

Dear *Galápagos Invasion* Earthwatch expedition team members,

Thank you for helping to make the Earthwatch *Galápagos Invasion* expedition a success. Thanks to you, the second and final field year of the Galápagos Invasion project has been completed, with a number of accomplishments.

In the second field year of this project, Earthwatch volunteers mapped and controlled 25 hectares of invaded *Scalesia* forest, monitored numerous permanent vegetation plots and cleared 22 hectares of invasive weeds. All of this was possible because you dedicated your time, brains and, of course, muscle power.

In the face of hard physical work you maintained a positive attitude and a sense of humour that you brought to this demanding work. Hands-on plant conservation on Galápagos is a physically challenging undertaking and we are grateful that so many folks have braved the work conditions with a smile.

Just to repeat an important point: without your dedication and the benefit of this research, there would be little hope for preserving the natural integrity of the Los Gemelos Forest.

The enclosed field report gives you an overview of the achievements and challenges in the project's second year. As you will see, we had to learn and adapt to the project's challenges.

The unique collaboration established in this project between Eastern Michigan University and the Charles Darwin Research Station was formulated as a two-year research project. We are happy to report that in as little as the two-year allotted time-frame we were able to fulfil our objectives and make significant headway towards establishing an ongoing programme of control at the research site. The success of the project has inspired the first collaboration between the Charles Darwin Research Station and the Galápagos National Park Service to control invasive plants at Los Gemelos. The Charles Darwin Research Station has secured funding to continue the weed removal portion of the work.

One of our considerations is whether this project can become a model for a new way of carrying out conservation research in Galápagos. As you well know, the needs are great because the ecological balance of the archipelago is under great pressure from anthropogenic influence.

We would love it if we could stay in touch with you and keep you informed about the ongoing successes and challenges in this project and Galápagos in general. One way you can stay in touch with Galápagos is to read updates on the Darwin Station's website (<http://www.darwinfoundation.org/>).

In any case, we hope you will keep good memories of your time on Galápagos and keep the islands in a special corner of your heart.

Your PIs, Dr. Rachel Atkinson and Dr. Uli Reinhardt

EARTHWATCH INSTITUTE FIELD REPORT

Project Title: Galapagos Invasion

Principal Investigators: Ulrich Reinhardt /Rachel Atkinson

Position/Affiliations: Associate Professor, Eastern Michigan University/ Research
Scientists Botany Dept., Charles Darwin Research Station

Research Site:

Los Gemelos Site (Latitude -0.626/Longitude -90.38), Santa Cruz Island, Galapagos Islands, Ecuador

Local Management Status of the Research Site:

Galapagos National Park, World Heritage Site

Scientific names of primary species being studied:

Scalesia tree (*Scalesia pedunculata*), passionfruit (*Passiflora edulis*), grasses (*Pennisetum purpureum*, *Panicum maximum* and *Melinis minutiflorus*) blackberry (*Rubus niveus*), sauco (*Cestrum auriculatum*), Cuban cedar (*Cedrela odorata*), quinine (*Cinchona pubescens*), guava (*Psidium guajava*)

Key Research Objectives:

- Determine the distribution and abundance of invasive plant species in the study area by detailed mapping
- Determine the effectiveness of the control of invasive species by repeated measuring of the type and number of invasive plants found in the study area, their location and the type of control treatment they receive
- Determine the patterns of regeneration of native plants (species composition and abundance of seedlings)
- Monitor the growth rate of selected native and introduced plants under canopy cover and in gaps

Data Collection and Results

a) Give a concise account of the data you have collected during the past field season.

The location and number of weeds was mapped over 25 ha, and control of key weed species was carried out over 22 ha. Data were collected about the number, size and species of the specific plants under study. Permanent quadrants over the whole area and beneath certain invasive species (with and without control) were set up and have been monitored once in each season.

b) What progress have you made towards achieving your original objectives?

- Distribution and abundance of invasive plants species at Los Gemelos is known
- Monitoring of vegetation structure before control has been accomplished
- Permanent quadrates have been established and monitored once each season

- 22 ha have been cleared of the specific invasive plants under study by manual and chemical means

c) Please provide a summary of your results (even if they are preliminary).

The distribution and abundance of invasive plant species at the last remaining fragment of *Scalesia* forest at Los Gemelos (Santa Cruz) was mapped. The degree of invasion in this apparently pristine area of was found to be much greater than expected:

In the 25 ha area surveyed, the most common invasive trees were: Sauco (*Cestrum auriculatum*) with 44 178 stems (mean density 1,767/ha), Quinine (*Cinchona pubescens*) with 648 stems (mean density 26/ha) and, Cuban cedar (*Cedrela odorata*) trees with 565 stems (mean density 23/ha), Guava (*Psidium guajava*) with 506 stems (mean density 20/ha). The species covering the largest area was Passionfruit (*Passiflora edulis*), which occupied 1.3 ha approximately .

Control of the five key species mentioned above was carried out over 22 ha, using chemical and manual methods. The number of plants controlled is shown in Table 1.

Species	Individuals controlled	
	Manual	Chemical
Sauco	20 523	23655
Passion fruit	44	1309
Quinine	53	595
Cuban cedar	14	551
Guava	74	432

Table 1: Individuals controlled for each species.

Significance/Benefits of Research

a) What is/are the significance/benefits of your research at the following levels?

- Local (in the area of the research site):

Restoration of an important remnant forest on Santa Cruz.

Scalesia pedunculata once occupied a significant portion of the lush highland vegetation on several different islands in the archipelago. Its range has been significantly degraded due to the presence of aggressive animal (i.e. goats) and plant invasive species. The *Scalesia* forest at Los Gemelos is the last, largest remaining stand of this unique forest type.

The Earthwatch project may become a model for other conservation projects on Galápagos. A significant benefit of the research is the collection of data on the degree of invasion. This may convince decision-makers to prioritise the conservation of this area.

- National:

Training and employment for Ecuadorian biologist Jorge Renteria, good jobs for local biologists are hard to find. Training and involvement of several Ecuadorian interns from the Charles Darwin Research Station. Capacity building for the Darwin Research Station.

- International:

Through publication of research this study makes a case for more conservation research of endangered forest types that are based on volunteer contributions

- b) How do your findings contribute to issues of sustainability?
- Through publication in international journals, the findings from this study may be used in the sustainable management of other forests that have experienced invasive weed infestations.

Dissemination of Results

- a) Have you provided details of results from your research to or within:

- Scientific papers

Renteria, J.L. and Buddenhagen, C. 2006. Invasive plants in the *Scalesia pedunculata* forest at Los Gemelos. Santa Cruz, Galapagos. Galapagos Research. No. 64: 31-35. peer-reviewed publication.

- Management plans and reports
 - The proposal document is a management plan for the site has been used by the Charles Darwin Research Station and Galapagos National Park Service.
- Popular articles or films (in progress or completed)
 - Televised on French TV: France 3, November of 2005
 - <http://www.longwood.edu/longwood/summer06/glenda.htm>

Volunteer Tasks and Accomplishments

- a) How did the volunteers contribute ideas, skills, expertise and motivations beyond that which you anticipated?

Beyond the basic rolling up their sleeves and getting the work done, the volunteers contributed their brain power, giving the project the benefit of their skills, talents, and ingenuity. A great deal of the suggestions and ideas of the previous cohort of volunteers have been implemented. In addition, the volunteers were generous and patient with the research staff in making sure the second field year was carried out successfully. The heart and spirit that each volunteer contributed to this project has changed the fate of this endangered ecosystem in the Galápagos.

- b) How have volunteers helped you to achieve your research or educational objectives? Please give specific and quantitative measures of the volunteers' contribution to your data collection.

The current management by the Galápagos National Park is limited by resource constraints, and involves control of only one of many invasive species at the site, *Rubus niveus*. Without this Earthwatch project, no monitoring or scientific input would have contributed to the preservation of this unique forest type. With the assistance of the volunteers, 22 ha were cleaned from invasive plants and 30 monitoring plots monitored, in the *Scalesia* forest that encircles the entire west crater of the Los Gemelos.

The data from the field season that we collected about invasive plants distribution and control were entered into a database and will provide needed information to evaluate the long-term impacts of weed control. Since most of the volunteers were people with experience working in teams, they gave us many ideas and suggestions in order to achieve the objectives of the project.

Project Development

- a) Have you used any additional methods/strategies to meet your research objectives?
If so, please describe them.

Jennifer Young continued her master thesis work by interviewing volunteers about their experience in the project.

- b) How will you develop your research in the coming field season?

As 2006 was the final year of this project, there will be no next field season.

Educational Opportunities

- a) Does your project directly or indirectly involve the following groups in your research topic?

- Early career scientists

Yes, local volunteers and the field supervisor Jorge Renteria, in addition to other young staff scientists and interns from the Charles Darwin Research Station.
Jennifer Young (M.S. Student).

- Other groups:

Involvement of 12 students from Eastern Michigan University

- b) Please tell us the ways your research helps these groups better understand the conservation of a sustainable environment.

The project allows local volunteers to appreciate the complexities of conservation research and the benefits of prevention measures (rather than restoration). Local volunteers may also gain a better understanding how the local economy (tourism) relies on preservation of a natural habitat. The EMU student group deepened their understanding of the impact of economic activity (tourism, trade, migration) on natural ecosystem balance.

- c) Has your project helped lead to the completion of Masters theses, or other educational research findings?

Masters thesis research by co-P.I. Jennifer Young is in progress, estimated completion in early 2008.

Partnerships

- a) List partnerships or collaborations with other organisations that you have developed or maintained in the past season.

Charles Darwin Research Station (CDRS), Galápagos National Park Service (GNPS) and Conservation International (CI).

- b) How have these organisations contributed to your project objectives?

The CDRS has provided student volunteers who have assisted the project, CI is co-funding invasive plant research and assisted with rainy-day alternatives, GNPS is permit grantor for access to the site and provides some additional invasive plant control at the site.

- c) How do you anticipate these organisations will use the results generated by the project, and in what timeframes?

The CDRS provides the GNPS with the research results, the GNPS then applies the recommendations to augment its management of the flora and fauna in the Galápagos.

Acknowledgements

Thanks to the Charles Darwin Research, the Galápagos National Park, The Nature Conservancy, Eastern Michigan University and the University of Michigan for their ongoing guidance and support.

Carrying out a project of such a scale is no easy task and we have to thank a number of dedicated people: Jorge, Anne, Rachel and Jennifer for their untiring labor of love in the field and after work hours. Carlos, Pablo, Omar and Carla the local Galapagos volunteers, Heather Pruiksma, Kim Ciano and the rest of the Earthwatch crew for their patient help in getting us started, and Gaby and Paul McFarling for managing the logistics of transportation, food, accommodation as well as time-off activities. Galápagos is full of surprises and a lot of behind-the-scenes effort was needed to maintain a smooth operation.

Thanks to each and every volunteer whose sweat and hard work made this project possible, and whose individual contributions to the project not only made a difference, but made the project a delight to be a part of.