

# **Walking in the Footsteps of Darwin: Carolina's Collaborative & Interdisciplinary Program in the Galapagos Islands of Ecuador**

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# Galapagos



The natural history of these islands is eminently curious and well deserves attention.....Both in space and time, we seem to be brought somewhat near to that great fact -- that mystery of mysteries -- the first appearance of new beings on this earth.

## Charles R. Darwin



















# Galapagos Islands in Crisis

- Development of the tourism industry and a boom in fishing more than tripled the local population in the past 15-years.
- The number of tourists visiting the Islands has quadrupled over the same period and is now 223,000/year.
- Nearly 30,000 local residents.
- A World Heritage Site “At Risk” (2007-2010): Declaration by UNESCO & the Ecuadorian Government.

















# GALAPAGOS SCIENCE CENTER

USFQ • UNC-CHAPEL HILL







# **The Galapagos Initiative: A Scientific Partnership & the Galapagos Science Center**

- **University of North Carolina at Chapel Hill**
  - Office of the Provost
  - Office of the Vice Chancellor for Research
  - College of Arts & Sciences
  - Renaissance Computing Institute
  - Center for Galapagos Studies
  - Galapagos Science Center, San Cristobal Island
- **Universidad San Francisco De Quito, Ecuador**
- **Galapagos National Park**

# Mission – Galapagos Science Center

- Improve the scientific understanding of the social, terrestrial & marine sub-systems of the Galapagos Islands.
- Understand the linkages among human population, tourism, human & ecological health, and environment to address the twin challenges of economic development & resource conservation.
- Provide NC students and faculty scientists with world-class opportunities & facilities in this unique natural laboratory.
- Translate research technologies and findings to industry, government, conservation NGOs, and to the classroom.
- Apply the “Galapagos Model” to other settings around the globe, including, the State of North Carolina.



# Galapagos Science Center - Facilities

- Research & Teaching Laboratories
  - Microbiology & Molecular Biology
  - Marine Ecology
  - Terrestrial Ecology
  - Spatial Analysis & Modeling
- Community Classroom
- Conference Room
- Faculty, Student & Staff Offices
- IT Server & Communications and Terraces for outside teaching & physical experiments





# Galapagos Initiative: A Broad Agenda Across the Sciences

## • Research

- Population, tourism & migration
- Marine Turtle Ecology
- Invasive Species
- Conservation & Evolutionary Biology
- Food Security
- Water, Hygiene & Sanitation
- Health, Nutrition & Medicine
- Climate & Environmental Change

## • Education

- UNC Study Abroad – Undergraduate Education during Summers & Spring Semesters
- UNC & USFQ Collaborative Teaching
- Graduate Student Theses, Dissertations & Undergraduate Honors Theses

- Student Internships
- Alumni Programs
- Visiting Scholars & Post-Doc Programs
- Symposiums & Workshops on Special Topics and Research Methods
- Student Lab & Teaching Assistants

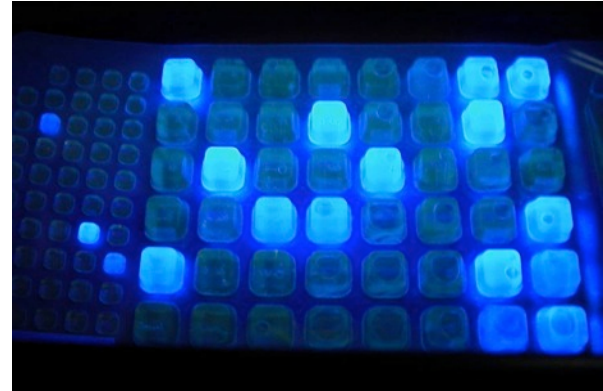
## • Community Engagement

- Science in the Schools: Science & Conservation Fair
- Technical Assistance to the Municipal Government
- Health & Medicine
- Water, Hygiene & Sanitation
- Small Businesses & Tourism
- Sustainable Energy & Conservation



# Water Studies

- Drinking water quality
  - Evaluating sanitary quality of tap water through treatment and distribution
- Recreational water quality
  - Evaluating if human sewage discharge is affecting recreational water quality and levels of antibiotic resistant bacteria

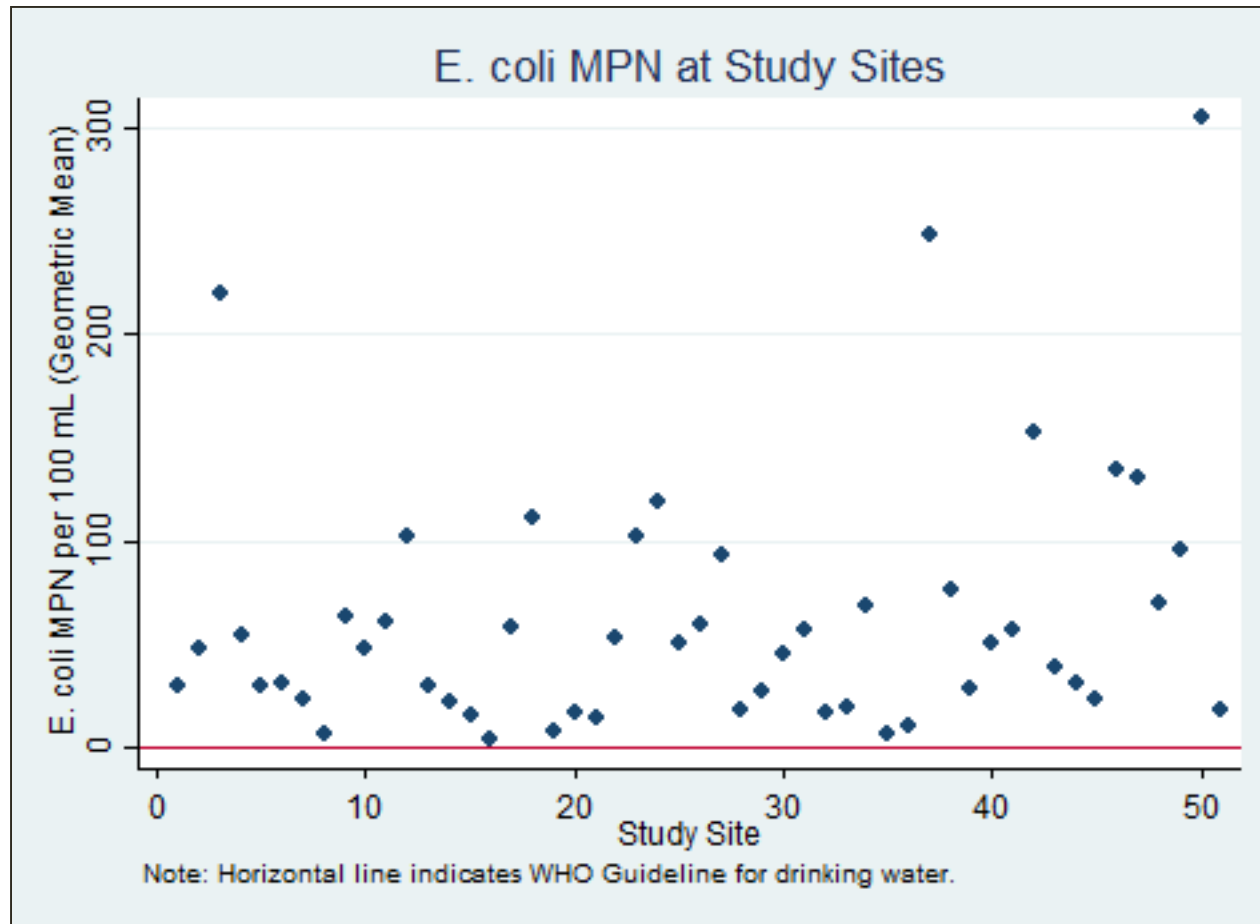


# Participatory Pilot Program on Water Quality on San Cristobal Island





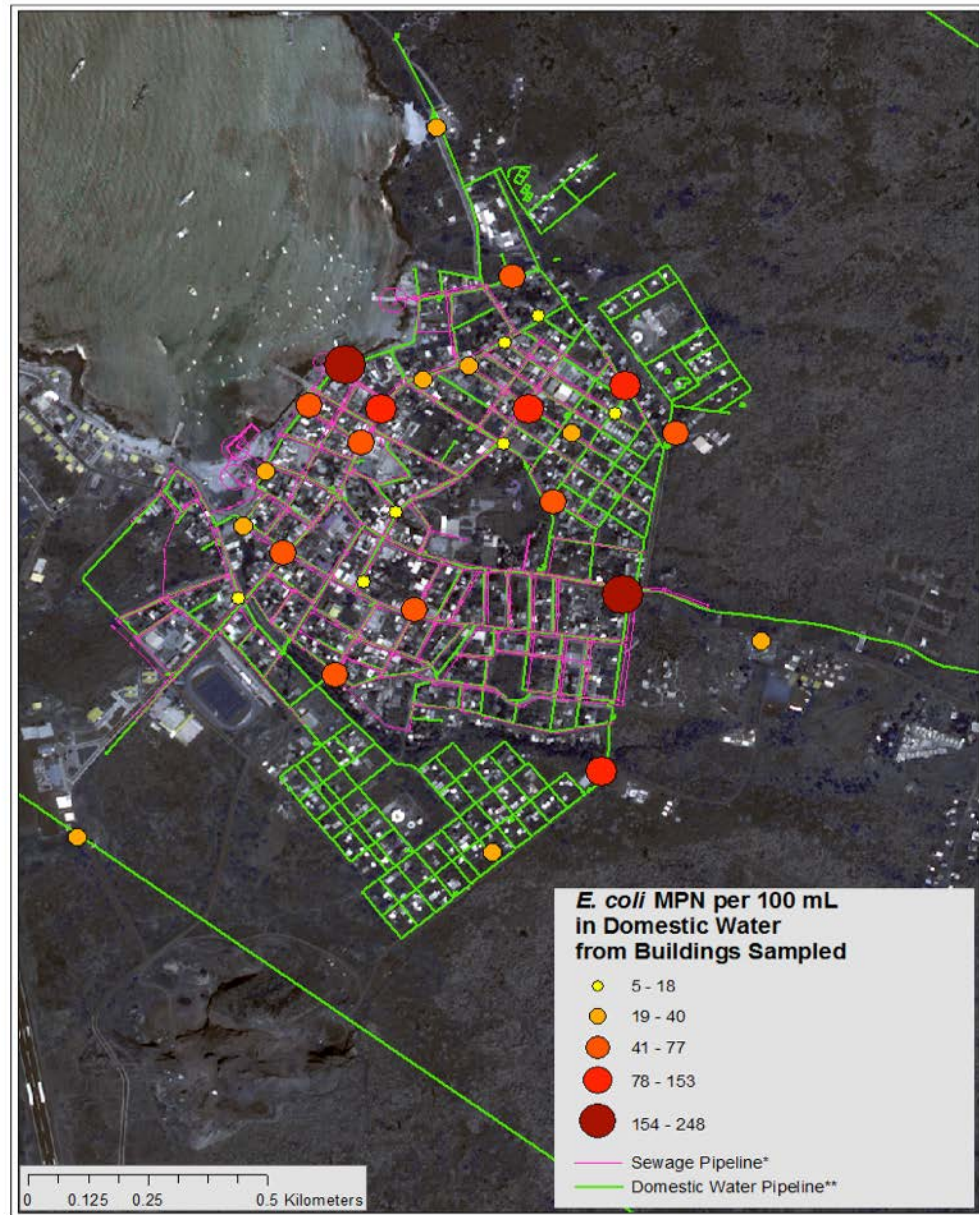
# Drinking Water Quality



All tap water samples collected in 2013 on San Cristobal exceeded the World Health Organization (WHO) guidelines for drinking water quality (0 MPN/100mL)

# Drinking Water Quality

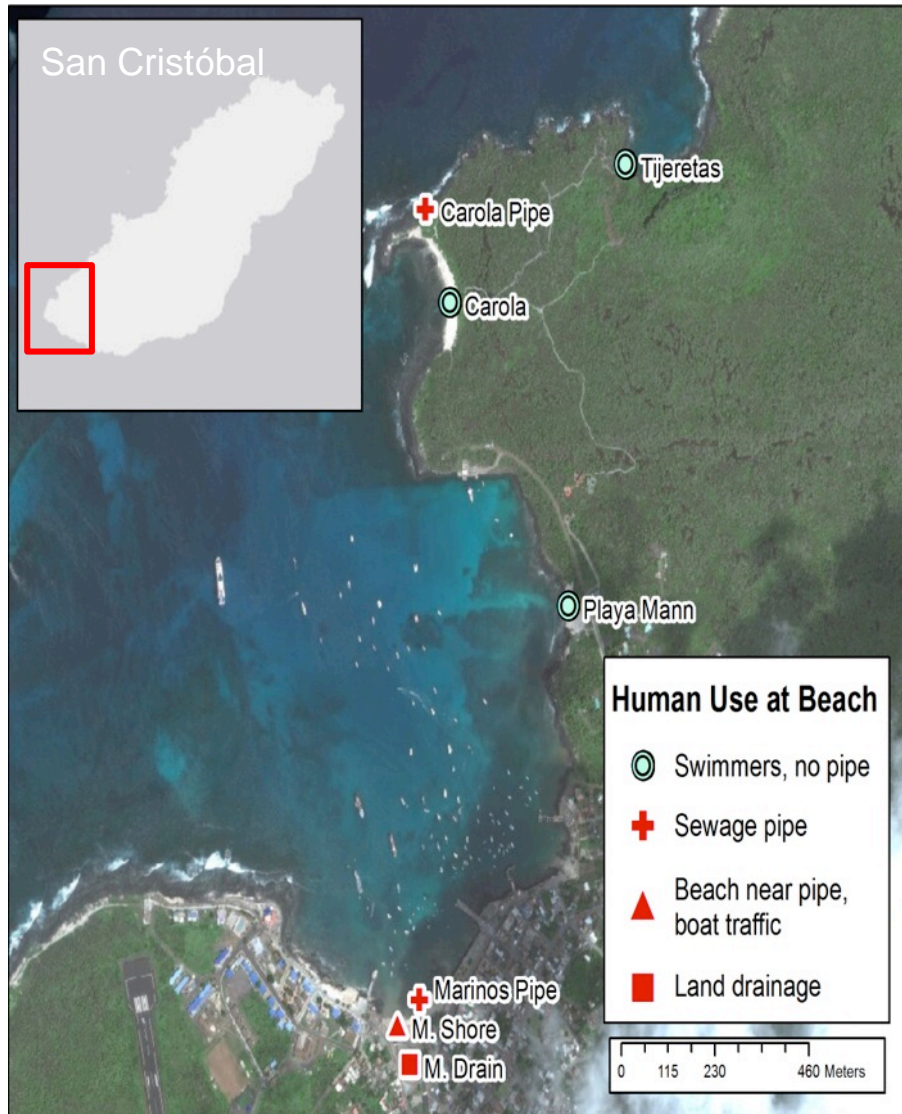
- Water leaving treatment plant was negative for coliforms and *E. coli*
- However, water quality degraded immediately in distribution system
- Potential contamination from leaky sewage pipes?



Geometric averages for *E. coli* concentrations (MPN/ 100 mL) of domestic water samples collected within Puerto Baquerizo Moreno.



# Recreational Water Quality

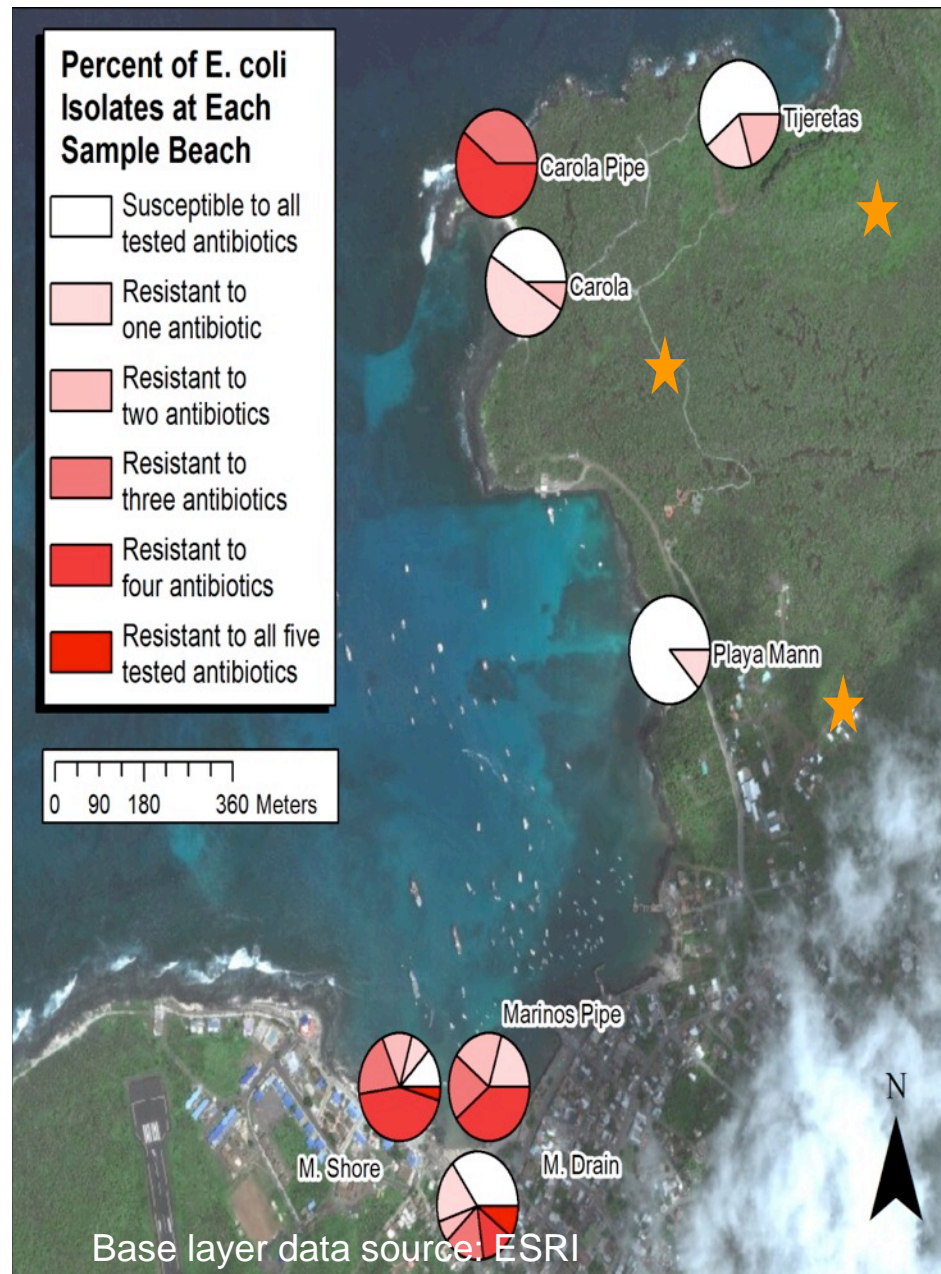


Baselayer Data Source: ESRI

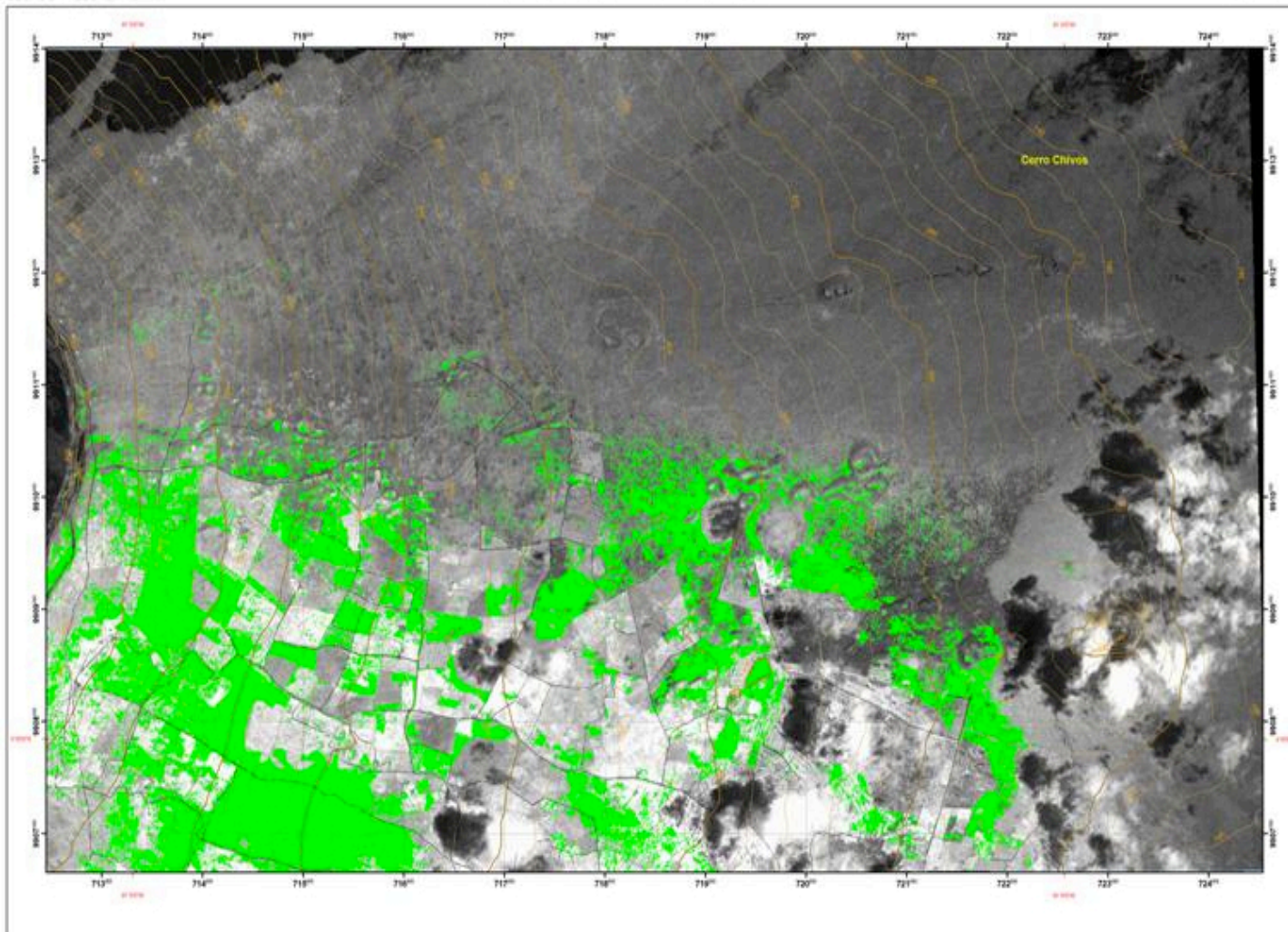
- Compared beaches with and without sewage discharge
  - 71 samples total
- Measured concentrations of *Enterococci* using Enterolert® kit
- *E. coli* was isolated from samples using M. coli blue media the tested for antibiotic resistance using Kirby-Bauer disk diffusion method:
  - Ampicillin
  - Ciprofloxacin
  - Tetracycline
  - Gentamicin
  - Trimethoprim/Sulfamethoxazole

# Recreational Water Quality

★ Beaches without sewage



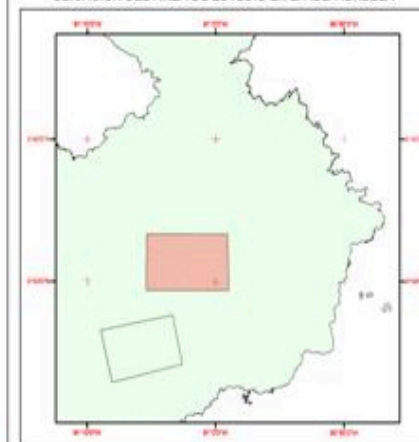




## LEYENDA

Código	Descripción
	Guayaba, <i>Psidium guajava</i>

## UBICACION DEL AREA DE ESTUDIO EN LA ISLA ISABELA



## UBICACIÓN DE LAS ISLAS GALÁPAGOS SEGÚN EL CONTINENTE



ESCALA 1 : 25.000



CURVAS DE NIVEL CON INTERVALOS DE 20 METROS  
 PROYECCION UNIVERSAL TRANSVERSA DE MERCATOR  
 ELIPSOIDE Y DATUM HORIZONTAL: SISTEMA GEODESICO MUNDIAL WGS 84  
 CUADRICULA: UTM 1000 METROS ZONA 18 SUR



Este mapa debe citarse como: "Cartografía planimétrica y temática de las Islas Galápagos"  
 The Nature Conservancy y CURSEN

## SIMBOLOGÍA

	Camino principal
	Camino secundario
	Sendero
	Curva indice
	Curva intermedia
	Hidrografía
	Ciudades

The Nature Conservancy

SAVING THE LAST GREAT PLACES ON EARTH



CENTRO DE LEVANTAMIENTOS INTEGRADOS DE  
 RECURSOS NATURALES POR SENSORES REMOTOS

PROYECTO: CARTOGRAFÍA PLANIMÉTRICA Y  
 TEMÁTICA DE LAS ISLAS GALÁPAGOS

TEMA: ESPECIES INVASORAS

COLABORADORES:



FUENTE:

MAPAS QUICHIMBO 23 - OCTUBRE - 2004  
 Curvas de nivel generadas a partir del IGN (IGN 1:50,000)  
 Mapa Topográfico de Ecuador - Transmisión Especial  
 Trabajo de campo: febrero - 2005  
 Cartografía temática no oficial, generada por este proyecto  
 a partir de interpretación de datos satelitales

FECHA:

JUNIO - 2006







