



# **Conference cycle**

## **Knowing and protecting nature:**

### **2010 International Year of Biodiversity**

**April to November 2010**

**Angra do Heroísmo, Açores, Portugal**

**Organisers**

**CITAA – Grupo da Biodiversidade dos Açores**

**RCE AÇORES**

**Organizing Committee**

Paulo A. V. Borges<sup>1</sup>, Rosalina Gabriel<sup>1, 2</sup>, Ana Moura Arroz<sup>1</sup>, Alfredo Borba<sup>3</sup>, Rui Luís<sup>3</sup>, Ana Maria Ávila Simões<sup>1</sup>, Alison Laurie Neilson<sup>2</sup>, Tânia Fonseca<sup>2</sup>, Paulo Barcelos<sup>4</sup> & Hélder Xavier<sup>2</sup>

1- Grupo da Biodiversidade dos Açores – CITAA, Universidade dos Açores, Campus de Angra do Heroísmo

2- Direcção do RCE Açores – Universidade das Nações Unidas

3 – Centro de Informação Europe Direct – Açores

4 – Os Montanheiros

Partly financed by the Project DRCT- M.4.2.2 / I / 002 / 2010



**UNITED NATIONS  
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**Governo dos Açores**



# ***Knowing and protecting nature: 2010 International Year of Biodiversity***

## **GOAL**

Our main goal is to develop and share knowledge concerning biodiversity on islands with the local community.

## **MOTIVATION**

2010 is the International Year of Biodiversity (<http://www.countdown2010.net/year-biodiversity>) and we want to celebrate biodiversity in the Azores. This opportunity is reinforced by our responsibility in belonging to the RCE AÇORES (Regional Centre of Expertise in Education for Sustainable Development) and by the publicly expressed priorities of the government. Therefore, the Azorean Biodiversity Group will host a Conference Cycle on Island Biodiversity, including a number of lectures, workshops and exhibitions to enhance the discussion possibilities and the interest of the community around biodiversity.

## **GENERAL OBJECTIVES**

The general objectives of this Conference Cycle are:

- to promote awareness about the importance of biodiversity to the human species;
- to gain in-depth knowledge from the visiting scientists and
- to engage in fruitful discussions with the attendants of the lectures, inspiring us all to work together for a sustainable future, that surely will include the conservation of local biodiversity.

## **OPERATIONAL OBJECTIVES**

The operational objectives of this Conference Cycle are:

- to provide a stimulating context for the learning about biodiversity;
- to develop the knowledge about different components of biodiversity, including among others, ecology, evolution, biogeography, conservation, environmental education and sustainability;
- to further the professional development of all the participants, namely students and teachers.
- to foster the collaboration among the University of the Azores, schools, museums, parks, NGOs and other political and economic organizations.

## **SPEAKERS**

The invited speakers are international leaders in their areas, and attending their lectures will be a way of learning about the recent advances in the science of islands biodiversity and conservation. Besides these senior scientists, a number of post-graduated students (PhD's and Post-docs) will also present the results of their most recent studies concerning biodiversity in the Azores.

## **SCOPE**

The lectures will be interesting to a wide audience, including students, educators, conservation managers, tourist operators, environmentalists, researchers and the general public.

## **DURATION of the CONFERENCE CYCLE**

In order to be able to focus on distinct components of biodiversity, this meeting will be spread through all the year, with conferences occurring from April to November 2010, keeping the subject present in the minds and hearts of people.

## **SCHEDULE and VENUE of the CONFERENCE**

Most of the lectures will take place in the new *Campus* of Pico da Urze (Universidade dos Açores, Angra do Heroísmo), from 17h30 – 19h30, preferentially on Fridays, on dates to be announced each month, as they suit the lecturers (but see provisional program).

## **OFFICIAL LANGUAGES**

The main language of the conference cycle is Portuguese. Besides Portuguese, and in the spirit of diversity, other languages will be used during the lectures, according to the speakers' preference (Spanish, French, Italian and English).

Simultaneous translation will not be provided however, a Portuguese outline of each lecture will be available for each lecture and questions from the audience will be translated to the speakers. The language of communication of each of the presentations is indicated in the Program.

## **COST**

The attendance of the lectures will be free for all, and in the end of each session, all the participants that so wish, will receive a presence certificate. Nevertheless, the participants are invited to contribute with a fund to buy trees to compensate the carbon emissions associated with the lecture.

## **ASSOCIATED EVENTS**

## BOOK LAUNCHINGS

Four book launchings will occur in the 2010 – International Year of Biodiversity. The first three are partially funded by DRCT (Direcção Regional da Ciência e Tecnologia); the fourth is financed by the FCT (Fundação para a Ciência e Tecnologia):

1. Borges, P.A.V., Costa, A., Cunha, R., Gabriel, R., Gonçalves, V., Martins, A.F., Melo, I., Parente, M., Raposeiro, P., Rodrigues, P., Santos, R.S., Silva, L., Vieira, P. & Vieira, V. (Eds.) (2010). *A list of the terrestrial and marine biota from the Azores*. Princípiã, Oeiras, 388 pp.
2. Gabriel, R., Arroz, A. M., Borges, P. A. V., Rodrigues, A. F., Sousa, J. R. (coords.) (in prep.). ***Abordagens do ambiente em contexto educativo***. Universidade dos Açores, Angra do Heroísmo.
3. Arroz, A. M., Borges, P. A. V., Rodrigues, A. F., *et al.* (in press). ***Para uma gestão de risco informada pelas perspectivas dos cidadãos: Riscos ambientais em contexto açoriano***. Universidade dos Açores, Angra do Heroísmo.
4. Serrano, A. R. M., Borges, P. A. V., Boieiro M. & Oromí, P. (eds.) (in prep.). ***Terrestrial arthropods of Macaronesia – Biodiversity, Ecology and Evolution***. Sociedade Portuguesa de Entomologia, Lisboa.

## PHOTOGRAPHY EXHIBITION

Following the 2nd Competition on Biodiversity Photography in the Azores, directed to all the schools of the archipelago, a public exhibition of photography will be arranged and the best photographs will be displayed in various public places.

## THEMATIC WORKSHOPS

Considering that biodiversity includes a great number of associated disciplines, some thematic workshops will be held during 2010, allowing participants to further their instruction on selected subjects.

1. A workshop, focusing on environmental education, will be held on the 24<sup>th</sup> of April, animated by Professor Linda Cronin-Jones and different teachers and colleagues of the University of the Azores.

## ECO-RESPONSABILITY

The organizing committee will try to minimize the carbon emissions associated to the event. There will be virtually no printing and all the lecture materials will be available on-line. We will try to engage several groups on the plantation of trees in the University campus in Angra do Heroísmo.

## DIVULGATION

To divulgate the event there will be a poster placed in several strategic places in Terceira Island (Museums, Schools, ONG's, etc.). We will also use sms's and e-mail. Besides, all the information regarding the lectures will be available on-line in the Azorean Biodiversity Portal

(<http://www.azoresbioportal.angra.uac.pt>), in the Azorean Biodiversity Group webpage (<http://cita.angra.uac.pt/biodiversidade/>) and the RCE AÇORES webpage (<http://rceazores.ning.com/>).

## **PARTNERSHIPS**

The Azorean Biodiversity Group and the RCE AÇORES are responsible for the organization of this event, together with the funding institutions (SRCTE – Secretaria Regional da Ciência, Tecnologia e Equipamentos da Região Autónoma dos Açores e Universidade dos Açores; Project DRCT- M.4.2.2 / I / 002 / 2010; “Os Montanheiros”; “Europe Direct”). The following projects also support the trips of several speakers:

FCT - PTDC/BIA-BEC/104571/2008 – “What can the Macaronesian islands teach us about speciation? A case study of Tarphius beetles and Hipparchia butterflies”

FCT- PTDC/BIA-BEC/100182/2008 – “Predicting extinctions on islands: a multi-scale assessment”

FCT - PTDC/AMB/70801/2006 - Understanding Underground Biodiversity: Studies of Azorean Lava Tubes

DRCT - M.2.1.2//003/2008 “Consequences of land-use change on Azorean fauna and flora - the 2010 Target”

DRCT - M221-I-002-2009 TERMODISP - A térmita de madeira seca *Cryptotermes brevis* (Walker) nos Açores: Monitorização dos voos de Dispersão e prevenção da colonização.

## PROGRAM

DATE	LECTURERS	AREA	TITLE	L
<b>April 2010</b>				
9	José A. P. Marcelino	Agro-Ecology	Arthropod bioindicators as a biological tool to assess anthropogenic impacts in Azorean ecosystems' biodiversity	Pt
16	Ana Costa	Biogeography	Marine biodiversity in Azores: Unveiling the past, picturing the present and foreseeing the future	Pt
16	António Onofre Soares	Agro-Ecologia	A presença dos Coccinélídeos em diversos habitats: a forma como ocupam os nichos e o seu contributo para a biodiversidade	Pt
23	Henrique Miguel Pereira	Conservation	Scenarios for biodiversity change in the 21st century	Pt
23	Luís Borda-de-Água	Ecology	Scaling biodiversity under neutrality	Pt
24	Linda L. Cronin-Jones	Sustainability	Biodiversity education: Challenges and opportunities	En
<b>May 2010</b>				
7	Ana M. C. Santos	Biogeography	Ecology and biogeography of island parasitoid faunas	Pt
7	Joaquin Hortal	Ecology	How local are local communities? The importance of the species pool in the diversity and ecology of local assemblages	Pt
14	Ricardo Serrão Santos	Conservation	Conservation and utilization of biodiversity in seamounts	Pt
28	Alison Laurie Neilson	Sustainability	Diversity of Island Voices - EDUMAR: Perspectives about the sea in the Azores and Newfoundland, Canada	En

(L – Presentation language: Pt – Portuguese; Es – Spanish; Fr – French; It – Italian; En – English)

DATE	LECTURERS	AREA	TITLE	L
<b>June 2010</b>				
11	Maria Rosa Paiva	Ecology	Use of semiochemicals in biodiversity studies	Pt
17	Sérvio Pontes Ribeiro	Ecology	Forest insect galls density and herbivory distribution: Canopy and understorey comparisons for Panama and Australia	Pt
17	Pedro Cardoso	Conservation	The IUCN redlist criteria: Not good for arthropods and in need of adaptation	Pt
25	Lina Nunes	Plague Management	Termite infestation risk in Portuguese buildings	Pt
25	Valerie K. Brown	Agro-Ecology	Agricultural biodiversity: Can it be restored?	En
<b>July 2010</b>				
2	Michele Aleffi	Biogeography	Bryogeographic patterns in the small islands surrounding the Italian peninsula, Sicily and Sardinia	It
2	Helena Hespanhol	Ecologia	Comunidades briofíticas de afloramentos rochosos exposto: caracterização ecológica e conservação	
9	Diana Northup	Evolution	Lava Tubes in the Açores and Hawai'i Harbor Abundant Novel Bacterial Diversity	En
9	Isabel Amorim	Evolution	Azorean cave biodiversity	Pt
21	Silvia Calvo Aranda	Biogeography	Do theories of Island Biogeography perform well for bryophytes?	Es
23	Alain Vanderpoorten	Evolution	What can the study of island speciation tell us about dispersal and evolutionary rates in early land plants?	En
23	Simone Fattorini	Biogeography	Biogeography of the Aeolian Islands: the influence of island geography and history on species richness and beta-diversity	It

(L – Presentation language: Pt – Portuguese; Es – Spanish; Fr – French; It – Italian; En – English)

DATE	LECTURERS	AREA	TITLE	L
<b>September 2010</b>				
17	Maria Teresa Ferreira	Biogeography	Origin and extent of the infestation by the West Indian drywood termite <i>Cryptotermes brevis</i> (Walker) in the Azores Islands	Pt
17	Rudolf H. Scheffrahn	Ecology	Termite diversity and island establishment of exotic species in the West Indies	En
22	Hanno Schaefer	Biogeografia	Characteristics of flowering plant lineages of the Azores and the Azores diversity enigma	En
22	Juana Maria González Mancebo	Ecología	Frecuencia y causas de rareza de briófitos en islas Macaronésicas	Es
24	Pedro Oromí	Evolução	The Canarian insects and their kin: Insular evolution and phylogeography	Es
27	José María Fernández-Palacios	Biogeografia	The role of forgotten seamounts in shaping the Macaronesian relict laurel forest	Es
27	Robert Whittaker	Biogeografia	Dynamic oceanic island biogeography: a general model and its application to Macaronesia	En
<b>October 2010</b>				
8	Rosalina Gabriel	Conservation	Natural Azorean forests: Conserving a wealth of bryophytes	Pt
8	Jeffrey William Bates	Conservation	Are alien tree species all bad news for Terceira's epiphytic bryophytes?	En
22	Ana Moura Arroz	Conservação	Hortênsias e outras belezas enjeitadas: o contributo dos modelos psicossociais para a compreensão da relação com a natureza	Pt
22	Godfrey Baldacchino	Environmental Economy	The contribution of the environment to the economic development of small island jurisdictions	En
29	François Guilhaumon	Conservation	Spatial variation of Azorean arthropods species richness: using recent advances in SAR modelling for a better knowledge and conservation in the Azores	En
29	Konstantinos Triantis	Conservation	Extinction debt on oceanic islands	En

(L – Presentation language: Pt – Portuguese; Es – Spanish; Fr – French; It – Italian; En – English)

DATE	LECTURERS	AREA	TITLE	L
<b>November 2010</b>				
12	Catarina Melo	Agro-Ecology	Aplicação de fungos micorrízicos arbusculares nativos dos Açores no controlo de nemátodos endoparasitas formadores de galhas ( <i>Meloidogyne javanica</i> )	Pt
12	Paulo A. V. Borges	Conservação	Heaven or hell: A portrait of the conservation of the Azorean arthropod's diversity	Pt
19	Frederico Cardigos	Sustentabilidade	Estratégias para a conservação e recuperação da Biodiversidade dos Açores	Pt
19	Luisa Schmidt	Sustentabilidade	Biodiversidade e mudança social: uma "paisagem" complexa	Pt

(L – Presentation language: Pt – Portuguese; Es – Spanish; Fr – French; It – Italian; En – English)



# **Ciclo de Palestras**

## **Conhecer e proteger a natureza:**

### **2010 Ano Internacional da Biodiversidade**

**Abril a Novembro de 2010**  
**Angra do Heroísmo, Açores, Portugal**

## **ABSTRACTS / RESUMOS**

**Organização**

**CITAA – Grupo da Biodiversidade dos Açores**

**RCE AÇORES**

**Comité organizador**

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Alison Laurie Neilson<sup>2</sup>, Tânia Fonseca<sup>2</sup>, Paulo Barcelos<sup>4</sup> & Hélder Xavier<sup>2</sup>

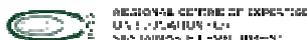
1- Grupo da Biodiversidade dos Açores – CITAA, Universidade dos Açores, Campus de Angra do Heroísmo

2- Direcção do RCE Açores – Universidade das Nações Unidas

3 – Centro de Informação Europe Direct – Açores

4 – Os Montanheiros

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## **BRYOGEOGRAPHIC PATTERNS IN THE SMALL ISLANDS SURROUNDING THE ITALIAN PENINSULA, SICILY AND SARDINIA**

**Michele Aleffi**

Botany and Ecology Sector of the Department of Environmental Sciences, University of Camerino, Italy

This lecture aims to analyse the role played by some physiographic and ecologic variables such as area, isolation, altitude and substratum type on the bryophyte species richness of 49 small Italian islands. Both floristic similarity between islands and bryophyte species richness depend above all on the island size. The other variables, i.e. the proximity to the closest continent or major island, the distance between islands and the type of substratum, account for only small differences between the islands bryofloras. Unexpectedly, the number of bryophytes species in these islands is not negatively related to the distance from the continent. This outcome is due to the confounding effect of island size and age, as well as to the stronger human impact that is likely to occur in close-to-continent islands. The high slope of the species-area curve indicates a very scarce bryophyte immigration, even from the closest islands. The low dispersion ability is partly related to some life history traits of the xerophilous mosses. The only two endemic species (*Rhynchostegium strongylense* and *Thamnobryum cossyrense*) that occur in no more than five islands were not sufficient to test whether the isolation from the continent has favoured the differentiation of new species. The outcome of the analyses performed reflects the current bryo-chorological knowledge concerning the small Italian islands, and thus it is likely that reports of new species could change some bryogeographic patterns revealed in this study.

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## **AZOREAN CAVE BIODIVERSITY**

**Isabel Amorim**

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal

School of Biological Sciences, University of East Anglia, UK

The Azores are volcanic islands, which is easily attested by a landscape dominated by lava flows, volcanic cones and craters. The volcanic eruptions have also led to the formation of an extensive network of underground paths, and around 270 volcanic cavities (caves and pits) have been catalogued to date in the Azores. The vast underground environment is inhabited by multiple species which together with the species found on the surface account for the total terrestrial biodiversity of the archipelago. Historically the Azores have not captured the attention of naturalists and as a consequence of this lack of interest, the biodiversity of the archipelago has been the least known among all the Macaronesian Islands. However, in the last few decades, interest in the organisms that inhabit this archipelago has grown, which resulted in a

significant increase in the number of species known from the Azores. This was also the trend for the underground inhabitants of the archipelago as biospeleologic expeditions in the Azores did not start until 1987. Since then several species have been recorded from underground habitats, many of which are new species to science. Ongoing biospeleologic studies in the Azores include the survey of vegetation at the entrance of volcanic caves and pits, and of microorganisms (biofilm) and invertebrates found inside those cavities. *Trechus* beetles are among the small invertebrates that inhabit the underground environment of the Azores and in the last two decades seven new species of *Trechus* have been described from lava tubes and volcanic pits. This makes the genus *Trechus* quite unique in terms of Azorean cave biodiversity: it is the group with the highest number of cave restricted species, more than double the number of species found in any other invertebrate cave group, and represents 35% of the cavernicolous species of the Azores. The total number of *Trechus* species may in fact be even higher, as molecular data suggests the existence of cryptic species. The molecular data also shows that the intraspecific genetic variability is geographically structured, where haplotype distribution is concordant with a pattern of isolation by distance. Field surveys and molecular data indicate that the area protected in the Azores is insufficient to guarantee the maintenance of species richness and genetic diversity of *Trechus* beetles found in the archipelago and therefore should be increased to arrest the generalized trend of insular biodiversity decline.

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## **DO THEORIES OF ISLAND BIOGEOGRAPHY PERFORM WELL FOR BRYOPHYTES?**

**Silvia Calvo Aranda**

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal

Dept. Biodiversidad y Biología Evolutiva, Museo Nacional de Ciencias Naturales, Spain.

It is believed that Macaronesia, which comprises five Atlantic archipelagos (Azores, Canaries, Cape Verde, Madeira and Salvage), survived the Pleistocene glaciations and that much of the subtropical vegetation that covered the Western Europe during the Tertiary remained refuge here. As a consequence, the flora of this region is exceptionally rich and diverse. Bryophytes represent a good example of this, being well represented in the broadleaf evergreen forests (the so-called 'laurisilva') as shows the maximum of around 500 species in the Madeira archipelago (almost a quarter of European diversity). To explain the varying species richness between islands, different biogeographical hypothesis have been proposed. Among them, the classical Equilibrium Theory of MacArthur and Wilson prevailed for many taxa and geographical regions. Does it work equally well for long-distance dispersal organisms like bryophytes? Since it has never been tested, here I will examine the effects of island area and isolation on the main gradients of species richness using bryophyte data in the Macaronesian archipelagos. Also, I will try to discriminate the importance of other factors related to the island age, habitat

heterogeneity and disturbance, which other authors have also suggested as relevant determinants influencing diversity patterns on islands.

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## **HORTÊNSIAS E OUTRAS BELEZAS ENJEITADAS: O CONTRIBUTO DOS MODELOS PSICOSSOCIAIS PARA A COMPREENSÃO DA RELAÇÃO COM A NATUREZA**

**Ana Moura Arroz**

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal.

Pretende dar-se uma visão panorâmica sobre as contribuições da psicologia para a intervenção social em torno da sustentabilidade ambiental e da conservação da biodiversidade. Assume-se que compreender as perspectivas das pessoas acerca da natureza, bem como os distintos modos como a experienciam, é crucial para pensar e gerir a mudança de práticas sociais no âmbito da biodiversidade. Considerando que se jogam nas dissidências entre leigos e peritos, diferentes lógicas e interesses passíveis de mediação com vista à negociação de consensos estratégicos, é apresentado um modelo psicossocial das condicionantes das práticas ambientais de risco e das dinâmicas subjacentes a processos de comunicação de risco que visam promover mudanças comportamentais mais funcionais e adaptativas. O modelo conjuga características pessoais (como, por exemplo, experiência prévia, enviesamentos cognitivos e atitudes), características relativas à fonte de risco (como, por exemplo, atribuições causais, controlabilidade, probabilidade de ocorrência, impactos potenciais), factores sociais (como, por exemplo, *media* e *opinion makers*, confiança pública e as agendas dos diferentes grupos de pressão implicados) factores culturais (como, por exemplo, representações sociais e ideologias dominantes relativas ao ambiente, à natureza e ao risco) e características da mensagem (como, por exemplo, conteúdos, formatos e fontes) que se determinam o impacto potencial de uma medida ou programa de intervenção. Três processos se encontram implicados e necessitam de ser analisados conjuntamente:

- como é que os cidadãos interpretam e lidam com os riscos;
- como é que processam e avaliam a informação de risco;
- como é que a informação aceite afecta a percepção e o comportamento de risco.

São ilustradas aplicações em curso no âmbito dos riscos associados a espécies infestantes.

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## THE CONTRIBUTION OF THE ENVIRONMENT TO THE ECONOMIC DEVELOPMENT OF SMALL ISLAND JURISDICTIONS

**Godfrey Baldacchino**

University of Prince Edward Island, Charlottetown, Canada

Lecture will focus on the strong link between natural/cultural heritage management and the sustainable development of island jurisdictions. The presentation would be based on ongoing global research about sub-national island regions (like the Azores) of which there are over a hundred around the world. The lecture would start with a review and explanation of the three key types of 'development trajectories' that island regions are following today: those that are driven by aid/remittances., those driven by tourism; and those driven by jurisdictional capacity. The latter is the more sustainable of the three and includes a strategic use/appreciation of natural assets/land (and sea). Biodiversity becomes a key asset in promoting a specific tourism niche plus safeguarding precious space from encroaching human impacts ... UNESCO World Heritage Sites, RAMSAR sites, national parks or reserves are all expressions of the need to protect such environmental resources and their biodiversity.

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## ARE ALIEN TREE SPECIES ALL BAD NEWS FOR TERCEIRA'S EPIPHYTIC BRYOPHYTES?

**Jeffrey William Bates**

Honorary academic', Imperial College London, U.K.

The native evergreen forest of the volcanic and often mountainous Azores archipelago is renowned for a rich flora including several endemic vascular and cryptogamic species. The situation on Terceira is typical: there is a clear altitudinal zonation through forest types dominated by *Laurus azorica* in the sub-tropical lowlands to *Juniperus brevifolia*-*Sphagnum* woodland in the cloud zone. The tree heather *Erica scoparia* ssp. *azorica* also becomes important in dry sites irrespective of altitude. The native forests are characterised by a luxuriant epiphytic flora of bryophytes, lichens and filmy ferns. The communities of the bryophytes in native forest, and their relationships with the various available substrata, have recently been described (Gabriel & Bates, 2005). Native forest on Terceira and elsewhere in the Azores is now greatly diminished in extent owing particularly to clearances for pasture and for plantations of the alien trees *Cryptomeria japonica* (higher altitudes) and *Eucalyptus globulus* (below 500 m). In addition, the small alien tree *Pittosporum undulatum* has become established at lower altitudes and now forms extensive areas of woodland in the coastal zone and has also penetrated native forest fragments elsewhere. The lecture will summarise the results of a quantitative survey of epiphytic bryophytes growing on the trunks of *Cryptomeria*, *Eucalyptus*

and *Pittosporum* within some of the main plantations and invasively- colonised areas for these species on Terceira. It will be shown that although the alien trees support limited epiphyte diversity compared to native forest, the more mature examples have some value as habitats for limited sets of Azorean specialities.

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## **SCALING BIODIVERSITY UNDER NEUTRALITY**

**Luís Borda-de-Água** & Stephen P. Hubbell

Department of Ecology and Evolutionary Biology, University of California, Los Angeles, USA

The unified neutral theory (UNT) in ecology is a dynamical theory of relative species abundance and a set of null hypotheses for the assembly of communities under the assumption that trophically similar species are symmetric. The symmetry assumption is that, to a first approximation, ecologically similar species are demographically equivalent on a per capita basis in birth and death rates, rates of dispersal, and in the probability of speciation. Previous work on the UNT did not explicitly consider the effect of the shape of the dispersal kernel on the distribution and abundance of species. Which dispersal kernel is used can profoundly affect both local and large-scale patterns of species diversity and abundance. Here we model dispersal using Lévy-stable distributions. The scaling properties of Lévy-stable distributions have long been studied in research on fractals but have seldom been applied in ecology. We discuss in particular the implications of long distance dispersal to the species richness and species abundance distributions on local and regional scales. Although species richness and the size of the community have for long been explored (species area relationship), the scaling properties of the species abundance distributions as a function of dispersal have received much less attention. The symmetric UNT describes the consequences for community assembly of pure ecological drift (demographic stochasticity) accompanied by random dispersal and speciation. As such, the UNT is useful in generating quantitative null hypotheses for testing how much symmetry-breaking is actually required to explain observed patterns of species abundance and diversity. The UNT can also be used to estimate the proportion of variance in species abundance that can be ascribed to ecological drift, and what cannot.

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## **HEAVEN OR HELL: A PORTRAIT OF THE CONSERVATION OF THE AZOREAN ARTHROPOD'S DIVERSITY**

**Paulo A. V. Borges**

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal.

Arthropods are the most diverse of all the terrestrial biota from the Azores. In addition, they are also the richest group in endemic taxa. Currently we have spatial data on the distribution and abundance of Azorean arthropods in different scales in native forests: islands, protected areas within islands, sites within protected areas, habitats within sites. In addition we have data on the occurrence of arthropod species in other habitats (*Cryptomeria japonica* exotic forest, semi-natural pasture and intensive pasture) for four islands (Terceira, Faial, Flores and Santa Maria). Within the bigger context of a standardized sampling program both for epigeal and canopy insects and spiders we want to find out which species are truly rare and which are pseudo-rare species in the Azores. Two dimensions of rarity were measured: abundance and habitat specialization. Two domains of rarity were identified: “among habitats” and “geographic”. Some interesting patterns emerged. The high dispersal abilities of many insect and spider species together with the fact that many species from islands tend to be generalists imply that many species tend to be vagrants in several habitats and consequently are locally habitat pseudo-rarities. Two types of local pseudo-rare species were identified: “habitat (or land-use)” and “host plant” pseudo-rarities. Some species are rare in one habitat type whilst they are more common in another, often related habitat, or they are relatively rare in many habitats. This is a consequence of a “mass effect”, with many species demonstrating a “source-sink” dynamics. Truly regionally rare species are those that are habitat specialists and many of them are threatened endemic species or recently introduced exotic species. We suggest several hypotheses for the patterns found, based on the former larger distribution and disturbance regimes of the native Laurel forest. Although this study demonstrates the important role of the native forest in arthropod conservation in the Azores, it also shows that unmanaged exotic forests have provided alternative habitat suitable for some native species of forest specialist arthropods, particularly saproxylic beetles.

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## **AGRICULTURAL BIODIVERSITY: CAN IT BE RESTORED?**

**Valerie K. Brown**

UK's Government Review on the Protected Areas, U.K.

The lecture will use the British Isles as an example of the declines which have occurred in the biodiversity associated with agricultural habitats over the last half century, but will emphasise the processes in place to address the decline. By means of Agri-Environment Schemes, farmers are subsidised for farming in a more environmentally-friendly way, though the early success of these schemes has been variable. However, the lecture will demonstrate recent and ongoing research which probes into the mechanisms under-pinning agricultural biodiversity and some of the innovative techniques that are being developed to either re-create or restore functional ecosystems. The lecture will focus on grassland systems, though reference to arable and mixed farming systems will also be made. It will draw particular attention to the multi-trophic

interactions between soil biota, vegetation, invertebrates and birds inter-alia, as pre-requisites for resilience and sustainability of future farming systems.

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### **THE IUCN REDLIST CRITERIA:**

#### **NOT GOOD FOR ARTHROPODS AND IN NEED OF ADAPTATION**

**Pedro Cardoso**

Smithsonian Institution, USA

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal

The World Conservation Union (IUCN) redlisting criteria are used worldwide to assess the degree of threat to species and give priorities to conservation management of species and their habitats. They are objective and easy to assess for well-known groups such as vertebrates and vascular plants, but are mostly inadequate (even if applicable) for invertebrates. As a consequence, very few invertebrate species have been assessed to date.

Current work on the subject will propose redlisting criteria appropriate for invertebrate taxa. Building on current criteria it will: (1) Assess current criteria against the data quantity and quality feasible to obtain for invertebrates. Criteria relying on absolute (vs. relative) abundance, for example, are less useful as absolute abundance is nearly impossible to obtain for most invertebrates. (2) Include new criteria that are important to evaluate the threat status of invertebrate species. These will include, e.g., co-extinction of exclusive host species.

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### **ASSESSING THE ECOLOGICAL BASIS OF CONSERVATION PRIORITY LISTS FOR SPECIES IN AN ISLAND SCENARIO: A CASE STUDY WITH BIRDS OF THE CANARY ISLANDS.**

**Luis M. Carrascal**

Dept. Biodiversidad y Biología Evolutiva, Museo Nacional de Ciencias Naturales, Spain.

Proneness to extinction varies naturally and continuously according to the ecological phenomena that compound rarity even before anthropogenic effects may play a role. This is particularly obvious in islands, where populations tend naturally to be small and fragmented and, consequently, conservation priority lists may have a large number of species clustered unhelpfully in the higher threat categories.

In this talk we propose a simple model of threat based on natural descriptors of rarity and taxonomic distinctiveness (area of occupancy, population abundance and trend, and endemism), assess its correlation with ecological features of the species (habitat preferences

and body size) and test whether the Spanish Red data Book and a normative conservation priority list (the Canary Islands Catalogue of Threatened Species and its administrative revision) includes these ecological bases for birds.

We found that a large variation in threat (42.3%) was explained by phylogeny, habitat breadth and preference for urban areas (with a negative effect), and preference for agricultural environments (a positive effect). The Spanish Red data Book and the administrative lists tested are poorly related to descriptors ordering the extinction risk and loss of taxonomic singularity, so some changes would make their categories more coherent. We contend that the ecological bases of rarity should be taken into account to understand why some populations/species are at higher extinction risk whereas others remain relatively safe, as this would provide firmer grounds on which to base conservation priorities.

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## **MARINE BIODIVERSITY IN AZORES: UNVEILING THE PAST, PICTURING THE PRESENT AND FORESEEING THE FUTURE**

**Ana C. Costa**

Centro de Investigação em Biodiversidade e Recursos Genéticos (CIBIO)—Pólo Açores,  
Universidade dos Açores, Portugal

Since Darwin (1859) islands' biodiversity has always caught the attention of researchers in biogeography and evolution.

The Azores archipelago has consequently received the visit of interested researchers ever since. Marine diversity in the Azores is characterized by a mixture of cold temperate, temperate and tropical species from different origins. Its volcanic nature, youth, central remote and privileged location influenced by the Gulf Stream provide the conditions for the establishment of a very unique biodiversity and an interesting model for evolutionary, biogeographic and ecological studies. However, the remote position and youthness of the archipelago are blamed for low number of littoral marine species. Isolation is the key feature that makes islands such interesting models for evolutionary and ecological studies as it promotes differentiation and speciation by reducing gene flow between insular and continental populations and even between islands of the archipelago.

The knowledge of the marine biodiversity in the Azores is still restricted to more conspicuous groups in spite of the ecological role of some other organisms as marine benthic invertebrates, reflection of technical difficulties in subtidal sampling and lack of local expertise in taxonomic difficult groups. The University of the Azores has been playing a very important role to overcome these limitations namely international scientific cooperation and new technologies presently available as on-line databases and thematic scientific discussion lists have been largely used by local researchers to make good progress in the knowledge of the local

biodiversity. In spite of some persistent difficulties, as the long coastal line and associated costs of a good sampling and lack of a full taxonomic coverage, updated lists of organisms are produced in an yearly basis

Present-day patterns in marine biodiversity are the result of the interaction of many factors acting at different scales. Developing an understanding of the processes that regulate the diversity of this oceanic ecosystem is thus challenging. Here several studies are presented to illustrate some of the present achievements of several works developed aiming this goal.

The majority of the Azorean marine biota is very recent and comprises species that have arrived predominantly from the eastern Atlantic, especially the area between southern Europe (Lusitanian Region) and northwest Africa (Mauretania Region), with a great Mediterranean contribution and also includes species from other Atlantic sources. Various marine organisms show population differentiation between the Atlantic and the Mediterranean Sea and the Macaronesian Islands seem to have played an important role in the speciation and diversification of some marine *taxa*.

Mitochondrial DNA studies can be very important to enlighten not only phylogeographic patterns within some groups but also to point out the need for taxonomic revision of others. These studies integrating molecular approaches into marine biodiversity research as implementing DNA barcoding and investigating phylogeographic patterns, are present research lines that are quite promising to reveal past patterns of colonization and evolution. The present work being developed under Luso MarBol project not only enables the local participation in the worldwide research effort to the major worldwide initiative on biodiversity, the International Barcode of Life (iBOL) for the development of a new universal species identification system, but can also provide molecular data to be linked to the more traditional biodiversity databases. Data can be used to understand phylogeographical relations and contribute to a better understanding of North Atlantic global patterns of biogeography and factors affecting the dispersal of organisms in ecological and historical times. For littoral organisms, islands are particularly suitable models allowing the test of predictions related to the efficacy of pelagic larvae dispersal. Molecular studies may contribute to establish if the pelagic larvae are enough to ensure regular connectivity between islands or if inter-island migration is only achieved through rare events of long-range dispersal. Additionally, these works may also identify recent colonization and migration events and recognize whether they resulted from human transport, as has already been observed for several marine *taxa* with some important ecological consequences

In recent years, the great amount of natural bio-active chemical compounds obtained from diverse marine organisms highlighted the need for a deeper collaborative work between chemists and marine biologists to optimise their efforts in obtaining the right specimens to pursue their purposes. As a consequence, a new understanding of marine biodiversity has been developed, taking into consideration the known distribution of the species and bearing in mind that ecological conditions can shape the physiology, metabolism, and consequently the magnitude of marine organisms' chemical signature. Therefore several collaborative research

proposals are underway to couple the different scales of biodiversity and to drive the marine diversity' studies to a different level in a context of integrative studies.

An effort has been made to make an inventory of the marine flora and fauna of the Azores that started with several sparse initiatives. A major step was given by the BioNatura project that tried to overcome the limitations due to sparse literature and geographic and taxonomic bias by promoting the inventory of the biodiversity of the Azores and its data storage in a sole database – Atlantis database, which gather large sets of geo-referenced biodiversity data, including the marine littoral invertebrates. Biodiversity mapping is a basic tool for managing and protecting the marine environment and in fact this database has been already used in marine coastal planning as integration of this biological data with socio-economic information on GIS support enables a strong baseline for management decisions namely by modelling some basic interference, a next step in marine spatial planning in the region.

Moreover the public internet interface of Atlantis database, the Azorean Biodiversity portal promotes the dissemination of research results on biodiversity in the Azores.

BIONATURA project has also contributed to identify areas for which information is priority and to channel inventory efforts to these sites and to the selection of priority species for management and conservation. It also highlighted the need for a deeper study of most marine invertebrates as life history traits of many species, even some of the heavily exploited and threatened eg. *Megabalanus azoricus* remain unknown. We are deeply engaged to contribute to overcome this by studying autoecological traits of local emblematic species as this barnacle and the red seastar *Ophidiaster ophidianus*, as accurate information about endangerment level, population status, geographical range, and the ecological role of species can increase the reliability of the contingent-valuation that has been used in biodiversity conservation policies and can provide useful information about alternative conservation strategies. The delineation of stock boundaries is fundamental to management schemes of exploited and protected species. Stock boundaries are needed to estimate abundance, set catch limits, assess population dynamics, and establish territorial jurisdiction. Not only can these be derived from the above mentioned studies but strongly benefit from knowledge of population genetics – an approach that is now being applied to these and some other scientific interesting species.

Numerous marine species are presently being moved beyond their natural ranges as a result of anthropogenic activities such as shipping, aquaculture and ornamental trade. This artificial redistribution of species and bio-invasions with potential ecological and economic consequences are being assessed under the ongoing project Inspect. This study was designed to identify current established marine alien species and potential new invaders in the Azores but also aims to clarify some aspects of the introduction processes, such as the identification of environmental conditions that favour or inhibit invaders, species with enhanced invasive characteristics and evaluate the importance of several entrance vectors (e.g. ballast water and fouling hulls). Moreover we hope to evaluate the impact of establishment of these species to local biodiversity.

In conclusion, the academy commitment to guaranty the knowledge and safeguard biodiversity in the Azores has been a fruitful reality together with a good cooperation with local government has become transposed into responsible legislation that coupled to an effort on public education can be envisaged as a sustainable development role model for other regions.

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## **BIODIVERSITY EDUCATION: CHALLENGES AND OPPORTUNITIES**

**Linda L. Cronin-Jones**

School of Teaching and Learning, University of Florida, USA

This interactive session will model and describe a few of the latest research-based approaches for effectively educating Kinder through College-age students and the general public about pressing biodiversity issues, with an emphasis on leading learners from awareness to action. It will also address some of the challenges associated with potentially sensitive biodiversity issues and identify strategies for dealing with these challenges.

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## **DIVERSITY AND DIVERSIFICATION IN THE MACARONESIAN ISLANDS**

**Brent C. Emerson**

School of Biological Sciences, University of East Anglia, UK

Oceanic island ecosystems have for a long time been recognised as natural laboratories for studying evolution owing to their discrete geographical nature and diversity of species and habitats. The origin of this species diversity within an archipelago and on individual islands is of great interest to biologists, and the development of molecular genetic methods for phylogenetic reconstruction provides a useful tool to address this issue. In this talk I focus on two general questions regarding the origin of species diversity in the Macaronesian islands: when did it happen and how did it happen? I examine the ability of recent evolutionary work to address these questions, and the insights they provide on the roles of immigration, speciation and extinction in community assembly on island ecosystems. While the evidence for speciation on island archipelagos is clear, evidence for extinction is less obvious. However, absence of evidence does not mean absence of process, and an appreciation of the mutual importance of both extinction and speciation provides a more satisfying dynamic of diversification.

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## **BIOGEOGRAPHY OF THE AEOLIAN ISLANDS: THE INFLUENCE OF ISLAND GEOGRAPHY AND HISTORY ON SPECIES RICHNESS AND BETA-DIVERSITY**

## **Simone Fattorini**

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The study of beta-diversity, i.e. the spatial turnover or change in the identities of species, it is central to a wide array of ecological and evolutionary topics, and it has recently attracted the attention of ecologists and conservationists. Much debate exists about the most appropriate approach to the analysis of the factors that influence beta-diversity, because researchers are interested in different 'levels of abstractions' of community analyses: (1) community composition; (2) variation in community composition data, i.e. beta-diversity; or (3) variation in beta-diversity, i.e., variation in variation in community composition data. Island ecosystems may be particularly useful to understand the importance of different environmental factors in regulating species richness and beta-diversity. In the present study the Aeolian Islands, a small archipelago in the Mediterranean, were used as a case study to investigate the influence of island area, age, distance to the mainland, distance to the nearest island and land cover on: (1) species richness, (2) beta-diversity, and (3) variation in beta diversity for various arthropod groups. The influence of environmental variables on species richness was analysed using pair-wise correlations and the General Dynamic Model proposed by Whittaker, Triantis and Ladle, with two mathematical implementations. These analyses allowed the calculation of equilibrium value of species richness and equilibration time for each group. As regards the analysis of beta-diversity, the use of different animal groups in the same archipelago allowed the development of two complementary approaches based on Canonical Correspondence Analysis - a 'taxon-focused' and an 'island-focused' approach - to elucidate, respectively, how different taxa respond to the same environmental factors, and which factors are mainly responsible for the composition of the faunas of a certain location. Finally, to analyse the influence of different environmental factors in determining variations in beta-diversity, three hypotheses were formulated: the target-area-distance effect, stepping stone dispersal and island age. Matrices of inter-island dissimilarities were constructed under each hypothesis and correlated with matrices of faunal dissimilarities using Mantel tests. Inter-island distances had a significant role in determining patterns of beta diversity in most invertebrates. For several groups even relatively short distances preclude animals from colonizing an island regularly from the mainland, and most colonization probably results from inter-island faunal exchanges. All these results indicate that the origin of most of the Aeolian invertebrate fauna is quite recent, and species appear to have established on the islands predominantly by stepping stone dispersal. Tempos and modes of colonization varied among groups, depending on their dispersal ability and ecological needs. As further studies on other islands become available, comparative analyses will confirm whether the factors influencing variations in beta diversity in this study and their relationships with species dispersal ability are consistent across scales and geographical context.

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**THE ROLE OF FORGOTTEN SEAMOUNTS IN SHAPING  
THE MACARONESIAN RELICT LAUREL FOREST**

**José María Fernández-Palacios**

Island Ecology and Biogeography Research Group, La Laguna University, Canaries, Spain

The important development achieved in the last years by the sea floor mapping and the seamounts-dating technology has enabled the reconstruction, albeit still with a high degree of uncertainty, of the geologic history of the Eastern Central Atlantic Ocean during the Cenozoic. Today we know that as early as 60 My BP there were already some volcanic islands (PalaeoMacaronesia) in this region, located much closer to the mainland than today's extant archipelagos, reflecting the long-lasting activity of The Madeiran and The Canarian volcanic hot-spots. Many of these palaeoislands, now submerged as guyots (flat-topped seamounts) due to erosion and sea floor subsidence, still retain summits less than 120 m below the sea level, which enabled them to emerge during the Pleistocene sea level regressions and act as stepping stones. The present essay tries to vindicate the important role played by these palaeoislands both in the long-distance Europe-North America Trans-Atlantic dispersal of tropical taxa between 40 and 25 My BP, after the closure of the North Atlantic (Scotland-Greenland) corridor, as well as in their role in the colonization of the present archipelagos by palaeoendemics species, especially those constituting the Macaronesian relict laurel forest, an impoverished remnant of the South Europe and North Africa palaeotropical flora.

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**ORIGIN AND EXTENT OF THE INFESTATION BY THE WEST INDIAN DRYWOOD TERMITE  
*CRYPTOTERMES BREVIS* (WALKER) IN THE AZORES ISLANDS**

**Maria Teresa Ferreira**

Fort Lauderdale Research and Education Center, University of Florida, USA

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal.

The West Indian drywood termite *Cryptotermes brevis* (Walker) is a serious urban pest that causes great damage to wood structures and furniture. It was first identified as a pest in the Azorean Island of Terceira in the year 2000. It has since been found infesting buildings and furniture in the Islands of São Miguel, Santa Maria, Faial, and São Jorge. In order to study the

origin of this infestation in the Azores, samples of termites were collected from four different islands in the Azores during the summer of 2009. These samples were brought to the University of Florida laboratories where the DNA was extracted and both mitochondrial and nuclear genes were used to assess differences between the Azorean populations and the endemic populations of Chile and Peru. Furthermore these were also compared to populations from South Florida.

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## **NATURAL AZOREAN FORESTS: CONSERVING A WEALTH OF BRYOPHYTES**

**Rosalina Gabriel**

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal.

The natural forests of the Azores are some of the most interesting European forests due to their rich and diverse flora, which includes endemic as well as relict species. Bryophytes are the most diverse component of the flora. In fact, the study of Terceira Island's natural fragments revealed a remarkable wealth of species (n=106), making bryophytes the most hyperdiverse group of this native habitat. Among the species found, there were 41 mosses, 64 liverworts and one hornwort. All of the examined substrata (*Juniperus brevifolia* and *Laurus azorica* barks, soil and rock), are very rich both in number of species (some 30 x 30 cm quadrats revealed 25 species!) and in cover areas (which may be higher than 100%), however there are few specialists, and the differences among the four substrata are more in terms of dominance of species than in terms of species composition. A quantitative analysis of the vegetation environment relationships consistently showed that the distributions of the native forest bryophytes and lichens of Terceira are governed by a complex set of factors related to water availability, the status of the substrata and the influences of the vascular plant community. Almost a third of the identified species (n=32), are of conservation concern in Europe according to the European Red List of Bryophytes and the luxuriant presence of these bryophytes support the idea that the native forest fragments should be given full recognition as protected areas.

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## **BEYOND NATURAL FORESTS: WHAT OTHER HABITATS CAN TELL US ABOUT ARTHROPOD DIVERSITY AND CONSERVATION IN THE AZORES?**

**Clara Gaspar**

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal.

More than 10 years of intensive studies in the Azorean natural forests have offered valuable insights on the general diversity and distribution patterns of arthropods in this habitat. Still, important questions remain unanswered regarding the contribution and the impact of arthropod

communities from different land-uses to the overall diversity of the region. In the last years, the standardised methods previously applied to the natural habitats were extended to other land-uses: exotic forests, semi-natural and intensively managed pastures. Pitfall, beating and/or sweeping methods were conducted in more than 48 transects outside natural forests on Flores, Faial, Terceira and Sta. Maria islands. An extensive standardised database of arthropods covering four different land-uses/habitats in four islands of the Azores is now available. Data from vascular plants, climate and land-use are being crossed with arthropod data to: a) understand the overall distribution and the effective contribution of each habitat to the regional diversity; b) unravel the effects of land-use change on arthropod diversity and distribution; and c) propose, to stakeholders and managers, strategies for arthropod conservation planning and sustainable management of different land-uses (including the recently established Island Nature Parks) by maintaining the ecosystem services and preserving the arthropod diversity. Preliminary analyses on Terceira island using pitfall samples, suggest that exotic forests and semi-natural pastures may act as corridors between natural forest fragments for endemic and native species. These results and other patterns are now being tested with the larger, standardised database available.

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## **FRECUENCIA Y CAUSAS DE RAREZA DE BRIÓFITOS EN ISLAS MACARONÉSICAS**

**Juana Maria González-Mancebo**

Dep. of Biology, University of La Laguna, Canary Islands, Spain

Macaronesia (Azores, Madeira, Salvajes, Canarias y Cabo Verde), ha sido reconocida como una unidad biogeográfica diferenciada, asociada a la evidencia de que, al menos parte de su flora, constituye un relictos de la flora subtropical ampliamente distribuida en el terciario en toda la cuenca mediterránea, llegando incluso a latitudes más septentrionales. Sin embargo, la posición latitudinal en la que se encuentra cada uno de estos archipiélagos, así como sus propias características, condicionan diferencias importantes en el espectro biogeográfico de su brioflora. Esto puede influir no sólo en los principales modelos de distribución y abundancia de las especies en cada archipiélago, sino también en las causas de rareza de las especies, que como veremos no siempre están relacionadas con factores antrópicos. El estudio de las causas de rareza de las especies de briófitos en relación con diferentes factores como, requerimientos de hábitat, estrategia de vida o biogeografía, nos permite analizar las principales diferencias entre los tipos de rareza de distintas islas macaronésicas y responder a preguntas como:

1- ¿Está la rareza aleatoriamente distribuida en las islas, o depende de otros factores, como el tipo de hábitat?

2- ¿Los diferentes tipos de rareza varían dependiendo de las islas o de los pisos bioclimáticos?.

3- ¿Cómo se distribuyen las especies raras en las islas?.

4- ¿ Está correlacionada la rareza con variaciones en la estrategia de vida (en términos de longevidad, capacidad de dispersión y forma de crecimiento) el tipo de hábitat o las afinidades biogeográficas?.

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### **SPATIAL VARIATION OF AZOREAN ARTHROPODS SPECIES RICHNESS:**

**USING RECENT ADVANCES IN SAR MODELLING FOR A BETTER KNOWLEDGE AND CONSERVATION IN THE AZORES**

**François Guilhaumon**

Laboratoire Ecosystèmes Lagunaires, Centre National de la Recherche Scientifique- Université Montpellier, France

The species-area relationship (SAR) is fundamental to the present understanding of many key and high profile issues in theoretical ecology and conservation biology. For example this fundamental tool is used to estimate broad patterns of diversity when regions differ in area and predict species extinctions rates after habitat loss. This project will use available datasets from the Azorean Biodiversity Group and recent methodological advances in SAR modelling developed by the research fellow. The goal of the project is to build a relevant framework to evaluate and compare habitat size effects on the species richness of native versus exotic free-living herbivore insects and predatory spiders. We anticipate the results to provide an advanced SAR modelling machinery crucial for both theoretical and conservation applications in the Azores.

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### **HOW LOCAL ARE LOCAL COMMUNITIES? THE IMPORTANCE OF THE SPECIES POOL IN THE DIVERSITY AND ECOLOGY OF LOCAL ASSEMBLAGES**

**Joaquín Hortal**

NERC Centre for Population Biology, Imperial College London, UK

The origin and nature of ecological communities is a key question in ecology. A large amount of evidence leads to the current paradigm of communities being a random assortment of the species present in the regional pool, rather than fully coherent entities. If local communities were a mere aggregate of co-occurring species, their diversity and structure would be

determined by their regional species pool (i.e., all the species that could be able to colonize the locality) rather than by deterministic processes dependent on the ecological interactions among species. However, species do interact locally, and their presence, abundance and role in the ecosystem depend at least in part of these interactions. Thus, identifying how much of local assembly processes relies on either unconstrained colonization from the regional pool or local processes (e.g. interactions among the species, area limitations) is key to understand what determines the structure and functioning of communities. I will review the current evidence on the relative importance of local and regional effects on the communities, coming from both large-scale studies involving many local communities and analyses of the relationship of single communities with their species pool. Then I will discuss how geographical variations in the species pool, large-scale environmental gradients, and local environmental factors interact to affect local communities. Finally, I will discuss how the local and regional perspectives on diversity can be reconciled in a reformulation of community ecology that explicitly accounts for the importance of the species pool in the local ecological processes.

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## **ARTHROPOD BIOINDICATORS AS A BIOLOGICAL TOOL TO ASSESS ANTHROPOGENIC IMPACTS IN AZOREAN ECOSYSTEMS' BIODIVERSITY**

**José A. P. Marcelino**

Departamento de Biologia, Universidade dos Açores, Portugal

The critical importance of preserving biodiversity is currently widely recognized, however, the increasing demand for arable land has drastically altered biotic assemblages in the Azores archipelago. Because of their isolation, islands are particularly sensitive to biodiversity loss, this in turn renders them less resilient to invasion stress. In the ongoing multi-year project described herein we have surveyed the arthropod fauna in eight ecosystem types, representing a gradient of anthropogenic impact, on 5 islands of the archipelago. Our primary goal is to test the correlation between species diversity and degree of anthropogenic disturbance through the use of bioindicator species, and concomitantly determine intra and inter-island genetic diversity of some endemic species, as a measure of their adaptability resilience to ecosystem impacts. All available strata per ecosystem type were sampled. Accumulation curves show that despite this degree of sampling we have yet to reach a plateau for arthropod richness. Preliminary nestedness temperature of presence-absence matrices ( $T=9.6$ ) indicates a non-random distribution of species along the gradient. Non-metric Multi-Dimensional Scaling (MDS) for community composition across the gradient reveals a clear differential abundance of species between natural and artificial habitat types, with ubiquitous artificial ecosystems (ie, *Cryptomeria* production forest) showing a disquiet depauperate biodiversity trend, in opposition to pristine forest. Preliminary molecular analysis for *Collembola* spp. using 1600bp of COI shows that *Heteromurus major* has a discrete biogeographic pattern and isolation by distance indicating a

likely endemic species. Molecular data suggests that this species was able to take advantage of the change in habitat (resulting from landscape fragmentation and pastures) thus, possessing valuable adaptive resilience characteristics. We believe data from this project can contribute for the sustainable management of the insular agro-and-pristine ecosystems of the Azores. This is necessary to insure the continued economic, ecological and tourist value of major terrestrial habitat types of this archipelago.

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## **CHANGES IN THE BIOTA OF CANARY ISLANDS DUE TO GLOBAL WARMING**

**José Luis Martín Esquivel**

Servicio de Biodiversidad, Consejería de Medio Ambiente y Ordenación Territorial, Gobierno de Canarias, Canarias, España

The global warming is one of the main environmental global problems, not only because it affects directly to the human populations but also because it is connected with the losses in biodiversity in many regions of the world. Although it is perceived with main intensity in the poles, also is notorious in lower latitudes. In the Canary Islands, the climate is strongly influenced by the North Atlantic Oscillation (NAO) -the anticyclone of the Azores- which is responsible of the mild climate of the Archipelago, instead the aridity that would correspond by latitude. However, one of the changes observed in recent decades is the shift of the NAO, which implies a higher frequency of east winds. The implication for biodiversity is that now, many African species reach the islands more easily than in the past. The local climate is also changing, in recent decades the average temperature has increased on terrestrial and marine areas, and the humidity has growing slightly in the lowlands. The forecasts of climate models indicate increases in this century of up to 6 ° C in some areas, such as those above 2,000 m above sea level of the higher islands. The variation in the composition of biota in the last years reflects these changes and the number of species coming from warmer territories is increasing dramatically, mainly in groups like the flora, birds and fishes, where many species move more freely than before. For these groups, global warming and globalization of transport is a powerful engine for the biotic homogenization. The Natural habitats are also susceptible to changes in their distribution, in fact, recent predictions for some of the islands of Tenerife and Gran Canaria show as the forest habitats surface could be strongly reduced. In areas where forests occupy the summits, as in the mountains of Anaga (Tenerife), the loss may be complete, meaning that extinctions may be significant if we consider the high degree of local endemism of its biota.

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**APLICAÇÃO DE FUNGOS MICORRÍZICOS ARBUSCULARES NATIVOS DOS AÇORES NO  
CONTROLO DE NEMÁTODOS ENDOPARASITAS FORMADORES DE GALHAS (*MELOIDOGYNE  
JAVANICA*)**

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Os fungos micorrízicos arbusculares (FMA) desempenham um papel crucial na sustentabilidade dos sistemas agrícolas e naturais. Os FMA colonizam as raízes e a rizosfera de 85% das plantas herbáceas incrementando o seu desenvolvimento, produtividade e resistência ao stress ambiental e aos agentes patogénicos. O arquipélago dos Açores tem uma extensa área de pastagem (intensiva e natural). Os nemátodos galhadores têm vindo afectar não só a produtividade de culturas hortícolas, como também a de culturas forrageiras. No entanto, o potencial da aplicação de FMAs nativos dos Açores no controlo de nemátodos e aumento da produtividade nunca foi investigado até à data. Foi desenvolvido um estudo para avaliar a capacidade dos FMA em reduzir a infecção e reprodução de nemátodos em *Holcus lanatus*. Na ilha Terceira, a diversidade das comunidades de FMA foi estudada em pastagens semi-naturais e intensivas. Nestes 2 sistemas procedeu-se à recolha de amostras de solo, para a instalação de culturas experimentais que permitiram a esporulação das espécies presentes em cada sistema de uso de solo e, conseqüentemente a sua identificação a partir de técnicas moleculares (PCR/Sequenciação). Verificou-se que a inoculação de FMA (*G. mosseae*, *G. intraradices*, *G. claroideum*, *G. microaggregatum* e *G. etunicatum*) teve um efeito significativamente positivo no controlo dos danos causados por *M. javanica*, assim como no crescimento da própria planta. Estes resultados revelam-se promissores para a aplicação no futuro de FMAs, não só no aumento da produtividade dos sistemas agrícolas como também na protecção contra factores bióticos e abióticos.

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**DIVERSITY OF ISLAND VOICES - EDUMAR: PERSPECTIVES ABOUT THE SEA IN THE  
AZORES AND NEWFOUNDLAND, CANADA**

**Alison Neilson**

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal.

Alison will discuss EDUMAR, a research project of the Biodiversity Group. This work emerges from the perspective that research has implications which can serve or hinder environmental and social justice within sustainable development. Who we listen to and how we listen are

important to what narratives are highlighted through research. This study involves local residents as well as international tourists and people in the marine tourism industry and marine sciences in the Azores, Portugal in comparison with Newfoundland, Canada. This study about perceptions of the ocean explores whose voices provide the driving force for education and conservation. It also looks at the dynamic nature of socio-environmental heritage as it responds to changes in work, play and politics. Using various interview techniques including photo elicitation and focus groups, we gather rich narratives of visiting, living near and working in the sea. Multiple frames of lived experiences, ethics and politics support the narratives told. Some frames support the perceptions of diverse groups of people, while others privilege the stories of only a few. This study explores local power dynamics and global forces by asking about the ways in which people have learned about the ocean as well as how people decide what is relevant to their learning and what is important to sustain.

### **LAVA TUBES IN THE AÇORES AND HAWAII**

#### **HARBOR ABUNDANT NOVEL BACTERIAL DIVERSITY**

Jennifer J. M. Hathaway<sup>1</sup>, Matthew G. Garcia<sup>1</sup>, Monica Moya<sup>1</sup>, Michael N. Spilde<sup>2</sup>, Fred D. Stone<sup>3</sup> Maria de Lurdes N. E. Dapkevicius<sup>4</sup> & **Diana E. Northup**<sup>1\*</sup>

(<sup>1</sup>) Department of Biology, University of New Mexico, USA; (<sup>2</sup>) Institute of Meteoritics, University of New Mexico, USA; (<sup>3</sup>) University of Hawaii at Hilo, and Bishop Museum, Honolulu, USA; (<sup>4</sup>) CITA-A (Grupo da Nutrição), Universidade dos Açores, Portugal

Lava tubes in the Açores and Hawai'i host extensive, colorful microbial mats. Previous studies of the bacteria inhabiting these mats are rare and utilized traditional microbiological culturing, which misses much of the diversity present. We have undertaken a culture-independent study of white and yellow colored mats in the Açores and Hawai'i and tested the hypothesis that these differently colored mats will differ in species composition. We also wished to begin to elucidate the environmental controls on microbial diversity in the subsurface. White and yellow microbial mats were collected from four lava tubes from the Azorean island of Terceira and from four lava tubes on the Big Island of Hawai'i. Scanning electron microscopy of mat samples showed similarities and differences between Azorean and Hawaiian mat microorganisms. To assess the species composition of the bacterial mats, we extracted DNA from samples collected aseptically and preserved in sucrose lysis buffer. The 16S rRNA gene was amplified, purified, and sequenced in order to determine the diversity within these caves. PCA analysis conducted in UniFrac showed that geographical location was the major contributor to differences in community structure. Fifteen phyla were found across the samples, with notable differences in the number of clones retrieved from phyla at any given location. More *Actinobacteria* clones were retrieved from Hawaiian communities, while more *Alphaproteobacteria* clones were found

in Azorean communities. The *Actinobacteria* exhibited considerable novel diversity, with several distinct novel clades.

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## **TERMITE INFESTATION RISK IN PORTUGUESE BUILDINGS**

**Lina Nunes**

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Termites can cause damage to living trees and many crop plants, but the fact that they can use dead wood makes them a major pest for timber used both outdoors and inside buildings. In Portugal and in other termite-infested areas of Europe, considerable problems have already been reported and there is a clear trend of increasing infestations. In mainland Portugal, subterranean termites of the genus *Reticulitermes* are indigenous and a well-established pest of wood in service. This has particular relevance in the maintenance of historic buildings. Dry wood termites of the genus *Cryptotermes* are now also recognized as a major problem in the conservation of old buildings in the islands of Madeira and in several of the Azorean Islands. The present recorded distribution of dry wood and subterranean termites in Portugal is discussed. The very recent discovery of *Cryptotermes brevis* in Lisbon is highlighted and the possible impacts of this finding discussed.

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## **THE CANARIAN INSECTS AND THEIR KIN: INSULAR EVOLUTION AND PHYLOGEOGRAPHY**

**Pedro Oromí**

Dep. of Biology, University of La Laguna, Canary Islands, Spain

The Canary islands form an archipelago very peculiar among those of oceanic origin, mainly due to its proximity to the mainland (only 100 km from the easternmost island to NW Africa) and for its prolonged geological history (maximum ages of the islands from 22 to 1 My). These features have allowed high natural immigration rates of continental animal species, thus having relevant primary species diversity. The allopatric conditions in seven islands independent to each other since their beginning, combined with their remarkable ecological diversity due to elevated altitudes in small areas, have greatly promoted processes of insular evolution, thus enriching the local fauna with abundant endemisms. The species radiation among arthropods is very noticeable (43 genera including more than 10 endemic species) which is an excellent material to study the evolutionary processes occurred so far. Along the last 15 years abundant phylogenetic and phylogeographic studies have been accomplished to explain the possible

ways of diversification in the Canary Islands, mainly using molecular genetics applied to many cases of evolutive radiation. A compilation of such studies carried out so far are here presented, pointing out not only the high diversity of the arthropod fauna, but also the existence of a variety of biogeographic patterns.

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### **USE OF SEMIOCHEMICALS IN BIODIVERSITY STUDIES**

**Maria Rosa Paiva, Artur Santos & Eduardo Mateus**

DCEA, Faculty of Sciences and Technology, Universidade Nova de Lisboa, Portugal

Living organisms functions are ruled by semiochemicals, olfactory communication being one of the most common mechanisms used, both at intra- and interspecific level, through the emission of pheromones, kairomones and allelochemicals.

At species level, blends of different substances are often required for receptor detection to be reached, some of which may be sequestered from the hosts of the sender. At community level, sympatric species such as scolytids in the Family Ipinae, may use semiochemicals denoting a scale of complexity, the evolutionary pathways of which are still poorly understood.

Recent advances in analytical technology, such as enantioselective gas chromatography (eGC), allow for the discrimination of species which are taxonomically closely related, like in the genus *Pinus*, based upon the emission of secondary metabolites, mainly terpenes. Furthermore, volatile emissions were statistically correlated with the degree of attack experienced by the different species

Fundamental questions such as “Which factors determine the existence of biodiversity rich and poor regions?”, or “Why is the coexistence of a large number of related species with narrow niches, possible in some habitats /regions and not in others?” still await to be answered. However, the study of semiochemical diversity, provides valuable information allowing for an insight into the evolutionary mechanisms that shape biodiversity.

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### **SCENARIOS FOR BIODIVERSITY CHANGE IN THE 21ST CENTURY**

**Henrique Miguel Pereira**

Center for Environmental Biology of the Faculty of Sciences of the University of Lisbon, Portugal

The Millennium Ecosystem Assessment and other recent studies have developed scenarios for the future of global terrestrial, freshwater and marine biodiversity. Here we revise the main

results of these scenarios and their implications for ecosystem services and human well-being. Terrestrial biodiversity will continue to be lost due to land-use change, and unless human population growth and consumption patterns are minimized, we may lose more than 20% of plant species by the end of the century. Freshwater systems are perhaps where biodiversity has been more threatened, mainly due to invasives, pollution and habitat fragmentation by dam construction. Climate change over this century and water withdrawal will further exacerbates the effects of these drivers. Marine biodiversity has been declining due to overfishing and unless better fisheries management is implemented worldwide, the growing demand for fish will bring many marine fisheries to collapse by 2050.

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## **FOREST INSECT GALLS DENSITY AND HERBIVORY DISTRIBUTION: CANOPY AND UNDERSTOREY COMPARISONS FOR PANAMA AND AUSTRALIA**

**Sérvio Pontes Ribeiro**

DEBIO/ICEB, Universidade Federal de Ouro Preto, Brasil

IBISCA project has developed a protocol for comparative analyses of vegetation and herbivory distribution between forest canopy and understorey. Gall-forming insects reach highest diversity on sclerophyllous vegetation, thus the upper canopies may represent a suitable habitat for gall-forming insects. At the San Lorenzo Protected Area, Panama, we estimated free-feeding herbivory and gall densities within five sites in 2003 and 2004, by surveying leaves in vertical and horizontal transects (canopy and understorey pin-transects). A second study was developed in the National Park of Lemington, Queensland, Australia, in 2006 and 2007, in a high altitude montane forest. Along an altitudinal gradient, four independent canopy pin-transects and one understorey pin-transect were sampled at 300, 700, 900, and 1100 metres. All same measurements were taken. In Panamá and Australia, leaf sclerophylly increased significantly with sampling height, while free-feeding herbivory decreased inversely. In Panamá, the number of live galls collected in the canopy was 13-16 times higher than in the understorey, a pattern consistent across sites and years. In contrast, both total and alive galls increased with canopy height for the Australian forest, while leaf-chewing decreased significantly, despite seasonal variation. Altitude had little effect on herbivory distribution. The probability of gall survivorship increased with increasing leaf sclerophylly as death by fungi, parasitoids or accidental chewing were greater in the understorey. The present work supports the existence of a global positive effect of sclerophylly on gall establishment and survivorship in the upper canopy of tropical forests, along with a decrease of other herbivory types in this habitat.

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## **ECOLOGY AND BIOGEOGRAPHY OF ISLAND PARASITOID FAUNAS**

**Ana M. C. Santos**

Division of Biology, Imperial College London, UK.

CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal.

Islands are effective natural laboratories for the study of evolutionary and ecological patterns. One of the consequences of their discrete and isolated character is that their biotas are both species poor and disharmonic compared to those of the mainland, usually with high proportions of endemic taxa. Individual organisms reaching islands are likely to face the absence of the ecological conditions where their source populations have evolved, and therefore must be able to cope with different resources if they are to survive. It therefore seems likely that generalists should be more likely to be successful in colonising islands. Parasitoid faunas are probably no exception to this, as preferred hosts of individuals arriving on islands may be absent: they must either attack less-preferred hosts, or fail to establish. Thus, one would expect species resident on islands to be more generalist (biased towards idiobiont species). Different approaches were used to understand the differences in host-parasitoid systems between islands and mainland, with special emphasis on the Ichneumonoidea. Specific questions addressed include: i) are island parasitoid faunas biased in favour of generalists?; ii) will hosts of more specialist parasitic wasps in islands be different from those on mainland?; iii) is the presence/absence of generalist/specialist species and the structure of parasitoid communities on islands affected by geologic, habitat and/or environmental characteristics of islands? A published database on the worldwide distribution of Ichneumonoidea was used in order to answer these questions at a large scale. But first, the reliability of using this database and of using archipelagos as distinct units in large-scale biogeographical studies was assessed. Patterns at a smaller scale were explored by conducting a field survey in the Macaronesian region, collecting both hosts and their parasitoids in several islands and the adjacent mainland, and identifying them by barcoding. Preliminary results show that island faunas host higher proportions of generalist species than adjacent mainland areas, and that this proportion is affected by some environmental factors and by the composition of the regional species pool.

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## **CHARACTERISTICS OF FLOWERING PLANT LINEAGES OF THE AZORES AND THE AZORES DIVERSITY ENIGMA**

**Hanno Schaefer**

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CITA-A (Azorean Biodiversity Group), Universidade dos Açores, Portugal.

Endemism in the flora of the Azores is high (33%) but in other respects, notably the paucity of evolutionary radiations and the widespread distribution of most endemics, the flora differs markedly from the floras of the other archipelagos in the Atlantic and elsewhere. We evaluate hypotheses to explain the distinctive patterns observed in the Azorean endemic flora. It seems that Island age, age of endemic lineages and ecological diversity considered individually cannot explain the lack of radiations and the widespread distribution of Azorean endemics. We suggest that palaeoclimatic variation, a factor rarely considered in macroecological studies of island diversity patterns, may be an important factor. Palaeoclimatic data suggest frequent and abrupt transitions between humid and arid conditions in the Canaries during the late Quaternary, and such an unstable climate may have driven the recent diversification of the flora by inter-island allopatric speciation, a process largely absent from the climatically more stable Azores. Further phylogenetic/phylogeographic analyses are necessary to determine the relative importance of palaeoclimate and other factors in generating the patterns observed.

**TERMITE DIVERSITY AND ISLAND ESTABLISHMENT OF EXOTIC SPECIES  
IN THE WEST INDIES**

**Rudolf H. Scheffrahn**

Fort Lauderdale Research and Education Center, University of Florida, USA

A comprehensive survey of the termites of the West Indies has recently been completed. A revisionary assessment of this fauna shows a lack of endemic genera on these islands although some genera, such as *Cryptotermes*, are very diverse and contain numerous island endemic species. Both overwater dispersal and vicariant interaction with Central America have shaped West Indian termite diversity. Unlike the other older Greater Antilles, the later-emerging island of Jamaica has no soil nesting higher termites. Trinidad and Tobago, part of South America during the Pleistocene, have a high percentage of non-insular termite diversity. Exotic termite establishments abound in the West Indies. Some invasive exotics including *Cryptotermes brevis*, described from Jamaica in 1853, and *Coptotermes gestroi* from Asia. A century after establishment, *C. gestroi* has saturated the island of Barbados. The structure-infesting arboreal species, *Nasutitermes corniger*, may have been spread recently from island to island. Curiously, Guadeloupe, in the Lesser Antilles, harbours two native African species thought to have become established during the slavery era.

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**BIODIVERSIDADE E MUDANÇA SOCIAL: UMA “PAISAGEM” COMPLEXA**

**Luísa Schmidt**

ICS-UL - Instituto de Ciências Sociais da Universidade de Lisboa, Portugal

Ainda há poucos anos, as questões da biodiversidade eram um assunto reservado a algumas elites científicas. Hoje o tema está presente em todos os programas e agendas políticas, o que não quer dizer na consciência pública. Se o quadro dos problemas que afectam a biodiversidade é dramaticamente reconhecido ao nível científico, o certo é que as suas implicações sociais ainda não se tornaram evidentes. A falta de informação e de conhecimentos por parte da opinião pública sobre esta matéria variam na razão inversa da demonstração científica da afectação dos recursos e dos seus limites. Já não é possível manter os níveis de crescimento económico baseados na exploração dos recursos naturais, nem há condições para expandir o modelo da sociedade de consumo ocidental tal como hoje o conhecemos. Esta situação requer um programa complexo: restaurar os sistemas naturais e mobilizar as sociedades para a mudança. Se o restauro dos sistemas naturais pode ser aventado na base do saber científico e tecnológico, já a mudança social - sobretudo num contexto de urgência e movida pelo voluntarismo (mesmo que esclarecido) - parece altamente problemática. A questão do tempo para acorrer aos problemas da biodiversidade é, pois, decisiva, devendo a urgência das questões da biodiversidade trazer autoridade e legitimidade às decisões políticas apoiadas nos cientistas e técnicos. Contudo, só uma democracia informada e participativa proporcionará a mudança de paradigma que as crises ambiental e da biodiversidade necessitam. Neste quadro de mudanças, será crucial a relevância do conhecimento científico integrado, tal como a necessidade de activação da cidadania e a abertura de novas vias de interacção cívica.

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## **AN OVERVIEW OF DEEP-SEA BIODIVERSITY IN THE AZORES IN THE CONTEXT OF CONSERVATION**

**Ricardo Serrão Santos et al.**

IMAR & Departamento de Oceanografia da Universidade dos Açores, Portugal.

The deep-sea is a major of the Azores in the Azores. Only around 1% of its EEZ is above 600 metres.

The most relevant and well known habitats are the seamounts, hydrothermal vent fields and the island slopes. The water column is also an important habitat of deep-sea pelagic deep-sea species. In this presentation I give an overview of the most representative aspects of the biodiversity of deep-sea habitats of the region of the Azores and the connection with surrounding areas. I will put in focus the main threats to deep-sea biodiversity and the context of its conservation.

## **A PRESENÇA DOS COCCINELÍDEOS EM DIVERSOS HABITATS: A FORMA COMO OCUPAM OS NICHOS E O SEU CONTRIBUTO PARA A BIODIVERSIDADE**

**António Onofre Soares**

Departamento de Biologia, Universidade dos Açores, Portugal

Os coccinelídeos predadores (Coleoptera: Coccinellidae) são, do ponto de vista biológico e ecológico, um importante, diversificado e bem estudado grupo de organismos. O facto destes ocuparem um lugar cimeiro nas cadeias tróficas de diversas comunidades bióticas de artrópodes e de, recorrentemente, se introduzir novas espécies em novos habitats para o controlo biológico de pragas agrícolas, eles constituem um óptimo modelo biológico para um olhar mais atento sobre a forma como os organismos ocupam os habitats, partilham os nichos ecológicos e interagem entre si. São vários os casos de espécies simpátricas que diferem na sua capacidade de interagir e utilizar os recursos alimentares, espaciais e temporais numa escala macro, ao nível de uma cultura e mesmo ao nível da planta. De um ponto de vista prático, em certas circunstâncias, estas diferenças permitem uma complementaridade no impacte que promovem sobre os herbívoros em particular sobre as pragas agrícolas.

## **EXTINCTION DEBT ON OCEANIC ISLANDS**

**Kostas A. Triantis**

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Oxford University Centre for the Environment, University of Oxford, UK

Habitat destruction is the leading cause of species extinctions. However, there is typically a time-lag between the reduction in habitat area and the eventual disappearance of the remnant populations. These 'surviving but ultimately doomed' species represent an extinction debt. Calculating the magnitude of such future extinction events has been hampered by potentially inaccurate assumptions about the slope of species–area relationships, which are habitat- and taxon- specific. We overcome this challenge by applying a method that uses the historical sequence of deforestation in the Azorean Islands, to calculate realistic and ecologically-adjusted species–area relationships. The results reveal dramatic and hitherto unrecognized levels of extinction debt, as a result of the extensive destruction of the native forest: more than 95%, in less than 600 years. Our estimations suggest that more than half of the extant forest arthropod species, which have evolved in and are dependent on the native forest, might eventually be driven to extinction. Data on species abundances from Graciosa Island, where only a very small patch of secondary native vegetation still exists, as well as the number of species that have not been found in the last 40 years, despite the extensive sampling effort, offer support to the

predictions made. We argue that immediate action to restore and expand native forest habitat is required to avert the loss of numerous endemic species in the near future.

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## **WHAT CAN THE STUDY OF ISLAND SPECIATION TELL US ABOUT DISPERSAL AND EVOLUTIONARY RATES IN EARLY LAND PLANTS?**

**Alain Vanderpoorten**

Belgian Funds for Scientific Research at University of Liège, Institute of Botany, Belgique

Recent advances in phylogenetics and, in particular, molecular dating, indicate that transoceanic dispersal has played an important role in shaping plant and animal distributions, obscuring any effect of tectonic history. Taxonomic sampling in biogeographic studies is, however, systematically biased towards vertebrates and higher plants and the possibility remains that a much stronger signature of ancient vicariance might be evident among other organisms, particularly among basal land plants. In fact, analyses of worldwide bryophyte distribution patterns contrast with the idea that, in spore-dispersed organisms, dispersal obscures evidence of vicariance. Extant species distribution patterns, which at first sight are congruent with the expectations of the continental drift theory, may, however, conceal a complex mixture of relictual distributions and more recent dispersal events, making it necessary to set vicariance events within an explicit time frame. The scarcity of the fossil record in non-vascular organisms like bryophytes hampers, however, the possibilities of calibration of the molecular clock. Even when fossils exist, their use to calibrate phylogenetic trees is limited because their morphology often does not allow for their definitive placement in the phylogeny, hence increasing the error associated with the estimate of the divergence dates. In this context, calibration dates derived from major geological events assumed to have been responsible for lineage divergence, and the use of island neo-endemic speciation events in particular, appears as a promising alternative possibility. Therefore, island biogeography provides the appropriate framework for describing and understanding evolutionary patterns and processes in bryophytes and in particular, the significance of dispersal and cryptic diversification.

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## AND ITS APPLICATION TO MACARONESIA

Robert J. Whittaker

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Oceanic islands have played a central role in our understanding of the distribution and origins of life on Earth, as exemplified by key contributions from Charles Darwin, Joseph Hooker and Alfred Russel Wallace in the 19<sup>th</sup> Century, and Robert MacArthur & Edward Wilson in the 20<sup>th</sup> Century. The dominant paradigm of the last 40 years in island biogeography has been the dynamic equilibrium model put forward by Robert H. MacArthur and Edward O. Wilson. This simple macroecological model describes ecological dynamics with reference to the three fundamental biogeographical processes – speciation, (im)migration and extinction – accounting for the persistence of the model as a conceptual framework even though it often fails to satisfy empirical testing. In this presentation I argue that the applicability of these simple models varies as a function of both the spatial scale of the island system and the temporal scale of its dynamics. I illustrate these points with reference both to near-shore systems of fast ‘ecological’ dynamics, such as the Krakatau Islands, and remote systems of slow ‘evolutionary’ dynamics, such as the Macaronesian Islands. By incorporating the long-term dynamics of island environments into a new general dynamic model for oceanic islands, Whittaker, Triantis and Ladle (2008, in *Journal of Biogeography*) have recently shown how several new sets of predictions can be generated from this macroecological approach – predictions concerning both numbers of endemics and the phylogenies of island lineages. I will conclude this presentation by reviewing the results derived from tests of these predictions to date.

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### **Estratégias para a conservação e recuperação da Biodiversidade dos Açores**

**Frederico Cardigos**

Direcção Regional do Ambiente, Governo Regional dos Açores.

Em final do Ano Internacional da Biodiversidade, em jeito de súmula das actividades efectuadas, o departamento do Governo dos Açores com a missão de proteger a diversidade biológica do arquipélago, faz uma apresentação das actividades realizadas em 2010. Estas actividades tiveram três eixos de actuação: 1. Conservação, 2. Recuperação, e 3. Promoção.

De uma forma geral, a **Conservação** é feita através de acções que tenham influência directa na protecção e valorização das espécies e habitats pertencentes ao património natural. Serão dados como exemplos a implementação dos Parques Naturais de Ilha e algumas das

actividades por si promovidas: o combate à flora invasora e a luta contra a alga *Caulerpa webbiana*.

A **Recuperação** integra um conjunto de actividades específicas tendentes a melhorar, directa ou indirectamente, os efectivos de uma espécie do património natural que esteja em perigo. Serão dados os exemplos do priolo, do cagarro e da *Veronica dabneii*.

O Governo dinamiza diversas acções de **Promoção** da biodiversidade quer pela disponibilidade da informação que pela implementação de actividades que valorizam as espécies endógenas. Serão dados os exemplos das Ecoescolas, o GeoParque dos Açores, os Trilhos pedestres e as marcas específicas como “O Priolo agradece” e a “Biosfera Açores”. Espera-se que as acções promocionais tenham efeitos positivos na biodiversidade dos Açores, incluindo a aceitação do investimento efectuado na Conservação e Recuperação de espécies e habitats.

O sucesso crescente e a adesão de diversas instituições públicas e privadas a temas relacionados com a biodiversidade e o reconhecimento da sua importância coloca este tema como um dos valores universais. Talvez este seja o melhor resultado das actividades realizadas durante o presente ano.