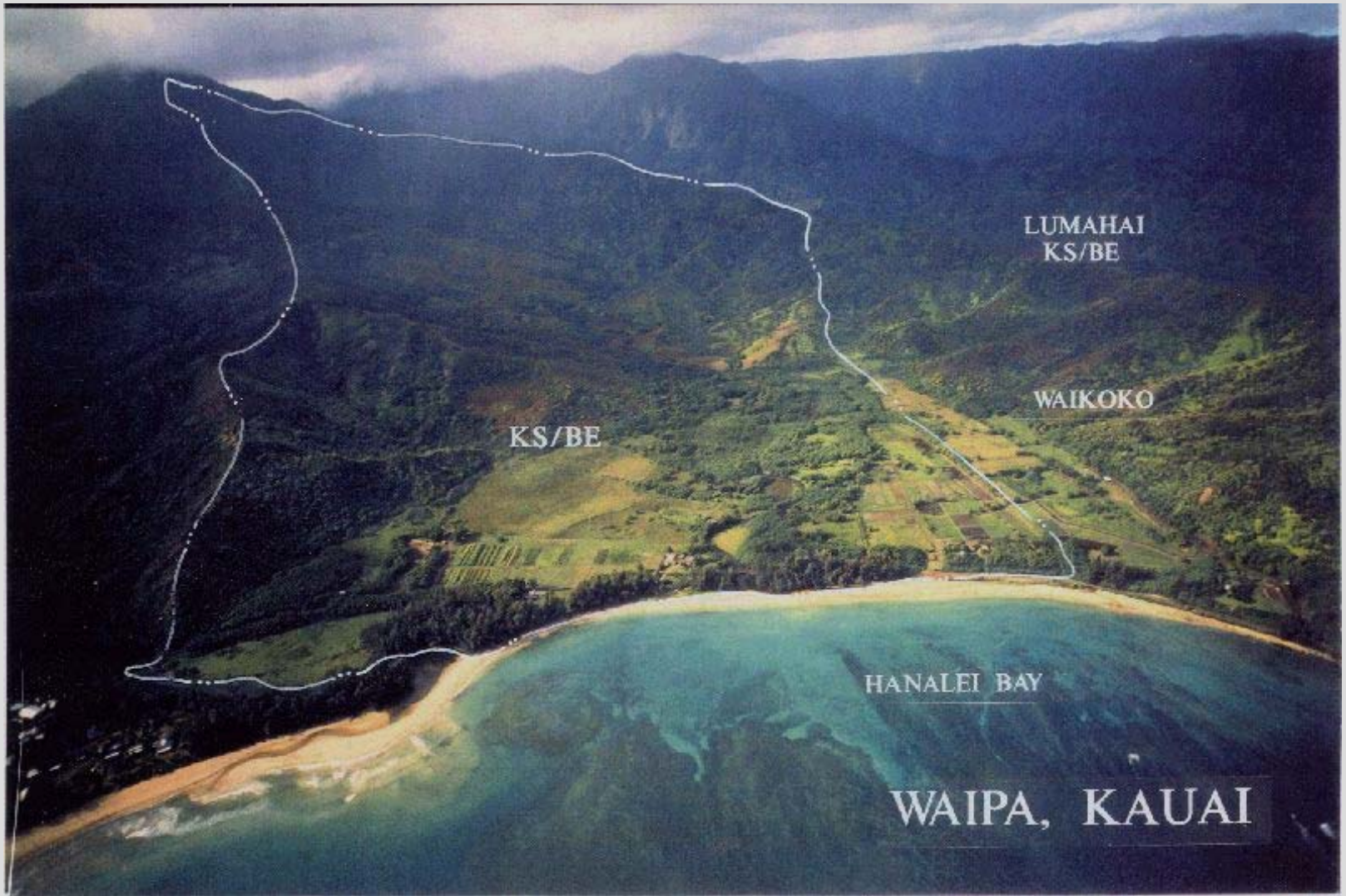
**University of Hawaii at Manoa  
College of Tropical Agriculture & Human Resources**

# AHUPUA`A ON KAUA`I

Ancient Hawaiian Boundaries and Place Names



STATE OF HAWAII



KS/BE

LUMAHAI  
KS/BE

WAIKOKO

HANALEI BAY

WAIPA, KAUAI

# Hanalei Watershed

An aerial photograph of the Hanalei River valley in Hawaii. The river flows through a lush green landscape with terraced rice fields on either side. In the background, there are rolling green hills and mountains. A bridge is visible in the lower right corner of the image.

- Hanalei River designated as an American Heritage River in 1998
- An EPA-funded Watershed Initiative Grant was funded in 2002, also including Wai'oli, Waipa, and Waikoko streams
- Partners include USFW, NRCS, USGS, Univ. of Hawaii, State and County agencies, and private organizations

<http://www.hanaleiwatershedhui.org/>



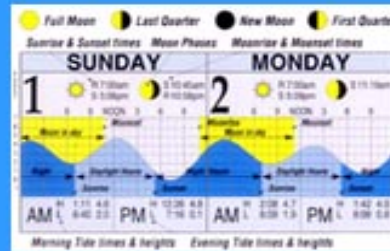
# HANALEI WATERSHED HUI

E Małama Kumu Wai

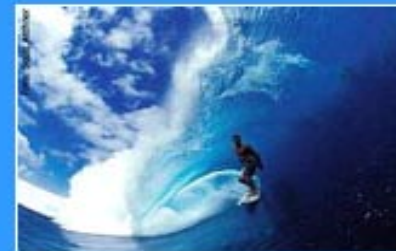
## HANALEI TODAY



[Weather](#)



[Tides](#)



[Surf Report](#)



[See Hanalei Live](#)

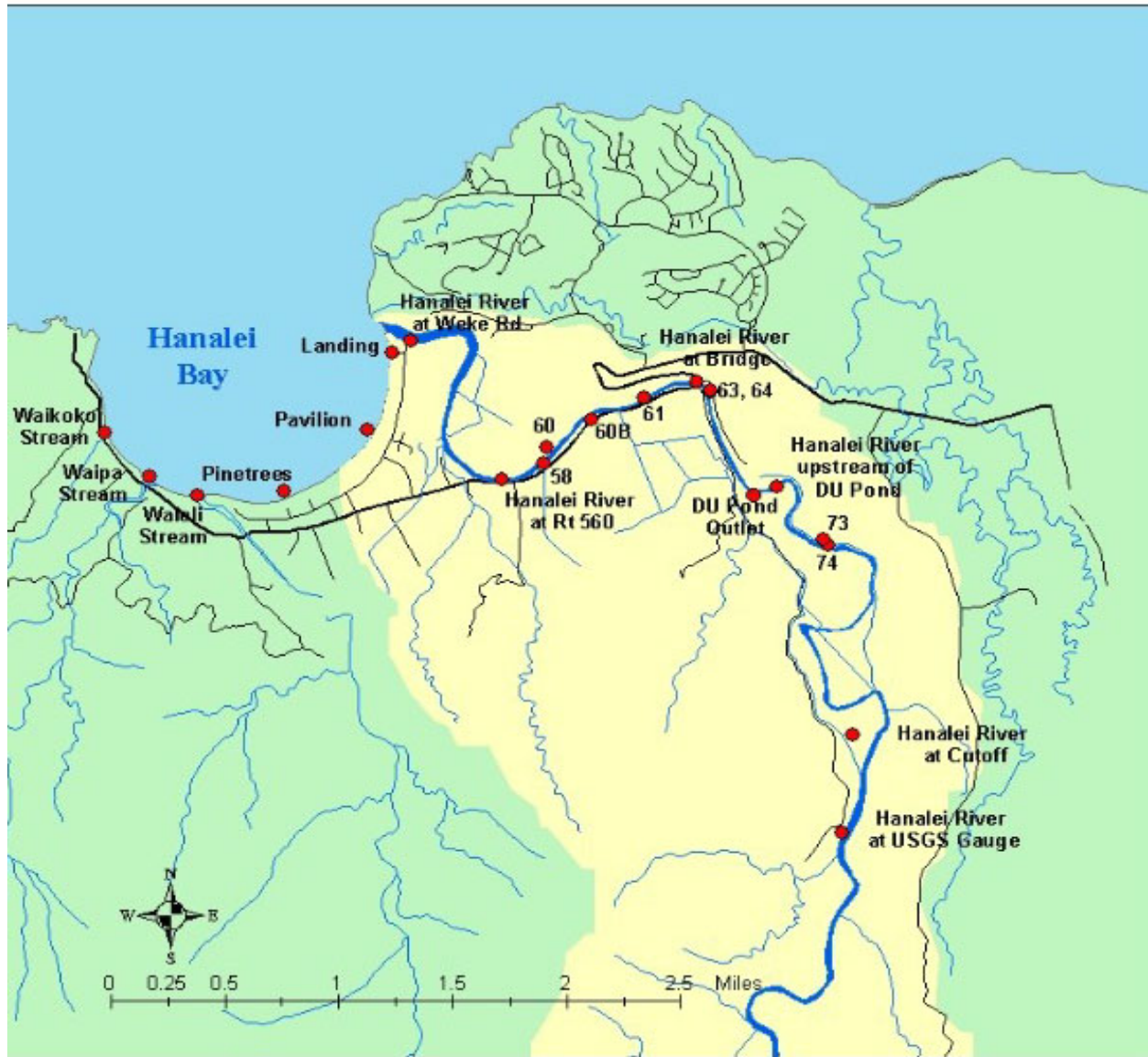


[Safe To Swim?](#)



[Is the River Flooding?](#)

# Water Quality Sampling Locations in Hanalei



## Safe to Swim?

**Red:** Bacteria level exceeds state standards of clean water for **both** current value & average of the last 5 values

**Yellow:** Bacteria level exceeds state standards of clean water for **either** current value or average of the last 5 values

**Green:** Bacteria level below state standards of clean water for **both** current value & average of the last 5 values

Date: January 31, 2005	Hanalei River	Black Pot Beach Park	Pavilion Beach Park	Pinetrees Beach Park	Waioli Stream	Waipa Stream	Waikoko Stream
Enterococcus Levels at date above:	148	86	<10	<10	1081	771	1046
Geometric mean of latest 5 bacteria levels	206	335	49	16	519	592	1007

Bacteria levels are for fecal indicating Enterococcus bacteria

Colors based on Hawaii State Standards of geometric mean <7 and single sample value <100

U.S. EPA standards are geometric mean of <35 and single sample value <104



**Ahupua'a ~ A traditional Hawaiian approach to sustainable watershed management also called Ridges to Reefs, White Water to Blue Water, and Summit to Sea**

# Regional Stream Buffers Research

Researchers from the University of Nevada and UC-Davis are testing the effectiveness of several management practices, including stream buffers and sedimentation ponds, with respect to microbial loading.



Research Plots at Sierra Foothills, California





# Microbial pollutants of concern in California

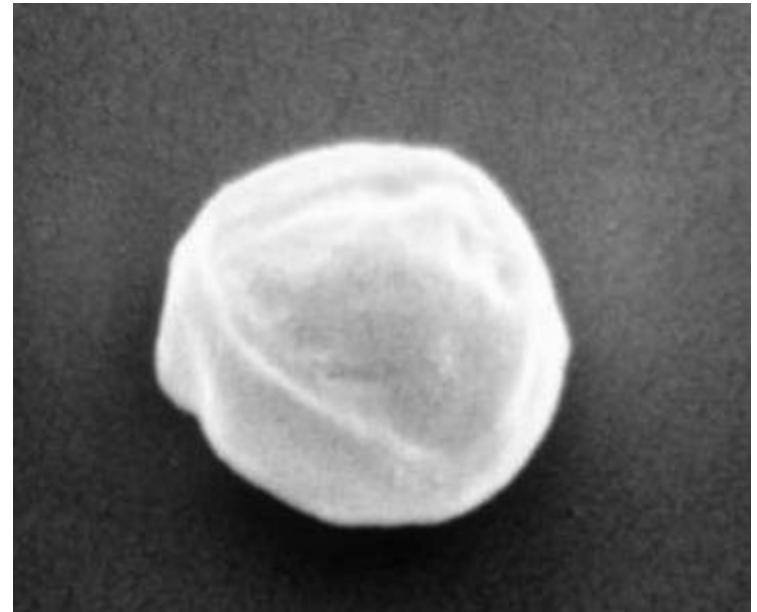
## Pathogens

- *Cryptosporidium parvum*, *Giardia*, pathogenic *E. coli*

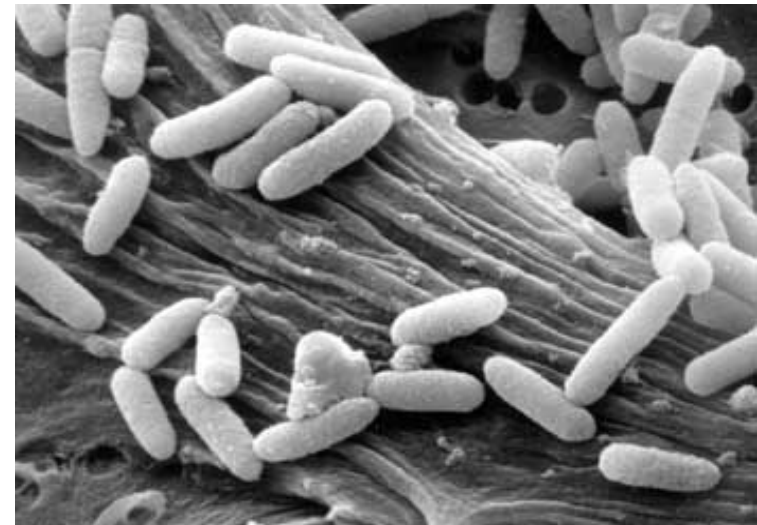
## Indicator Bacteria

- Fecal coliforms, generic *E. coli*
- Intended to be a cheap, easy test for possible presence of pathogens.

(Ken Tate, UC Davis)



*C. Parvum* oocyst, 5-6 micron sphere



Bacteria, 2-5 micron long X 0.5-1.5 wide

# Stream Buffer Research in Hawaii

In Waipa, a grazed tropical watershed, University of Hawaii researchers have begun evaluating riparian hydrology and the effectiveness of buffer strips in preventing microbial and nutrient contamination of streams.



Mark Walker (Nevada) and Rob Atwill & Ken Tate (California) assist scientists in Hawaii to plan stream buffer research in Waipa, in March 2004

# Waipā Watershed



**Waipa Stream mouth**



**Ocean-side**



**Mid-valley pasture**



**Up-stream**

# Waipā Riparian Research

- **Riparian Vegetation**

Ground and canopy cover, species composition, basal area of woody spp.

- **Riparian Soils**

Infiltration, nutrient content, microbial (*E. coli* and *Enterococcus*), lysimeters

- **In-stream Water Quality**

Streamflow, temperature, turbidity, DO, EC, salinity, *Enterococcus*

- **Climate data**

2 weather stations, rain gauges

# Streambank along Waipā Stream







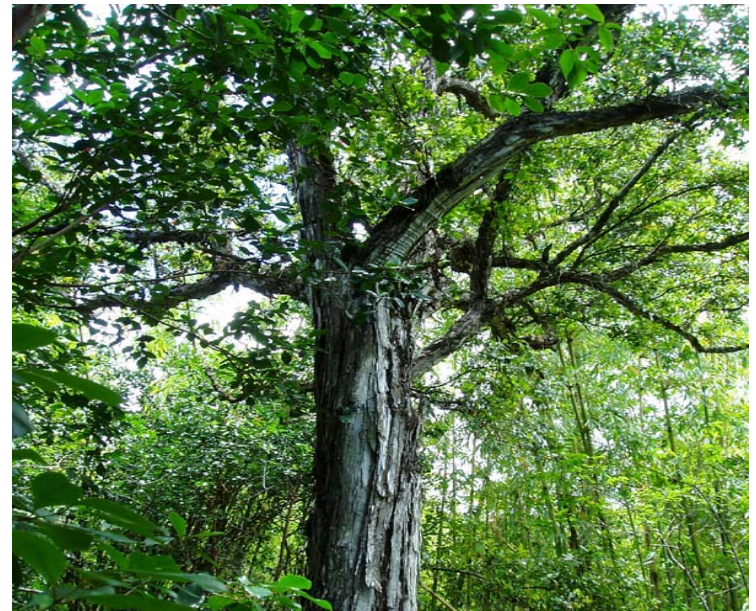
**Cattle Pasture**



**Hau Bush**



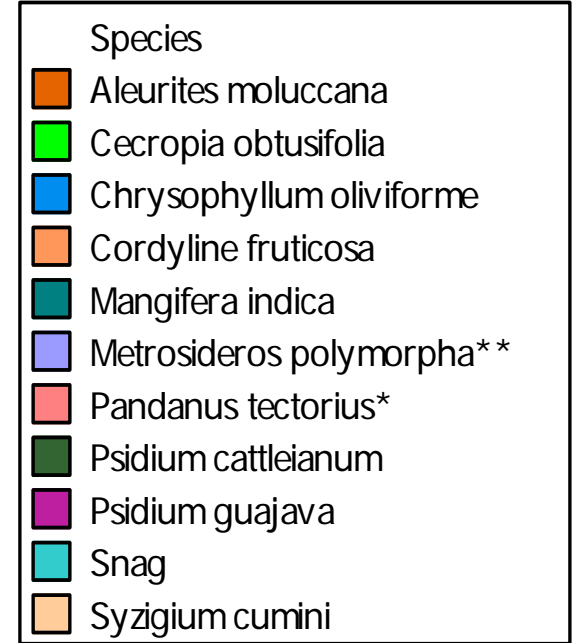
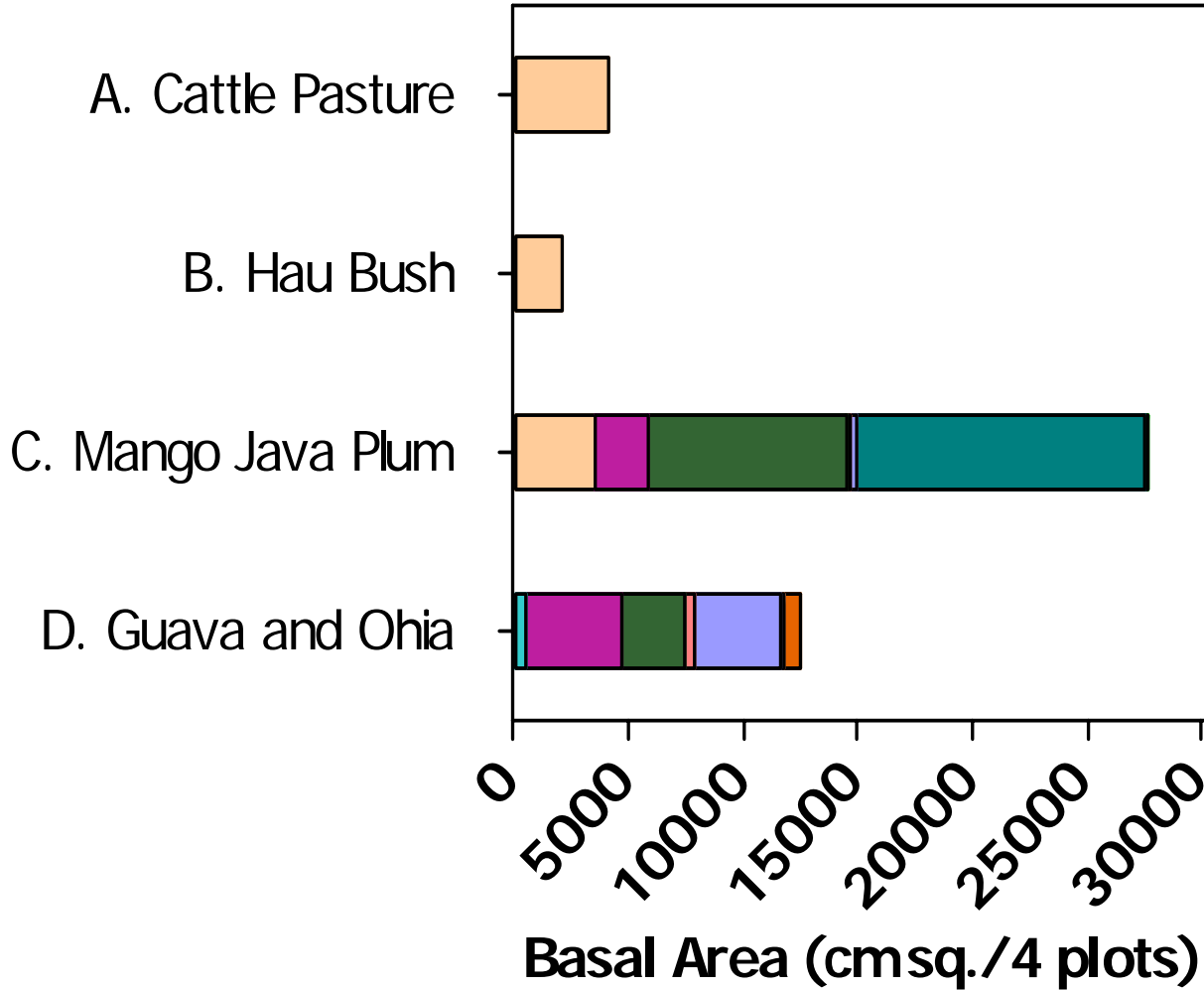
**Mango – Java Plum**



**Guava – Ohia**

# Total Basal Area for Species per Section

Section



\*\* = Endemic

\* = Native



# Total Canopy Cover with Increasing Elevation

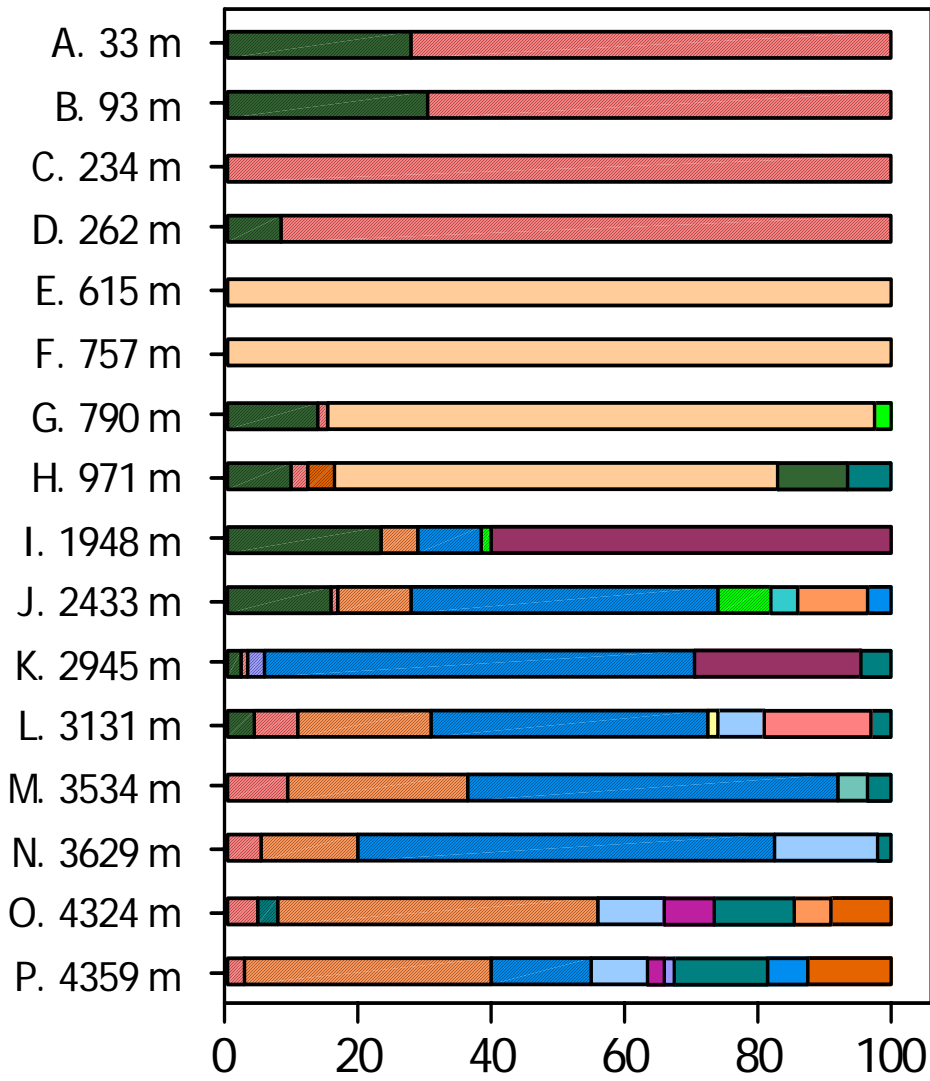
Meters Upstream

CATTLE  
PASTURE

HAU BUSH

MANGO  
JAVA PLUM

GUAVA  
OHIA



Percent Total Canopy Cover

Species

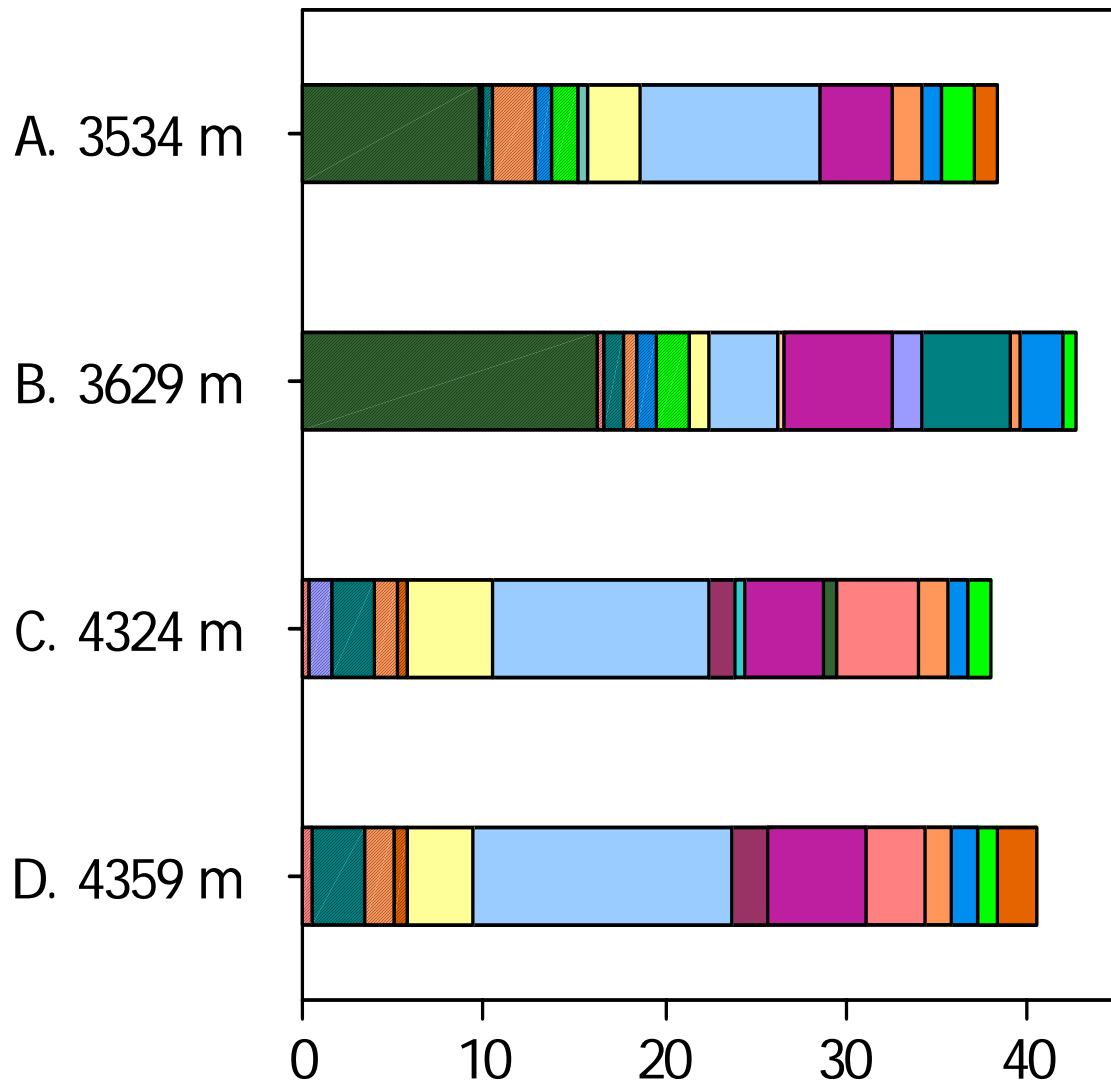
- Aleurites moluccana
- Ardisia spp.
- Cecropia obtusifolia
- Chrysophyllum oliviforme
- Clidemia hirta
- Cordyline fruticosa
- Dicranopteris linearis\*
- Erechites valerianifolia
- Freycinetia arborea\*
- Grevillea banksii
- Hibiscus tiliaceus\*
- Mangifera indica
- Metrosideros polymorpha\*
- Nephrolepis multiflora
- Pandanus tectorius\*
- Picture 129
- Picture 134-136
- Psidium cattleianum
- Psidium guajava
- Psychotria spp.
- Sample 3
- Sky
- Syzigium cumini

\* = Native



# Percent Sward for Upper Elevation Ground Cover

Meters Upstream



\*\* = Endemic

Mean of Percent Sward

Shampoo ginger (*Zingiber zerumbet*)



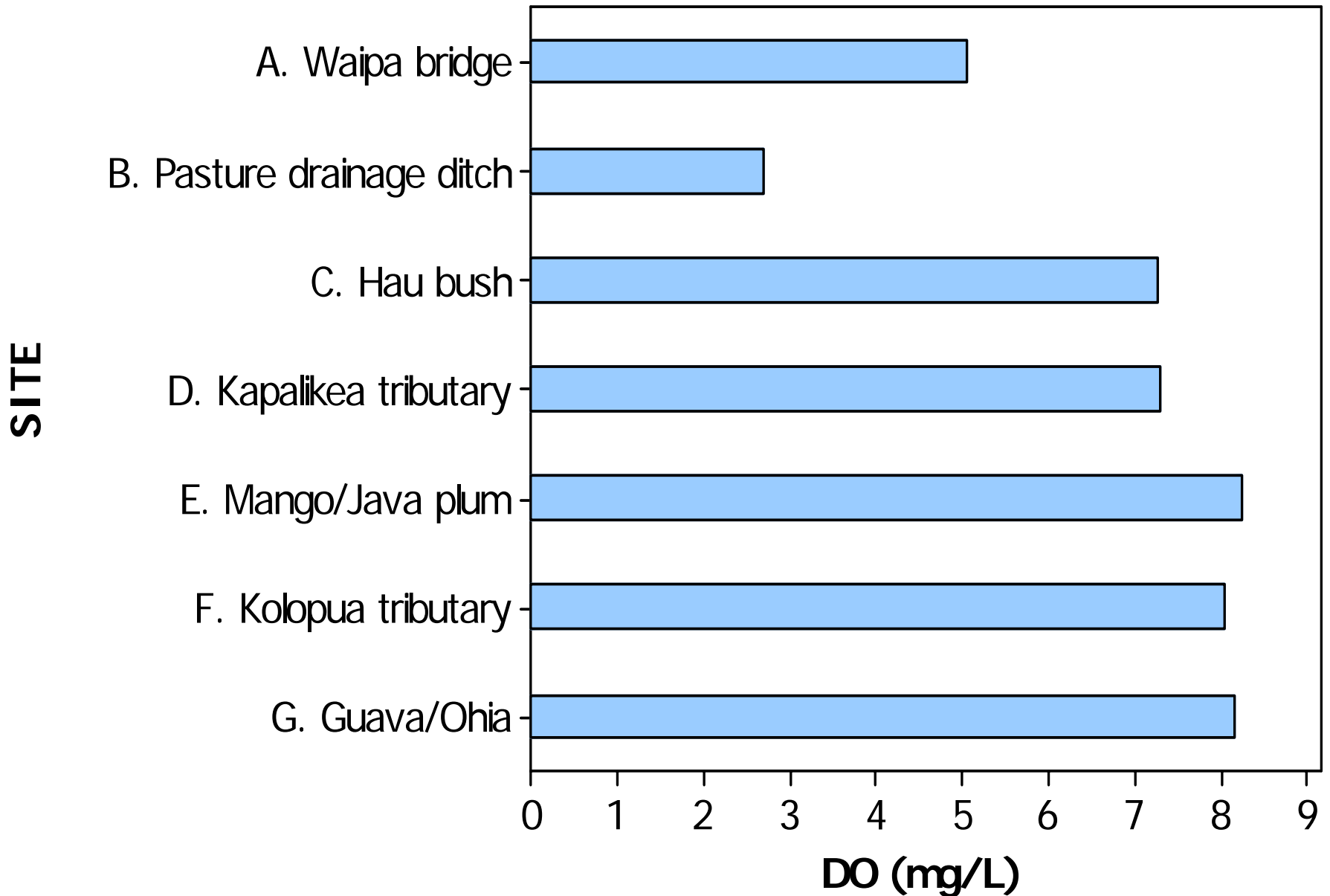
`le `le (*Freycinetia arborea*)



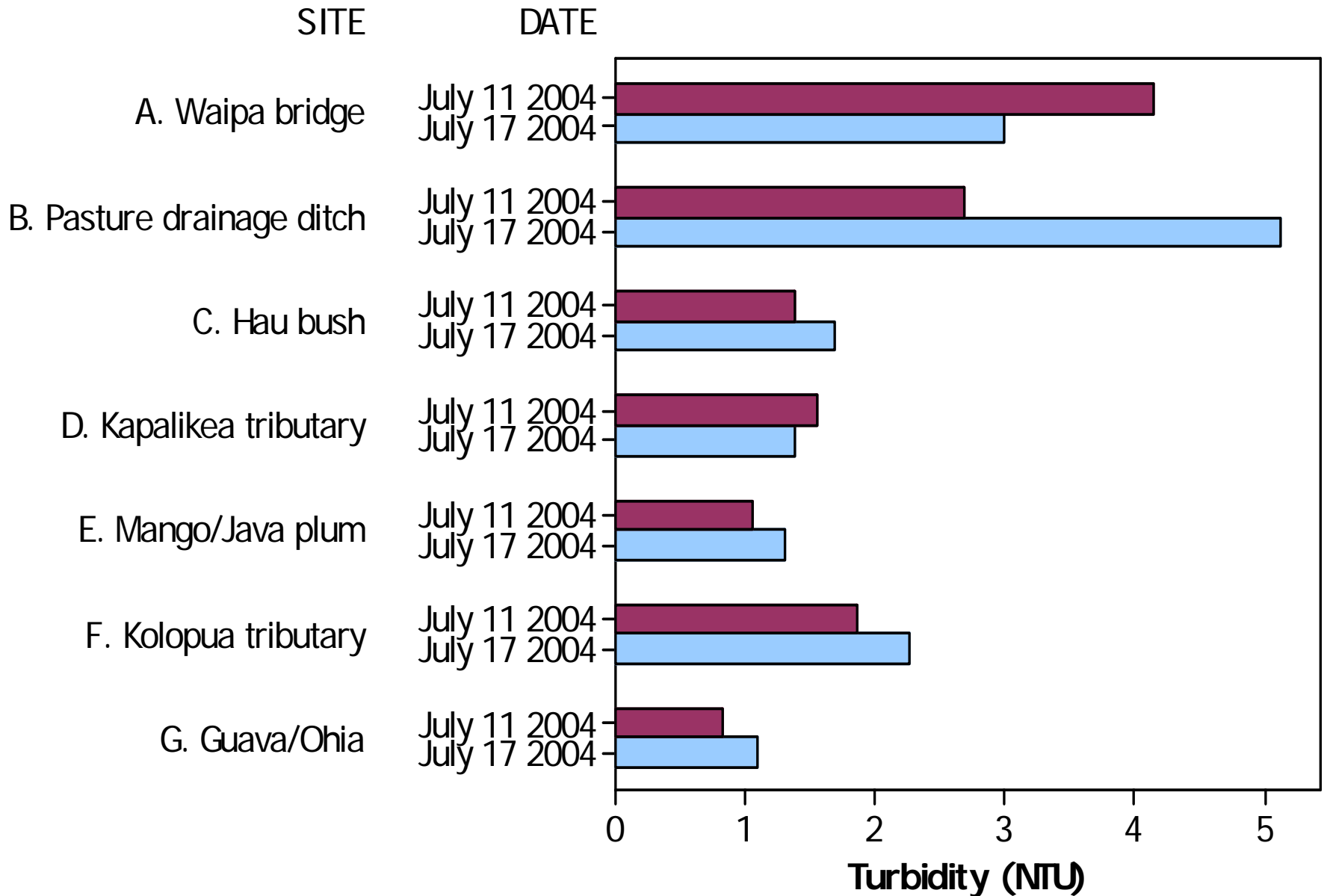
Trumpet Tree (*Cecropia obtusifolia*)



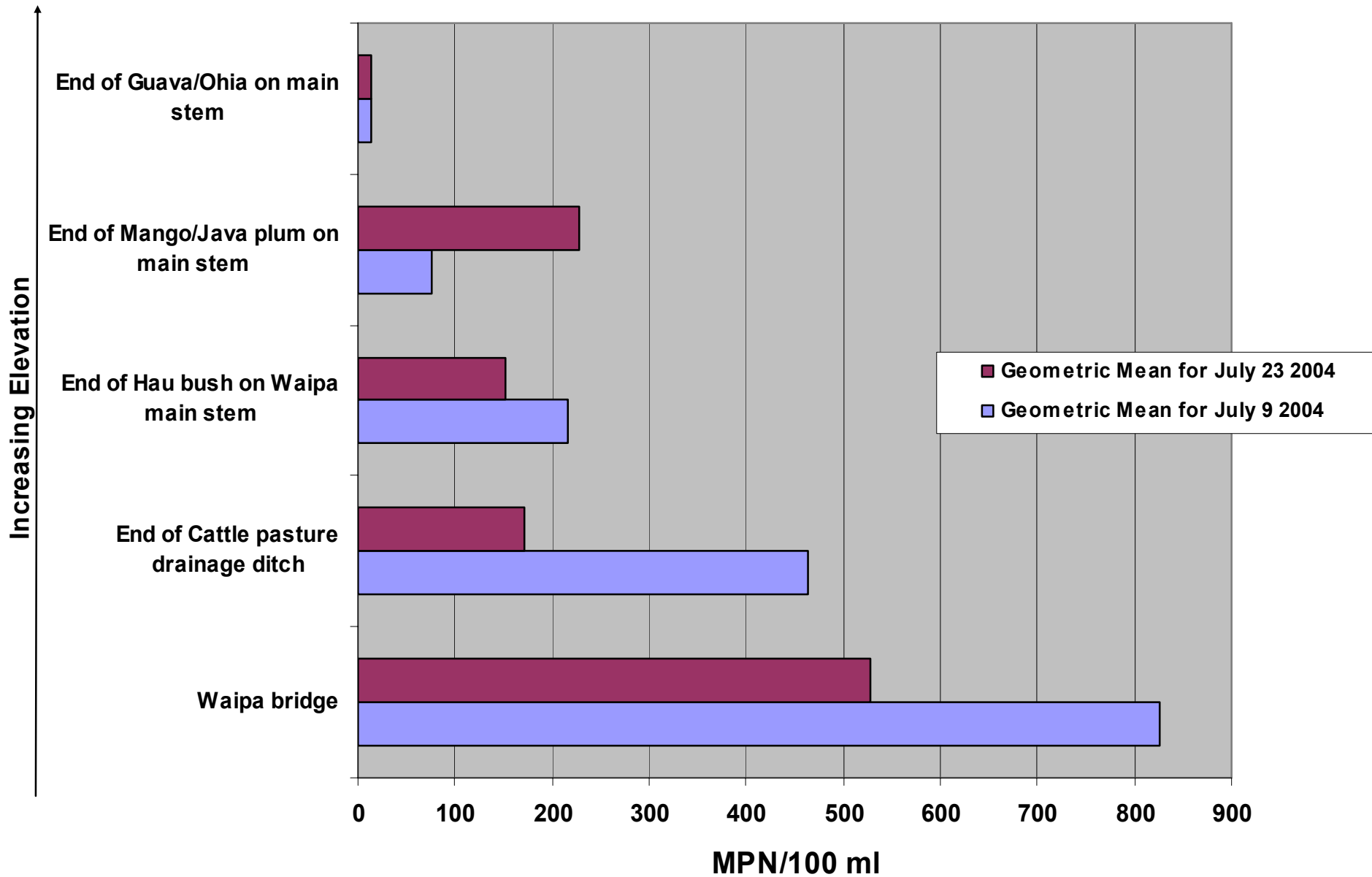
# Dissolved Oxygen in Waipa Stream on July 11 2004



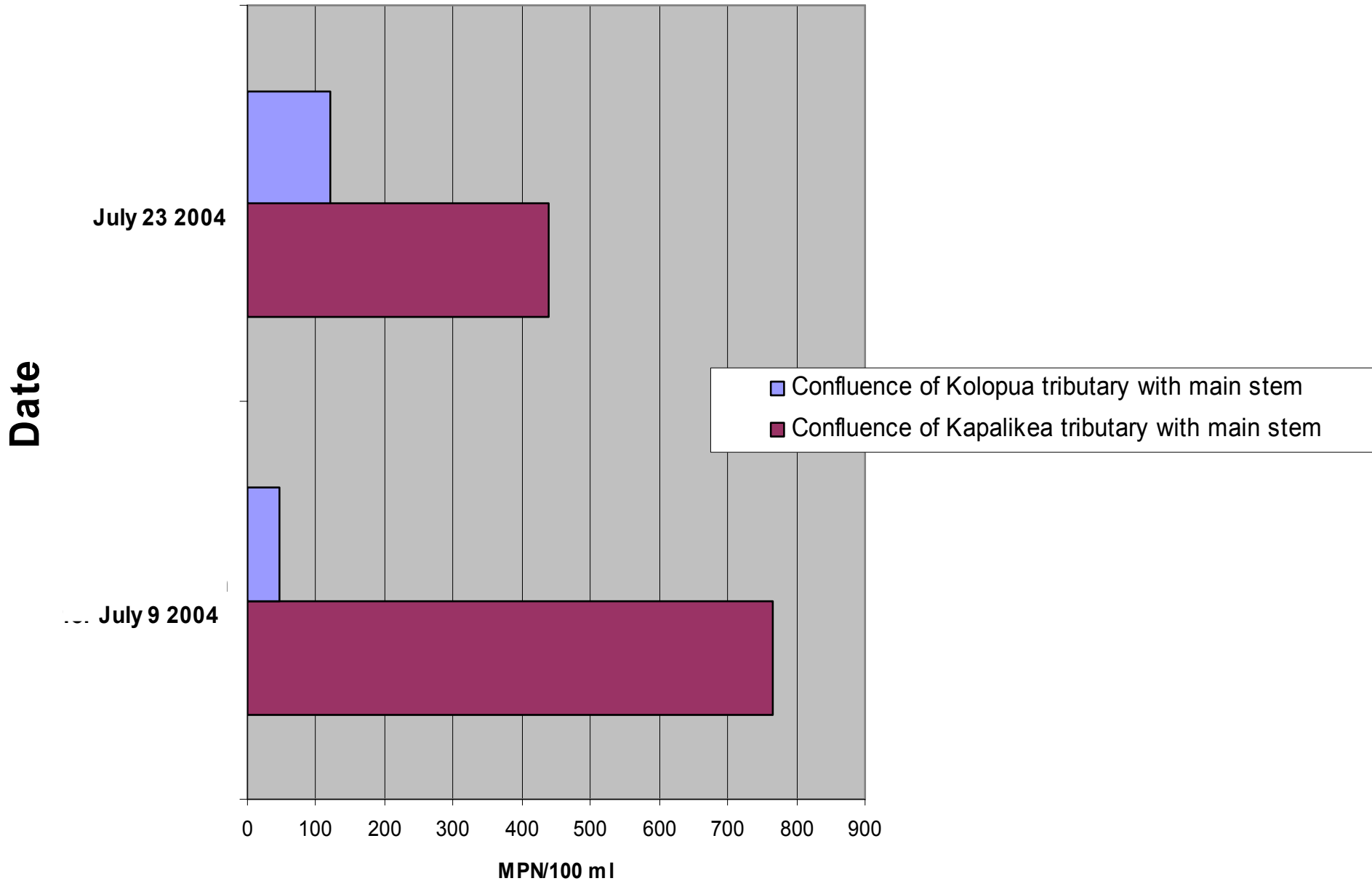
# Waipa Stream Turbidity at Increasing Elevations



# Enterococcus Concentrations in Waipa stream



# Enterococcus Concentrations for Tributaries of Waipa Stream





# Conclusions

- Alien species are prevalent along Waipā stream
- 1-2 dominant woody species characterize each vegetation type
- Diversity of plant species increases with elevation
- Water transport is primarily via subsurface flow, with minor surface runoff
- Woody riparian species stabilize stream banks and maintain lower stream temperatures

# Future Research & Management

- Expanded research on Waipā plants, water quality, hydrology, and soils
- Manage riparian buffer zones to decrease contamination to Waipā stream and Hanalei Bay
- Consider rotational grazing and fencing
- Native riparian ecosystem restoration
- Establish Waipā as a major educational watershed for Hawaii

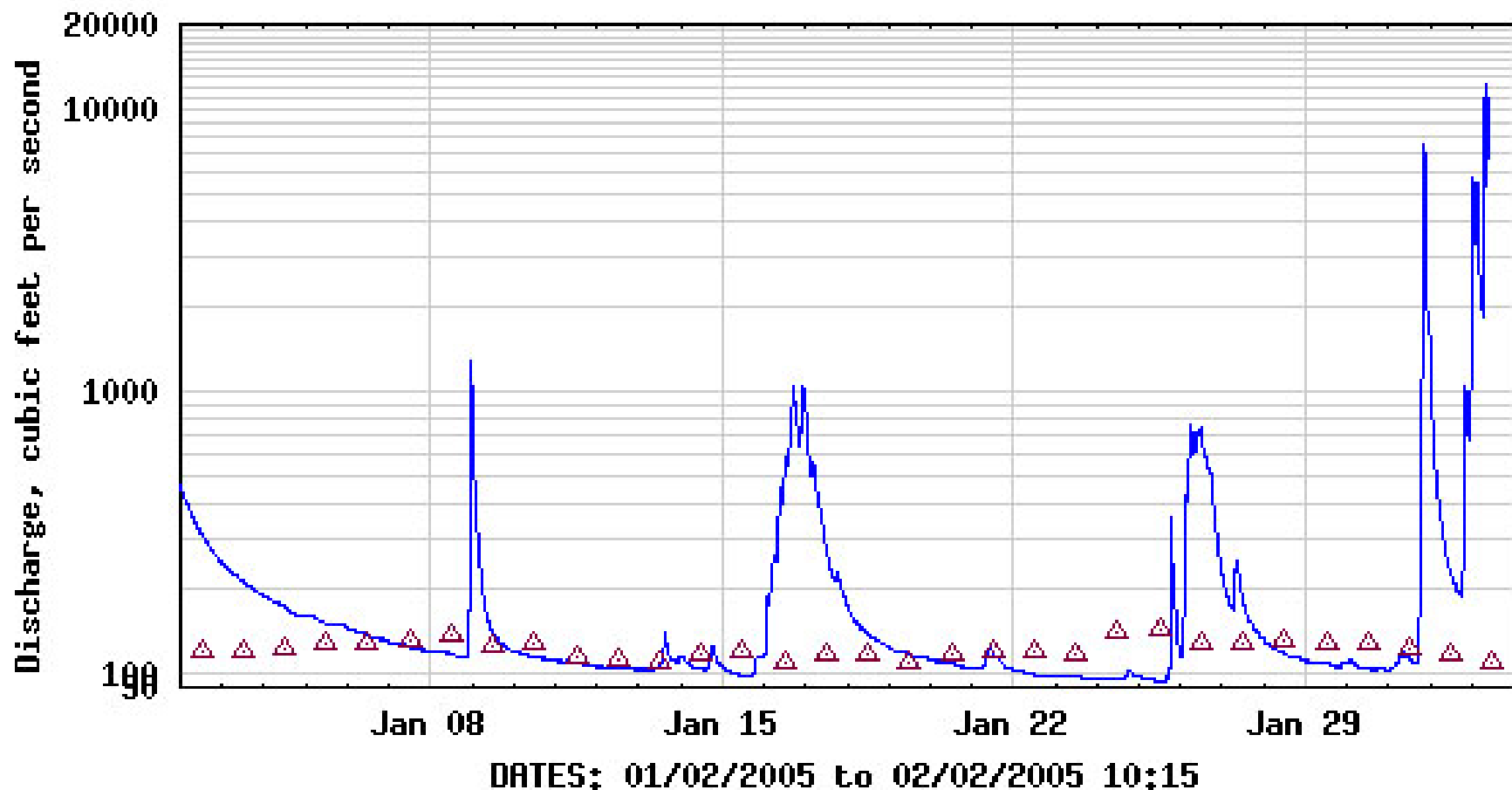
# Acknowledgements

- **Waipā Foundation**
- **Dr. Adam Asquith, UH Sea Grant**
- **Dr. Carl Berg, Hanalei Watershed Hui**
- **Drs. Ken Tate and Rob Atwill, UC Davis**
- **Dr. Mark Walker, UN Reno**

# Pasture Area at Waipā



## USGS 16103000 Hanalei River nr Hanalei, Kauai, HI



### EXPLANATION

— DISCHARGE

△ MEDIAN DAILY STREAMFLOW BASED ON 49 YEARS OF RECORD



**Flooded pasture at Waipa, 2 Feb 2005**