

JUAN PABLO ARROYO MORA

PhD candidate
Ecology and Evolutionary Biology
University of Connecticut
75 N. Eagleville Road, Unit 3043
Storrs, CT 06269
USA
Email: pablo.arroyo@uconn.edu

EDUCATION

2002 Master of Science University of Alberta Alberta, Canada
1996 Bachelor on Forestry Instituto Tecnológico de Costa Rica, Costa Rica

EXPERIENCE

Research Assistantships

June-July 2003 University of Connecticut
Bosques Project tree census data.

February 2002 University of Alberta
Measurement of leaf area index with fish-eye photography in a tropical dry forest ecosystem. Santa Rosa National Park, Costa Rica.

July 2001 University of Alberta
Field plot establishment for Leaf Area Index and fPAR measurements in forest fire areas, Chisholm, Alberta, Canada.

June 2001 University of Alberta
Field plots establishment for Leaf Area Index measurements in different successional stages in the tropical dry forest. Santa Rosa National Park, Guanacaste, Costa Rica.

May to September 2000 Cornell University
Land Use Cover Change for the San Vito region, Cotobrus (1987-1997) Costa Rica using Landsat imagery.

June 2000 University of Alberta
Ground truth data collection on the Nicoya Peninsula, in the Guanacaste province of Costa Rica, as part of my thesis fieldwork.

NGO work experience

1997 to August 1999
-Tropical Science Center's Project Assistant
-Editor of the Center's Home Page, collaborating with computer support and providing additional consultations for the Center's projects.

1996 – August 1998

Organization for Tropical Studies, Operations Manager for TRIALS Project

- Supervised maintenance of the Agroforestry plots progeny tests as well as project tests.
- Provided and organized project lectures.
- Coordinated technical field demonstrations and workshops (Forestry Extension and Education Program).

1996 – 1997

Project Assistant - Native Species for the Reforestation of the Southern Zone of Costa Rica Project

- Co-editor of the bulletin Native Species for the Reforestation of the Southern Zone of Costa Rica, for the Degraded Land Recuperation and Productive Management Project: Native Species Reforestation of the Southern Zone of Costa Rica. Organization for Tropical Studies (OTS)- Costa Rican Institute of Technology (ITCR)- DUKE University- USAID.

- Provided soil compaction analysis and edited the plot localization maps for the Degraded Land Recuperation and Productive Management Project: Native Species Reforestation of the Southern Zone of Costa Rica. OTS- ITCR- DUKE University- USAID.

TEACHING EXPERIENCE

Organization for Tropical Studies

Research Experience for Undergraduate Students NSF-OTS Program (REU) 2005 and 2006: Mentor for the program in both years and Program Coordinator in 2005 at La Selva Biological Station, Costa Rica

Summer 2003 and 2004: Resource person for “Tropical Biology: An Ecological Approach” at Palo Verde National Park, Costa Rica. This is a graduate level field course in tropical ecology.

University of Connecticut, USA

Fall 2006: TA EEB 293S Methods of Ecology

Spring 2004: TA Principles of Biology I

Fall 2002 and Spring 2003: TA Principles of Biology II

Fall 2003: TA EEB 293S Methods of Ecology

University of Alberta, Canada

Winter 2001: TA Laboratory EAS221 Introduction to Geographic Information Systems and Remote Sensing

Summer 2000: TA ENCS 465 Environmental and Conservation Field Studies (Course TA in Costa Rica)

Fall 2000: TA Laboratory EAS351 - Environmental Applications of Geographic Information Systems

PUBLICATIONS – Peer-reviewed journals / Book Chapter / Thesis / Book

Palomaki, M. B., Chazdon R. L., **Arroyo J. P.**, and Letcher S. G.. 2006. Juvenile tree growth in relation to light availability in second-growth tropical forests. *Journal of Tropical Ecology*. 22 (2): 223-226

This study is part of Bosques Project in Costa Rica. In this project my advisor, Dr. Robin Chazdon, has been studying secondary forest dynamics for 10 years in lowland forests. For this paper Dr. Chazdon and I co-mentored Ms. Palomaki when she attended the Research Experience for Undergraduates program (REU-2004) from the Organization for Tropical Studies funded by NSF and carried out at La Selva Biological Station in Costa Rica. Since 2004, I have mentored two REU students in 2005 and 2006 for the same program. The results of the projects conducted with those students are presented in a book chapter (see below in forthcoming publications).

In this publication we examined the variation in growth rates and crown development for three species of trees between 5 and 9.9 cm in diameter at breast high as a function of incoming light. This is the first study of its kind that was carried out in secondary forest. We found that there are variations in the response (i.e. growth, crown shape) of juvenile trees in secondary forest. Our finding is a first step towards understanding of the dynamics of these complex ecosystems in the tropics. We chose the *Journal of Tropical Ecology* both because it is widely read internationally in the fields of ecology, forestry and environmental sciences and because of its impact factor; it is one of the highest ranked journals addressing tropical ecology.

Arroyo-Mora, J. P., Sánchez-Azofeifa G. A., Rivard B., Calvo J. C. and Janzen D.H. 2005. Dynamics in landscape structure and composition for the Chorotega region, Costa Rica from 1960 to 2000. *Agriculture, Ecosystems & Environment*. 106: 27–39

This is a publication from my M.Sc. thesis at the University of Alberta. Even though the field of landscape ecology has several tools to describe landscape patterns, as part of this study I used new approaches for the understanding of landscape connectivity in a time-series. I also showed the unique forest recovery trends in a region that was previously thought have little forest area. We chose the journal *Agriculture, Ecosystems and Environment* both to reach an international audience interested in landscape ecology and also because of its impact factor.

Arroyo-Mora J.P., Sánchez-Azofeifa G.A., Kalácska M., Rivard B. and Janzen D.H. 2005. Secondary forest detection in a Neotropical dry forest using Landsat 7 ETM+ imagery. *Biotropica* 37 (4): 497-507

This is the second publication from my M.Sc. thesis. This is one of the first studies in the tropics that integrates medium (Landsat ETM+) and high (IKONOS) resolution satellite imagery. It is the first one to specifically assess the challenges of using remote sensing to assess a tropical dry (deciduous) forest. Moreover, in a novel and challenging way, I developed an ecological approach to the classification of secondary forest areas using remote sensing imagery. This approach of integrating forest structure into the classification of “successional stages” has been the foundation for developing the field data and remotely sensed data collection protocols of TROPI-DRY, an interdisciplinary collaborative research network, expanding tropical dry forest research from Costa Rica to Mexico, Cuba, Panama, Brazil and Venezuela. We chose *Biotropica* because it is the official journal of the Association for Tropical Biology and Conservation and is a journal that is widely read in the field of tropical ecology and conservation research.

Kalácska M., Sanchez-Azofeifa G.A., Rivard B., Calvo-Alvarado J.C., Journet A.R.P., **Arroyo-Mora J.P.**, Ortiz-Ortiz D. 2004. Leaf area index measurements in a tropical moist forest: A case study from Costa Rica. *Remote Sensing of Environment*. 91: 134-152.

This study took advantage of the secondary forest classification system that I proposed (in the publication described above) to be used in remote sensing of forest areas. In addition, this paper presents a novel approach to the spatial sampling for optical measurement of Leaf Area Index that I developed. Furthermore, we show in this publication the importance of considering the saturation of spectral vegetation indices when mapping leaf area index from satellite imagery in a tropical ecosystem. We chose the journal *Remote Sensing of Environment* because it is the top ranked remote sensing journal and because it is widely read in the international community.

Sanchez-Azofeifa G.A., Kalacska M., Quesada M., Stoner K.E., Lobo J.A., **Arroyo-Mora P.** 2003. Tropical Dry Climates *in* Phenology an Interactive Environmental Science. Schwartz M.D. (ed). pp 121-137. Kluwer Academic Publishers. The Netherlands.

This book chapter highlights the challenges of using remote sensing technologies in tropical dry forests both because of their deciduous nature and because of the complexity in their structure and species composition. Historically, tropical dry forests have been neglected in research studies. In this chapter we present a need for a greater focus on this endangered ecosystem.

Haggan, J. P., Rheingans, R., **Arroyo-Mora J. P.**, Alvarado B. 2003. Benefits and costs of intercropping reforestation in the Atlantic lowlands of Costa Rica. *New Forests*, 25(1): 41-48

This publication was part of the agroforestry component of a 12 year project dedicated to the research of native species for reforestation in degraded lowland areas in the northern zone of Costa Rica (TRIALS Project). In this very pragmatic research the project worked with farmers from areas around La Selva Biological Station and also included permanent plots within the Station. Findings of this project were fundamental in assessing the economic productivity of small to medium scale reforestation projects in the area. For instance, the results from this publication showed a higher tree growth when intercropping is used.

Arroyo-Mora, J.P. 2002. Forest cover assessment, fragmentation analysis and secondary forest detection for the Chorotega Region, Costa Rica. M. Sc. Thesis. University of Alberta. Alberta, Canada. 111 p.

This is my MSc. thesis from the Earth and Atmospheric Sciences Department at the University of Alberta, Canada. Two peer-reviewed publications were developed from this thesis.

Arroyo, P. 1996. Ensayos de Adaptabilidad de Especies Nativas en la Zona Sur de Costa Rica. *Práctica de Especialidad*. Instituto Tecnológico de Costa Rica. Departamento de Ingeniería Forestal. Cartago, Costa Rica. 70 p

This publication is my honors thesis/internship for my degree in forestry engineering at the Costa Rican Institute of Technology. In this project I established five forestry plantation experiments along a longitudinal gradient in the southern zone of Costa Rica. These screening trials were the basis from which the most suitable species for reforestation projects with native species were established for the study area.

Jiménez, Q., Estrada, A., Rodríguez, A., **Arroyo, P.** 1996. Manual Dendrológico de Costa Rica. Proyecto Reforma. ITCR-CIIBI. Cartago, Costa Rica. 165 p.

This was my first publication when I was an undergraduate student at Costa Rica Institute of Technology. Although I am still far from being a good dendrologist today, I developed the idea for a publication that would help foresters improve their tree identification skills and presented this fresh idea to my colleagues. Most of my work in this publication was at the Museum gathering data about the phenology of the approximately 1,000 species presented in this book.

CONFERENCE ORAL PRESENTATIONS

- Arroyo, J. P.** and R. L. Chazdon. 2005. Natural forest management plans in Costa Rica: a potential framework for assessing tree biodiversity. *Frontiers in Tropical Biology and Conservation*. ATBC meeting. Uberlândia, Brazil
- Arroyo-Mora J.P.**, Sanchez-Azofeifa G.A., Calvo J.C. 2004. Fragmentation analysis for the Chorotega Region, Costa Rica from 1960 to 2000. *Geographic and Conceptual Frontiers of Tropical Biology* ATBC meeting. Miami, Fl.
- Arroyo-Mora, J. P.**, Sánchez-Azofeifa G. A., Rivard B., Calvo J. C. 2003. Integrating very high and high resolution imagery for detecting secondary growth in a neotropical dry forest ecosystem: a vegetation indices approach. XI Simposio Brasileiro de Sensoramento Remoto. Belo Horizonte, Minas Gerais, Brazil.
- Arroyo-Mora J.P.** Sanchez-Azofeifa G.A., Rivard B., Calvo-Alvarado J.C. 2002. Tropical dry forest secondary forest detection: an ecological approach. In: *Tropical forests: past, present, future*. Smithsonian Tropical Research Institute (ed). Panama City, Panama. pp 4
- Arroyo, P.**; Sanchez-Azofeifa, G.A.; Calvo, J. 2000. Defining a monitoring system for tropical dry forest in Costa Rica: implementation of algorithms using remote sensing and geographical information systems. *Geographic Information Systems and Remote Sensing for Sustainable Forest Management: Challenge and innovation in the 21st Century*. Abstracts and Workshop program.

CONFERENCE/WORSHOP ABSTRACTS

- Calvo J., Sanchez-Azofeifa A. **Arroyo-Mora J.** 2002. Dynamics of forest cover change and its implications to conservation in Costa Rica. In: *Tropical forests: past, present, future*. Smithsonian Tropical Research Institute (ed). Panama City, Panama. pp 15
- Sanchez-Azofeifa A.G., Calvo J., **Arroyo-Mora J.** Dynamics of forest cover in Costa Rica Using Landsat Images 1986/87, 1996/97 and 1997/2000. In: *Tropical forests: past, present, future*. Smithsonian Tropical Research Institute (ed). Panama City, Panama. pp 103
- Arroyo-Mora, J.P.**; Kalácska, M. and Sánchez-Azofeifa, G.A. 2002. A new sampling scheme for optically estimating leaf area index in a Tropical Dry Forest. *Tropical Forests: Past, Present, Future*. The Association of Tropical Biology Annual Meeting. Smithsonian Tropical Research Institute. pp 134
- Sanchez-Azofeifa, G.A., Kalácska, M., Rivard, B., **Arroyo-Mora, P.**, Hall, R., and Zhang, J. 2001. Observations of Phenological Changes in Mesoamerican Tropical Dry Forests and Implications for Conservation Strategies. *Tropical Ecosystems: Structure, Diversity and Human Welfare*. Proceedings of the International Conference on Tropical Ecosystems K.N. Ganeshiah, R. Uma Shaanker and K.S. Bawa (eds) Published by Oxford – IBH, New Delhi. pp. 754-757
- Kalácska, M., Sanchez-Azofeifa, G.A., Rivard, B., **Arroyo-Mora, P.**, Hall, R., Zhang, J., Dutchak, K. 2001. Implications of phenological changes in the extraction of Mesoamerican Tropical Dry Forests through remote sensing: A case study from Costa Rica and Mexico. *'The times they are a changing!'; Climate change, phenological responses and their consequences for biodiversity, agriculture, forestry, and human health*. Proceedings of the International Conference. Wageningen University, The Netherlands.
- Arroyo-Mora, P.** and Sanchez-Azofeifa, A. 2001. Tropical dry forest detection in Costa Rica: Its impact on tropical biology research. *Tropical Ecosystems: Structure, Diversity and Human Welfare*. Proceedings of the International Conference on Tropical Ecosystems K.N. Ganeshiah, R. Uma Shaanker and K.S. Bawa (eds) Published by Oxford – IBH, New Delhi. Pp 307

LANGUAGE ABILITIES

English and Spanish	Bilingual and bicultural
Portuguese	Basic writing and conversational skills
French	Taking a class

MEMBERSHIPS

1996- current	Colegio de Ingenieros Agrónomos de Costa Rica
2000-2004	Association for Tropical Biology
2003-2004	Ecological Society of America

AWARDS AND ACHIEVEMENTS

2005-2006	National Science Foundation of the U. S. Doctoral Dissertation Enhancement Project (DDEP) Developing Global Scientists and Engineers (US\$7,000)
2005	Wildlife Fund (WWF) – Russell E. Train Education for Nature Program Alumni award (\$3,000)
2005	Organization for Tropical Studies (OTS) Research Fellowship (US\$3,000)
2005	DEMI award. Ecology and Evolutionary Biology Department. University of Connecticut (US\$5000)
1999-2001	The John D. and Catherine T. MacArthur Foundation, The Ford Foundation, The William and Flora Hewlett Foundation - Regional Program of Graduate Fellowships in the Social Sciences (US\$ 15,000)
1999-2000	World Wildlife Fund (WWF) – Russell E. Train Education for Nature Program (US\$ 3,427)

HONORS

1990 to 1994	Sportsmanship Mention of Merit as a basketball team member of the Technology Institute of Costa Rica.
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OTHER

Date of Birth	March 15, 1971
Citizenship	Costa Rican
References	Available upon request

November 3, 2006