



UNIVERSIDAD SAN FRANCISCO DE QUITO

Department: GAIAS-Galapagos Academic Institute for the Arts & Sciences

Class: BIO 0420 - Ecology and management of native and introduced plants of the Galapagos

Semester: 201910 - First Semester 2019/2020 - NRC: 1014

Schedule: MTWThF 09:00 - 11:55

Professor Information

Names: Gonzalo Rivas Torres, Ph.D.

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Office: GSC

Office hours: 2-3pm every day, please send an email for appointments

Class Information:

Credits: 3

Pre requisites: None

Co-requisites: None

COURSE DESCRIPTION

In this intensive field-based course we will discuss the factors that contribute to the high plant endemism in Galapagos and analyze the processes promoting invasions by introduced plant species in this archipelago. After understanding the ecological context and interactions between native and non-native plants, we will discuss the human dimensions and conservation implications regarding both, indigenous and introduced species.

SPECIFIC COURSE LEARNING OUTCOMES:

No.	Learning outcome	Level
1	Understand the interaction between ecological and biotic variables occurring in Galapagos	Initial
2	Define specific terms such as native and invasive and, understand the differences for these definitions	Final
3	Learning how to identify species using taxonomic tools and how to write scientific names	Mid
4	Use the obtained knowledge about ecological processes to frame conservation issues regarding plant species	Mid
5	Practice scientific writing and use of communication tools	Mid
6	Learning of field techniques for data acquisition and management	Mid

COURSE CONTENTS



- Natural history of the Galapagos
- Factors contributing to plant endemism
- The indigenous flora
- Native ecosystems.
- General threats to native flora
- The issue of non-native invasive plants
- The importance of plants for the local economy
- Novel ecosystems management and its implication for Galapagos conservation.

Lectures will be reinforced with papers on relevant topics. This knowledge will be combined with field practices and group and individual projects. Students will have to choose a topic for personal and group projects that will be the midterm and (part of) final exams respectively. Both, personal and group projects will be peer reviewed by professor and classmates. The professor in the first classes will deliver more details about projects. Students will be using most of their hours outside classes on developing their personal and group projects.

METHODOLOGY TO INTEGRATE COURSE CONTENTS AND PRACTICE

The teaching methodologies used to teach USFQ courses, following the philosophy of Liberal Arts, foster dialogue and facilitate the construction of knowledge through the continuous exchange of ideas and experiences between professors and students. It is expected that in all courses the theoretical concepts will be linked to the professional practice and work contexts where students will perform in the future, with the intent to integrate activities and simulations of a diverse nature that promote the understanding of practical and realistic contexts.

COURSE EVALUATION:

Quizzes	15%
Participation	5%
Paper discussion	10%
Personal paper	15%
iNaturalist Group project	10%
Final group project	20%
Final Exam	25%
Total	100

GRADING SCALE

Percentage	Grade	Consideration	Points
91-100%	A	Excellent	4
81-90%	B	Good	3



71-80%	C	Intermediate	2
61-70%	D	Deficient	1
-60%	F	Failed	0

DESCRIPTIONS OF THE EVALUATION CATEGORIES:

Quizzes

Quizzes will be short (1 to 2 questions) regarding previous lectures and summaries of the assigned papers. You have to be able to remember the main ideas about previous lectures and the core of the papers and provide comments about them. Tests will be taken before each lecture.

Lectures and class participation

Lectures will be around one hour plus questions/discussion. Participation will be graded depending on presence and the time each student interacts with the class. In each class, we will have short field trips that will complement lectures' contents.

Paper discussion

Papers assigned for the class will be discussed after each lecture (in the class schedule below). Each student will be presenting at least one paper and will guide the discussion according to a random selection. This means you will have to read the paper and be prepared to present it and guide the discussion for every session. For each paper, please locate another publication citing this paper and read it to use it for the discussion. Make us participate. After you read the paper, please prepare one question related to the manuscript and save it to deliver it at the end of the class as a quiz question. Look in the folder and WITHIN ebooks for some of the papers/chapters. Reading the paper for discussion is mandatory, quizzes will include topics from this section. The other papers for that same date are provided as supporting material i.e. not mandatory.

Personal paper

Also as part of this class, you will have to write a one page single-space document (plus cited literature, at least 10 papers different than the ones provided by this class-will need to provide the papers as pdfs) containing your personal analysis about NOVEL ECOSYSTEMS. Specifically, you need to take a side between the novel ecosystems vs. pristine/restoration positions. USE a title to summarize your side. This paper will be peer reviewed by other class member and edited after reviews. Reviewers won't "accept or reject" the ideas in the paper, will provide insight and edition to the manuscript. We will discuss as a group the outcomes of your papers in class. Please use Science letters format as a guide <http://science.sciencemag.org/content/358/6361/313>

Group project iNaturalist

You have to collect 50 plants records and uploaded to iNaturalist app. Please download this app before going to Galapagos. You will be also using Survey123 app, also please have this installed in your phones before travelling to the islands. Both are available in Android and IOS platforms.

Final Project



We will use data collected from previous classes to write as a group a paper to update the analyses on significance of the Novel Ecosystems paradigm. More details will be provided the first day of classes.

Final Exam

Final Exam will cover all the lectures and papers contents that were reviewed in the class. It will include 20 questions from multiple choice to short answers.

Extra project-credits.

Perform a quick analysis of most invasive plants and native indicators (per ecosystem) in Galápagos. Take pictures of them and put together a plant guide using Field Museum's format <http://fm2.fieldmuseum.org/plantguides/>

Write a review of one of the papers for the class and uploaded in our web page

Texts

M.A. Davis (2009). *Invasion Biology*. Oxford University Press, Oxford, UK. 288 pp. Paperback. ISBN13: 9780199218769. PDF PROVIDED BY INSTRUCTOR

Wiggins, L, Porter D and Anderson 1971. *Flora of the Galapagos Islands*. Stanford University Press.

Jackson, M. 1993. *Galapagos : A Natural History*. Calgary : University of Calgary. 285 pp. (ISBN 0-919813-10-0). SUGGESTED FOR PURCHASE

McMullen, C.K. 1999. *Flowering Plants of the Galapagos*. Comstock Publishing Associates. 370 pp. (ISBN 0-8014-8621-1 (pbk); ISBN 0-8014-3710-5 (cloth). SUGGESTED FOR PURCHASE

Hobbs RJ, Higgs ES, Hall C (2013) *Novel Ecosystems: Intervening in the New Ecological World Order*. Wiley-Blackwell, UK. PDF PROVIDED BY INSTRUCTOR

Foxcroft, Pyzek et al 2013 *Plant invasions in Protected areas*. Springer series in invasion ecology No.7. PDF PROVIDED BY INSTRUCTOR or download here:

<https://drive.google.com/file/d/0B30AfDRiQsl6Vm1vTF1qT05CUjFqUFJBZjdMNExmYmVYQmlr/view?pli=1>

Seminal papers (DOWNLOAD BEFORE COMING TO GALAPAGOS). If not able to download I will provide the pdfs in Galapagos.



- Buddenhagen C and Rentería JL (2006) Invasive plants in the *Scalesia pedunculata* forest at los Gemelos, Santa Cruz, Galapagos. *Galapagos Research* 64: 31-35.
- Buddenhagen CE, Tye A (2015) Lessons from successful plant eradications in Galapagos: commitment is crucial. *Biol Invasions* 17:2893–2912. doi: 10.1007/s10530-015-0919-y
- Castro SA, Daehler CC, Silva L, et al (2010) Floristic homogenization as a teleconnected trend in oceanic islands. *Diversity and Distributions* 16:902–910. doi: 10.1111/j.1472-4642.2010.00695.x
- Denslow JS (2003) Weeds in paradise: Thoughts on the invasibility of tropical islands. *Ann Mo Bot Gard* 90:119–127. doi: 10.2307/3298531
- Denslow JS, Space JC, Thomas PA (2009) Invasive Exotic Plants in the Tropical Pacific Islands: Patterns of Diversity. *Biotropica* 41:162–170. doi: 10.1111/j.1744-7429.2008.00469.x
- Essl, F., S. Bacher, P. Genovesi, P. E. Hulme, J. M. Jeschke, S. Katsanevakis, I. Kowarik, I. Kühn, P. Pyšek, W. Rabitsch, S. Schindler, M. van Kleunen, M. Vilà, J. R. U. Wilson, and D. M. Richardson (2018) Which Taxa Are Alien? Criteria, Applications, and Uncertainties. *BioScience* 68:496–509.
- Gardener MR, Atkinson R, Rentería JL (2010) Eradications and People: Lessons from the Plant Eradication Program in Galapagos. *Restoration Ecology* 18:20–29. doi: 10.1111/j.1526-100X.2009.00614.x
- Guézou A, Trueman M, Buddenhagen CE, et al (2010) An Extensive Alien Plant Inventory from the Inhabited Areas of Galapagos. *PLoS One* 5:e10276. doi: 10.1371/journal.pone.0010276
- Hobbs RJ, Higgs E, Harris JA (2009) Novel ecosystems: implications for conservation and restoration. *Trends in Ecology & Evolution* 24:599–605. doi: 10.1016/j.tree.2009.05.012
- Itow, S. 1992. “Altitudinal Change in Plant Endemism, Species Turnover, and Diversity on Isla Santa Cruz, the Galapagos Islands,” *Pacific Science* 46 (2): 251 – 268.
- Jeschke J, Aparicio LG, Haider S, et al (2012) Support for major hypotheses in invasion biology is uneven and declining. *NeoBiota* 14, 14:1–20. doi: 10.3897/neobiota.14.3435
- Lawesson, J.E., H. Adersen and P. Bentley. 1987. “An Updated and Annotated Check List of the Vascular Plants of the Galapagos Islands,” *Reports from the Botanical Institute, University of Aarhus*, No. 16.



- McKinney M (2008) Do humans homogenize or differentiate biotas? It depends. *Journal of Biogeography* 35:1960–1961. doi: 10.1111/j.1365-2699.2008.02011.x
- Miller J., and Beltesmeyer B. (2016) What’s wrong with novel ecosystems, really? *Restoration Ecology*. DOI: 10.1111/rec.12378
- Pimentel D, McNair S, Janecka J, et al (2001) Economic and environmental threats of alien plant, animal, and microbe invasions. *Agric Ecosyst Environ* 84:1–20. doi: 10.1016/S0167-8809(00)00178-X
- Restrepo A, Colinvaux P, Bush M, et al (2012) Impacts of climate variability and human colonization on the vegetation of the Galapagos Islands. *Ecology* 93:1853–1866.
- Rivas-Torres, G. F., F. L. Benítez, D. Rueda, C. Sevilla, and C. F. Mena (2018) A methodology for mapping native and invasive vegetation coverage in archipelagos: An example from the Galápagos Islands. *Progress in Physical Geography: Earth and Environment* 42:83–111.
- Schlaepfer, M. A. 2018. Do non-native species contribute to biodiversity? *PLOS Biology* 16:e2005568.
- Truitt AM, Granek EF, Duveneck MJ, et al (2015) What is Novel About Novel Ecosystems: Managing Change in an Ever-Changing World. *Environmental Management* 55:1217–1226. doi: 10.1007/s00267-015-0465-5
- Vince G (2011) Embracing Invasives. *Science* 331:1383–1384. doi: 10.1126/science.331.6023.1383
- van Kleunen, M., W. Dawson, F. Essl, J. Pergl, M. Winter, E. Weber, H. Kreft, P. Weigelt, J. Kartesz, M. Nishino, L. A. Antonova, J. F. Barcelona, F. J. Cabezas, D. Cárdenas, J. Cárdenas-Toro, N. Castaño, E. Chacón, C. Chatelain, A. L. Ebel, E. Figueiredo, N. Fuentes, Q. J. Groom, L. Henderson, Inderjit, A. Kupriyanov, S. Masciadri, J. Meerman, O. Morozova, D. Moser, D. L. Nickrent, A. Patzelt, P. B. Pelsler, M. P. Baptiste, M. Poopath, M. Schulze, H. Seebens, W. Shu, J. Thomas, M. Velayos, J. J. Wieringa, and P. Pyšek. 2015. Global exchange and accumulation of non-native plants. *Nature*. doi:10.1038/nature14910
- Willerslev, E., A. J. Hansen, K. K. Nielsen, and H. Adersen. 2002. Number of Endemic and Native Plant Species in the Galápagos Archipelago in Relation to Geographical Parameters. *Ecography* 25:109–119.

POLICIES:



All courses are governed by the USFQ Student Manual which can be downloaded at Manual del Estudiante

ABOUT ELECTRONIC EQUIPMENT: Cell phones, Ipods and other devices have to be switched off in class. You're allowed to use ipad/computers only for taking notes.

ASSISTANCE: Come to class on time. Plus, field excursions are mandatory. In the case of illness or any other justified cause, students can be relieved from the excursion and cover the qualification with additional tasks.

MATERIALS

For excursions bring notebooks/slates, camera, hat, sunblock, water and snacks.

SCHEDULE OF ACTIVITIES:

Class Schedule

<u>Date</u>	<u>Topic</u>	<u>Papers/chapters to read before</u>
Oct 28 Lecture 1	Natural history of the Galapagos Factors contributing to plant endemism	We will assign papers and groups for the different activities. START CHECKING Novel Ecosystems papers and data-choose coordinator
29 Lecture 2	The indigenous flora. Id techniques	Quiz 1 Rivas-Torres et al. 2018 (Gonzalo will lead) Observation walk in the dry forest
30 Lecture 3	The indigenous flora Native ecosystems.	Quiz 2 <u>Willerslev et al. 2002</u> Schlaepfer 2018 Observation walk in the dry forest
31	General threats to native	Quiz 3



	flora The issue of non-native invasive plants	<u>Denslow 2003</u> <u>Denslow JS, Space JC, Thomas PA (2009)</u>
Nov 1	General threats to native flora The issue of non-native invasive plants	<u>van Kleunen et al 2015</u> <u>McKinney M (2008)</u>
4	The issue of non-native invasive plants in Galapagos Main invasive plants in Galápagos-identification	Quiz 4 <u>Gardener et al in Foxcroft 2013, pag 349</u> Essl et al. 2018
5 Lecture 5	The issue of non-native invasive plants in Galapagos Main theories in Invasion Ecology WORK ON FINAL PROJECT	Quiz 5 <u>Gardener MR, Atkinson R, Rentería JL (2010)</u> <u>Buddenhagen and Tye 2015</u> Jaschke et al. 2012
6 Lecture 6	The importance of plants for the local economy WORK ON FINAL PROJECT	Quiz 6 <u>Guézou A, Trueman M, Buddenhagen CE, et al (2010)</u> <u>Restrepo A, Colinvaux P, Bush M, et al (2012)</u> FINAL PROJECT: Bring ideas to class, discuss with Gonzalo, start delineating the final document/graphs.
7	The issue of non-native	FIELD TRIP uplands whole day



Lecture 7-in field	invasive plants	Field work to identify main native and invasive plants in the highlands.
8		Work on final Project Turn in field book and report- instead of quiz
11 Lecture 8	Novel ecosystems management and its implication for Galapagos conservation: Concepts	Quiz 7 Ewel et al 2013 in Hobbs RJ, Higgs E, Harris JA (2009), pag. 29. <u>Truitt et al 2015</u>
12 Lecture 9	Novel ecosystems management and its implication for Galapagos conservation *Short fieldtrip to Tijeretas trail-dry forest. Debate in class	Quiz 8 <u>Pimentel D, McNair S, Janecka J, et al (2001)</u> Gardener 2013 in Hobbs RJ, Higgs E, Harris JA (2013), pag. 185 <u>Miller and Beltesmeyer 2016</u> Discussion paper on Tijeretas
13	Work on group's final Project data	PERSONAL PAPER DUE DATE, bring final paper. Present preliminary data and document with next steps/ideas following our data for paper analysis/format -bullet points for intro.
14	FINAL EXAM ONE DAY	TURN IN EXTRA PROJECT



	BEFORE THE FINAL DAY	Field Guides-iNaturalist
15	GROUP PROJECT ppt	DUE DATE FOR GROUP PROJECT

This syllabus was reviewed and approved by the academic coordinator of the major/department, such that all sections should follow this syllabus. If it is necessary to make changes/adjustments to the syllabus, please ask the academic coordinator so that the approved changes/adjustments are reflected in the Curriculum Design system.