



Investigaciones Científicas Ambientales 2022-2023: aportes para la toma de decisiones



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INTRODUCCIÓN

La Política Nacional del Ambiente (PNA) al 2030 identifica como problema público la disminución de los bienes y servicios que proveen los ecosistemas, los cuales afectan el desarrollo de las personas y la sostenibilidad ambiental. Entre las causas indirectas de este problema destaca el insuficiente conocimiento tecnológico y científico ambiental para la gestión ambiental, la innovación y el desarrollo sostenible, así como la inadecuada gestión de la información ambiental para la toma de decisiones.

En respuesta a este desafío, el MINAM ha impulsado el desarrollo de la Agenda de Investigación Ambiental (AIA) al 2030, con objetivo de articular la investigación científica y la política pública, generando evidencia que sustente las políticas y la toma de decisiones, abordando así las necesidades ambientales identificadas en la PNA al 2030.

En este contexto, el MINAM ha elaborado la segunda edición del compendio *Investigaciones científicas ambientales 2022-2023: aportes para la toma de decisiones*, que reúne 235 publicaciones científicas ambientales realizadas o promovidas por los Institutos Públicos de Investigación (IPI) adscritos al MINAM. Entre ellos se encuentran el Instituto de Investigaciones de la Amazonía Peruana (IIAP), el Instituto Geofísico del Perú (IGP), el Servicio Nacional de Meteorología e Hidrología del Perú (Senamhi) y el Instituto Nacional de Investigación en Glaciares y Ecosistemas de Montaña (Inaigem). También incluye aportes del Servicio Nacional de Áreas Naturales Protegidas por el Estado (Sernanp) y el Organismo de Evaluación y Fiscalización Ambiental (OEFA).

El presente compendio está organizado según los ejes temáticos de la AIA al 2030. En ese sentido, muestra los avances en la generación de conocimiento del sector ambiental en relación con los ejes temáticos de conservación de las especies y la diversidad genética (116), gestión de riesgos y adaptación al cambio climático (76), deforestación y degradación de los ecosistemas (16), reducción de emisiones de gases de efecto invernadero (11), calidad ambiental (9), economía circular y cadenas productivas sostenibles (2), gobernanza ambiental (4), y gestión integrada de los recursos naturales (1).

El MINAM agradece a los organismos adscritos que participaron en la elaboración de este compendio, un esfuerzo que refleja su compromiso conjunto con la generación de nuevo conocimiento. Este documento, además de reafirmar dicho compromiso, se presenta como una herramienta clave para tomadores de decisiones, investigadores y el público en general, al proporcionar evidencia científica sólida y actualizada que respalda la formulación de políticas públicas y la implementación de acciones que contribuyan al desarrollo sostenible.



Calidad ambiental

$^{240}\text{Pu}/^{239}\text{Pu}$ signatures allow refining the chronology of radionuclide fallout in South America

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Instituto Geofísico del Perú

Abstract

Atmospheric nuclear tests (1945–1980) have led to radioactive fallout across the globe. French tests in Polynesia (1966–1974) may influence the signature of fallout in South America in addition to those conducted by USA and former USSR until 1963 in the Northern hemisphere. Here, we compiled the $^{240}\text{Pu}/^{239}\text{Pu}$ atom ratios reported for soils of South America and conducted additional measurements to examine their latitudinal distributions across this continent. Significantly lower ratio values were found in the 20–45° latitudinal band (0.04 to 0.13) compared to the rest of the continent (up to 0.20) and attributed to the contribution of the French atmospheric tests to the ultra-trace plutonium levels found in these soils. Based on sediment cores collected in lakes of Chile and Uruguay, we show the added value of measuring $^{240}\text{Pu}/^{239}\text{Pu}$ atom ratios to refine the age models of environmental archives in this region of the world.

Enlaces: <http://hdl.handle.net/20.500.12816/5370>

<https://doi.org/10.1016/j.scitotenv.2022.156943>

Determination of atmospheric aerosol components in an urban area to evaluate the air quality and identify the sources of contamination

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

The need to generate objective evidence and reliable information for decision makers to improve environmental policies for a better air quality, led us to evaluate the atmospheric aerosol components in the urban area of Carabayllo, by monitoring $PM_{2.5}$ and PM_{10} to determine mass concentration and analyzing PM_{10} using k_0 -INAA and ICP-MS for metals quantification, ion chromatography for anions and the NIOSH method to determine organic and elemental carbon. The results obtained from mass concentration of $PM_{2.5}$ and PM_{10} exceeded the permissible breathing annual average of WHO guidelines of $15 \mu g m^{-3}$ and $45 \mu g m^{-3}$, respectively, which evidence an unhealthy air quality. Likewise, using the model Positive Matrix Factorization five sources of pollutants were defined: metallurgical industry, sea salt, industrial activity, dust and non-exhaust emissions and vehicle emissions.

Enlaces: <https://doi.org/10.1007/s10967-023-08805-8>

<https://hdl.handle.net/20.500.12542/3004>

Heavy metals and ecological alterations resulting from wastewater discharge in Inner Puno Bay, Lake Titicaca

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Organismo de Evaluación y Fiscalización Ambiental

Abstract

Wastewater continuously affects lacustrine ecosystems, such is the case of Lake Titicaca, the highest navigable lake in the world. To assess this impact, the concentration of heavy metals in water and sediment samples, physicochemical parameters, and the diversity of phytoplankton were evaluated in locations near the wastewater effluent. With the data on heavy metals in sediments, the Individual Potential Risk Factor Index (E_r^i) was assessed and the analysis of Potential Ecological Risk was conducted (PERI). The results revealed that pH, BOD₅, NAMO and Phosphorus exceeded the limits established by Peruvian law. Additionally, we identified 14 metal elements in surface water samples; with a positive correlation between these metals and the sampling point (4), as well as total suspended solids (TSS). In the sediment samples, 35 different metal elements were detected. Specifically, point 4 showed the highest metal contamination levels, while point 9 exhibited the lowest levels. The (E_r^i) in sediments demonstrated that the concentration of cadmium (57.6) represents a moderate risk, while zinc represents the lowest risk (0.0); regarding the PERI, the sampling point closest to the discharge point (4) showed a moderate risk of contamination (113.48), and the point 9 represents the lowest value (14.68); reflecting that sewage affects water quality, negatively impacting phytoplankton diversity. Additionally, the As, Cu, Hg and Pb exceeded the limits set by regulations. Regarding phytoplankton diversity, generally low diversity values were recorded compared to other areas of the lake, with the species *Oocystis* sp. and *Aulacoseira* sp prevailing in most of the sampling points. Therefore, urgent measures are needed to remedy the situation in the Inner Puno Bay (IPB) of Lake Titicaca.

Enlace: <https://doi.org/10.1016/j.enmm.2023.100903>

High incidence of plastic debris in Andean condors from remote areas: Evidence for marine-terrestrial trophic transfer

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Servicio Nacional de Áreas Naturales Protegidas por el Estado



Abstract

Plastic pollution is an alarming environmental problem affecting diverse species worldwide. Scavenging birds are currently exposed to plastic due to contamination of their food sources. Here, we evaluated the ingestion of plastic by a threatened top scavenger, the Andean condor (*Vultur gryphus*), and the potential origin of the plastic. We analyzed the biotic (organic items from the diet) and abiotic (synthetic material) composition of regurgitated pellets in two remote areas of Peru associated with protected areas: a marine-coastal region and an Andean region. Condors consume mainly Pinnipeds and South American camelids in the marine-coastal region, and camelids and livestock in the Andean region. We found different sizes and varieties of plastic debris, with a very high frequency of occurrence (85–100%) of microplastics in pellets of both areas studied. The occurrence of microplastics differed between sites; although very high in general, the rate of occurrence and density were higher in the marine-coastal region. We also confirmed that carcasses consumed by condors in both study areas were contaminated with plastic. Therefore, plastic in Andean condors is most probably acquired through the food web in both the marine and terrestrial environments. Andean condors from Peru are highly contaminated with plastic, which may affect their health, population dynamics, and conservation. Moreover, as condors are apex scavengers, our results highlight the fact that plastic pollution in remote areas of Peru is present at different levels of the food web and in the environment. Urgent Action should be taken to reduce environmental contamination with this hazardous pollutant.

Enlace: <https://doi.org/10.1016/j.envpol.2022.120742>

Peces en peligro: revelando la diversidad oculta de una laguna vulnerable en la región Amazónica peruana

Fish at risk: unveiling the hidden diversity of a vulnerable lake in the peruvian Amazon region

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Resumen

El estudio se enfoca en la laguna Huachana, un ecosistema vulnerable en la región amazónica peruana, que recibe aguas residuales de la ciudad de Iquitos. A pesar de su importancia en la ictiología y su papel como localidad tipo para diversas especies, los cuerpos de agua cerca de Iquitos enfrentan amenazas. Si bien se conoce parte de la diversidad ictiológica en la región de Loreto, la cocha Huachana nunca había sido objeto de muestreo, lo que hace que este estudio sea el primero en examinar la diversidad de peces en este ambiente acuático. Se identificaron 52 especies de peces de 5 órdenes, 20 familias y 39 géneros. Los Characiformes presentan la mayor riqueza (30 especies), seguido por Cichliformes (12 especies). Cichlidae y Characidae son las familias más ricas en especies. Ninguna especie está en peligro según la IUCN, la mayoría se considera de preocupación menor. El estudio también identificó especies ornamentales y comerciales, proporcionando información crucial sobre la ictiofauna en zonas urbanas cercanas y su posible impacto ambiental a largo plazo. Preservar la laguna Huachana y ecosistemas similares en Loreto es crucial. Debemos monitorear los efectos potenciales de la urbanización y la contaminación mientras implementamos fuertes medidas de conservación para proteger la diversa ictiofauna y todo el ecosistema. Este estudio subraya la necesidad de tomar medidas proactivas urgentes para salvaguardar los entornos ecológicamente significativos de la región amazónica y sus especies únicas.

Abstract

The study focuses on the Huachana lake, a vulnerable ecosystem in the Peruvian Amazon region that receives wastewater from the city of Iquitos. Despite its significance in ichthyology and its role as a type locality for various species, water bodies near Iquitos face threats. While a portion of the ichthyological diversity in the Loreto region is known, the Huachana lake had never been subject to sampling, making this study the first to examine fish diversity in this aquatic environment. A total of 52 fish species from 5 orders, 20 families, and 39 genera were identified. The Characiformes presents the greatest species richness (30 species), followed by Cichliformes (12 species). Cichlidae and Characidae are the families richest in species. No species are endangered according to the IUCN; the majority are considered of least concern. The study also identified ornamental and commercial species, providing crucial information about ichthyofauna in nearby urban areas and its potential long-term environmental impact. Preserving Huachana Lake and similar ecosystems in Loreto is crucial. We must monitor urbanization and pollution's potential effects while implementing strong conservation measures to protect the diverse ichthyofauna and the entire ecosystem. This study underscores the need for urgent proactive steps to safeguard the Amazon region's ecologically significant environments and its unique species.

Enlace: <https://doi.org/10.24841/FA.V32I2.682>

Photochemical sensitivity to emissions and local meteorology in Bogotá, Santiago, and São Paulo: An analysis of the initial COVID-19 lockdowns

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Servicio Nacional de Meteorología e Hidrología del Perú

Abstract

This study delves into the photochemical atmospheric changes reported globally during the pandemic by analyzing the change in emissions from mobile sources and the contribution of local meteorology to ozone (O_3) and particle formation in Bogotá (Colombia), Santiago (Chile), and São Paulo (Brazil). The impact of mobility reductions (50%–80%) produced by the early coronavirus-imposed lockdown was assessed through high-resolution vehicular emission inventories, surface measurements, aerosol optical depth and size, and satellite observations of tropospheric nitrogen dioxide (NO_2) columns. A generalized additive model (GAM) technique was also used to separate the local meteorology and urban patterns from other drivers relevant for O_3 and NO_2 formation. Volatile organic compounds, nitrogen oxides (NO_x), and fine particulate matter ($PM_{2.5}$) decreased significantly due to motorized trip reductions. In situ nitrogen oxide median surface mixing ratios declined by 70%, 67%, and 67% in Bogotá, Santiago, and São Paulo, respectively. NO_2 column medians from satellite observations decreased by 40%, 35%, and 47%, respectively, which was consistent with the changes in mobility and surface mixing ratio reductions of 34%, 25%, and 34%. However, the ambient NO_2 to NO_x ratio increased, denoting a shift of the O_3 formation regime that led to a 51%, 36%, and 30% increase in the median O_3 surface mixing ratios in the 3 respective cities. O_3 showed high sensitivity to slight temperature changes during the pandemic lockdown period analyzed. However, the GAM results indicate that O_3 increases were mainly caused by emission changes. The lockdown led to an increase in the median of the maximum daily 8-h average O_3 of between 56% and 90% in these cities.

Enlaces: <https://doi.org/10.1525/elementa.2021.00044>

<https://hdl.handle.net/20.500.12542/3006>

Seasonal differences in trace metal concentrations in the major rivers of the hyper-arid southwestern Andes basins of Peru

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

The southern rivers of Peru originate in the Andes Mountains and flow in a southwestern direction to the Pacific Ocean through one of the most hyper-arid regions of the world. During each sub-equatorial summer from December to February, rains and snow melt in the Andes increase the streamflow in these rivers, even as they pass through the 100 km arid zone to the ocean. This study quantified seasonal dynamics of 34 trace metal elements (TM) and other constituent concentrations in four southern river basins of Peru (Chili-Quilca, Tambo, Camana-Majes-Colca, and Ocoña) during 2019–2020. Consistent with previous studies, we observed that: (1) the river water in the southern basins had relatively high concentrations of B, As, Fe, Al, Mn, P, Pb and Ni, with As the most ubiquitous toxic TM in all the basins, often detected at concentrations surpassing Peruvian and USEPA regulated concentrations; and (2) basins with the most to least toxic TM contamination were the Tambo > Chili-Quilca > Camana-Majes-Colca > Ocoña. Seasonal streamflow strongly influenced the concentrations of twenty TM, with 15 TM (Al, Au, Ba, Cd, Co, Cu, Fe, Gd, Mn, Ni, P, Pb, Ti, Yb and Zr) consistently higher in the wet season, and with As, B, Ge, Li, and Pd higher in the dry season. Our results improve the understanding of seasonal variability and vulnerability in western Andes superficial water sources, which are highly influenced by both local geogenic and anthropogenic conditions.

Enlaces: <https://doi.org/10.1016/j.jenvman.2023.118493>

<https://hdl.handle.net/20.500.12542/2866>

Unravelling and understanding local perceptions of water quality in the Santa basin, Peru

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Instituto Nacional de Investigación en Glaciares y Ecosistemas de Montaña



Abstract

Water quality is an integral part of water security. Measuring the physico-chemical indicators for water quality can provide an objective picture of water health, but it does not provide information on lived experiences related to water quality, expectations of water resources, nor how the quality of water affects its usage. Perceptual information and traditional ecological knowledge on water quality can help to understand interactions between water and people, and thereby support locally appropriate sustainable water resource strategies. Accordingly, our project sought to collect and synthesise insights from local perspectives on water quality in the upper Santa River basin, Peru, a region where water quality directly relates to people's livelihoods. Perceptual data was collected via the Nuestro Rio mobile app ($N = 149$) as well as walking interviews ($n = 84$) (July-August 2021) in two main study areas, Olleros and Catac. We find that water quality perspectives differ within, and between, study areas and communities, however four overarching themes were identified, and are explored here: i) environmental indicators for water quality; ii) water uses; and iii) perceived causes of water quality; iv) water quality perceptions behind emotions. Most rural participants felt the main cause of poor water quality was mineral pollution, likely linked to local geology, however we also found that local perceptions of water quality depend on water usage, directly linked to domestic water use and agricultural livelihoods. Qualitative data highlighted the complex relationships between water quality, perceptions and emotions. More inclusive citizen-based science that considers what people observe, think and feel about the quality of their rivers can help provide a much deeper contextual understanding of dynamic human-water systems, with further benefits for improving water management and policy implementation.

Enlaces: <https://doi.org/10.1016/j.jhydrol.2023.129949>

<https://repositorio.inaigem.gob.pe/handle/16072021/497>

Water Quality in Small-Scale Coffee Production Units, Amazonas, Peru

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Abstract

The objective of this research was to determine water quality in small-scale coffee production units in the Amazon Region, Peru. The characterization of the factors associated with coffee farmers was collected through surveys. The Standard Methods for the Examination of Water and Wastewater (APHA) method was used to determine the physicochemical and microbiological parameters of the incoming water (AE) (water for human consumption) and the outgoing water (AS) (wastewater from coffee washing). The results indicated that the coffee growers do not have adequate technology for washing the coffee and that they use water for these activities. In the characterization of the water, significant differences were found between the parameters of the AE and the AS, where the pH of the AE ranged from 7.00 to 7.32 and the pH of the AS from 3.76 to 4.44. The turbidity of the AS showed high values of 1814.47 NTU. Total Coliforms (TC) and heavy metals such as copper and chromium all increased in value up to 0.20 and 0.15 ppm in the AS compared to the AE. The characteristics of the water quality consumed by the coffee growers are poor and values above Peruvian standards were found.

Enlace: <https://doi.org/10.3844/ojbsci.2022.448.455>



II

Conservación de las especies y la diversidad biológica

Abundancia de la taricaya (*Podocnemis unifilis*) en la Reserva Nacional Pacaya Samiria, al norte de la Amazonía peruana

Abundance of the yellow-spotted river turtle *Podocnemis unifilis* in the Pacaya Samiria National Reserve, north of the Peruvian Amazon

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Resumen

El programa de aprovechamiento con fines comerciales de huevos y crías de *Podocnemis unifilis* de la Reserva Nacional Pacaya Samiria necesita información de la población adulta y juvenil para evaluar su éxito. Nuestro objetivo fue estimar la abundancia de adultos y juveniles de *P. unifilis* mediante el método de conteo de asoleadoras en la cuenca del Pacaya y Samiria, Loreto, Perú. Se tuvo 15 transectos en la cuenca del Samiria y 13 en el Pacaya. Nuestros conteos permitieron estimar 13,4 ind./km (10,3-17,9 ind./km) en el Pacaya y 7,2 ind./km (3,4-12,2 ind./km) en el Samiria, esta diferencia fue significativa ($Z(U)=1,95$; $p=0,05$). El análisis comparativo de abundancia de adultos entre cuenca baja y alta del Pacaya y Samiria mostró diferencias ($Z(U)=2,13$; $p=0,03$ y $Z(U)=2,44$; $p=0,01$, respectivamente) y reveló que la cuenca baja del Pacaya y la cuenca alta del Samiria tuvieron mayor abundancia, 6,9 ind./km (2,0-8,0 ind./km) y 5,6 ind./km (4,3-8,6 ind./km), respectivamente. A lo largo de 425,5 km de los ríos Samiria y Pacaya se estimó una población de 5163 individuos (1748 adultos y 3415 juveniles). El estado de conservación se considera de regular a bueno.

Abstract

The program for the commercial use of *Podocnemis unifilis* eggs and hatchlings in the Pacaya Samiria National Reserve needs information on the adult and juvenile population to evaluate its success. Our objective was to estimate the abundance of adults and juveniles of *P. unifilis* by counting sunbathers turtle in the Pacaya and Samiria basin, Loreto, Peru. There were 15 transects in the Samiria basin and 13 in the Pacaya. Our counts allowed us to estimate 13,4 ind./km (10,3 – 17,9 ind./km) in the Pacaya and 7,2 ind./km (3,4 – 12,2 ind./km) in the Samiria, this difference was significant ($Z(U)=1,95$; $p=0,05$). The comparative analysis of adult abundance between the lower and upper Pacaya and Samiria basins showed differences ($Z(U)=2,13$; $p=0,03$ and $Z(U)=2,44$; $p=0,01$, respectively) and revealed that the lower Pacaya basin and the upper Samiria basin had higher abundance, 6,9 ind./km (2,0 – 8,0 ind./km) and 5,6 ind./km (4,3 – 8,6 ind./km), respectively. Along 425,5 km of the Samiria and Pacaya rivers, a population of 5163 individuals (1748 adults and 3415 juveniles) was estimated. The state of conservation is considered fair to good.

Enlace: <https://doi.org/10.22386/ca.v10i1-2.363>

A dated phylogeny of the Neotropical Dipterygeae clade reveals 30 million years of winged papilionate floral conservatism in the otherwise florally labile early-branching papilionoid legumes

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Abstract

The early-branching clades of Fabaceae subfamily Papilionoideae are characterized by their remarkable lability in floral architecture. In contrast, more derived papilionoid lineages are marked by evolutionary conservatism towards strongly bilateral, papilionate flowers. Here, we show an unexpected example of conservatism of a unique floral architecture during the early diversification history of the papilionoids. We built the most comprehensively sampled molecular phylogenetic tree with a focus on the early-diverging papilionoid Dipterygeae clade to evaluate conservatism of the winged papilionate architecture and associated traits related to flower specialization (e.g. zygomorphy, petal differentiation, stable stamen number and stamen sheath). Dipterygeae comprise c. 22 species of mostly giant trees from across tropical forests in Central America and the Amazon, but they are also ecologically dominant in the savannas of the Brazilian Central Plateau. Phylogenetic analyses of nuclear ribosomal ITS/5.8S and plastid *matK* and *trnL* intron sequences strongly supported inter-relationships and the monophyly of each genus (*Dipteryx*, *Monopteryx*, *Pterodon* and *Taralea*). Bayesian relaxed-clock dating and a Bayesian model of ancestral character estimation revealed c. 30 Myr of conservatism of all winged papilionate-related flower traits in a clade comprising the most recent common ancestor of *Dipteryx*, *Pterodon* and *Taralea*, but lability in fruit morphology during the diversification of the entire Dipterygeae clade. Despite *Monopteryx* and remaining Dipterygeae being florally discrepant, they are collectively defined by a floral synapomorphy that is unique among all papilionoid Fabaceae: the highly differentiated calyx, where the two upper lobes are enlarged and wing-like, whereas the other three lower lobes are reduced. We suggest that the different dispersal strategies and the ancient winged papilionate floral conservatism in Dipterygeae, which has maintained effective ecological interactions with specialized pollinators and ensured the protection of young flower buds and developing fruits, may explain successful evolutionary and ecological persistence of the clade across the main Neotropical biomes.

Enlace: <https://doi.org/10.1093/botlinnean/boad003>

A new species of *Chiasmocleis* Méhely, 1904 (Anura: Microhylidae) from the Peruvian Amazonia

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Instituto de Investigaciones de la Amazonía Peruana



Abstract

We describe a new species of *Chiasmocleis* from the Amazonian forest of Peru. The new species is characterized by its medium size (snout-to-vent length = 18.2–20.8 mm in females, and 16.5 mm in one male), hands and feet with slightly developed fridges in females (more developed in male), and presence of a femoral line in all individuals. We also infer its phylogenetic position using DNA sequences of fragments of the mitochondrial genes for 16S rRNA and cytochrome oxidase subunit 1 (COI), and describe the mineralized skeleton through 3D models generated by computed tomography (CT-scan). Based on our results, we discuss the variation of some osteological characters traditionally used in the systematics of the genus.

Enlace: <https://doi.org/10.11646/zootaxa.5195.1.2>

A new species of the fish louse genus *Dipteropeltis* Calman, 1912 (Crustacea: Branchiura) from Peru

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Abstract

Dipteropeltis is a poorly described genus of fish louse endemic to South America. In a small blackwater region within Loreto, Peru, 13 adult and juvenile specimens of an unidentified species of *Dipteropeltis* Calman, 1912, as well as one adult specimen of *D. hirundo* Calman, 1912, were observed and collected. Scanning electron and light micrographs were acquired to examine and measure key features of these specimens. Morphological differences from the two known species of *Dipteropeltis*, *D. hirundo* and *D. campanaformis* Neethling *et al.*, 2014, indicate that the collected specimens represent a new species. *Dipteropeltis longicaudatus* sp. nov. is diagnosed by elongate abdominal lobes, a chevron-shaped carapace, and uniquely shaped maxillae. One specimen represents the longest branchiuran documented to date at 31.5 mm. Additionally, we provide the first sequence data for this genus using DNA barcoding, which corroborates our designation of a new species. Videos were also captured that document behaviors including host attachment, pulsating abdominal lobes, suction disc “walking”, and swimming. Findings have implications for its teleost hosts, *Triportheus albus* Cope, 1872 and *Brycon amazonicus* Spix & Agassiz, 1829, the latter being a critical species for aquaculture and commercial fisheries in Amazonia.

Enlace: <https://doi.org/10.11646/zootaxa.5315.2.1>

Age validation and contrasted growth performances of *Pseudoplatystoma punctifer* (Siluriformes: Pimelodidae) in two river systems of the Western Amazon

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Resumen

La doncella *Pseudoplatystoma punctifer* es un bagre de importancia económica y ecológica en la cuenca Amazonica. Pese a ello, poco se conoce acerca de parámetros de edad, crecimiento y dinámica poblacional. Este estudio tuvo como objetivo validar la formación de marcas de crecimiento en vértebras de individuos colectados en dos sistemas fluviales de la Amazonia Peruana (Amazonas-Marañón-Ucayali y Putumayo) y comparar los parámetros de crecimiento usando la función de von Bertalanffy entre sexos y sistemas. Fueron analizados 372 individuos del sistema Amazonas-Marañón-Ucayali (AMU) y 93 del Putumayo. Se validó la formación de un anillo de crecimiento por año, la edad osciló entre cero y nueve años. Las hembras fueron significativamente más grandes que los machos en ambos sistemas. Para ambos sexos el crecimiento fue significativamente mayor en el sistema AMU que en el Putumayo. Las máximas tallas y edades de primera madurez observadas en el sistema AMU fueron menores a las reportadas en estudios previos en el área, y junto con un considerable porcentaje de juveniles presentes en las capturas, se sugiere que la especie está siendo fuertemente explotada. Son necesarios estudios de biología reproductiva y dinámica poblacional de doncella para implementar medidas de manejo acordes a la situación actual.

Abstract

The doncella *Pseudoplatystoma punctifer* is an economically and ecologically important catfish in the Amazon basin. However, little is known about its age, growth and population dynamics parameters. This study aims to validate the formation of growth marks in vertebrae of individuals collected from two rivers systems of the Peruvian Amazon (Amazon-Marañón-Ucayali and Putumayo) and compare growth parameters using the von Bertalanffy growth function between sexes and systems. A total of 372 individuals from the Amazon-Marañón-Ucayali (AMU) system and 93 from the Putumayo River were analyzed. The formation of one growth ring per year was validated and the individual ages ranged from zero to nine years old. Females grew significantly larger than males in both systems. Both females and males grew significantly better in the AMU system than in the Putumayo River. Maximum observed length and size at maturity in the AMU system were lower than those reported in previous studies in the area, and together with an important proportion of juveniles in the catches, suggest that the species is heavily exploited. Further studies on the reproductive biology and population dynamics of the doncella are needed in order to implement management measures more in line with the current situation.

Enlace: <https://doi.org/10.1590/1982-0224-2021-0099>

Anti-biofilm and anti-inflammatory active diterpene isolated from the fruit of *Xylopia benthamii* R.E.Fr.

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Abstract

Xylopia benthamii (Annonaceae) is a plant with limited phytochemical and pharmacological evidence. Thus, using LC-MS/MS, we performed exploratory analyses of the fruit extract of *X. benthamii*, resulting in the tentative identification of alkaloids (1–7) and diterpenes (8–13). Through the application of chromatography techniques with the extract of *X. benthamii*, two kaurane diterpenes were isolated, xylopinic acid (9) and ent-15-oxo-kaur-16-en-19-oic acid (11). Their structures were established using spectroscopy (NMR 1D/2D) and mass spectrometry. The isolated compounds were submitted to anti-biofilm analysis against *Acinetobacter baumannii*, anti-neuroinflammatory and cytotoxic activity in BV-2 cells. Compound 11 (201.75 μ M) inhibited 35% of bacterial biofilm formation and high anti-inflammatory activity in BV-2 (IC_{50} = 0.78 μ M). In conclusion, the results demonstrated that compound 11 was characterized for the first time with pharmacological potential in the development of new alternatives for studies with neuroinflammatory diseases.

Enlace: <https://doi.org/10.1080/14786419.2023.2208357>

Anticoagulants and their effects on the hematological and biochemical parameters of yellow-spotted amazon river turtle

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Abstract

Knowledge of suitable methods and reagents for assessing the health condition of specimens of a given species is essential. The present study evaluated the efficacy of the heparin anticoagulants 5,000 I.U. mL⁻¹, Na₂EDTA, and K₃EDTA on the blood parameters of yellow-spotted amazon river turtle *Podocnemis unifilis*, employing different solutions for red blood cells count. The use of the various anticoagulants evaluated after 10 hours of storage efficiently inhibited coagulation in blood samples from *P. unifilis*. An increased number of erythrocytes was observed with the use of K₃EDTA 5% when compared with heparin. Statistically significant changes in the erythrocyte number were observed with the use of the different solutions. Solutions which featured sodium citrate and formaldehyde in their composition, allowed erythrocytes counting up to 120 hours after blood collection, without a change in values. The use of the heparin anticoagulants 5,000 I.U. mL⁻¹, Na₂EDTA 3%, Na₂EDTA 5%, K₃EDTA 3% was recommended in the hematological analysis of *P. unifilis*. Also recommended was the use of the formaldehyde-citrate solution containing 1.9 g of sodium citrate and 1.0 mL of formaldehyde (in 50 mL of distilled water) to perform red blood cells counts in yellow-spotted amazon river turtle.

Enlace: <https://doi.org/10.1590/0103-8478cr20210489>

Antioxidant and antidiabetic activity and phytoconstituents of lichen extracts with temperate and polar distribution

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Abstract

The objective of this research was to characterize the chemical composition of ethanolic extracts of the lichen species *Placopsis contortuplicata*, *Ochrolechia frigida*, and *Umbilicaria antarctica*, their antioxidant activity, and enzymatic inhibition through *in vitro* and molecular docking analysis. In total phenol content, FRAP, ORAC, and DPPH assays, the extracts showed significant antioxidant activity, and in *in vitro* assays for the inhibition of pancreatic lipase, α -glucosidase, and α -amylase enzymes, together with *in silico* studies for the prediction of pharmacokinetic properties, toxicity risks, and intermolecular interactions of compounds, the extracts evidenced inhibitory potential. A total of 13 compounds were identified by UHPLC-ESI-QTOF-MS in *P. contortuplicata*, 18 compounds in *O. frigida*, and 12 compounds in *U. antarctica*. This study contributes to the knowledge of the pool of bioactive compounds present in lichens of temperate and polar distribution and biological characteristics that increase interest in the discovery of natural products that offer alternatives for treatment studies of diseases related to oxidative stress and metabolic syndrome.

Enlace: <https://doi.org/10.3389/fphar.2023.1251856>

Antioxidant, Antiproliferative and Anti-Enzymatic Capacities, Nutritional Analysis and UHPLC-PDA-MS Characterization of Ungurahui Palm Fruits (*Oenocarpus bataua* Mart) from the Peruvian Amazon

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Abstract

Ungurahui, or Patawa, fruits are a popular fruit and medicinal food used in the Amazon. Here, we have studied nine natural populations of unguurahui from the Peruvian Amazon regarding their nutritional and biological activities, including metal composition, proximal analyses, cytotoxic, antioxidant and cholinesterase inhibition activities. Twenty-four compounds have been detected in these Peruvian natural populations by UHPLC-MS, including nine phenolic acids (peaks 1–6, 8, 9 and 11), four C-glycosyl flavonoids (peaks 12, 16, 17 and 18), two flavonols (peaks 7 and 10), one flavanol (peak 15), three anthocyanins (peaks 13, 14 and 22) and five resveratrol derivatives (peaks 19–21, 23 and 24). Sample 9, Tunaants, showed the highest DPPH clearing capacity regarding the content of Trolox equivalents (2208.79 $\mu\text{mol Trolox/g}$), but an ORAC test of the sample collected in San Lorenzo showed the highest clearing activity (1222.28 $\mu\text{mol Trolox/g}$) and the sample collected in Allpahuayo Mishana showed the most powerful ABTS (1803.72 $\mu\text{mol Trolox/g}$). The sample from Jenaro Herrera was the most powerful in AChE inhibition (IC_{50} $2.05 \pm 0.03 \mu\text{g/mL}$), followed by the sample from Contamana (IC_{50} $2.43 \pm 0.12 \mu\text{g/mL}$). In BChE inhibition, the sample from Palestina was the most active ($4.42 \pm 0.06 \mu\text{g/mL}$), followed by samples from Tunaants and San Lorenzo. The differences among bioactivities can be related to the different growing conditions of the populations of unguurahui. The palm tree fruit proved to be a good source of natural antioxidants and dietary fatty acids, and their consumption represents an alternative for the prevention of neurodegenerative or related non-chronic transmittable diseases.

Enlace: <https://doi.org/10.3390/antiox11081598>

Application of a deep learning image classifier for identification of Amazonian fishes

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Resumen

Dado el aumento del desarrollo agrícola e infraestructura y la escasa información disponible para apoyar la toma de decisiones con respecto al manejo y la conservación de la fauna, es necesario contar con una herramienta más rápida y precisa para la identificación de peces en el ecosistema de agua dulce más grande del mundo, la Amazonía. Las estrategias actuales para la identificación de peces de agua dulce requieren altos niveles de capacitación y experiencia taxonómica para la identificación morfológica o las pruebas genéticas para el reconocimiento de especies a nivel molecular. Para superar estos desafíos, construimos un modelo de enmascaramiento de imágenes (U-Net) y una red neuronal convolucional (CNN) para clasificar los peces amazónicos en las fotografías. Los peces utilizados para generar datos de entrenamiento fueron recolectados y fotografiados en afluentes de bosques inundables de la cuenca alta del río Morona en Loreto, Perú en 2018 y 2019. Las identificaciones de especies en las imágenes de entrenamiento ($n = 3.068$) fueron verificadas por ictiólogos expertos. Estas imágenes se complementaron con fotografías tomadas de ejemplares adicionales de peces amazónicos alojados en la colección ictiológica del Museo Nacional de Historia Natural del Smithsonian en Washington, DC. Se generó un modelo CNN que identificó 33 géneros de peces con una precisión media del 97,9%. Una mayor disponibilidad de herramientas precisas de reconocimiento de imágenes de peces de agua dulce, como la que se describe aquí, permitirá a los pescadores, las comunidades amazónicas y los “científicos ciudadanos” participar de manera más efectiva en la recopilación y el intercambio de datos de sus territorios para informar las políticas y decisiones de gestión que los afectan directamente.

Abstract

Given the sharp increase in agricultural and infrastructure development and the paucity of widespread data available to support conservation management decisions, a more rapid and accurate tool for identifying fish fauna in the world's largest freshwater ecosystem, the Amazon, is needed. Current strategies for identification of freshwater fishes require high levels of training and taxonomic expertise for morphological identification or genetic testing for species recognition at a molecular level. To overcome these challenges, we built an image masking model (U-Net) and a convolutional neural net (CNN) to classify Amazonian fish in photographs. Fish used to generate training data were collected and photographed in tributaries in seasonally flooded forests of the upper Morona River valley in Loreto, Peru in 2018 and 2019. Species identifications in the training images ($n = 3068$) were verified by expert ichthyologists. These images were supplemented with photographs taken of additional Amazonian fish specimens housed in the ichthyological collection of the Smithsonian's National Museum of Natural History. We generated a CNN model that identified 33 genera of fishes with a mean accuracy of 97.9%. Wider availability of accurate freshwater fish image recognition tools, such as the one described here, will enable fishermen, local communities, and citizen scientists to more effectively participate in collecting and sharing data from their territories to inform policy and management decisions that impact them directly.

Enlace: <https://doi.org/10.1002/ece3.9987>

***Azadirachta indica* y *Jatropha curcas* reducen el ataque de *Hypsipyla grandella* Zéller en *Swietenia macrophylla* King plantada en sistemas agroforestales**

***Azadirachta indica* and *Jatropha curcas* reduce the attack of *Hypsipyla grandella* Zéller in *Swietenia macrophylla* King planted in agroforestry systems**

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Resumen

S. macrophylla es una importante especie forestal con valor económico, sin embargo, su principal problema es su vulnerabilidad ecológica al ataque de *H. grandella*. En ese sentido, el objetivo en este trabajo fue determinar el efecto de *A. indica* y *J. curcas* en la reducción del ataque de *H. grandella* en plantas de *S. macrophylla* plantada en sistemas agroforestales. Para ello, fue evaluado el diámetro basal (mm), altura de planta (cm), plantas atacadas (%), tallos atacados (%), ápices atacados (%), hojas atacadas (%), sobrevivencia y mortalidad de larvas (%). El menor porcentaje de ataque de *H. grandella* en plantas de *S. macrophylla* fue registrado en la asociación *S. macrophylla* con *T. cacao* y *A. indica* y también en *S. macrophylla* con *T. cacao* y *J. curcas*, plantadas a 1 m x 3 m, con 0,95 y 2,85%, respectivamente. Entre tanto, la mayor sobrevivencia y mortalidad de larvas de *H. grandella* fue registrado en la asociación *S. macrophylla* con *T. cacao* y en *S. macrophylla* con *T. cacao* y *J. curcas* con 90,20 y 88,89% respectivamente. De este modo, el uso de *A. indica* y *J. curcas* promueve significativamente la disminución del ataque de *H. grandella* en plantas de *S. macrophylla* plantada en sistemas agroforestales.

Abstract

S. macrophylla is an important forest species with economic value, however its main problem is its ecological vulnerability to the attack of *H. grandella*. In this sense, the objective in this study was to determine the effect of *A. indica* and *J. curcas* in reducing the attack of *H. grandella* on *S. macrophylla* plants planted in agroforestry systems. For this, the basal diameter (mm), height of plant (cm), attacked plants (%), attacked stems (%), apices attacked (%), leaves attacked (%), survival and mortality of larvae were evaluated (%). The lowest percentage of attack of *H. grandella* in *S. macrophylla* plants was registered in the association *S. macrophylla* with *T. cacao* and *A. indica* and also in *S. macrophylla* with *T. cacao* and *J. curcas*, planted at 1 m x 3 m, with 0.95 and 2.85%, respectively. However, the greater survival and mortality of larvae of *H. grandella* was registered in the association *S. macrophylla* with *T. cacao* and in *S. macrophylla* with *T. cacao* and *J. curcas* with 90.20 and 88.89% respectively. Thus, the use of *A. indica* and *J. curcas* significantly promote the reduction of *H. grandella* attack on *S. macrophylla* plants planted in agroforestry systems.

Enlace: <https://doi.org/10.18671/SCIFOR.V50.10>

Bacteriología de la miel de abeja sin aguijón en Loreto, Perú

Bacteriology of honey from stingless bees in Loreto, Peru

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Resumen

La manipulación inadecuada de la miel puede atribuirle características bacteriológicas perjudiciales para nuestra salud que se agudizan con la presencia de *Escherichia coli*. Por lo cual, el objetivo fue evaluar las características bacteriológicas de la miel de abeja sin aguijón en Loreto, Perú. En cuanto a las unidades formadoras de colonias, la miel madura fue la muestra que menos colonias presentó, con 800 UFC. Se empleó cepas de *E. coli* drogorresistente frente a cuatro muestras de miel madura, inmadura, colectada por el productor y envasada por el productor. *E. coli* logra sobrevivir hasta 32 h en las muestras de miel, mostrando una mayor capacidad antibacteriana en la miel envasada por el productor de 11,74 mm de halo inhibitorio, respecto a la concentración inhibitoria mínima y bactericida mínima, se obtuvo a 125 mg/ml siendo similares en muestras de miel madura, colectada por el productor y envasado por el productor, por lo que se necesita cuatro veces más de miel inmadura para lograr un efecto similar. La miel de meliponidos en nuestro estudio muestra efecto inhibitorio sobre el crecimiento de *E. coli* drogorresistente, por lo que su potencial uso medicinal es muy prometedor.

Abstract

Improper handling of honey can attribute to it bacteriological characteristics that are harmful to our health, which are exacerbated by the presence of *Escherichia coli*. Therefore, the objective was to evaluate the bacteriological characteristics of honey from stingless bees in Loreto, Peru. Regarding the colony-forming units, the mature honey was the sample that presented the fewest colonies, with 800 CFU. Strains of drug-resistant *E. coli* were used against four samples of mature, immature honey collected by the producer and packaged by the producer. *E. coli* manages to survive up to 32 h in the honey samples, showing a greater antibacterial capacity in the honey packaged by the producer of 11,74 mm of inhibitory halo, with respect to the minimum inhibitory and minimum bactericidal concentration, it was obtained at 125 mg /ml being similar in samples of mature honey, collected by the producer and packaged by the producer, so four times more immature honey is needed to achieve a similar effect. Meliponid honey in our study shows an inhibitory effect on the growth of drug-resistant *E. coli*, so its potential medicinal use is very promising.

Enlace: <https://doi.org/10.22386/ca.v10i1-2.358>

Biodiversity underpins fisheries resilience to exploitation in the Amazon river basin

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Abstract

Inland fisheries feed greater than 150 million people globally, yet their status is rarely assessed due to their socio-ecological complexity and pervasive lack of data. Here, we leverage an unprecedented landings time series from the Amazon, Earth's largest river basin, together with theoretical food web models to examine (i) taxonomic and trait-based signatures of exploitation in inland fish landings and (ii) implications of changing biodiversity for fisheries resilience. In both landings time series and theory, we find that multi-species exploitation of diverse inland fisheries results in a hump-shaped landings evenness curve. Along this trajectory, abundant and large species are sequentially replaced with faster growing and smaller species. Further theoretical analysis indicates that harvests can be maintained for a period of time but that continued biodiversity depletion reduces the pool of compensating species and consequently diminishes fisheries resilience. Critically, higher fisheries biodiversity can delay fishery collapse. Although existing landings data provide an incomplete snapshot of long-term dynamics, our results suggest that multi-species exploitation is affecting freshwater biodiversity and eroding fisheries resilience in the Amazon. More broadly, we conclude that trends in landings evenness could characterize multi-species fisheries development and aid in assessing their sustainability.

Enlace: <https://doi.org/10.1098/rspb.2022.0726>

Caracterización estructural, producción y fenología reproductiva de *Mauritia flexuosa* L.f. “aguaje” en plantaciones forestales de Jenaro Herrera, Loreto, Perú

Structural characterization, production and reproductive phenology of *Mauritia flexuosa* L.f. “aguaje” in forest plantations of Jenaro Herrera, Loreto, Perú

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Resumen

En este estudio, generamos información sobre las características estructurales y la fenología reproductiva del aguaje en seis plantaciones de 11,6 a 17 años establecidas en el Centro de Investigaciones Jenaro Herrera, Loreto, Perú. Realizamos observaciones y mediciones de la supervivencia de las plantas, sus características estructurales y la fenología. Los resultados muestran que la supervivencia de las plantas desde el inicio de la plantación varió desde 66% hasta 96%. La mayoría de las variables evaluadas no mostraron incremento con la edad de la plantación, a excepción de la altura promedio del estípite y la altura total que fueron mayores en las plantaciones de 17 años que en las plantaciones menores. La etapa reproductiva inició a los 6-7 años con la floración de pocos individuos, mostrando un aumento en el número de plantas en floración en todas las plantaciones cada año. La floración y fructificación ocurrió anualmente, con sincronía en la floración de las plantas femeninas y masculinas. Sin embargo, algunas plantas no florecieron durante periodos de 1 a 3 años. El periodo de floración duró en promedio $58,2 \pm 0,9$ días en las plantas femeninas y $55,1 \pm 0,8$ días en las masculinas, mientras que la fructificación duró $275,0 \pm 1,6$ días. La información obtenida contribuye al conocimiento silvicultural para el manejo del aguaje en plantaciones.

Abstract

In this study, we generated information on the structural characteristics and reproductive phenology of aguaje in six plantations from 11,6 to 17 years old established in the Jenaro Herrera Research Centre, Loreto, Peru. We observed and measured plant survival, structural characteristics, and phenology. The results showed that plant survival ranged from 66% to 96%. The majority of the variables did not show an increase with the age of the plantation, except for the mean stem height and total height, which were higher in the 17-year-old plantation than in the younger plantations. The reproductive stage of plants began at 6-7 years with the flowering of a few individuals and showing an increase in the number of flowering plants in the plantations each year. The flowering and fruiting of aguaje plants occurred annually with synchrony in the flowering of male and female plants. However, some plants did not flower for periods of one to three years. The flowering period lasted on average $58,2 \pm 0,9$ days in the female plants and $55,1 \pm 0,8$ days in the male plants, while fruiting lasted $275,0 \pm 1,6$ days. The obtained information contributes to the silvicultural knowledge for the management of aguaje in plantations.

Enlace: <https://doi.org/10.24841/fa.v32i1.632>

Chemical Fingerprinting, Aorta Endothelium Relaxation Effect, and Enzymatic Inhibition of Canelo (*Drimys winteri* J. R. Forst. & G. Forst, (D.C) A. Gray, Family Winteraceae) Fruits

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Abstract

Drimys winteri J.R. Forst. & G. Forst (D.C) G. Gray, var. *chilensis* (canelo) is an endemic tree from Chile. Since pre-Columbian times, it has produced a fruit known as the canelo pepper, (pimienta de canelo) or Foye pepper, which can be used as a spice. The chemical and biological analysis of canelo fruits is reported for the first time in this study, that is, its phenolic fingerprinting by UHPLC-PDA- Q-orbitrap MS, the antioxidant activity, the enzymatic inhibitory activity, and its relaxation effects on rat aorta. The proximal composition and the mineral content (Ca: 1.45 ± 0.03 mg/100 g; Mg: 7.72 ± 0.03 mg/100 g; Fe: 4.54 ± 0.21 mg/100 g; Zn: 2.99 ± 0.02 mg/100 g; Mn: 1.08 ± 0.03 mg/100 g; Cu: 0.82 ± 0.02 mg/100 g; K: 53.03 ± 0.20 mg/100 g; Na: 0.087 ± 0.00 mg/100 g) are also reported. The canelo fruits showed a total phenolic content of 57.33 ± 0.82 mg GAE/g dry weight. In addition, the total flavonoid content was 38.42 ± 1.32 mg equivalent of QE/g dry weight. The antioxidant activity was evaluated by employing DPPH and ABTS methods (IC_{50} of 6.65 ± 0.5 and 9.5 ± 0.05 μ g/mL, respectively), ORAC (25.33 ± 1.2 μ mol Trolox/g dry plant) and FRAP (45.56 ± 1.32 μ mol Trolox/g dry plant). The enzymatic inhibition of acetylcholinesterase, butyrylcholinesterase, and tyrosinase (IC_{50} : 1.94 ± 0.07 , 2.73 ± 0.05 , and 9.92 ± 0.05 μ g extract/mL, respectively) is also reported. Canelo extract led to an 89% relaxation of rat aorta. Our results confirm that *D. winteri* fruits are a rich source of secondary metabolites and can inhibit enzymes associated with neurodegenerative diseases; the results also suggest that canelo may induce a potentially hypotensive effect in rat aorta. The study demonstrates the medicinal properties of canelo fruit and spice.

Enlace: <https://doi.org/10.3390/foods12132580>

Climate Change Impact on Peruvian Biomes

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

The biodiversity present in Peru will be affected by climatic and anthropogenic changes; therefore, understanding these changes will help generate biodiversity conservation policies. This study analyzes the potential distributions of biomes (B) in Peru under the effects of climate change. The evaluation was carried out using the random forest (RF) method, six bioclimatic variables, and digital topography for the classification of current B in Peru. Subsequently, the calibrated RF model was assimilated to three downscaled regional climate models to project future B distributions for the 2035–2065 horizon. We evaluated possible changes in extension and elevation as well as most susceptible B. Our projections show that future scenarios agreed that 82% of current B coverage will remain stable. Approximately 6% of the study area will change its current conditions to conditions of higher humidity; 4.5% will maintain a stable physiognomy, but with an increase in humidity; and finally, 6% will experience a decrease in humidity but maintain its appearance. Additionally, glaciers and swamps are indicated as the most vulnerable B, with probable losses greater than 50% of their current area. These results demonstrate the need to generate public policies for the adaptation and mitigation of climate effects on B at a national scale.

Enlace: <https://doi.org/10.3390/f13020238>

***Compsonaura nallarettiana* (Myristicaceae), a new species from north-western Peru**

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Abstract

Esta publicación científica no cuenta con resumen disponible

Enlace: <https://repositorio.iiap.gob.pe/handle/20.500.12921/707>

Congruence of local ecological knowledge (LEK)-based methods and line-transect surveys in estimating wildlife abundance in tropical forests

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Abstract

1. Effective estimation of wildlife population abundance is an important component of population monitoring, and ultimately essential for the development of conservation actions. Diurnal line-transect surveys are one of the most applied methods for abundance estimations. Local ecological knowledge (LEK) is empirically acquired through the observation of ecological processes by local people. LEK-based methods have only been recognized as valid scientific methods for surveying fauna abundance in the last three decades. However, the agreement between both methods has not been extensively analysed.
2. We compared concomitant abundance data for 91 wild species (mammals, birds and tortoises) from diurnal line transects (9,221 km of trails) and a LEK-based method (291 structured interviews) at 18 sites in Central and Western Amazonia. We used biological and socioecological factors to assess the agreements and divergences between abundance indices obtained from both methods.
3. We found a significant agreement of population abundance indices for diurnal and game species. This relationship was also positive regardless of species sociality (solitary or social), body size and locomotion mode (terrestrial and arboreal); and of sampled forest type (upland and flooded forests). Conversely, we did not find significant abundance covariances for nocturnal and non-game species. Despite the general agreement between methods, line transects were not effective at surveying many species occurring in the area, with 40.2% and 39.8% of all species being rarely and never detected in at least one of the survey sites. On the other hand, these species were widely reported by local informants to occur at intermediate to high abundances.
4. Although LEK-based methods have been long neglected by ecologists, our comparative study demonstrated their effectiveness for estimating vertebrate abundance of a wide diversity of taxa and forest environments. This can be used simultaneously with line-transect surveys to calibrate abundance estimates and record species that are rarely sighted during surveys on foot, but that are often observed by local people during their daily extractive activities. Thus, the combination of local and scientific knowledge is a potential tool to improve our knowledge of tropical forest species and foster the development of effective strategies to meet biodiversity conservation goals.

Enlace: <https://doi.org/10.1111/2041-210X.13773>

Consumo, microbiología y bromatología de la carne silvestre durante la COVID-19 en Iquitos, Perú

Consumption, microbiology and bromatology of wild meat during COVID-19 in Iquitos, Peru

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Resumen

En Iquitos (Perú), la carne de *Cuniculus paca*, *Pecari tajacu*, *Tayassu pecari* y *Chelonoidis denticulatus* se consumen en gran cantidad, sin embargo, no hay un análisis bromatológico completo ni estudios actualizados de la carga bacteriana y presencia de coronavirus. Nuestro objetivo fue conocer el consumo y el estado microbiológico y bromatológico de la carne silvestre durante la pandemia de la COVID-19. Se realizaron entrevistas virtuales a 213 personas entre mayo y junio de 2020 en Iquitos; por cada especie se utilizaron cuatro muestras de carne de 500 g para el análisis bacteriológico y bromatológico, y una muestra de 500 g por especie para la búsqueda de coronavirus provenientes de los mercados Belén y Modelo. Encontramos que la carne silvestre representa el 4 % de fuente proteica, su consumo es independiente a factores educativos y económicos, a la mayoría les gusta esta carne y creen que su consumo no contagia de coronavirus. Esta carne no tuvo coronavirus y presentó menos carga bacteriana que otros productos de mayor consumo en los mercados estudiados. Asimismo, tuvo bajo contenido graso, baja proporción de fósforo/proteína, alto contenido de riboflavina y calcio. Es decir, esta carne durante la pandemia fue saludable y nutritiva.

Abstract

In Iquitos (Peru), the meat of *Cuniculus paca*, *Pecari tajacu*, *Tayassu pecari* and *Chelonoidis denticulatus* are consumed in large quantities, however, there is no complete bromatological analysis or updated studies of the bacterial load and presence of coronavirus. Our objective was to know the consumption and the microbiological and bromatological status of wild meat during the COVID-19 pandemic. Virtual interviews were conducted with 213 people between May and June 2020 in Iquitos; for each species, four 500-g meat samples were used for bacteriological and bromatological analysis, and a 500-g meat sample per species was used to search for coronaviruses from the Belén and Modelo markets. We found that wild meat represents 4% of the protein source, its consumption is independent of educational and economic factors, most people like this meat and believe that its consumption does not spread coronavirus. This meat did not have coronaviruses and presented less bacterial load than other products of greater consumption in the markets studied. Likewise, it had low fat content, low phosphorus/protein ratio, high riboflavin and calcium content. That is, this meat during the pandemic was healthy and nutritious.

Enlace: <https://doi.org/10.22386/ca.v9i2.339>

Consumption of wildlife-origin products by local residents at the largest wildlife market of Amazonian Peru: is there scope for demand reduction?

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Abstract

Wildlife and wildlife-origin products are illegally traded across Peru, with negative consequences for animal welfare, conservation, human health and livelihoods. We surveyed residents of Iquitos who regularly shop at Belén Market, the largest open-air market selling wildlife in the Peruvian Amazon. We wished to assess what proportion of the local population purchases wildlife for personal use, to determine the involvement of the local population in the wider national trade of Peruvian wildlife, and to assess whether information campaigns could reduce demand for these products among local consumers. We derived 265 responses. The principal purchases were meat from domesticated animals, and fish: 89.4% of respondents bought these on every or most visits. By comparison 75.1% purchased bushmeat, but only 3.0% did so frequently, and 58.1% purchased chelonian eggs, with < 1% doing so frequently. Percentages purchasing wildlife pets, and wildlife-origin artefacts and remedies were low (all under 14.7% of respondents). There was no evidence that respondents were selling wildlife or wildlife-origin products into the national wildlife trade. Over 90% of respondents held negative views of both animal welfare and conservation impacts of the capture of wildlife for sale, with lower proportions expressing negative views of issues surrounding zoonotic disease risks and illegality. When shown statements detailing these impacts, 51.3% of respondents stated they would be less likely to buy wildlife-origin products in the future. When asked to state which aspects of the Belén Market they would change, however, only six respondents referenced the sale of wildlife, with the vast majority (>95%) referencing levels of orderliness, hygiene or personal security at the market. Despite widespread consumption of bushmeat – albeit relatively infrequently – among respondents in Iquitos, many respondents to our questionnaire disliked the associated negative impacts, sufficient that making such impacts salient through repeated demand-reduction messaging might be expected to lower the likelihood of such purchases in the future. Such interventions should, however, be accompanied by action to address structural issues within the market.

Enlace: <https://doi.org/10.1016/j.gecco.2023.e02755>

Conteo automático de larvas de peces utilizando visión por computadora basado en redes neuronales

Automatic counting of fish larvae using computer vision based on neural networks

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Resumen

El conteo de larvas de peces es una técnica aplicada en la acuicultura para determinar la eficiencia de la etapa de inducción y conocer la cantidad de larvas fecundadas. Por esta razón, el objetivo de este trabajo fue mejorar el conteo de larvas bajo 3 pilares fundamentales: precisión, error y tiempo. Para esto realizamos una investigación experimental bajo un diseño completo al azar con dos sistemas de conteo: tradicional y de visión artificial; cada uno con 10 repeticiones, con 2000 larvas; posteriormente realizamos el conteo mediante visión artificial utilizando una cámara que capturaba las imágenes de una pecera con peces en movimiento. Los resultados muestran que el método propuesto es factible para el conteo de larvas, con un 92,65% de precisión, 7,41% de error y un tiempo promedio de 61 segundos por repetición en relación al sistema de conteo tradicional: precisión 64,44%, error 35,61% y tiempo 2009,3 s. El sistema desarrollado puede ser replicado en el sector acuícola por su efectividad y costo.

Abstract

Fish larvae counting is a technique applied in aquaculture to determine the efficiency of the induction stage and to know the number of fertilized larvae. For this reason, the research aims to improve the count of larvae under 3 fundamental pillars: precision, error and time. For this, we carried out an experimental investigation under a completely randomized design with two counting systems: traditional and artificial vision; each one with 10 repetitions, with 2000 larvae; Later, we carried out the count by means of artificial vision using a camera that captured images of a fish tank with moving fish. The results show that the proposed method is feasible for counting larvae, with 92.65% accuracy, 7.41% error and an average time of 61 seconds per repetition in relation to the traditional counting system: accuracy 64.44%, error 35.61% and time 2009.3 s. The developed system can be replicated in the aquaculture sector due to its effectiveness and cost.

Enlace: <https://doi.org/10.17268/sci.agropecu.2022.014>

Contrasting long-term changes in lake trajectories linked to differences in wind-induced mixing in the Peruvian Andes

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Abstract

1. Historically, many high-elevation lakes in the tropical Andes have been observed to mix frequently, with rare, brief periods of thermal stratification. As temperatures have risen in the Andes over the past several decades, thermistor data have shown that many lakes are now experiencing longer periods of thermal stratification with resultant ecological restructuring. Palaeolimnological studies from these lakes have recorded striking diatom assemblage shifts, coeval with recent changes in thermal stratification.
2. Here, we analyse subfossil diatom assemblages from a wind-sheltered lake, Laguna Yanacocha, in the Peruvian Andes. Thermistors deployed in the lake indicated that Laguna Yanacocha was more strongly thermally stratified and for longer periods than other nearby lakes. We hypothesised that, owing to its sheltered position, this lake is likely to have exhibited enhanced periods of thermal stratification even before the period of recent warming, and that these limnological conditions would be tracked in the subfossil diatom record.
3. The diatom assemblages from Laguna Yanacocha recorded consistently high abundances of the obligate planktonic taxon *Discostella stelligera* over the last several centuries. This taxon is known to flourish with warming and has been shown to increase in abundance with the onset of thermally stratified conditions in other Andean waterbodies, as well as lakes globally. The dominance of *D. stelligera* throughout the entire sediment record suggests a long history of thermal stratification that is likely to be a consequence of the study lake's surrounding topography, which shelters it from wind mixing.
4. The sub-fossil assemblage data from Laguna Yanacocha contrasts with assemblages from previously studied wind-swept lakes in the Andes, which primarily show low abundances of *D. stelligera* before well-documented temperature increases. The fossil diatom record from Laguna Yanacocha may provide an indication of how other lakes from the region will respond to warming temperatures and enhanced thermal stratification.

Enlace: <https://doi.org/10.1111/fwb.14184>

***Cosmetocleithrum infinitum* sp. n. (Monogenoidea: Dactylogyridae)
parasite of the gills of *Anadoras grypup* (Siluriformes: Doradidae) from
the Amazonas river, in Loreto, Peru**

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Abstract

Among Siluriformes, fishes of the family Doradidae harbor dactylogyrids from *Cosmetocleithrum* Kritsky, Thatcher and Boeger, 1986. *Anadoras grypup* (Cope) (Siluriformes, Doradidae) locally named in Peru as “rego-rego” hosts a new species of *Cosmetocleithrum* described herein as *Cosmetocleithrum infinitum* sp. n. The male copulatory organ (MCO) and vagina of the new species reveal its morphological uniqueness among members of *Cosmetocleithrum*. The MCO in the new species is an elongate, sclerotized sinuous tube, with 12 expanded coils, with counterclockwise orientation; the accessory piece is sclerotized, comprising a kind of cone, with a large opening at its base, with a branch in the posterior middle part and with pointed ends. The vagina is a sclerotized long, winding, coiled tube with a cone-shaped opening.

Enlace: <https://doi.org/10.1007/s11230-022-10056-2>

Cytotoxicity and Lipase Inhibition of Essential Oils from Amazon Annonaceae Species

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Abstract

Essential oils from Amazonian species are gaining increasing interest worldwide due to their medicinal and cosmetic applications; however, the relation among the chemical constituents and their biological properties are not well explored. Therefore, the present research aims to obtain an understanding of the bioactivity of chemical compounds in the essential oils of plants from the Annonaceae family (*Bocageopsis pleiosperma*, *Onychopetalum amazonicum*, *Unonopsis duckei*, *U. floribunda*, *U. rufescens*, *U. stipitata*, *U. guatterioides*, *Duguetia flagellaris* and *Xylopia benthamii*). By means of gas chromatography coupled to mass spectrometry, in vitro cytotoxic and anti-lipase assays, principal component analysis and molecular docking, it was possible to establish the main compounds that may be responsible for the cytotoxic effect of *O. amazonicum* and *B. pleiosperma*. Moreover, the anti-lipase potential of *D. flagellaris* was also established, as well as its composition related to the activity. Thus, by the employed strategy, *allo*-aromadendrene, cryptomerione, δ -cadinene and β -bisabolene were suggested as plausible cytotoxic agents against cancer cell lines, and dehydroaromadendrene, spathulenol and elemol, against lipase. The present study provides significant information on the chemical profile and bioactivity studies of Amazon Annonaceae aromatic plants.

Enlace: <https://doi.org/10.3390/chemistry4040081>

Daphnanes diterpenes from the latex of *Hura crepitans* L. and their PKC ζ -dependent anti-proliferative activity on colorectal cancer cells

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Abstract

Hura crepitans L. (Euphorbiaceae) is a thorn-covered tree widespread in South America, Africa and Asia which produces an irritating milky latex containing numerous secondary metabolites, notably daphnane-type diterpenes known as Protein Kinase C activators. Fractionation of a dichloromethane extract of the latex led to the isolation of five new daphnane diterpenes (1–5), along with two known analogs (6–7) including huratoxin. Huratoxin (6) and 4',5'-epoxyhuratoxin (4) were found to exhibit significant and selective cell growth inhibition against colorectal cancer cell line Caco-2 and primary colorectal cancer cells cultured as colonoids. The underlying mechanism of 4 and 6 was further investigated revealing the involvement of PKC ζ in the cytostatic activity.

Enlace: <https://doi.org/10.1016/j.bmc.2023.117366>

Death of a toad, *Rhinella* gr. *margaritifera*, after consuming a bullet ant, *Paraponera clavata*

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Abstract

Esta publicación científica no cuenta con resumen disponible

Enlace: <https://www.biotaxa.org/hn/article/view/74652>

Description of the life cycle of *Dolops discoidalis* (Branchiura: Argulidae), collected in *Pseudoplatystoma punctifer* raised in captivity in the Peruvian Amazon

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Abstract

Species of Branchiura have structures that undergo evolutionary modifications such as: oral suction apparatus and hook-shaped appendages, which are used for attachment to the host causing lesions on the skin (that can lead to secondary bacterial infections) and anaemia that can cause high mortality rates. The present study aimed to describe the life cycle of the branchiuran *Dolops discoidalis* (Bouvier, 1899) in order to contribute to the knowledge of the biology of this parasite and for future studies focused on its prevention and control in fish farming. Samples were collected in July 2021 from a fish pond located in Iquitos, Peru. Branchiurans were observed parasitizing the dorsal and ventral part of the body of *Pseudoplatystoma punctifer* (Castelnau, 1855). Parasites were collected using tweezers and placed in a container with water for later transfer to the laboratory. In the laboratory, collected branchiurans were placed in glass aquariums lined with plastic, waiting for mate and/or oviposition. Once oviposition was observed, eggs were transferred to 500 mL capacity beakers with constant aeration provided by a small diffuser stone connected to a hose. Eggs were observed once a day and changes in their morphology were photographed and registered. The observation of the eggs was carried out until the hatching of the juvenile. The life cycle of *D. discoidalis* from egg laying to juvenile hatching lasted 23 days. Since *P. punctifer* is being bred in captivity in the Peruvian Amazon, it is necessary to know aspects related to sanity, emphasizing the problems caused by parasites. The knowledge of the life cycle of *D. discoidalis* helps us to adopt measures to prevent and control the parasitism of this species and thus contribute to aquaculture activities in the Peruvian Amazon.

Enlace: <https://doi.org/10.1016/j.aquaculture.2022.738427>

Development, nutrition, and rearing practices of relevant catfish species (Siluriformes) at early stages

Enric Gisbert, Ronald Kennedy Luz, Ignacio Fernández, Pravata K. Pradhan, Maria Salhi, Mansour T. Mozanzadeh, Aditya Kumar, Yannis Kotzamanis, Diana Castro-Ruiz, Martin Bessonart, Maria J. Darias

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Abstract

Catfish (Siluriformes) are important species for aquaculture worldwide, with an annual production in 2018 of ca. 6 million t. This review focuses on reassessing larval development, first feeding, and early rearing practices of the most important farmed catfish species, along with some candidate species for aquaculture diversification: *Pangasianodon hypophthalmus* (Pangasiidae), *Clarias gariepinus* (Clariidae), *Ictalurus punctatus* (Ictaluridae), *Pseudoplatystoma* spp. (Pimelodidae), *Heteropneustes fossilis* (Heteropneustidae), *Rhamdia quelen* (Heptapteridae), *Ompok bimaculatus* (Siluridae), and *Lophiosilurus alexandri* (Pseudopimelodidae). These species are initially reared indoors from one day to two weeks and are then transferred to fertilised outdoor ponds where they either feed on natural zooplankton or compound feeds. With the exception of *C. gariepinus*, *I. punctatus*, *R. quelen* and *P. hypophthalmus*, consistent and reliable fry production is a bottleneck that limits the expansion of farming of other species, such as *Pseudoplatystoma* spp., *H. fossilis*, *O. bimaculatus*, and *L. alexandri*. Rearing systems (extensive, semi-extensive, intensive) and feeding protocols vary with species and geographical regions. Cannibalism and size heterogeneity are common, and these features create problems for larval and fry rearing of catfish species. Information about their nutritional requirements is required for the formulation of compound feeds that can guarantee high survival and good growth of catfish fries. However, such knowledge for most species is scarce, although some data are available for *I. punctatus*. Further genomic resources might allow fine-tuning rearing success. This review describes some successes in this field, and also highlights gaps in knowledge to guide future research that can promote the development of catfish aquaculture.

Enlace: <https://doi.org/10.1111/raq.12586>

DHA-enrichment of live and compound feeds influences the incidence of cannibalism, digestive function, and growth in the neotropical catfish *Pseudoplatystoma punctifer* (Castelnau, 1855) during early life stages

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Abstract

Pseudoplatystoma punctifer is a highly appreciated fish species native to the Amazon basin, whose commercial farming has been hampered by low survival during early life stages due to the high incidence of cannibalism and the low acceptability of compound diets at weaning. Dietary DHA is known to promote digestive system development and maturation and growth, whereas its deficiency induces stress. The aim of this study was to evaluate the effect of dietary DHA supplementation on the incidence of cannibalism, digestive physiology, and growth performance during the early life stages of *P. punctifer* to improve current feeding protocols. Four dietary treatments were generated using a commercial enrichment product with high DHA content. Fish larvae were fed non-enriched or enriched *Artemia* from 4 to 15 days post fertilization (dpf) and fed a non-enriched or enriched compound diet from 15 to 26 dpf, coinciding with the start of the juvenile stage. Growth, survival, incidence of cannibalism, proximate and fatty acid composition, histology of the intestine and liver, and quantitative gene expression of the main digestive enzymes (*amy*, *try*, *ctr*, *pga*, *pla2*, and *lpl*) were analyzed in the different dietary groups at the end of each feeding period. Results showed that dietary DHA supplementation influenced *P. punctifer* in a developmental stage-dependent manner. In particular, DHA-enriched *Artemia* provided during the larval stage contributed to reduce the incidence of cannibalism and improved survival at the early juvenile stage, while enriching the compound diet improved growth. The expression level of genes involved in protein and carbohydrate digestion (*ctr*, *amy*) was higher in groups fed enriched *Artemia* despite that both enriched and non-enriched *Artemia* displayed similar proximate composition, suggesting that different dietary fatty acid profiles may modulate the expression of these digestive enzyme precursors. The group transitioning from enriched *Artemia* to non-enriched compound diet showed a higher expression of most genes at the early juvenile stage. At the histological level, the group fed non-enriched *Artemia* and compound diet showed a significant accumulation of lipids in the intestine relative to the liver, contrary to the rest of the groups that showed similar amounts of lipids in both tissues, indicating a more balanced lipid metabolism. The group fed both DHA-enriched *Artemia* and compound diet provided the best results in terms of growth, survival, incidence of cannibalism, and digestive physiology. In conclusion, this study showed that the nutritional history during the larval period affected fish nutrition and behavior during the early juvenile stage.

Enlace: <https://doi.org/10.1016/j.aquaculture.2022.738667>

Diversidad de aves y su relación con la vegetación en la ciudad de Iquitos, Loreto, Perú

Diversity of birds and their relationship with the vegetation in the Iquitos city, Loreto, Peru

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Resumen

El estudio de las aves y la vegetación en ciudades amazónicas es importante porque brinda directrices que ayudan a solucionar los problemas de calidad ambiental en una ciudad. Por ello, con el objetivo principal de evaluar si la vegetación está relacionada con la diversidad de aves, se utilizaron los métodos de conteo por puntos, parcelas, imágenes satelitales y revisión bibliográfica, para conocer la diversidad de aves y plantas (árboles, palmeras, arbustos y hierbas) en ambientes urbanos con diferentes niveles de cobertura arbórea en la ciudad de Iquitos, Loreto, Perú. Se registraron 127 especies de aves y 117 especies de plantas. Las aves más abundantes y dominantes fueron *Coragyps atratus*, *Brotogeris versicolurus* y *Columba livia* y en plantas fueron *Adonidia merrillii* y *Cecropia membranacea*. La diversidad de aves se relacionó con la riqueza de especies de plantas, plantas nativas, árboles, cobertura arbórea y distancia de la parcela a una matriz de bosque continuo. Los resultados revelan la importancia de tomar acciones para lograr la conversión de la ciudad de Iquitos a una ciudad más verde, donde una mayor diversidad y abundancia de plantas y mayor cobertura arbórea beneficien a más especies de aves, ayudando a mejorar las condiciones ambientales de la ciudad, en beneficio de todos sus habitantes.

Abstract

The study of birds and vegetation in Amazonian cities is important because it provides guidelines that help solve environmental quality problems in a city. Therefore, with the main objective of evaluating whether vegetation is related to bird diversity, point count methods, plots, satellite images and literature review were used to know the diversity of birds and plants (trees, palms, shrubs and herbs) in urban environments with different levels of tree cover in the city of Iquitos, Loreto, Peru. A total of 127 bird species and 117 plant species were recorded. The most abundant and dominant birds were *Coragyps atratus*, *Brotogeris versicolurus* and *Columba livia* and in plants were *Adonidia merrillii* and *Cecropia membranacea*. Bird diversity was related to plant species richness, native plants, trees, tree cover and distance from the plot to a continuous forest matrix. The results reveal the importance of taking actions to achieve the conversion of the city of Iquitos to a greener city, where greater diversity and abundance of plants and tree cover benefit more species of birds, helping to improve the environmental conditions of the city, for the benefit of all its inhabitants.

Enlace: <https://doi.org/10.22386/ca.v10i1-2.364>

Ectoparásitos en branquias de tilapias adultas (*Oreochromis niloticus*) del Sector Bello Horizonte de la Banda de Shilcayo, San Martín, Perú

Ectoparasites in gills of adult tilapia (*Oreochromis niloticus*) from the Bello Horizonte Sector of the Banda de Shilcayo, San Martín, Peru

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Resumen

El objetivo del presente estudio fue determinar la presencia de ectoparásitos en branquias de 73 tilapias adultas (*Oreochromis niloticus*) provenientes de siete pozas ubicadas en el Sector Bello Horizonte, distrito de la Banda de Shilcayo, San Martín, Perú. Se realizó el muestreo entre enero a febrero de 2021. Se realizaron mediciones de tamaño, temperatura y pH de las pozas y se obtuvieron las medidas de las pozas y densidad de los peces a partir de los registros de las piscigranjas. Los peces fueron llevados al laboratorio para la disección de las branquias y la colecta y fijación de los ectoparásitos. El 35.6% (26/73) de peces estuvieron infestados con uno o más ectoparásitos. Se determinó la presencia de monogeneos del género *Chclidogyrus* sp, familia Dactylogyridae (28.8%) y del protozooario *Trichodina* sp (11.0%) (8/73).

Abstract

The aim of this study was to determine the presence of ectoparasites in the gills of 73 adult tilapia (*Oreochromis niloticus*) from seven ponds located in the Bello Horizonte Sector, Banda de Shilcayo district, San Martín, Peru. Sampling was carried out between January and February 2021. Measurements of size, temperature and pH of the ponds were recorded and the measurements of the ponds and fish density were obtained from fish farms records. The fish were taken to the laboratory for the dissection of the gills and the collection and fixation of the ectoparasites. Results showed that 35.6% (26/73) of fish were infested with one or more ectoparasites. The presence of monogeneans of the genus *Chclidogyrus* sp, family Dactylogyridae (28.8%) and the protozoan *Trichodina* sp (11.0%) (8/73) was determined.

Enlace: <https://doi.org/10.15381/RIVEP.V34I1.24596>

Efecto de la vegetación, ecosistema y formaciones geológicas en la abundancia de primates en la Reserva Nacional Pucacuro, al norte de la Amazonía peruana

Effect of Vegetation, Ecosystem, and Geological Formations on Primate Abundance in the Pucacuro National Reserve, North Peruvian Amazon

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Resumen

Las estrategias de conservación pueden no resultar efectivas al no considerar los factores naturales como la vegetación, ecosistemas y formaciones geológicas donde los primates pueden ser escasos o estar ausentes de forma natural. Esto nos motivó a estudiar la densidad de primates en ecosistema inundable y de tierra firme, en vegetación de bosque inundable de palmeras o aguajal (Bip), bosque de terraza baja (Btb), bosque de colina baja (Bcb) y bosque de terraza alta (Bta), y en las formaciones geológicas Pebas y Nauta en la Reserva Nacional Pucacuro. Utilizamos 21 transectos, 3 estuvieron en Bip, 5 en Btb, 3 en Bta y 10 en Bcb, y recorrimos un total de 335,2 y 103,6 km en Btb y Bip, y 337,1 y 1323,6 km en Bta y Bcb, respectivamente. Nuestros resultados indican que *Cebus apella*, *Saimiri cassiquiarensis* fueron abundantes en el ecosistema inundable, en el Bip y Btb. *Lagothrix lagotricha poeppigii* fue abundante en el ecosistema de tierra firme, específicamente en Bta y Bcb. *Plecturocebus discolor* fue abundante solamente en bosque de terraza baja. Las formaciones geológicas afectaron a la abundancia de *Callimico goeldii* y *Ateles belzebuth*, quienes se restringieron al Bcb de la Formación Nauta inferior y Formación Pebas, respectivamente. Otras especies de primates no fueron afectadas por estos factores naturales.

Abstract

Conservation strategies may not be effective by not considering natural factors such as vegetation, ecosystems, and geological formations where primates may be scarce or naturally absent. This motivated us to study the density of primates in floodplain and mainland ecosystems, as well as in its different vegetations such as floodplain forest of palm trees or aguajal (Bip), low terrace forest (Btb), low hill forest (Bcb) and high terrace forest (Bta), and Pebas and Nauta formations in the Pucacuro National Reserve. We used 21 transects, of which 3 were in Bip, 5 in Btb, 3 in Bta and 10 in Bcb. We covered a total of 335,2 and 103,6 km on Btb and Bip, and 337,1 and 1323,6 km on Bta and Bcb, respectively. Our results indicate that *Cebus apella* and *Saimiri cassiquiarensis* were abundant in floodplain forest, in Bip and Btb. *Lagothrix lagotricha poeppigii* was abundant in terra firme forest, specifically in Bta and Bcb. *Plecturocebus discolor* was abundant only in low terrace forest. Geological formations affected the abundance of *Callimico goeldii* and *Ateles belzebuth*, which were restricted to the Bcb of the lower Nauta Formation and Pebas Formation, respectively. Other primate species were not affected by these natural factors.

Enlace: <https://doi.org/10.22386/ca.v11i1-2.387>

Efecto de la yema de huevo sobre la calidad de semendescongelado de paco (*Piaractus brachypomus*)

Effect of egg yolk on thawed semen quality of paco (*Piaractus brachypomus*)

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Resumen

El objetivo del estudio fue evaluar el efecto del tipo de yema de huevo (codorniz-YC vs gallina-YG) sobre la calidad del semen de paco (*Piaractus brachypomus*) (volumen, color, concentración, motilidad, vitalidad y fertilidad) congelado. Se utilizaron 18 reproductores (15 machos y 3 hembras) cuya espermiación y ovulación, respectivamente, fue inducida con extracto de hipófisis de carpa. El semen fue colectado mediante masaje del abdomen del pez. El semen fresco fue evaluado y luego diluido con una solución crioprotectora que incluyó YC o YG. El semen diluido fue congelado y descongelado a los 30 días para la evaluación pos-descongelación y prueba de fertilidad. Se encontró una notoria disminución de los parámetros seminales por efecto de la congelación. La motilidad fue menor para la YC comparado a la YG (14.8 vs. 18.8%; $p < 0.05$), mientras que la vitalidad (31 vs. 28.8%), tiempo de activación (1.4 vs. 1.3 min) y la fertilidad (18.4 vs. 20.4%) fueron similares entre grupos. En conclusión, la motilidad fue mejorada con la adición de yema de huevo de gallina, mientras que la vitalidad, tiempo de activación y fertilidad no fueron influenciados por el tipo de yema.

Abstract

The objective of the study was to evaluate the effect of the type of egg yolk (quail-YC vs hen-YG) on the quality of frozen paco (*Piaractus brachypomus*) semen (volume, colour, concentration, motility, vitality and fertility). Eighteen breeders (15 males and 3 females) were used, whose spermiation and ovulation, respectively, were induced with carp pituitary extract. Semen was collected by massaging the abdomen of the fish. Fresh semen was evaluated and then diluted with a cryoprotective solution that included YC or YG. Diluted semen was frozen and thawed at 30 days for post-thaw evaluation and fertility testing. A notable decrease in seminal parameters was found due to the effect of freezing. Motility was lower for YC compared to YG (14.8 vs. 18.8%; $p < 0.05$), while vitality (31 vs. 28.8%), activation time (1.4 vs. 1.3 min) and fertility (18.4 vs. 20.4%) were similar between groups. In conclusion, the motility was improved with the addition of chicken egg yolk, while the vitality, activation time and fertility were not influenced by the type of yolk.

Enlace: <https://doi.org/10.15381/RIVEP.V34I1.24594>

Efecto de las sales de los medios de cultivo Murashige & Skoog y Knudson sobre el establecimiento *in vitro* de *Epidendrum schomburgkii* Lindl.

Effect of the salts of the Murashige & Skoog and Knudson culture media on the *in vitro* culture establishment of *Epidendrum schomburgkii* Lindl.

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Resumen

La multiplicación de orquídeas suele ser un impedimento para el éxito comercial de especies importantes. Con el fin de evaluar el crecimiento inicial de *Epidendrum schomburgkii* Lindl., bajo diferentes concentraciones de nutrientes, se inocularon *in vitro* plántulas provenientes de semilla sexual, de 20 mm de altura, en dos medios basales: Murashige & Skoog (ms) y Knudson (kn) a concentraciones de 25 %, 50 %, 75 % y 100 %. Se aplicó un diseño estadístico completamente al azar en arreglo factorial 2 × 3, y para el análisis se utilizaron los paquetes estadísticos spss, Infostat y Biostat. Después de 118 días de cultivo se obtuvo un promedio de 5,88 brotes vivos con una altura promedio de 92,80 mm y una longitud promedio de raíces de 80,74 mm. Se encontraron diferencias significativas para el número de brotes vivos entre concentraciones, mayor altura del tallo y mayor longitud de raíz, así como en la interacción media por concentración. En general, los valores promedios para el medio MS fueron más altos en comparación con el medio kn. En cuanto a la longitud del tallo de mayor extensión, no encontramos una diferencia estadísticamente significativa entre concentraciones, pero sí una clara diferencia en las tendencias (negativas para ms y positivas para kn). El crecimiento de raíces y tallos fue visiblemente mayor con el medio MS, con una concentración óptima del 25 %; por lo tanto, al evaluar las fórmulas y dosis aplicadas, se concluye que el medio MS a una concentración del 25 % presenta una mejor respuesta para el desarrollo de los propágulos de *Epidendrum schomburgkii* Lindl.

Abstract

Orchid multiplication is often an impediment to the commercial success of important species. In order to have a sowing technique to evaluate the initial growth of *Epidendrum schomburgkii* Lindl., seedlings from sexual seed 20 mm high were inoculated *in vitro* in two basal media: Murashige & Skoog (MS) and Knudson (KN) at concentrations of 25 %, 50 %, 75 % and 100 %. After 118 days of cultivation, an average of 5.88 live shoots with an average height of 92.80 mm and an average root length of 80.74 mm were obtained. Significant differences were found for the number of live shoots between concentrations, greater stem height and greater root length, as well as in the mean x concentration interaction. A completely randomized statistical design was applied in a 2 x 3 factorial arrangement, and the SPSS, INFOSTAT and BIOSTAT tests were used for the analysis. In general, the values for MS medium were higher compared to KN medium. Regarding the length of the longest stem, we did not find a statistically significant difference between concentrations, but a clear difference in trends (negative for MS and positive for KN). The growth of roots and stems was visibly higher with the MS medium, with an optimal concentration of 25 %. Therefore, when evaluating the formulas and applied doses, it is

concluded that the MS medium at a concentration of 25% offers the best response in the development of propagules.

Enlace: https://doi.org/10.21930/rcta.vol23_num3_art:2526

Efecto de sustratos y enraizadores en la propagación vegetativa de *Coffea arabica* var. *típica* en microtúneles

Effect of substrates and rooters on the vegetative propagation of *Coffea arabica* var. *typical* in microtunnels

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Resumen

El *Coffea arabica* variedad *típica* tiene una alta demanda a nivel mundial por su calidad organoléptica, sin embargo, en los últimos años las plantaciones han sido severamente afectadas por la roya del café (*Hemileia vastatrix*, Berkeley & Broome). La propagación asexual es una alternativa para regenerar plantas de la variedad *típica* con características agronómicas deseables como son porte alto, porcentaje de café supremo entre 63% y 72% y excelente calidad en taza. Con la finalidad de propagar vegetativamente a la variedad *típica* por enraizamiento de estaquillas en microtúneles, en este estudio se probaron tres tipos de sustratos y dos enraizadores, además de los tratamientos testigo (sustratos sin enraizador). Las estaquillas se instalaron bajo un diseño completo al azar con arreglo factorial de 3A x 3B, donde A son los sustratos: tierra agrícola, turba y arena y B son las auxinas: AIB-98% (ácido indol butírico) 2000 ppm y Root-hor (0,4 ANA (ácido alfa naftalenacético) + 0,1 AIB) a 5000 ppm. Se utilizaron estaquillas basales de 7cm de tamaño uniformizadas a 5 cm con 25% de área foliar, colectadas de jardines clonales. Se encontró que tanto el sustrato arena como el sustrato turba, más AIB-98% (ácido indol butírico) y el testigo (sin enraizador) no generaron mortalidad en las estaquillas. El empleo de turba + AIB-98% generaron efectos significativos en el enraizamiento y tuvieron efectos independientes para el número y el tamaño de raíces. La auxina AIB-98% potenció el enraizamiento de las estaquillas de café, sin embargo, las estaquillas tratadas con Root-hor no mostraron un efecto significativo sobre el enraizamiento, a pesar de interacción con los sustratos.

Abstract

Coffea arabica Típica variety is in high demand worldwide for its organoleptic quality; however, in recent years plantations have been severely affected by coffee rust (*Hemileia vastatrix*, Berk and Broome). Asexual propagation is an alternative to regenerate plants of the Típica variety with desirable agronomic characteristics such as high bearing, supreme coffee percentage between 63 % to 72 % and excellent cup quality. In order to vegetatively propagate the Típica variety by rooting cuttings in microtunnels, three types of substrates and two rooting agents were tested in this study, in addition to the control treatments (substrates without rooting agents). The cuttings were installed under a complete randomized design with a 3A x 3B factorial arrangement, where A are the substrates: agricultural soil, peat and sand; B are the auxins: AIB-98 % (indole butyric acid) 2000 ppm and Root-hor (0.4 ANA (alpha naphthaleneacetic acid) + 0.1 AIB) at 5000 ppm. Basal cuttings of 7 cm size uniformized to 5 cm with 25 % leaf area, collected from clonal gardens, were used. It was found that both sand and peat substrates, plus AIB-98 % (indole butyric acid) and the control (without rooting agent) did not generate mortality in the cuttings. The use of peat + AIB-98 % generated significant effects on rooting and had independent effects on the number and size of roots. Auxin AIB-98 % enhanced rooting of coffee cuttings; however, cuttings treated with Root-hor showed a significant effect on rooting, despite the interaction with the substrates.

Efecto del sustrato en la propagación sexual de *Cinchona officinalis* L. (Rubiaceae)

Effect of substrate on the germination of *Cinchona officinalis* L. (Rubiaceae)

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Resumen

Cinchona officinalis, conocida como árbol de la quina, es una especie emblemática de Perú, con alto valor medicinal, se popularizó por su uso antimalárico y se encuentra en peligro de extinción. El objetivo de la investigación fue estudiar el efecto del sustrato sobre la propagación sexual de *C. officinalis*. Se aplicó un diseño completamente al azar con cinco tratamientos de acuerdo con el tipo de sustrato T1 (25 % de tierra de bosque + 75 % de arena), T2 (50 % de tierra de bosque + 50 % de arena), T3 (75 % de tierra de bosque + 25 % de arena), T4 (100 % de tierra de bosque) y T5 (100 % de arena). En los tratamientos se emplearon tres repeticiones y 100 semillas por unidad experimental. El inicio de la germinación de *C. officinalis* ocurrió a partir de los 12 días después de la siembra hasta el día 42. El sustrato tierra de bosque tuvo mejor efecto en el índice (18.45 ± 3.63), velocidad (0.40 ± 0.06), tiempo (21.44 ± 0.98) y porcentaje de germinación ($85 \% \pm 13.23 \%$); seguido por los tratamientos T3 y T2. Por su parte, T5 fue el tratamiento con menor efecto sobre la germinación de *C. officinalis*. El estudio evidencia que el tipo de sustrato empleado favoreció el proceso de germinación de semillas de *C. officinalis*; sugiriendo usar un sustrato procedente de bosques naturales y puro (sin combinación).

Abstract

Cinchona officinalis, known as cinchona tree, is an emblematic species of Peru, with high medicinal value, became popular for its antimalarial use and is in danger of extinction. The objective of the research was to study the effect of substrate on the sexual propagation of *C. officinalis*. A completely randomized design was applied with five treatments according to the type of substrate T1 (25 % forest soil + 75 % sand), T2 (50 % forest soil + 50 % sand), T3 (75 % forest soil + 25 % sand), T4 (100 % forest soil) and T5 (100 % sand). Three replicates and 100 seeds per experimental unit were used in the treatments. The onset of germination of *C. officinalis* occurred from 12 days after sowing until day 42. The forest soil substrate had the best effect on the index (18.45 ± 3.63), speed (0.40 ± 0.06), time (21.44 ± 0.98) and germination percentage ($85 \% \pm 13.23 \%$); followed by treatments T3 and T2. T5 was the treatment with the least effect on *C. officinalis* germination. The study shows that the type of substrate used favored the germination process of *C. officinalis* seeds, suggesting the use of a substrate from natural forests and pure (without combination).

Enlace: <https://doi.org/10.7818/ECOS.2314>

Effect of arbuscular mycorrhiza on germination and initial growth of *Cinchona officinalis* L. (Rubiaceae)

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Abstract

Cinchona officinalis, known locally as cascarilla or cinchona, is a plant species native to South America. It was used as a source of quinine to combat malaria in the 17th century. The species is threatened by various anthropogenic activities. Further, the propagation of the species depends on seed dispersal and its germination capacity. Therefore, it is necessary to conserve and propagate this species. Because *C. officinalis* seeds have a low germination capacity, we determined the effect of arbuscular mycorrhizae (AM) on their germination and growth. A randomized design was employed with two treatments, one treated with mycorrhizae (CM) and another without mycorrhizae (SM). For each treatment, three replicates of 100 seeds were used. Germination, growth, and fungal characteristics were evaluated. In germination parameters, the CM treatment showed better performance, but the improvement was statistically insignificant. However, the application of AM significantly improved seedling height (cm), root length (cm), leaf area (cm²), and root number by 53.52, 28.72, 29.73, and 61.66%, respectively. Likewise, mycorrhization intensity (%), mycorrhization frequency (%), and extraradical mycelium length (cm) in the CM treatment were 37.13, 3.44, and 174.97% higher compared to the SM treatment, respectively. Therefore, the use of AM fungi proves to be advantageous in the propagation of *C. officinalis*, and these results provide a basis for the largescale and sustainable propagation of this species.

Enlace: <https://doi.org/10.1080/21580103.2022.2124318>

Effect of heparin and EDTA as anticoagulants on hematological values in farmed juvenile of *Arapaima gigas*

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Abstract

The rapid coagulation of fish blood makes the use of anticoagulants in hematological analysis necessary and means that choosing the most appropriate product is important. The aim of the present study was to evaluate the effect of two different anticoagulants (heparin sodium and K₂EDTA), storage time, and temperature on the hematological values of *Arapaima gigas* juveniles. Twelve juveniles (905.79 ± 111.2 g and 49 ± 1.74 cm) kept in captivity were used for the tests. Blood was collected from the caudal vein and divided for the analysis of the effects of K₂EDTA 10% and heparin sodium 5000 IU, storage time (0, 5, 10, and 24 h), and temperature (4 and 28 °C). The hematocrit, erythrocyte count, hemoglobin, mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH), and differential leukocyte count were evaluated. The results revealed significant differences in the hematocrit, lymphocytes, and neutrophils when the anticoagulants were compared at 0 h of storage. In the hematocrit, heparin sodium produced variations, while K₂EDTA maintained the values constant at 5 h, the erythrocyte count constant for up to 24 h, with the exception of at 4 °C, while hemoglobin produced variations in all the groups at 5 h. The blood indices MCV, MCHC, and MCH were best preserved, without variations, using K₂EDTA at 28 °C for up to 5 h. In conclusion, K₂EDTA 10% at 28 °C maintained constant hematological values of *Arapaima gigas* for 5 h, with the exception of hemoglobin, which should be analyzed as soon as possible.

Enlace: <https://doi.org/10.1007/s10499-021-00796-1>

Elucidating a history of invasion: population genetics of pirarucu (*Arapaima gigas*, Actinopterygii, Arapaimidae) in the Madeira River

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Abstract

The spread of non-native fish species is increasing globally and threatening aquatic ecosystems. Identifying the origins, the pathways, and vectors is crucial for managing biological invasions. We conducted a genetic characterization of *Arapaima gigas* from the Madeira River, considering native and non-native populations, to elucidate the invasion of the upper and middle Madeira River basin by *A. gigas*. We analyzed 9 microsatellite loci of 141 individuals from native (lower Madeira) and invasive (upper Madeira) populations, in addition to a locality from Peru outside the Madeira River basin drainage area, that previously was suggested to be one of the possible origins of the invasion. The results of discriminant analysis of principal components, Bayesian modeling of population structure, clustering and assignment tests (using microsatellite data from other Amazon locations) showed a clear separation between native and invasive populations and revealed a mixture of individuals from upper and middle Madeira and Peru. We confirm that the invasive population originates from Peru and was introduced by fish escapees from farms. Multiple secondary introductions may have advanced the invasion speed. Such a scenario represents a conservation paradox, because in its native habitat, *A. gigas* is endangered, whereas it has become invasive in non-native areas.

Enlace: <https://doi.org/10.1007/s10750-022-04977-8>

Embryonic development of eggs and stereological analysis of body of *Neoechinorhynchus buttnerae* (Golvan, 1956) (Eoacanthocephala: Neoechinorhynchidae)

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Abstract

The egg is one of the fundamental parts of the life cycle of *Neoechinorhynchus buttnerae*, and this stage involves the acanthor larva. It is also the infection phase for the intermediate host. Under normal conditions, the larva inside the egg can survive for months in the environment; however, information regarding this phase of life of the parasite is scarce. In addition, there is no quantitative information about the structural composition of the parasite's body from a histological point of view. Such information is essential in order to support decisions aimed at controlling infestations by these parasites in fish farming. This study aimed to present a detailed description of the stages of embryonic development of *N. buttnerae* eggs, as well as a stereological evaluation of the body of adult females of the parasite. Three phases of development characterized the eggs: cell division (with four stages), formation of the internal nuclear mass (with four stages) and formation of the acanthor larva (with five stages). The ovary comprised 26.61% of the volume of the animal and most of it contained eggs (21.28%), ovarian balls (3.88%) and empty spaces (1.45%). These results are of great importance and will support future studies that seek to interrupt the life cycle of this parasite.

Enlace: <https://doi.org/10.1017/S0031182021001712>

Endoparásitos zoonóticos en peces de consumo comercializados en los mercados de la ciudad de Iquitos, Loreto, Perú

Zoonotic endoparasites in consumer fish commercialized in the markets of Iquitos city, Loreto, Peru

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Resumen

La ictiofauna amazónica es muy importante para el desarrollo comercial de la Amazonia Peruana, siendo la carne de pescado, la principal fuente de proteína animal consumida por el poblador amazónico. Apesar de la alta demanda de pescado en los mercados de la ciudad, poco se conoce acerca de los parásitos presentes en su carne, existiendo un riesgo potencial para contraer algún parásito zoonótico. En tal sentido, el presente estudio tuvo como objetivo identificar a endoparásitos en peces de consumo comercializados en mercados de la ciudad de Iquitos, reportando la presencia de especies zoonóticas parasitando órganos internos y la musculatura de los peces. Muestras de peces fueron adquiridas de los mercados “Modelo”, “Secada”, “Cardozo” y “Belén” localizadas en la ciudad de Iquitos, Loreto, Perú. En total fueron analizadas 29 especies de peces, examinando los órganos internos, cavidad y musculatura. Los resultados obtenidos permitieron la identificación de 15 géneros y 22 especies parasitarias (ocho tremátodos, cuatro céstodos, dos acantocéfalos, 22 nemátodos y un pentastómido). Los parásitos zoonóticos registrados fueron: *Clinostomum marginatum* e *Ithyoclinostomum dimorphum* (Trematoda), *Anisakis* sp., *Contracaecum* sp., *Hysterothylacium* sp., *Terranova* sp., *Pseudoterranova* sp., *Eustrongylides* sp. (Nematoda) y *Sebekia* sp. (Pentastomida). Estos parásitos representan riesgos latentes a la salud del consumidor de ser ingeridos de forma accidental en preparaciones culinarias que utilizan la carne de pescado cruda o mal cocida como forma de preparación.

Abstract

The Amazonian ichthyofauna is very important for the commercial development of the Peruvian Amazon, being fish meat the main source of animal protein consumed by the Amazonian population. Despite the high demand for fish in the city's markets, little is known about the parasites present in its meat, and there is a potential risk of acquiring a zoonotic parasite. In this sense, the present study aimed to identify endoparasites in fish sold in markets in the city of Iquitos, reporting the presence of zoonotic parasites in internal organs and the musculature of the fish. Fish samples were acquired from the “Modelo”, “Secada”, “Cardozo” and “Belén” markets, located in Iquitos, Loreto, Peru. In total, 29 species of fish were analyzed, examining the internal organs, cavity and musculature. The results obtained allowed the identification of 15 genera and 22 parasitic species (eight trematodes, four cestodes, two acanthocephalans, 22 nematodes and one pentastomid). The registered zoonotic parasites were: *Clinostomum marginatum* and *Ithyoclinostomum dimorphum* (Trematoda), *Anisakis* sp., *Contracaecum* sp., *Hysterothylacium* sp., *Terranova* sp., *Pseudoterranova* sp. and *Eustrongylides* sp. (Nematoda) and *Sebekia* sp. (Pentastomida). These parasites represent latent risks to the consumer's health if they are accidentally ingested in culinary preparations that use raw or undercooked fish meat as a preparation.

Enlace: <https://doi.org/10.24841/fa.v31i1.604>

Environmental predictors of filarial infection in Amazonian primates: Ecological factors and primate filarial infection

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Abstract

Filarial nematode infections are common in primates, but have received little attention in the Neotropics. Epidemiological data on filarial infections in primates are still too sparse to fully understand the complex of this parasitism, especially because of the difficulty in studying the ecology and epidemiology of wild primates. We describe natural infections by *Dipetalonema* parasitizing 211 primates belonging to eight free-living primate genera in Amazonia, and assess the relationships between parasitic indicators and climatic (rainfall and river level), ecological (fruiting periods of plants) and biological (sex, species' body mass, group size and density) factors. The overall prevalence was 64.4% (95% CI: 64.0 – 64.9); parasitic mean abundance (N filariae per individual) and parasitic mean intensity (N filariae per infected host) of infection were 11.9 (95% CI: 8.3 – 15.6) and 18.4 (95% CI: 13.4 – 23.4) filariae/individual, respectively. Although we observed differences in parasitic parameters among primate genera, there was no correlation between parasitic parameters with density, body mass or group size. *Sapajus*, *Cebus* and *Lagothrix* had the highest prevalence and parasitic mean intensity. Using *Lagothrix lagotricha poeppigii*, the most sampled species ($n = 92$), as a model, we found that the number of filariae per infected host was associated with fruit production in swamp forests during the dry season, the time of food scarcity. The long periods of food shortage may cause environmental stress on primates, impairing their immune defenses and leading to increased parasite load but not affecting infection prevalence. However, the lack of information on vector ecology, key to understand risk factors associated to infection rate, prevents confirming the existence of an infection pattern dependent on food availability.

Enlace: <https://doi.org/10.1016/j.actatropica.2022.106670>

Evaluación de la injertación del camu camu (*Myrciaria dubia* (Kunth) McVaugh) por púa terminal

Grafting evaluation in camu camu (*Myrciaria dubia* (kunth) McVaugh) by terminal scion

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Resumen

El camu-camu (*Myrciaria dubia*) es posiblemente el fruto amazónico de mayor importancia por su potencial nutracéutico, con un contenido de ácido ascórbico superior al de los cítricos en unas 20 veces. Para evaluar la eficiencia de la injertación por púa terminal, se colectaron varas yemas de 43 plantas seleccionadas por alto rendimiento de fruta, procedentes de Loreto-Amazonia Peruana, los cuales se injertaron en patrones de Roraima-Brasil desarrollados en el vivero experimental del EMBRAPA, Boa Vista. Se practicaron 215 injertaciones (5 por cada planta seleccionada) cultivadas en macetas individuales con sustrato arenoso fertilizado con solución nutritiva. Respecto a los patrones tuvieron un diámetro promedio de tallo de 8.07 mm en el punto de injertación ubicado en promedio a 23.22 cm del cuello de la planta. La púa tuvo en promedio 7.30 cm de longitud, con 2.24 brotes vivos y 1.28 brotes muertos. No se encontró correlación entre el porcentaje de prendimiento y el porcentaje de plantas logradas con ninguna de las variables independientes. Respecto a la evaluación del método de injertación por púa terminal, se encontró un alto nivel de prendimiento (78.60%) que no concordó con el nivel bajo (20.54%) de plantas logradas y aptas para su trasplante a campo definitivo, lo cual sugiere mejorar la tecnología referida al desarrollo inicial de los injertos prendidos.

Abstract

The camu camu (*Myrciaria dubia*) is possibly the most important amazonian fruit for its nutraceutical potential, with an ascorbic acid content higher than that of citrus in about 20 times. To evaluate the efficiency of grafting by terminal scion, buds rods were collected from 43 plants selected for high fruit yield, coming from Loreto, Peruvian Amazon, which were grafted onto rootstocks of Roraima, Brazil developed in the experimental nursery of the EMBRAPA, Boa Vista. 215 grafts were performed (five per each selected plant) grown in individual pots with sandy substrate fertilized with nutrient solution. Regarding the rootstocks had an average stem diameter of 8,07 mm in the grafting point located on average 23,22 cm from the neck of the plant. The scion had an average length of 7,30 cm, with 2,24 live shoots and 1,28 dead shoots. It was not found correlation between the percentage of graft on and the percentage of plants achieved (good conditions to be planted) with none of the independent variables. Regarding the evaluation of the terminal scion grafting method a high level of graft on was found (78,60%) that did not agree with the low level (20,54%) of plants achieved and suitable for transplantation to the field, which suggests to improve the technology related to the initial development of the grafts.

Enlace: <https://doi.org/10.24841/FA.V31I2.579>

Evaluación temporal de la presencia de *Dolops discoidalis* (Branchiura: Argulidae) sobre *Pseudoplatystoma punctifer* (Pimelodidae) en Quistococha, Iquitos - Perú

Temporal evaluation of the presence of *Dolops discoidalis* (Branchiura: Argulidae) on *Pseudoplatystoma punctifer* (Pimelodidae) in Quistococha, Iquitos - Peru

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Resumen

El estudio reporta la presencia de branquiuros parasitando un plantel de 29 reproductores de doncella *Pseudoplatystoma punctifer* en Quistococha, Perú. Se identificó al parásito detallando sus aspectos morfométricos, calculando sus índices parasitológicos, registrando sus lugares de fijación y correlacionando la talla y peso de los peces hospederos con la abundancia de branquiuros. Tras el análisis de las muestras, se identificó el branchiuro *Dolops discoidalis* que parasita la parte dorsal y ventral del cuerpo de *P. punctifer*. Los índices parasitológicos, indicaron que todos los hospederos estuvieron infestados los 12 meses de muestreo, registrándose un total de 1143 branquiuros. Se reportaron correlaciones positivas entre la longitud total ($r = 0,58$; $p < 0,05$) y peso ($r = 0,64$; $p < 0,05$) de los hospederos y la abundancia de branquiuros. Los valores más altos en los índices parasitológicos se registraron después de varios meses de exposición a branquiuros sin ningún control, lo que resultó en un aumento desproporcionado de la carga parasitaria. El estudio demuestra que el comportamiento y biometría de los hospederos, así como la estación hidrológica, influyen directamente en la abundancia de *D. discoidalis*. Sin embargo, es importante evaluar si los factores reproductivos y ambientales influyen en las relaciones hospedero-parásito en estanques piscícolas de la Amazonía peruana.

Abstract

The study reports the presence of branchiurans parasitizing a breeding stock of 29 *Pseudoplatystoma punctifer* in Quistococha, Peru. The parasite was identified by detailing its morphometric aspects, calculating its parasitological indices, recording its attachment sites, and correlating the size and weight of the host fish with the abundance of parasites. After analyzing the samples, *Dolops discoidalis* was identified, which parasitizes the dorsal and ventral part of the body of *P. punctifer*. The parasitological indices indicated that all hosts were infested during the 12 months of sampling, registering a total of 1143 branchiurans. Positive correlations were reported between the total length ($r = 0.58$; $p < 0.05$) and weight ($r = 0.64$; $p < 0.05$) of the hosts and the abundance of parasites. The highest values in the parasitological indices were recorded after several months of exposure to branchiurans without any control, which resulted in a disproportionate increase in the parasite load. The study demonstrates that the behavior and biometry of the hosts, as well as the hydrological season, directly influence the abundance of *D. discoidalis*. However, it is important to evaluate whether reproductive and environmental factors influence host-parasite relationships in fishponds in the Peruvian Amazon.

Enlace: <https://doi.org/10.56926/repia.v2i2.45>

Evaluating future climate change exposure of marine habitat in the South East Pacific based on metabolic constraints

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Abstract

Introduction: On-going climate change is now recognized to yield physiological stresses on marine species, with potentially detrimental effects on ecosystems. Here, we evaluate the prospect of using climate velocities (CV) of the metabolic index (Φ) for assessing changes in habitat in the South East Pacific.

Methods: Our approach is based on a species with mean ecophysiotype (i.e. model species) and the use of a global Earth System Model simulation (CESM LE) under RCP 8.5 scenario. The SEP is chosen as a case study as it hosts an Oxygen Minimum Zone and seamounts systems sustaining local communities through artisanal fisheries.

Results and Discussion: Our results indicate that CV_{Φ} pattern is mainly constrained by the oxygen distribution and that its sign is affected by contrasting oxygen trends (including a re-oxygenation in the upper OMZ) and warming. We further show that CV_{Φ} is weakly dependent on physiological traits composing Φ , which conveys to this metrics some value for inferring the projected mean displacement and potential changes in viability of metabolic habitat in a region where physiological data are scarce. Based on sensitivity experiments to physiological traits and natural variability, we propose a general method for inferring broad areas of climate change exposure regardless of species-specific Φ . We show in particular that for the model used here, the upper OMZ region can be considered a “safe” area for the species with ecophysiotype close to that of 71 species used to derive the model species. Limitations of the approach and perspectives of this work are also discussed.

Enlaces: <http://hdl.handle.net/20.500.12816/5389>

<https://doi.org/10.3389/fmars.2022.1055875>

Evenness mediates the global relationship between forest productivity and richness

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Abstract

1. Biodiversity is an important component of natural ecosystems, with higher species richness often correlating with an increase in ecosystem productivity. Yet, this relationship varies substantially across environments, typically becoming less pronounced at high levels of species richness. However, species richness alone cannot reflect all important properties of a community, including community evenness, which may mediate the relationship between biodiversity and productivity. If the evenness of a community correlates negatively with richness across forests globally, then a greater number of species may not always increase overall diversity and productivity of the system. Theoretical work and local empirical studies have shown that the effect of evenness on ecosystem functioning may be especially strong at high richness levels, yet the consistency of this remains untested at a global scale.
2. Here, we used a dataset of forests from across the globe, which includes composition, biomass accumulation and net primary productivity, to explore whether productivity correlates with community evenness and richness in a way that evenness appears to buffer the effect of richness. Specifically, we evaluated whether low levels of evenness in speciose communities correlate with the attenuation of the richness–productivity relationship.
3. We found that tree species richness and evenness are negatively correlated across forests globally, with highly speciose forests typically comprising a few dominant and many rare species. Furthermore, we found that the correlation between diversity and productivity changes with evenness: at low richness, uneven communities are more productive, while at high richness, even communities are more productive.
4. *Synthesis.* Collectively, these results demonstrate that evenness is an integral component of the relationship between biodiversity and productivity, and that the attenuating effect of richness on forest productivity might be partly explained by low evenness in speciose communities. Productivity generally increases with species richness, until reduced evenness limits the overall increases in community diversity. Our research suggests that evenness is a fundamental component of biodiversity–ecosystem function relationships, and is of critical importance for guiding conservation and sustainable ecosystem management decisions.

Enlace: <https://doi.org/10.1111/1365-2745.14098>

Exceptional Genetic Differentiation at a Micro-geographic Scale in *Apistogramma agassizii* (Steindachner, 1875) from the Peruvian Amazon: Sympatric Speciation?

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Abstract

Mechanisms related to ecological or sexual selection have favoured sympatric speciation events in African and Central American lake cichlids. Allopatric divergence is the predominant speciation process observed in Amazonia, although, to the best of our knowledge, no study to date has attempted to determine whether speciation processes could exist under sympatric conditions in Amazonian cichlids. The *Apistogramma agassizii* species complex is an excellent model for investigating the existence of sympatric divergence events in the Amazon, as it shares many common life history characteristics with African Haplochromine cichlids in which sympatric speciation mechanisms are well documented. The genetic structure of *A. agassizii* was analysed by genotyping 889 individuals with ten microsatellite loci, collected from 26 sites distributed among small streams in 11 micro-basins in a very small portion of the Peruvian Amazon. It revealed 22 genetic populations identified according to panmictic criteria (F_{IS} estimator) and strongly differentiated: F_{ST} estimator (0.034 to 0.356). Such a strong genetic structuring on such small geographical areas has never been demonstrated before in an Amazonian fish. Several of these populations may have diverged sympatrically and repeatedly in small stream networks. The results are discussed with respect to divergence processes, including sympatric speciation, which may be associated with the observed genetic structure.

Enlace: <https://doi.org/10.1007/s11692-022-09587-9>

First records of Sphingidae, Saturniidae, and Arctiinae (Lepidoptera) in the forests of *Polylepis sericea* in the Huascarán National Park, Ancash, Peru

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Servicio Nacional de Áreas Naturales Protegidas por el Estado



Abstract

Polylepis forests are home to endemic species and are of great ecological importance. The degradation of these forests, a remarkable and unique biome in the Andean region, might cause severe consequences for the yet poorly studied high-altitude biota. In the context of Global Climate Change and other anthropogenic impacts, such as habitat loss and species invasion, the threat in this region is alarming. Therefore, studies informing about fauna and flora in this area are essential for conservation efforts and political decisions. In this study, we performed an inventory of three nocturnal Lepidoptera taxa (Sphingidae, Saturniidae, and Arctiinae) in *Polylepis* forests of the Huascarán National Park. The Huascarán National Park is a reserve in the Ancash region in the Andean zone of Peru. The specimens were collected using mixed light traps, from 18:00 to 24:00 hours in November (2015), February (2016), May (2016), and August (2016). We recorded seven species and 155 individuals, corresponding to two species of Sphingidae, one of Saturniidae, and four of Arctiinae. All the species presented are new records for the Huascarán National Park, three are new records for the department of Ancash and one new record for Peru.

Enlaces: <https://sis.sernanp.gob.pe/biblioteca/?publicacion=2600>

<https://doi.org/10.37486/2675-1305.ec04019>

Fur rubbing in *Plecturocebus cupreus* – an incidence of self-medication?

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Abstract

Fur rubbing, i.e. rubbing a substance or an object into the pelage, has been described in numerous Neotropical primate species, including species of titi monkeys, but it seems to be a rare behaviour. Here we describe a fur rubbing event in a wild coppery titi monkey (*Plecturocebus cupreus*) with *Psychotria* sp. (Rubiaceae) leaves observed and videotaped during a field study on vigilance behaviour between September–December 2019 in the Peruvian Amazon. Plants of the genus *Psychotria* contain a great diversity of secondary metabolites and are often used in traditional medicine. We suggest that the fur rubbing was an act of self-medication. This is the first record of fur rubbing in coppery titi monkeys in almost 4400 h of observation accumulated over more than 20 years.

Enlace: <https://doi.org/10.5194/pb-9-7-2022>

Genetic and Morphological Analyses Confirm the Presence of *Cebuella niveiventris* (Platyrrhini, Callitrichidae) in Bolivia

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Abstract

Esta publicación científica no cuenta con resumen disponible

Enlace: <https://doi.org/10.1007/s10764-023-00372-9>

Geographic patterns of tree dispersal modes in Amazonia and their ecological correlates

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Abstract

Aim: To investigate the geographic patterns and ecological correlates in the geographic distribution of the most common tree dispersal modes in Amazonia (endozoochory, synzoochory, anemochory and hydrochory). We examined if the proportional abundance of these dispersal modes could be explained by the availability of dispersal agents (disperser-availability hypothesis) and/or the availability of resources for constructing zoochorous fruits (resource-availability hypothesis).

Time period: Tree-inventory plots established between 1934 and 2019.

Major taxa studied: Trees with a diameter at breast height (DBH) ≥ 9.55 cm.

Location: Amazonia, here defined as the lowland rain forests of the Amazon River basin and the Guiana Shield.

Methods: We assigned dispersal modes to a total of 5433 species and morphospecies within 1877 tree-inventory plots across terra-firme, seasonally flooded, and permanently flooded forests. We investigated geographic patterns in the proportional abundance of dispersal modes. We performed an abundance-weighted mean pairwise distance (MPD) test and fit generalized linear models (GLMs) to explain the geographic distribution of dispersal modes.

Results: Anemochory was significantly, positively associated with mean annual wind speed, and hydrochory was significantly higher in flooded forests. Dispersal modes did not consistently show significant associations with the availability of resources for constructing zoochorous fruits. A lower dissimilarity in dispersal modes, resulting from a higher dominance of endozoochory, occurred in terra-firme forests (excluding podzols) compared to flooded forests.

Main conclusions: The disperser-availability hypothesis was well supported for abiotic dispersal modes (anemochory and hydrochory). The availability of resources for constructing zoochorous fruits seems an unlikely explanation for the distribution of dispersal modes in Amazonia. The association between frugivores and the proportional abundance of zoochory requires further research, as tree recruitment not only depends on dispersal vectors but also on conditions that favour or limit seedling recruitment across forest types.

Enlace: <https://doi.org/10.1111/geb.13596>

Growth, fillet composition, hematological parameters and disease resistance of juvenile *Brycon amazonicus* fed diets supplemented with essential oil of *Minthostachys mollis*

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Abstract

This study aimed to evaluate the effects of dietary supplementation with the essential oil of *Minthostachys mollis* on growth, fillet composition, hematological parameters, and disease resistance in juvenile *Brycon amazonicus*. A total of 120 fish (47.8 ± 7.7 g and 15.2 ± 0.7 cm) were randomly distributed in 12 tanks of 600 L (10 fish per tank) and fed commercial diets (28% protein and 5% lipids) supplemented with different levels of essential oil (0, 0.5, 1.0, and 1.5%), with three repetitions three times a day for 30 days. After 30 days, growth, hematological parameters, and fillet composition were evaluated. Disease resistance was tested by intraperitoneal injection of *Aeromonas hydrophila* (1.1×10^{12} CFU/mL) in five fish per tank, and mortality and hematological parameters were evaluated after 10 days. The results showed that the growth and hematological parameters of fish supplemented with 0.5 and 1.0% essential oil did not differ from the control group, but with 1.5% supplementation weight parameters, condition factor (1.27) and the mean corpuscular volume (188.9 fL) decreased, while glucose levels (114.8 mg dL^{-1}) increased. In the fillet composition, there was only an effect on protein, which increased (19.8–19.9%) in fish fed the diets supplemented with essential oil. The bacterial infection did not affect survival, in hematological parameters, only glucose (87.4 mg dL^{-1}) decreased in fish supplemented with 1.5% essential oil. It can be concluded that supplementation with the essential oil of *M. mollis* can increase the protein content in the fillets of *B. amazonicus* juveniles.

Enlace: <https://doi.org/10.1007/s10499-023-01260-y>

***Heterophrynus elaphus* (Amblypygi: Phrynidae): depredación por *Rhysida celeris* (Scolopendromorpha: Scolopendridae) y canibalismo**

***Heterophrynus elaphus* (Amblypygi: Phrynidae): predation by *Rhysida celeris* (Scolopendromorpha: Scolopendridae) and cannibalism**

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Oscoco

Servicio Nacional de Áreas Naturales Protegidas por el Estado

Resumen

Se registra el primer caso de depredación de amblopígidos por un ciempiés. Las especies involucradas son *Heterophrynus elaphus* Pocock, 1903 (Amblypygi: Phrynidae) y *Rhysida celeris* (Humbert & Saussure, 1870) (Scolopendromorpha: Scolopendridae). Además, se reporta el primer episodio de canibalismo observado en esta especie de amblopígido. Las observaciones se efectuaron en la cueva de las Lechuzas, Parque Nacional de Tingo María, departamento Huánuco, Perú.

Abstract

The first episode of centipede predation on a whip spider is recorded. The involved species are *Heterophrynus elaphus* Pocock, 1903 (Amblypygi: Phrynidae) and *Rhysida celeris* (Humbert & Saussure, 1870) (Scolopendromorpha: Scolopendridae). Also, the first observed cannibalistic episode in *H. elaphus* is herein recorded. Those observations were conducted in Cueva de las Lechuzas, Parque Nacional de Tingo María, Huánuco department, Peru.

Enlace: <https://sis.sernanp.gob.pe/biblioteca/?publicacion=2597>

Host–Parasite Interaction and Phylogenetic of a New Cnidarian *Myxosporean* (Endocnidozoa: Myxobolidae) Infecting a Valuable Commercialized Ornamental Fish from Pantanal Wetland Biome, Brazil

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Abstract

Myxozoans are a diverse group of parasitic cnidarians of wide distribution. A new species, *Myxobolus matogrossoensis* n.msp., is herein described infecting wild specimens of tetra matogrosso *Hyphessobrycon eques*, caught in the Pantanal biome, the world's largest tropical wetland area. Cysts were found in 3 of the 30 examined fishes. Mature myxospores were ovoid in shape in frontal and measured $6.6 \pm 0.4 \mu\text{m}$ ($6.2\text{--}7.0 \mu\text{m}$) in length and $3.5 \pm 0.2 \mu\text{m}$ ($3.3\text{--}3.7 \mu\text{m}$) in width. The two polar capsules were elongated in shape, equal in size and occupying almost half of the myxospore body. They measured $3.3 \pm 0.2 \mu\text{m}$ ($3.1\text{--}3.5 \mu\text{m}$) in length and $1.8 \pm 0.1 \mu\text{m}$ ($1.7\text{--}1.9 \mu\text{m}$) in width. The polar tubules presented three to four turns. Phylogenetic analysis placed the new species within a clade containing myxobolid species from South American characiforms fish and appears as a close species of *Myxobolus piraputangae* and *Myxobolus umidus*. Nevertheless, the sequences of the new species and *P. umidus* and *P. piraputangae* have a large genetic divergence of 12 and 12.2% in their 18S rDNA gene, respectively. To the best of our knowledge, this is the first report of a *Myxobolus* species parasitizing the tetra fish matogrosso, thus increasing our knowledge of cnidarian myxosporean diversity from South America.

Enlace: <https://doi.org/10.3390/pathogens11101119>

Identificación de parásitos zoonóticos en la musculatura y cavidad visceral de *Hoplias malabaricus* Bloch 1794 “fasaco” (Characiformes: Erythrinidae) provenientes del mercado Belén, Iquitos-Perú

Identification of zoonotic parasites in the musculature and visceral cavity of *Hoplias malabaricus* Bloch 1794 «fasaco» (Characiformes: Erythrinidae) from the Belén market, Iquitos-Peru

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Resumen

El presente trabajo tuvo como finalidad la identificación de parásitos zoonóticos en la musculatura y cavidad visceral de *Hoplias malabaricus* «fasaco» provenientes del mercado Belén en Iquitos, Perú. Se revisó la cavidad visceral realizando un corte longitudinal desde la abertura del ano hasta la altura de las branquias y se realizaron cortes finos en la musculatura de los peces para detectar parásitos enquistados o libres. Los nematodos se clarificaron utilizando ácido láctico, en los pentastómidos se utilizó el medio Hoyer y los trematodos se tiñeron con carmín alcohólico de Langeron. Se observó la presencia de endoparásitos zoonóticos: larvas L3 del nematodo *Eustrongylides* sp Jagerskiold, 1909 (Dioctophymatidae), el trematodo *Ithyoclinostomum dimorphum* Witenberg, 1925 (Clinostomidae) y el pentastómido *Sebekia* sp.

Abstract

The aim of this study was to identify zoonotic parasites in the musculature and visceral cavity of *Hoplias malabaricus* «fasaco» from the Belén market in Iquitos, Peru. The visceral cavity was reviewed through a longitudinal cut from the opening of the anus to the height of the gills. Besides, fine cuts were made in the musculature of the fish to detect encysted or free parasites. Nematodes were clarified using lactic acid, Hoyer's medium was used for pentastomids, and trematodes were stained with Langeron's alcoholic carmine. The presence of zoonotic endoparasites was observed: L3 larvae of the nematode *Eustrongylides* sp Jagerskiold, 1909 (Dioctophymatidae), the trematode *Ithyoclinostomum dimorphum* Witenberg, 1925 (Clinostomidae) and the pentastomid *Sebekia* sp.

Enlace: <https://doi.org/10.15381/rivep.v33i6.22491>

In vitro efficacy and tolerance of the essential oils of three species of the Lamiaceae family against monogeneans from the gills of *Piaractus brachypomus* from the Peruvian Amazon

Anai Flores Gonzales, Vanessa Mamani, Manuel Pereyra, Edwin Aguilar, Patrick Delgado Mathews, Marcos Tavares-Dias, Christian Fernández-Méndez

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Abstract

This study investigated the in vitro efficacy of the essential oil of *Minthostachys mollis*, *Origanum vulgare*, and *Salvia rosmarinus* against monogeneans from the gills of *Piaractus brachypomus* and the tolerance of this fish to these oils. In vitro concentrations of *M. mollis* (80, 200, 400, 600, 800, and 1000 mg L⁻¹), *O. vulgare*, *S. rosmarinus* (80, 200, 400, 600, 800, 1000, and 1500 mg L⁻¹) and two control groups (one containing only water from the growing tank and the other water from the tank + 70% alcohol) were evaluated at different exposure times. The concentrations were prepared at a proportion of 1:10 w/v with 70% alcohol, and after the in vitro tests, tolerance tests were carried out on fish with these oils. In the in vitro test, essential oil from *M. mollis*, *O. vulgare*, and *S. rosmarinus* showed dose-dependent efficacy against *Anacanthorus spathulatus*, *Anacanthorus penilabiatus*, and *Mymarothecium viatorum*. However, *M. mollis* caused the mortality of monogeneans in a shorter exposure time. In the two control groups using water from the growing tank and water from the growing tank + alcohol, the monogeneans showed similar behavior during the 6 h of exposure. In the tolerance tests with 80 mg L⁻¹ of essential oil from *M. mollis*, *O. vulgare*, and *S. rosmarinus* during 1 h of exposure, it was observed that *P. brachypomus* showed irregular swimming and tolerance without causing death. Fish exposed to the other concentrations showed opercular acceleration, irregular swimming, lethargy, loss of mobility, and death after 1 h of exposure. Therefore, these essential oils can be tested in consecutive therapeutic baths at concentrations that have efficacy and exposure times less than sedation for the control and treatment of *P. brachypomus* monogeneans.

Enlace: <https://doi.org/10.1007/s10499-022-00900-z>

Influencia de la desinfección, medios de cultivo y fitohormonas en el desarrollo morfogénico in vitro de germoplasma de *Guazuma crinita* Mart

Influence of disinfection, growth medium and phytohormones in the in vitro morphogenic development of germoplasm of *Guazuma crinita* Mart

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Resumen

El presente estudio, tuvo como objetivo determinar la influencia de procesos de desinfección, medio de cultivo y fitohormonas en el desarrollo morfogénico In vitro de explantes obtenidas a partir de semilla biológica de la especie *Guazuma crinita* Mart (Bolaina), el mismo que se realizó en el laboratorio de cultivo de tejidos y meristemas, de la Universidad Nacional de Ucayali. Para ello se desinfectaron las semillas con hipoclorito de sodio al 2%, por un espacio de 0, 5, 10, 15 y 20 minutos (T1, T2, T3, T4, T5). Para promover la germinación se utilizaron medios de cultivo y combinaciones de Fitogel, Fitogel + Sacarosa, Fitogel + Sacarosa + Murashige and Skoog (MS) y Fitogel + Sacarosa + ½ MS (M1, M2, M3, M4); y para la morfogénica se aplicaron cinco tratamientos de concentración de auxinas y citoquininas homogenizadas (AC1, AC2, AC3, AC4, AC5). Del estudio se obtuvo que el T5 (desinfección con hipoclorito de sodio al 2% con exposición de 20 minutos) tuvo un 95% de sobrevivencia; mientras que en la germinación, el medio M1 (Fitogel) presentó el más alto con un 72,55%; finalmente en la morfogénica se determinó que el mejor tratamiento para inducir la formación de callos es el tratamiento AC4 (Kin 12 ppm + AIB 12 ppm), para primordios radicales el mejor tratamiento AC5 (Kin 4 ppm + AIB 12 ppm) y se logró igual cantidad de brotes con todas las combinaciones de fitohormonas utilizadas.

Abstract

The objective of this study was to determine the influence of disinfection processes, culture medium and phytohormones on the in vitro morphogenic development of explants obtained from biological seed of the species *Guazuma crinita* Mart (Bolaina), which was carried out in the tissue culture and meristems laboratory of the National University of Ucayali. The seeds were disinfected with 2% sodium hypochlorite for 0, 5, 10, 15 and 20 minutes (T1, T2, T3, T4, T5). To promote germination, culture media and combinations of Phytogel, Phytogel + Sucrose, Phytogel + Sucrose + Murashige and Skoog (MS) and Phytogel + Sucrose + ½ MS (M1, M2, M3, M4) were used; and for morphogenesis, five homogenized auxin and cytokinin concentration treatments were applied (AC1, AC2, AC3, AC4, AC5). From the study it was obtained that T5 (disinfection with 2% sodium hypochlorite with exposure of 20 minutes) had a 95% survival rate; while in germination, the M1 medium (Phytogel) presented the highest with 72.55%; Finally, in morphogenesis, it was determined that the best treatment for inducing callus formation was AC4 (Kin 12 ppm + AIB 12 ppm), for root primordia the best treatment was AC5 (Kin 4 ppm + AIB 12 ppm) and the same number of shoots was achieved with all the combinations of phytohormones used.

Enlace: <https://doi.org/10.24841/fa.v31i1.572>

Influencia de los hongos micorrízicos arbusculares en el control biológico de la roya amarilla del café (*Hemileia vastatrix* Berk. & Broome)

Influence of arbuscular mycorrhizal fungi on biological control of coffee leaf rust (*Hemileia vastatrix* Berk. & Bromme)

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Resumen

La inoculación de plantas con hongo micorrízico arbuscular (HMA) induce protección contra factores estresantes bióticos como las enfermedades. Por lo tanto, este estudio tuvo como objetivo evaluar la influencia de los hongos micorrízicos arbusculares en el control biológico de la roya amarilla del café. Para ello, se utilizaron dos variedades de café (Caturra y Pache) y tres inóculos de HMA: Moyobamba (*Acaulospora mellea*, *Acaulospora* sp.1, *Glomus geosporum*, *Glomus* sp.1 y *Glomus* sp.2), El Dorado (*Acaulospora rugosa*, *Acaulospora spinosissima*, *Acaulospora lacunosa*, *Glomus* sp.1 y *Ambispora appendicula*) y Huallaga (*Acaulospora mellea*, *Acaulospora* sp.1, *Acaulospora* sp.2, *Glomus macrocarpum* y *Glomus* sp.2), además de un control sin aplicación de HMA. Las plantas de café propagadas vegetativamente e inoculadas con HMA mostraron tolerancia a la roya amarilla. La incidencia de roya amarilla en plantas que no fueron inoculadas con HMA fue de 43,7 %, mientras que en las plantas inoculadas con Moyobamba, El Dorado y Huallaga, las incidencias fueron 22,1; 22,7 y 13,2 %, respectivamente. Asimismo, la severidad en plantas que no fueron inoculadas fue de 34,8 %, mientras que en las plantas de café sometidas a los inóculos Moyobamba, El Dorado y Huallaga, las severidades encontradas fueron 21,1; 20,4 y 12,0 %, respectivamente. Se concluye que la inoculación micorrízica de plantas de café en etapa de vivero reduce los efectos negativos de la infección por roya amarilla luego de llevadas a condiciones de campo, y representa una opción sustentable para su control biológico.

Abstract

Inoculating plants with arbuscular mycorrhizal fungi (AMF) protects host plants against biotic stressors such as diseases. Therefore, the objective of this study was to evaluate the influence of arbuscular mycorrhizal fungi in the biological control of coffee leaf rust (CLR) infections. The research involved two varieties of coffee (Caturra and Pache) and three inocula of AMF: Moyobamba (*Acaulospora mellea*, *Acaulospora* sp.1, *Glomus geosporum*, *Glomus* sp.1, and *Glomus* sp.2), El Dorado (*Acaulospora rugosa*, *Acaulospora spinosissima*, *Acaulospora lacunosa*, *Glomus sinuosum* and *Ambispora appendicula*) and Huallaga (*Acaulospora mellea*, *Acaulospora* sp.1, *Acaulospora* sp.2, *Glomus macrocarpum* and *Glomus* sp.2), in addition to a control treatment without application of AMF (non-AMF). Inoculation of vegetatively propagated coffee plants with AMF was observed to induce tolerance to CLR. The incidence of CLR in non-AMF coffee plants was 43.7 %, while in the coffee plants subjected to the inocula Moyobamba, El Dorado and Huallaga, the incidences were 22.1, 22.7 and 13.2 %, respectively. Likewise, the severity in non-AMF coffee plants was 34.8 %, while in the coffee plants subjected to the three kinds of inocula, the severities were 21.1, 20.4 and 12.0 %, respectively. Thus, mycorrhizal inoculation of coffee plants at the nursery stage reduces the negative effect of CLR infection after the plants are taken to field conditions, representing a sustainable option for their biological control.

Enlace: <https://doi.org/10.51372/bioagro351.3>

Influencia de microalgas en el crecimiento del rotífero de agua dulce *Brachionus calyciflorus* (Pallas, 1766), Loreto Perú

Influence of microalgae on the growth of freshwater rotifer *Brachionus calyciflorus* (Pallas, 1766), Loreto Peru

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Resumen

El objetivo del presente estudio fue evaluar la influencia de las clorofitas en el crecimiento poblacional del rotífero *Brachionus calyciflorus*. El cultivo experimental se realizó en nueve recipientes de polietileno de 4 L con volumen útil de 800 mL de agua filtrada donde se sembraron diez rotíferos *Brachionus calyciflorus* por recipiente y fueron alimentados con microalgas a una concentración de 6×10^6 cel mL⁻¹: *Chlorella* sp. (Ch), *Scenedesmus* sp. (Sc) y *Chlorella* sp. + *Scenedesmus* sp. (Ch + Sc), durante 15 días de cultivo. Diariamente se realizó el conteo de los rotíferos y se evaluaron los parámetros de crecimiento poblacional. Los valores medios de: temperatura fueron de $27,7 \pm 0,31$ °C, oxígeno disuelto de $4,9 \pm 0,05$ mg L⁻¹ y pH de $6,6 \pm 0,22$. Los valores poblacionales más elevados en los rotíferos se obtuvieron alimentando con la mezcla de *Chlorella* sp. + *Scenedesmus* sp. (rendimiento de 1250 ± 523 ind mL⁻¹, velocidad de crecimiento de $1,0 \pm 0,1$ día, tiempo de duplicación de $0,7 \pm 0,1$ día y la densidad máxima de organismos de 8142,9 ind. mL⁻¹). La alimentación de los rotíferos en el presente estudio muestra mejores parámetros de crecimiento poblacional con la mezcla de *Chlorella* sp. y *Scenedesmus* sp.

Abstract

The objective of the present study was to evaluate the influence of chlorophytes on the population growth of the rotifer *Brachionus calyciflorus*. The experimental culture was carried out in nine 4 L polyethylene containers with a useful volume of 800 mL of filtered water where ten *Brachionus calyciflorus* rotifers were planted per container and fed with microalgae at a concentration of 6×10^6 cel mL⁻¹: *Chlorella* sp. (Ch), *Scenedesmus* sp. (Sc) and *Chlorella* sp. + *Scenedesmus* sp. (Ch + Sc), during 15 days of culture. Rotifers were counted daily and population growth parameters were evaluated. The mean values of: temperature were $27,7 \pm 0,31$ °C, dissolved oxygen $4,9 \pm 0,05$ mg L⁻¹ and pH $6,6 \pm 0,22$. The highest population values were with the mixture of *Chlorella* sp. + *Scenedesmus* sp. (yield of 1250 ± 523 ind mL⁻¹, growth rate of $1,0 \pm 0,1$ day, doubling time of $0,7 \pm 0,1$ day and the maximum density of organisms of 8142,9 ind mL⁻¹). The feeding of the rotifers in the present study shows better population growth parameters with the mixture of *Chlorella* sp. and *Scenedesmus* sp.

Enlace: <https://doi.org/10.24841/fa.v31i1.570>

Influencia del suelo en la diversidad alfa y estructura de la vegetación en los bosques de la carretera Iquitos - Nauta, Perú

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Resumen

El suelo es la parte superficial de la tierra donde crecen las plantas, entre ellas, especies de importancia económica que proporcionan alimentos, medicina y madera para la población, sin embargo, poco se ha estudiado sobre la influencia del suelo en las plantas de la Amazonía peruana. Por estas razones, se evaluó la relación entre las características físico-químicas del suelo y la diversidad y estructura en los bosques del ámbito de la carretera Iquitos-Nauta, Loreto, Perú. Para este estudio se establecieron 102 calicatas para el muestreo del suelo y 37 parcelas de 50 x 20 m para estudio de la vegetación. El índice de correlación de Spearman indicó que la diversidad alfa está relacionada negativamente con la capacidad de intercambio catiónico, potasio, fósforo y materia orgánica; y la estructura (cantidad de individuos) está relacionada negativamente con la cantidad de arcilla y pH. En conclusión, la diversidad alfa y estructura de la vegetación está determinada por las características físico-químicas del suelo.

Abstract

Soil is the superficial part of the earth where plants grow, among them, species of economic importance that provide food, medicine and wood for local people, however, little has been studied about the influence of the soil on the plants in the Amazon Peruvian. Due to these reasons, the relationship between the physical-chemical characteristics of the soil and the diversity and structure in the forests in the area of the Iquitos-Nauta highway, Loreto, Peru, was evaluated. 102 pits for soil sampling and 37 plots of 50 x 20 m for vegetation study, were settled. Spearman's correlation index indicated that alpha diversity is negatively related to cation exchange capacity, potassium, phosphorus, and organic matter; and the structure (number of individuals) is negatively related to the amount of clay and pH. In conclusion, the alpha diversity and structure of the vegetation is determined by the physical-chemical characteristics of the soil.

Enlace: <https://doi.org/10.24841/fa.v31i1.591>

Insect pests of *Theobroma cacao* (Malvaceae) in the Peruvian Amazon

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Abstract

Cocoa (*Theobroma cacao* L) has become one of the main crops in Peru. Insect pests cause substantial reduction in cocoa production in the Peruvian Amazon. This study sampled for the presence of insect pests over 6 years; 31 species were observed, seven of these were most abundant: *Xylosandrus compactus*, *Cyclocephala putrida*, *Carmenta foraseminis*, *Horiola picta*, *Toxoptera aurantii*, *Steirastoma breve*, *Dysmicoccus brevipes*, and two were new reported pests: *Cyclocephala putrida* and *Tetrataenia surinama*.

Enlace: <https://journals.sta.uwi.edu/ojs/index.php/ta/article/view/7854>

Intestinal endoparasitism in *Corydoras multiradiatus* (Siluriformes: Callichthyidae) in Iquitos, Loreto-Peru

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Abstract

Corydoras multiradiatus (Orcés V.1960), commonly called “hog-nosed brochis” and popularly known in Peru as “coridora jumbo” is a species of commercial importance among the Amazonian ornamental fish. It is known that the integrity of the health of aquatic organisms positively increases the production and trade of quality products, however, the opposite negatively affects financial losses and production costs. Among the possible diseases, parasitism stands out, and there is still a lack of information, mainly about metazoans, parasitic species that infect *C. multiradiatus*. Therefore, this study aimed to identify the species of endoparasite metazoans in *C. multiradiatus* and evaluate the histological lesions present to provide information to ornamental fish producers about these pathologies. Thirty specimens of *C. multiradiatus* were collected by fishermen in the municipality of “Belén” in Iquitos, Peru. The results revealed the presence of *Tylodelphys* sp. and nematode larvae in the intestinal wall and *Procamallanus* (*Spirocamallanus*) *pinto*i (Kohn & Fernandes 1988) present in the intestine. The histopathological analysis of the intestine showed several lesions: necrosis; cell desquamation; infiltration of lymphocytes in the mucosa; transepithelial infiltration of lymphocytes; enterocyte hyperplasia; goblet cell hyperplasia and enterocyte desquamation. The study revealed the presence of endoparasites in *C. multiradiatus* collected in Iquitos, Loreto-Peru, and a moderate degree of damage caused by histological lesions in the intestine of infected fish. The results of this work will serve the fishermen, collectors and aquarists of the city of Iquitos, who, knowing the endoparasites present in *C. multiradiatus* and the damage they can cause to the fish, will be able to adopt prophylactic measures in order to guarantee the good condition of the fish for its consequent commercialization at a local, national and international level.

Enlace: <https://doi.org/10.5965/223811712242023631>

La abundancia de animales de caza estimada por cazadores en la cuenca del Putumayo, Amazonía nor-peruana

The abundance of game animals estimated by hunters in the Putumayo basin, northern Peruvian Amazon

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Resumen

El conocimiento ecológico local (CEL) de los cazadores indígenas puede ser usado para estimar la abundancia de animales de caza porque se desarrolla con la experiencia y es coherente con el conocimiento científico. Nuestro objetivo fue conocer la percepción de los cazadores sobre la abundancia de animales de caza en la cuenca del Putumayo (Perú) para evaluar su estado de conservación. Usamos el método de consenso cultural para entrevistar a 101 personas de 13 comunidades indígenas de la cuenca del Putumayo. De 37 especies, 21 fueron percibidas como abundantes, 13 frecuentes, 1 rara y 2 ausentes. Las especies percibidas como las más abundantes fueron *Saimiri cassiquiarensis*, *Tayassu pecari*, *Alouatta seniculus* y *Pteronura brasiliensis*. La especie ausente en cuenca alta y baja fue *Callimico goeldii*, y en toda la cuenca fue *Ateles belzebuth*. *Cebus apella* no fue reconocido por cazadores de la cuenca alta. De las 13 comunidades indígenas, 11 estuvieron en buen estado de conservación y 2 en regular estado por tener menor número de especies abundantes, abundancias disminuidas de especies indicadoras y comerciales. Estas comunidades, están cerca del gran centro poblado El Estrecho. Los animales de caza y las comunidades están en buen estado de conservación.

Abstract

Local ecological knowledge (LEK) of indigenous hunters can be used to estimate game abundance because it is developed with experience and is consistent with scientific knowledge. Our objective was to know the perception of hunters about the abundance of game animals in the Putumayo (Peru) basin in order to evaluate their conservation status. We used the cultural consensus method to interview 101 people from 13 indigenous communities in the Putumayo basin. Of 37 species, 21 were perceived as abundant, 13 frequent, 1 rare, and 2 absent. The species perceived as the most abundant were *Saimiri cassiquiarensis*, *Tayassu pecari*, *Alouatta seniculus* and *Pteronura brasiliensis*. The species absent in the upper and lower basin was *Callimico goeldii*, and the one absent in the entire basin was *Ateles belzebuth*. *Cebus apella* was not recognized by hunters in the upper basin. Of the 13 indigenous communities, 11 were in a good state of conservation and 2 in a fair state due to having fewer abundant species, decreased abundances of indicator and commercial species. These communities are close to the large populated center El Estrecho. Game animals and communities are in a good state of conservation.

Enlace: <https://doi.org/10.22386/ca.v11i1-2.386>

Life history trait variations and population dynamics of *Calophysus macropterus* (Siluriformes: Pimelodidae) in two river systems of the Colombian and Peruvian Amazon

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Resumen

El bagre *Calophysus macropterus* está fuertemente explotado en la cuenca Amazónica. Sin embargo, su ciclo de vida está poco documentado, lo que dificulta su gestión pesquera. Para llenar este vacío, se realizaron muestreos mensuales en el alto río Putumayo alrededor de Puerto Leguizamo y en el Amazonas y los ríos bajo Marañón y Ucayali (AMU) cerca de Iquitos durante varios años (2013-2015 en AMU, 2013-2017 en Putumayo) para generar información sobre su reproducción, crecimiento y mortalidad. La reproducción, que se produce durante la estación seca y el inicio de la inundación, sólo se observó en el curso superior del río Putumayo y no en la parte muestreada del sistema de la AMU, lo que sugiere que la especie se reproduce más cerca de los Andes que otros pimelodidos. El tamaño de primera madurez sexual no difirió entre sexos o entre sistemas fluviales, oscilando entre 25-28 cm. En ambos sistemas fluviales, las hembras tuvieron un crecimiento más rápido que los machos y ambos géneros también tendieron a tener un mejor crecimiento en el AMU que en el alto Putumayo. Estimaciones de mortalidad y explotación indicaron una sobreexplotación en ambos sistemas. Se discuten las implicaciones de estos resultados para la gestión y conservación de las pesquerías.

Abstract

The catfish *Calophysus macropterus* is heavily exploited in the Amazon basin, yet its life history characteristics are poorly documented, hampering proper fisheries management. In order to fill this gap, monthly sampling in the upper Putumayo River and in the Amazonas, lower Marañón and Ucayali (AMU) rivers were carried out over several years (2013-2015 in the AMU, 2013-2017 in the Putumayo) to provide detailed information about its reproduction, growth and mortality patterns (using length frequency data). Reproduction, which occurs during the dry and early flooding season, was only observed in the upper Putumayo River and not in the sampled portion of the AMU system, suggesting that the species reproduces closer to the Andes than other pimelodid catfishes. Size at first sexual maturity did not differ significantly among sex or among river systems, ranging from 25-28 cm SL. In both river systems, females had a faster growth than males and both genders also tended to have a better growth in the AMU than in the upper Putumayo. Mortality and exploitation estimate all indicated overexploitation of the species in both river systems. The implications of these results for fisheries management and conservation are discussed.

Enlace: <https://doi.org/10.1590/1982-0224-2021-0082>

Lipid composition of the Amazonian ‘Mountain Sacha Inchi’ including *Plukenetia carolis-vegae* Bussmann, Paniagua & C.Téllez

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Abstract

Several Amazonian species of *Plukenetia* are remarkably rich sources of polyunsaturated fatty acids, in particular α -linolenic acid. The lipid composition of the large-seeded, recently described ‘Mountain Sacha Inchi’ *Plukenetia carolis-vegae* is reported here for the first time, and compared with *Plukenetia huayllabambana*, two cultivars of *Plukenetia volubilis*, and a newly developed hybrid between *P. volubilis* and *P. carolis-vegae*. All species and cultivars had a very high content of polyunsaturated fatty acids, 82.6–86.7% of total fatty acids, and at least 46.6% α -linolenic acid of total fatty acids. The highest content was found in *P. carolis-vegae* which had 57.4%. The exceptionally high α -linolenic acid content suggests that *P. carolis-vegae* may be an important plant-derived dietary source of this essential fatty acid and that the species has considerable potential for further domestication and commercialisation of its seeds and seed oil. A TAG analysis was carried out for the two *P. volubilis* cultivars, in which LLnLn and LnLL were most prevalent, and for *P. huayllabambana*, in which LLnLn constituted the largest fraction, followed by LnLnLn, indicating that this large-seeded species also has interesting dietary properties.

Enlace: <https://doi.org/10.1038/s41598-022-10404-8>

Making forest data fair and open

Renato A. F. de Lima, Oliver L. Phillips, Alvaro Duque, J. Sebastian Tello, Stuart J. Davies, Alexandre Adalardo de Oliveira, Sandra Muller, Euridice N. Honorio Coronado, Emilio Vilanova, Aida Cuni-Sanchez, Timothy R. Baker, Casey M. Ryan, Agustina Malizia, Simon L. Lewis, Hans ter Steege, Joice Ferreira, Beatriz Schwantes Marimon, Hong Truong Luu, Gerard Imani, ... Rodolfo Vásquez.

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Abstract

Esta publicación científica no cuenta con resumen disponible

Enlace: <https://repositorio.iiap.gob.pe/handle/20.500.12921/666>

Manejo de sombra y poda en dos variedades de café vs. crecimiento de la planta y roya de la hoja en la Amazonía Peruana

Shade management and pruning in two coffee varieties vs. plant growth and leaf rust in the peruvian amazon

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Resumen

La roya amarilla del café es una infección fúngica que está devastando plantaciones de café susceptibles en América del Sur en los últimos años. El objetivo de este estudio fue analizar los efectos del manejo de árboles de sombra y podas de dos variedades de café contra la roya amarilla en la Amazonía peruana. Se usó un diseño experimental de bloques al azar con arreglo factorial 2A × 2B × 4C con 16 tratamientos y cuatro repeticiones, para un total de 64 unidades experimentales, en las que cada unidad experimental contó con 16 plantas de café. Los factores estudiados fueron sistemas agroforestales (A), variedades de café (B) y métodos de poda (C). Los datos se analizaron estadísticamente mediante análisis de varianza y las comparaciones de medias según la prueba de Tukey. Se encontró que la sombra de Inga y la poda de recepa favorecieron el crecimiento de la planta. Asimismo, el uso del sistema agroforestal de café sombreado con distintas especies de árboles, con aproximadamente 40 % de sombra, y recepa, un método de poda que consiste en cortar el tallo de las plantas de café a 40 cm del suelo, redujo la incidencia y severidad de la roya amarilla en plantas de café. La incidencia y severidad de la enfermedad fue menor en la variedad Typica en comparación con la variedad Pache. Este estudio confirma que el manejo de la sombra y la poda de las plantas de café estimulan el crecimiento vegetativo nuevo y, al mismo tiempo, reducen la incidencia y severidad de la roya amarilla en cafetales.

Abstract

Coffee leaf rust (CLR) is a fungal infection which is devastating susceptible coffee plantations throughout the South American region in the last years. The objective of this study was to analyze the effects of shade trees management and pruning in two coffee varieties against coffee leaf rust in the Peruvian Amazon. The experimental design was a randomized complete block with factorial scheme 2A × 2B × 4C with 16 treatments and four repetitions, making a total of 64 experimental units, in which each experimental unit had 16 coffee plants. The studied factors were agroforestry system (A), coffee varieties (B), and pruning methods (C). The data were statistically examined by analysis of variance and mean comparisons using Tukey test. It was found that plant growth was favored by the use Inga shade and recepa pruning in Typica variety. Also, the use of polyculture-shaded coffee with about 40 % of shadow, and recepa, a pruning method which consists of cutting the stem of the coffee plants at 40 cm from the ground, reduce the incidence and severity of CLR in coffee plants. The incidence and severity of CLR was lower in the Typica variety as compared to Pache variety. This study confirms that a shadow management and pruning coffee plants stimulate the growth of new branches and reduce incidence and severity of CLR in coffee plantations.

Enlace: <https://doi.org/10.51372/bioagro351.6>

Manejo integrado de *Conotrachelus dubiae* sobre la retención de frutos de *Myrciaria dubia* (camu-camu) en zona inundada, en Loreto-Perú

Integrated management of *Conotrachelus dubiae* in relation to fruit retention of *Myrciaria dubia* (camu-camu) in a flooded area, in Loreto-Peru

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Resumen

Myrciaria dubia (camu-camu) es un frutal amazónico de importancia económica. Los problemas más comunes son el daño ocasionado por *Conotrachelus dubiae* y la caída de los frutos en desarrollo. El objetivo fue encontrar los factores que influyen sobre la retención de frutos post-defoliación en áreas inundables. Se aplicaron cuatro tratamientos: testigo (T1), trampa botella (T2), trampa cinta adhesiva (T3) y fertilización foliar (T4). La investigación se realizó en una parcela de camu-camu en la orilla del río Amazonas. Como testigo adicional se evaluaron plantas en tierra firme. Se obtuvieron datos sobre la retención de flores y frutos, su rendimiento y calidad. Se monitoreó la presencia de plagas; además, se cosecharon frutos atacados por *C. dubiae*. T2 mostró los niveles más altos de frutos dañados ($11,9\% \pm 9$) y de retención de frutos ($24,5\% \pm 21$). Esto respalda la hipótesis de que la primera causa de la caída de frutos no se debe al daño por plagas. De hecho, T4 resultó ser el control de plagas más efectivo (frutos dañados: $4,1\% \pm 4$). El período crítico para la retención del fruto fue inmediatamente después de su cuajado. La defoliación no afectó la calidad de los frutos. La inducción floral, ocurrida inusualmente durante la inundación, explica el alto estrés que causó una baja retención de frutos.

Abstract

Myrciaria dubia (camu-camu) is an Amazonian fruit of economic importance. The most common problems are the damage caused by *Conotrachelus dubiae* and the drop of developing fruits. The objective was to clarify the factors influencing post-defoliation fruit retention influenced by *C. dubiae* in flooded areas. Four treatments were applied: control (T1), bottle trap (T2), adhesive tape trap (T3), and foliar fertilization (T4). The research was conducted at a camu-camu plot on the Amazon River banks. As an additional control, plants at a highland plot were evaluated. Data on the retention of flowers and fruits, yield, and quality were obtained. The presence of pests was monitored, and fruits attacked by *C. dubiae* were harvested. T2 showed the highest levels of damaged fruit ($11.9\% \pm 9$) and fruit retention ($24.5\% \pm 21$). This supports the hypothesis that the primary cause of fruit drop is not pest damage. In fact, T4 was the most effective pest control (damaged fruits: $4.1\% \pm 4$). The critical period for fruit retention was right after the fruit set. Defoliation did not have any effects on fruit quality. Flowering induction, unusually occurring during the flooding period, explains the high stress that caused low fruit retention.

Enlace: <https://doi.org/10.24841/FA.V31I2.567>

Mapping density, diversity and species-richness of the Amazon tree flora

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Abstract

Using 2,046 botanically-inventoried tree plots across the largest tropical forest on Earth, we mapped tree species-diversity and tree species-richness at 0.1-degree resolution, and investigated drivers for diversity and richness. Using only location, stratified by forest type, as predictor, our spatial model, to the best of our knowledge, provides the most accurate map of tree diversity in Amazonia to date, explaining approximately 70% of the tree diversity and species-richness. Large soil-forest combinations determine a significant percentage of the variation in tree species-richness and tree alpha-diversity in Amazonian forest-plots. We suggest that the size and fragmentation of these systems drive their large-scale diversity patterns and hence local diversity. A model not using location but cumulative water deficit, tree density, and temperature seasonality explains 47% of the tree species-richness in the terra-firme forest in Amazonia. Over large areas across Amazonia, residuals of this relationship are small and poorly spatially structured, suggesting that much of the residual variation may be local. The Guyana Shield area has consistently negative residuals, showing that this area has lower tree species-richness than expected by our models. We provide extensive plot meta-data, including tree density, tree alpha-diversity and tree species-richness results and gridded maps at 0.1-degree resolution.

Enlace: <https://doi.org/10.1038/s42003-023-05514-6>

Metazoarios parásitos de *Triportheus angulatus* (Spix & Agassiz, 1829) “sardina” adquiridos en el mercado “Belén” Iquitos, Perú

Parasitic metazoa of *Triportheus angulatus* (spix & agassiz, 1829) “sardina” acquired in the “Belén” Iquitos market, Peru

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Resumen

Se determinaron los metazoarios parásitos en *Triportheus angulatus* (Spix & Agassiz, 1829) adquiridos del mercado “Belén” Iquitos, Perú. Se colectaron 30 individuos de *T. angulatus*, de las cuales las branquias, musculatura y el tracto digestivo se analizaron con la finalidad de encontrar metazoarios parásitos. Los grupos de parásitos identificados fueron Monogenoidea y Nematoda. De los monogenoideos colectados se prepararon láminas permanentes clarificadas con medio Hoyer para su identificación. En el caso de los nematodos se prepararon láminas semipermanentes clarificadas con ácido láctico. Se calcularon los índices parasitarios como prevalencia, intensidad, intensidad media y abundancia media. Se colectaron 151 individuos metazoarios parásitos en *T. angulatus* adquiridos del mercado “Belén” Iquitos, Perú de las cuales se identificaron nueve especies de monogenoideos; *Anacanthorus acuminatus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus chaunophallus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus Chelophorus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus euryphallus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus lygophallus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus pithophallus* Kritsky, Boeger & Van Every, 1992; *Ancistrohaptor falciferum* Agarwal & Kritsky, 1998; *Ancistrohaptor falcunculum* Agarwal & Kritsky, 1998, tres especies no identificadas pertenecientes al género *Jainus*: *Jainus* sp1, *Jainus* sp2, *Jainus* sp3; y una especie de Nematoda, *Procamallanus (Spirocamallanus) inopinatus* Travassos, Artigas et Pereira, 1928. Se concluye que los índices parasitarios de la especie perteneciente a la clase nematoda presento la mayor prevalencia con 53,33% y una abundancia media 1,83 larvas en promedio y en el caso del género *Jainus* sp3 presentó la mayor intensidad media de 4,50 en promedio.

Abstract

Parasitic metazoans were determined in *Triportheus angulatus* (Spix & Agassiz, 1829) acquired from the “Belén” market in Iquitos, Peru. Thirty individuals of *T. angulatus* were collected, of which the gills, muscles and digestive tract were analyzed to find parasitic metazoans. The groups of identified parasites were Monogenoidea and Nematoda. Permanent slides cleared in Hoyer's medium were prepared for monogenoids for their identification. In nematodes, semi-permanent slides cleared with lactic acid were prepared. Parasitological indices were calculated for prevalence, intensity, mean intensity and mean abundance. One hundred fifty-one metazoan parasites were collected from *T. angulatus* acquired from the “Belén” market in Iquitos, Peru. The following monogenoids were identified: *Anacanthorus acuminatus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus chaunophallus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus Chelophorus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus euryphallus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus lygophallus* Kritsky, Boeger & Van Every, 1992; *Anacanthorus pithophallus* Kritsky, Boeger & Van Every, 1992; *Ancistrohaptor falciferum* Agarwal & Kritsky, 1998; *Ancistrohaptor falcunculum* Agarwal & Kritsky, 1998, three unidentified species belonging to the genus *Jainus*: *Jainus* sp1, *Jainus* sp2, *Jainus* sp3; and one species of Nematoda, *Procamallanus (Spirocamallanus) inopinatus* Travassos, Artigas et Pereira, 1928. The species belonging to nematoda presented the highest prevalence with 53.33% and an average

abundance of 1.83 larvae on average. The genus *Jainus* sp3, presented the highest average intensity of 4.50.

Enlace: <https://repositorio.iiap.gob.pe/handle/20.500.12921/660>

Metazoarios parásitos en *Hoplias malabaricus* (Bloch, 1794) “fasaco” colectados en el mercado Belén, Iquitos-Perú

Parasitic metazoans in *Hoplias malabaricus* (Bloch, 1794) "fasaco" collected at the Belén market, Iquitos-Peru

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Resumen

El trabajo se realizó mediante la observación directa, búsqueda e identificación de la fauna endoparasitaria de *Hoplias malabaricus* tanto en órganos internos como en la musculatura de 50 ejemplares. El análisis de los peces se llevó a cabo en el Laboratorio de Parasitología y Sanidad Acuícola del Instituto de Investigaciones de la Amazonia Peruana (IIAP). Se identificaron 7 nemátodos (*Eustrongylides* sp, *Procamallanus* sp, *Contracaecum* sp, *Spiroxys* sp, *Pseudoproleptus* sp, *Terranova* sp, *Heliconema* sp); 1 tremátodo (*Ithioclinostomun* sp) y 1 pentastómido (*Sebekia* sp). De los parásitos mencionados se identificaron parásitos zoonóticos (*Eustrongylides* sp., *Contracaecum* sp., *Terranova* sp., *Ithioclinostomun* sp. y *Sebekia* sp.) que podrían transmitir y ocasionar daño al ser humano (zoonosis). Asimismo, se realizó el cálculo de los índices parasitarios para tener en cuenta el grado de infección parasitaria que poseen estos peces, teniendo los géneros *Eustrongylides* sp y *Heliconema* sp. como dominantes en estos índices con una prevalencia de 26% y 18%; intensidad de 28 y 78 individuos, intensidad media de 2,15 y 8,67 y abundancia media de 0,56 y 1,56 respectivamente. Se concluye que la fauna de endoparásitos encontrados en *Hoplias malabaricus* “Fasaco” analizadas está representada por nemátodos, trematodos y pentastómidos; encontrándose entre estos grupos a especies zoonóticas.

Abstract

The work was carried out by direct observation, search and identification of the endoparasitic fauna of *Hoplias malabaricus* both in internal organs and in the musculature of 50 specimens. The analysis of the fish was carried out at the Parasitology and Aquaculture Health Laboratory of the Peruvian Amazon Research Institute (IIAP). Seven nematodes (*Eustrongylides* sp, *Procamallanus* sp, *Contracaecum* sp, *Spiroxys* sp, *Pseudoproleptus* sp, *Terranova* sp, *Heliconema* sp); one trematode (*Ithioclinostomun* sp) and one pentastomid (*Sebekia* sp) were identified. Of the parasites mentioned, zoonotic parasites (*Eustrongylides* sp., *Contracaecum* sp., *Terranova* sp., *Ithioclinostomun* sp. and *Sebekia* sp.) that could be transmitted and cause harm to humans (zoonosis) were identified. Likewise, the calculation of the parasitic indexes was carried out to take into account the degree of parasitic infection that these fish possess, having genera *Eustrongylides* sp. and *Heliconema* sp. as dominant in these indexes with a prevalence of 26% and 18%; intensity of 28 and 78 individuals, mean intensity of 2.15 and 8.67, and mean abundance of 0.56 and 1.56 respectively. It is concluded that the fauna of endoparasites found in *Hoplias malabaricus* "Fasaco" analyzed in the present study is represented by nematodes, trematodes and pentastomids; finding among these groups zoonotic species.

Enlace: <https://doi.org/10.51252/raa.v3i2.531>

Morfología y biometría de racimos, frutos y semillas de *Attalea bassleriana* en Alto Amazonas, Perú

Morphology and biometry of racemes, fruits and seeds of *Attalea bassleriana* in Alto Amazonas, Peru

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Resumen

Se evaluó la morfología y biometría de racimos, frutos y semillas de *Attalea bassleriana* en las localidades de Paraíso, Libertad de Cuiparillo y Santa Lucía en la provincia de Alto Amazonas, Perú, para comprender su variabilidad interpoblacional y contribuir al esclarecimiento taxonómico de la especie. Adicionalmente, se describió el ambiente donde se desarrolla la palmera. Para ello, se tuvieron en cuenta 70 descriptores (38 biométricos y 32 morfológicos) que fueron comparados con ANOVA y Kruskal-Wallis, correlacionados a través Spearman y visualizados gráficamente mediante el Análisis de Componentes Principales (PCA). Para la descripción del ambiente se utilizó una ficha de toma de datos para muestras de campo. En total, 23 descriptores biométricos presentaron diferencias significativas ($p < 0,05$). Las correlaciones más altas fueron número de frutos/peso de racimo (0,921) y peso del fruto/diámetro del fruto (0,844). El PCA demuestra la variabilidad de los frutos entre las poblaciones y denota a Paraíso como la menos variable y más diferenciada. Asimismo, se observó que la especie se encuentra en bosques de terraza, bosques pantanosos, tierras agrícolas y ganaderas, entre 145 y 159 m s. n. m. Esta información evidencia la identificación taxonómica del shebón y es un referente tanto para el aprovechamiento adecuado de frutos y semillas como para su aplicación en el mejoramiento genético.

Abstract

We evaluated the morphology and biometrics of racemes, fruits, and seeds of *Attalea bassleriana* in the localities of Paraíso, Libertad de Cuiparillo and Santa Lucía in the Alto Amazonas Province, Peru, to understand its interpopulational variability and contribute to the taxonomic clarification of the species. Additionally, we described the environment where the palm grows. To do so, we used 70 descriptors (38 biometric and 32 morphological), which were compared with ANOVA and Kruskal-Wallis, correlated through Spearman, and graphically visualized by Principal Component Analysis (PCA). A data sheet for field samples was used for the description of the environment. In total, 23 biometric descriptors presented significant differences ($p < 0.05$). The highest correlations were fruit number/raceme weight (0.921) and fruit weight/fruit diameter (0.844). The PCA demonstrates the variability of fruits between populations and denotes Paradise as the least variable and the most differentiated. Likewise, we observed that the species is found in terrace forests, swampy forests, agricultural and livestock lands, between 145-159 m.a.s.l. The data evidence the taxonomic identification of shebon and constitute a reference for both the proper utilization of fruits and seeds and their application to genetic improvement.

Enlace: <https://doi.org/10.21068/2539200X.1107>

Morfometría de *Dawestrema cycloancistrum* (Dactylogyridae: monogenoidea) colectados de *Arapaima gigas* (Schinz, 1822) “Paiche” (Osteoglossiformes: Arapaimidae) provenientes de estanques piscícolas, Loreto-Perú

Morphometry of *Dawestrema cycloancistrum* (Dactylogyridae: monogenoidea) collected from *Arapaima gigas* (Schinz, 1822) “Paiche” (Osteoglossiformes: Arapaimidae) from fish ponds, Loreto-Peru

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Resumen

En la Amazonía peruana el estudio sobre el parasitismo de peces es poco abordado, por lo que se desconoce sobre los parásitos que pueda poseer cada pez (ornamental o de consumo), y mucho menos sobre las características morfológicas y sus medidas en particular. El objetivo del presente estudio fue caracterizar morfométricamente al monogenoideo *Dawestrema cycloancistrum* colectado de ejemplares moribundos de *Arapaima gigas* procedentes de estanques piscícolas de la carretera Iquitos - Nauta. Fueron analizadas las branquias de 3 ejemplares moribundos de *A. gigas* provenientes de estanques piscícolas, encontrando con ayuda de un estereoscopio, un total de 993 individuos parasitarios, que fueron identificados como la especie *Dawestrema cycloancistrum* (Monogenoidea: Dactylogyridae) con la ayuda de un medio de clarificación Hoyer y un microscopio óptico. Al concluir el proceso de identificación, se capturaron imágenes de las estructuras distintivas que facilitan la identificación de *D. cycloancistrum*. Los datos se registraron en hojas de Excel, lo que posibilitó el cálculo de los índices parasitarios de los peces analizados. Concluyendo que, *Dawestrema cycloancistrum* es un parásito monogenético de gran tamaño en base a las medidas morfométricas realizadas en la presente investigación.

Abstract

In the Peruvian Amazon, the study on fish parasitism is little addressed, so it is unknown about the parasites that each fish (ornamental or for consumption) may have, much less about the morphological characteristics and their measurements in particular. The objective of this research work is to morphometrically characterize the monogenoid *Dawestrema cycloancistrum* collected from moribund specimens of *Arapaima gigas* from fish ponds on the Iquitos - Nauta highway. The gills of 3 moribund specimens of *A. gigas* from fish ponds were analyzed, in which a total of 993 parasitic individuals were found with the help of a stereoscope, which were identified as the species *Dawestrema cycloancistrum* (Monogenoidea: Dactylogyridae), with the aid of Hoyer's clarifying medium and light microscope; at the end of the identification, photos of the characteristic structures that facilitate the identification of *D. cycloancistrum* were taken; The data obtained were saved in Excel sheets, which allowed calculating the parasite indices of the fish analyzed. The present work concludes that *Dawestrema cycloancistrum* is a large monogenean parasite based on the morphometric measurements made in the present investigation.

Enlace: <https://doi.org/10.51252/raa.v3i2.508>

Mycorrhizal effects on glomalin-related soil protein and chlorophyll contents in coffee plants in the Peruvian Amazon

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Abstract

The inoculation of vegetatively propagated coffee plants with arbuscular mycorrhizal fungi (AMF) prior to field establishment may positively influence the plant growth and physiology. This study aimed to evaluate the AMF effects on the glomalin-related soil protein and chlorophyll contents in vegetatively propagated coffee plants inoculated in a greenhouse and transplanted to an open field, in the Peruvian Amazon. The experiment consisted of eight treatments, in a 2 × 4 factorial design, being two coffee varieties (Caturra and Pache) and four AMF inocula (control, Moyobamba, El Dorado and Huallaga). The inocula were collected from organic coffee crops and named according to the province from which they were collected. The mycorrhizal colonization and chlorophyll content were statistically higher in the plants inoculated with AMF, if compared to the non-inoculated plants, while the glomalin-related soil protein content ranged from 61.6 to 69.1 mg g⁻¹ and showed no statistically significant differences among the inocula, although the Moyobamba inoculum showed to be numerically superior. The effect of the coffee variety was not statistically significant among the variables under study.

Enlace: <https://doi.org/10.1590/1983-40632022v5272303>

Native diversity buffers against severity of non-native tree invasions

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Abstract

Determining the drivers of non-native plant invasions is critical for managing native ecosystems and limiting the spread of invasive species. Tree invasions in particular have been relatively overlooked, even though they have the potential to transform ecosystems and economies. Here, leveraging global tree databases, we explore how the phylogenetic and functional diversity of native tree communities, human pressure and the environment influence the establishment of non-native tree species and the subsequent invasion severity. We find that anthropogenic factors are key to predicting whether a location is invaded, but that invasion severity is underpinned by native diversity, with higher diversity predicting lower invasion severity. Temperature and precipitation emerge as strong predictors of invasion strategy, with non-native species invading successfully when they are similar to the native community in cold or dry extremes. Yet, despite the influence of these ecological forces in determining invasion strategy, we find evidence that these patterns can be obscured by human activity, with lower ecological signal in areas with higher proximity to shipping ports. Our global perspective of non-native tree invasion highlights that human drivers influence non-native tree presence, and that native phylogenetic and functional diversity have a critical role in the establishment and spread of subsequent invasions.

Enlace: <https://doi.org/10.1038/s41586-023-06440-7>

Neotropical Monogenoidea 64. *Cosmetocleithrum falsunilatum* sp. n. (Monogenoidea, Dactylogyridae) parasite of the gills of *Megalodoras uranoscopus* (Siluriformes, Doradidae) from the Solimões river, near Iquitos, Peru

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Abstract

Megalodoras uranoscopus (Eigenmann & Eigenmann) (Siluriformes, Doradidae) (the giant-talking catfish or the giant-raphael catfish), from the Peruvian Amazon, hosts a new species of *Cosmetocleithrum* described herein as *Cosmetocleithrum falsunilatum* sp. n. The male copulatory organ of the new species closely resembles that of *Unilatus* spp. – with multiple tight loops and non-articulated accessory piece - which reveals its morphological uniqueness among members of *Cosmetocleithrum*. A phylogenetic analysis using 28S rDNA of available sequences suggests that *Cosmetocleithrum* is composed by two basal clades, one of them composed by sequences of the new species and *C. trachydorasi*.

Enlace: <https://doi.org/10.1007/s11230-022-10030-y>

New species of *Philocorydoras* Suriano, 1986 (Monogenoidea: Dactylogyridae): *Philocorydoras maltai* n. sp., *Philocorydoras beleniensis* n. sp. and *Philocorydoras alcantarai* n. sp. from the gills of callichthyids (Siluriformes: Callichthyidae) from the Peruvian Amazonia

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Abstract

During a research on gills ectoparasites of callichthyids fishes from the Peruvian Amazonia, the following new monogenoideans species were recovered: *Philocorydoras maltai* n. sp. from *Corydoras splendens* (Castelnau) and *Brochis multiradiatus* (Orcés, V.); *Philocorydoras beleniensis* n. sp. from *C. ambiacus* (Cope) and *C. agassizii* (Steindachner) and *Philocorydoras alcantarai* n. sp. from *C. virginiae* (Burgess). All new species described herein are mainly differentiated from their congeners based on the morphology of the copulatory complex. In *P. maltai* n. sp. the cirrus corresponds to a very thin curved and slightly sclerotized tube, with an inflated and distally narrow base; the accessory piece is sclerotized, curved in the anterior portion, sickle-shaped and with the terminal portion slightly bent. In *P. beleniensis* n. sp. the cirrus corresponds to a slightly curved sclerotized robust tube with its base folded back ending in three finger-like projections; the accessory piece is sclerotized, cobra-shaped, distal part with an inwardly-directed curvature. In *P. alcantarai* n. sp. the cirrus corresponds to a sclerotized arched long tube, with sclerotized accessory piece with a bifid termination, curved in its middle portion.

Enlace: <https://doi.org/10.1007/s11230-022-10064-2>

Non-destructive estimation of leaf area and leaf weight of *Cinchona officinalis* L. (Rubiaceae) based on linear models

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Abstract

Non-destructive methods that accurately estimate leaf area (*LA*) and leaf weight (*LW*) are simple and inexpensive, and represent powerful tools in the development of physiological and agronomic research. The objective of this research is to generate mathematical models for estimating the *LA* and *LW* of *Cinchona officinalis* leaves. A total of 220 leaves were collected from *C. officinalis* plants 10 months after transplantation. Each leaf was measured for length, width, weight, and leaf area. Data for 80% of leaves were used to form the training set, and data for the remaining 20% were used as the validation set. The training set was used for model fit and choice, whereas the validation set allowed assessment of the model's predictive ability. The *LA* and *LW* were modeled using seven linear regression models based on the length (*L*) and width (*Wi*) of leaves. In addition, the models were assessed based on calculation of the following statistics: goodness of fit (*R*²), root mean squared error (*RMSE*), Akaike's information criterion (*AIC*), and the deviation between the regression line of the observed versus expected values and the reference line, determined by the area between these lines (*ABL*). For *LA* estimation, the model $LA = 11.521(Wi) - 21.422$ ($R^2 = 0.96$, $RMSE = 28.16$, $AIC = 3.48$, and $ABL = 140.34$) was chosen, while for *LW* determination, $LW = 0.2419(Wi) - 0.4936$ ($R^2 = 0.93$, $RMSE = 0.56$, $AIC = 37.36$, and $ABL = 0.03$) was selected. Finally, the *LA* and *LW* of *C. officinalis* could be estimated through linear regression involving leaf width, proving to be a simple and accurate tool.

Enlace: <https://doi.org/10.1080/21580103.2023.2170473>

Non-random host tree infestation by the Neotropical liana *Marcgravia longifolia*

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Abstract

The question whether or not tropical lianas infest host trees randomly or they exert host selection has implications for the structure and dynamics of tropical rainforests, particularly if colonization by lianas impacts host fitness. In this study, we present evidence that the Neotropical liana *Marcgravia longifolia* (Marcgraviaceae) infests host trees non-randomly. We identified host trees to species or genus level for 87 of the 100 *M. longifolia* individuals found in the study area of the Estación Biológica Quebrada Blanco (EBQB) in north-eastern Peruvian Amazonia. Data on host availability were taken from two 1-ha plots sampled at EBQB as part of a large-scale tree inventory in western Amazonia. Of the total of 88 tree genera with two or more individuals present in the inventory, 18 were represented amongst hosts. Host genera with a probability of colonization higher than expected by chance were *Eschweilera* (Lecythidaceae), *Pouteria* (Sapotaceae), *Brosimum* (Moraceae), and *Hymenaea* (Fabaceae). These findings suggest that *M. longifolia* exerts some level of host selectivity, but the mechanisms for this are completely unknown. Given the large number of animal species (41 bird species, three primate species) that are dispersing the seeds of *M. longifolia* and that have diverse ecological strategies, directed seed dispersal is unlikely to account for the observed patterns of host infestation.

Enlace: <https://doi.org/10.7717/peerj.14535>

Occurrence and characterization of insect galls in two reserves of the Peruvian Amazon

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Abstract

An insect gall inventory was carried out in two reserves of the Peruvian Amazon, Allpahuayo-Mishana National Reserve and Quistococha Regional Reserve, both situated in Iquitos, northeastern Peru. Four vegetation types were surveyed between December, 2021 and December, 2022: *terra firme* forest, white-sand wet forest, and white-sand dry forest in Allpahuayo-Mishana National Reserve, and palm swamp forest in Quistococha Regional Reserve. Overall, we found 262 gall morphotypes, distributed across 75 host species representing 66 plant genera and 30 families. Fabaceae was the plant family with the greatest number of gall morphotypes ($n = 48$), followed by Calophyllaceae ($n = 21$) and Euphorbiaceae ($n = 20$). The plant genera that supported the highest diversity of galls were *Caraipa* ($n = 17$), *Eschweilera* ($n = 16$), *Tapirira* ($n = 16$), *Micrandra* ($n = 14$), and *Iryanthera* ($n = 10$). The plant species *Tapirira guianensis* ($n = 16$), *Caraipa utilis* ($n = 14$), *Micrandra elata* ($n = 14$), *Eschweilera coriacea* ($n = 11$), and *Sloanea parvifructa* ($n = 10$) exhibited the highest richness of galls. Among the host plants, *C. utilis* stands alone as the only species noted as both endemic to the Amazonian region and bearing a Vulnerable (VU) conservation status. The leaves were the most attacked organs (90% of all galls). Most morphotypes are glabrous (89%), green (67%), globoid (53%), and one-chambered (91%). We found galling insects belonging to the orders Diptera, Thysanoptera, Lepidoptera, and Hemiptera. The galling insects of Cecidomyiidae (Diptera) were the most common, inducing 22% of the gall morphotypes. In addition to the gallers, we also observed the presence of successors, cecidophages, and parasitoids. Among the sampled vegetation types, the *terra firme* forest presented the highest richness of gall morphotypes and host plant species. This is the first systematic inventory of insect galls in this part of the Peruvian Amazon.

Enlace: <https://doi.org/10.1590/1676-0611-BN-2023-1568>

Occurrence of *Eustrongylides* sp. (Nematoda: Dioctophymatidae) in Fish Species Collected in the Peruvian Amazonia and Its Implications for Public Health

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Abstract

Purpose: The present study aims to report the occurrence of *Eustrongylides* sp. in some neotropical fish species commercialized in the Peruvian Amazonia.

Methods: Samples of young farmed *Arapaima gigas* were collected from a fish farmer; young *Brachyplatystoma tigrinum* were acquired from a fish exporter and samples of adult specimens of *Acestrorhynchus falcistrostris*, *Pseudoplatystoma punctifer*, *Cichla monoculus*, *Hoplias malabaricus*, *Hydrolycus scomberoides*, *Raphiodon vulpinus*, and *Serrasalmus rhombeus* were acquired from a fish market of Iquitos, Loreto-Peru. Samples were transported to the “Laboratorio de Parasitología y Sanidad Acuicola” from “Instituto de Investigaciones de la Amazonía Peruana” located in Iquitos, Peru.

Results: Larvae L4 of *Eustrongylides* sp. were found in the host body, in the muscle, and in the visceral cavity of studied fish species. Notorious damages were reported in young *A. gigas* (lumps in the muscle, inflammation and severe redness of the skin) and in young *B. tigrinum* (perforation of the abdominal cavity), while in adult specimens of the remaining species, no external damage was reported.

Conclusion: The presence of *Eustrongylides* sp. in various fish species collected in the city of Iquitos-Peru contributes to the distribution of this parasite in the Peruvian Amazon, reporting it, for the first time in this country. Its presence in the muscle of various fish species commercialized in fish markets, warn a possible public health concern and implications for their marketability in the city of Iquitos, Peru.

Enlace: <https://doi.org/10.1007/s11686-022-00574-w>

Participatory Action Research for Conservation and Development: Experiences from the Amazon

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Abstract

Research that features participation and action orientation, such as participatory action research (PAR), is especially valuable in contexts where there is rapid change, high social inequality, and great uncertainty about the future, which drives stakeholder demands for information to support their goals. The Amazon offers such a context, for it is a region where diverse stakeholders engage in contestation over environmental governance to address issues such as climate change to achieve conservation and sustainable development. Stakeholder mobilization has changed the terms by which research is conducted, from the definition of priority topics to the application of findings. Due to stakeholder mobilization, more and more research in the Amazon is now necessarily participatory, for stakeholders routinely issue demands about how the research will be conducted and for what purpose. In this paper, we provide an overview of several experiences of implementing methods such as PAR by different teams or networks, focusing on the complementary contributions of outside researchers and local stakeholders. The heart of the paper reports on three broad types of experiences focusing on conservation and development in the Amazon: (1) participatory data collection for co-production of knowledge for environmental governance, (2) inclusive environmental monitoring systems, and (3) innovative models of knowledge exchange to facilitate collective action. Within each type, we report multiple experiences with distinct approaches to participation and action in research. These experiences constitute models that can be replicated in other places for broader impact to support conservation and development.

Enlaces: <https://doi.org/10.3390/su14010233>

<https://hdl.handle.net/20.500.12542/1718>

Pathogenic *Aeromonas* spp in Amazonian fish: Virulence genes and susceptibility in *Piaractus brachypomus*, the main native aquaculture species in Peru

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Abstract

The aim of this study was to isolate and identify *Aeromonas* species, characterize their virulence genes factors, and to evaluate their lethality in *Piaractus brachypomus*. Presumptive *Aeromonas* (n = 34) were selected from 44 bacteria retrieved from diseased Amazonian fish. Nineteen isolates were chosen based on fish species, group, the location where were isolated, and colony morphology. Isolates were biochemically and molecularly identified as *Aeromonas hydrophila*, *A. dhakensis*, *A. veronii*, *A. jandaei*, and *A. caviae* using API 20E, API 20NE and the analysis of 16 S rRNA and *gyrB* genes, respectively. Eight virulence genes (*aer*, *altA*, *act*, *hly*, *ser*, *lip*, *fla* *ahyB*) were found in one *A. dhakensis* and two *A. hydrophila* isolates. *A. veronii*, *A. jandaei*, and another two *A. hydrophila* isolates harbored four, two and three virulence genes, respectively. All *A. caviae* were *fla* +, *ahyB* + and *lip* +, except two isolates that also presented *ser* and *altA*. *P. brachypomus* (9 ± 1 cm), infected intraperitoneally (4×10^6 , 4×10^7 , and 4×10^8 CFU/fish), showed susceptibility to all *Aeromonas* species, each harboring a different virulence genes profile. Both *A. hydrophila* and *A. dhakensis* caused > 80% mortality at the lowest evaluated concentration ($\sim 10^6$ CFU/fish). *A. veronii* and *A. jandaei* isolates produced 20% and 70% mortality, respectively, using $\sim 10^7$ CFU/fish, but with lower intensity compared to *A. hydrophila* and *A. dhakensis*. At the highest concentration ($\sim 10^8$ CFU/fish), *A. veronii* caused 70% mortality, while *A. caviae* isolates caused mortality ranging from 50% to 80%. Remarkably, *A. jandaei* resulted in 100% mortality at this level, similar to *A. hydrophila* and *A. dhakensis*. This report confirms the variety of *Aeromonas* species infecting farmed native Amazonian fish. The study also suggests that virulence genes evaluated in *Aeromonas* species may not always be an indicator of virulence. Moreover, *P. brachypomus*, an economically important aquaculture fish species could be susceptible not only to the high mentioned *A. hydrophila* but also to other less observed species such as *A. dhakensis*, *A. veronii*, *A. jandaei*, and *A. caviae*, bacteria that should be taken into account in health surveillance for the implementation of aquaculture disease prevention strategies.

Enlace: <https://doi.org/10.1016/j.aqrep.2023.101811>

Plantas arbóreas de Iquitos monumental, Loreto, Perú

Tree plants of monumental Iquitos, Loreto, Peru

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Resumen

Las plantas tienen importancia ecológica y social en la arborización de las ciudades. En la ciudad de Iquitos no se han realizado muchos estudios al respecto. El objetivo del presente estudio fue determinar la diversidad y composición de plantas arbóreas en las calles del centro de Iquitos, Loreto, Perú. El inventario se realizó en diez calles de la ciudad y se consideraron las plantas con tallos ≥ 5 cm de diámetro a la altura del pecho (DAP), las muestras fueron herborizadas. Se registraron 199 individuos que pertenecen a 25 especies, 23 géneros y 17 familias; la riqueza por calle varió entre 0 a 15 especies; en cuanto a la diversidad beta, de acuerdo al índice de similaridad de Bray-Curtis, varió entre 0 a 0,62 % entre las calles. Las especies más representativas fueron *Ficus benjamina* L., *Roystonea regia* (Kunth) O.F. Cook, *Syzygium malaccense* (L.) Merr. & L.M. Perry, *Terminalia catappa* L., *Adonidia merrillii* (Becc.) Becc., *Elaeis guineensis* Jacq., *Mangifera indica* L. Las familias registradas fueron Arecaceae, Moraceae, Myrtaceae, Combretaceae, Anacardiaceae, Fabaceae y otras. Iquitos tiene una baja diversidad de plantas (comparada con otras ciudades) y la mayoría de especies de plantas arbóreas de Iquitos no son nativas.

Abstract

Plants have great ecological and social importance in the afforestation of cities. In the city of Iquitos few studies were carried out in this regard. The objective of this study was to determine the diversity and composition of plants in streets of the center of Iquitos, Loreto, Peru. The inventory was carried out in ten streets of the city; all plants with stems ≥ 5 cm in diameter at breast height (DBH) were included; the samples were herborized. 199 individuals belonging to 25 species, 23 genera and 17 families were found; species richness per street varied from 0 to 15; regarding the beta diversity the Bray-Curtis similarity index showed variation from 0 to 0,62 % between the street; and the most representative species were: *Ficus benjamina* L., *Roystonea regia* (Kunth) O.F. Cook, *Syzygium malaccense* (L.) Merr. & L.M. Perry, *Terminalia catappa* L., *Adonidia merrillii* (Becc.) Becc., *Elaeis guineensis* Jacq., *Mangifera indica* L.; and as for the families we found: Arecaceae, Moraceae, Myrtaceae, Combretaceae, Anacardiaceae, Fabaceae and others. Iquitos has a low plant diversity (compared to other cities) and most plant species in Iquitos are not native.

Enlace: <https://doi.org/10.22386/ca.v10i1-2.361>

Plantas y animales usados para combatir la pandemia del Covid-19 en dos comunidades indígenas ticuna del departamento de Loreto, Perú

Plants and animals used to combat the Covid-19 pandemic in two indigenous ticuna communities in the department of Loreto, Peru

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Resumen

El COVID-19 golpeó las comunidades indígenas amazónicas del Perú durante dos años, fomentando la recuperación de conocimientos, prácticas y estrategias tradicionales para combatir sus síntomas. Presentamos las especies de plantas y animales usadas por dos comunidades ticuna del bajo Amazonas peruano durante la pandemia del COVID-19, describiendo la forma de preparación y administración de los preparados. La información se obtuvo a partir de entrevistas semiestructuradas a hombres y mujeres de las comunidades durante las dos primeras olas de la pandemia, de mayo del 2020 a junio del 2021. Las entrevistas fueron presenciales, en los trabajos de campo realizados en las comunidades, y virtuales, usando la vía telefónica y aplicaciones de mensajería disponibles en las comunidades o en los centros poblados mayores cercanos. Durante los trabajos de campo en Nueva Galilea se realizaron visitas a los puntos de colecta de las especies vegetales. Se identificaron catorce especies de plantas y tres especies de animales usados en la pandemia. Las partes más usadas de las especies vegetales, en orden de importancia fueron las hojas, las raíces, los bulbos y los frutos, realizándose preparados en forma de infusiones, al fresco, en baños y en inhalaciones de vapor. Se evidencia cómo el conocimiento tradicional en el uso de las plantas y animales que curan, de manera integrada con la apropiación de conocimientos externos, sigue vigente en las comunidades ticuna. El conocimiento sobre las propiedades curativas de catorce especies de plantas y tres especies animales identificadas ha permitido combatir los síntomas de una enfermedad muy agresiva.

Abstract

COVID-19 hit the Amazonian indigenous communities of Peru for two consecutive years, forcing them to recover traditional knowledge, practices and strategies to combat it. We present the plant and animal species used by two Ticuna communities in the Peruvian Amazon during the COVID-19 pandemic, describing the preparation and administration of the preparations. The information was obtained from semi-structured interviews with men and women from the communities during the first two waves of the pandemic, from May 2020 to June 2021. The interviews were face-to-face, in the field work carried out in the communities, and virtual, using the telephone and messaging applications available in the communities or in the nearby major population centers. During the field work in Nueva Galilea, visits were made to the collection points of the plant species. Fourteen plant species and three animal species used in the pandemic were identified. The most used parts of the plant species, in order of importance, were the leaves, roots, bulbs and fruits, making preparations in the form of infusions, fresh, in baths and in steam inhalations. It is evident how traditional knowledge in the use of plants and animals that heal, in an integrated manner with the appropriation of external knowledge, is still valid in the Ticuna communities. Knowledge about the healing properties of fourteen plant species and three identified animal species has made it possible to combat the symptoms of a very aggressive disease.

Enlace: <https://doi.org/10.24841/fa.v31i2.618>

Plant species used by *Melipona eburnea* bees in seasonally-flooded agroforestry systems in the Peruvian Amazon

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Abstract

From September 2018 to December 2019 and between July and November 2021 we conducted a study on the association of *Melipona eburnea* bees with fruit-producing trees in seasonally flooded small agroforestry systems in the Peruvian Amazon. We found 40 plant species that were used by *Melipona eburnea*: 22 flowering species that were visited by the bees as a source for food, 15 species that were used as nest habitat, and 8 species that were used by the bees for their resin. The plant species most visited as a food source were *Eugenia stipitata* with 45 (16.9% of total) individuals, *Myrciara dubia* with 37 individuals (13.9% of total) and *Inga edulis* with 32 individuals (12% of total). The species most used as nesting habitat were *Calycophyllum spruceanum* with 31 individuals (32% of total) *Maquira coriacea* with 15 individuals (15.5% of total), together representing 47.5% of the total number of individuals. We recorded eight plant species that are used as a resin source: *Croton lechleri*, *Protium apiculatum*, *Copaifera officinalis*, *Mangifera indica*, *Anacardium occidentale*, *Garcinia macrophylla* and two species of *Vismia*. *M. eburnea* is an important bee species that depends on a large diversity of plants for its survival. An effective conservation strategy will have to take into account all of the different uses of plants by the bees.

Enlace: <https://www.lrrd.org/lrrd34/11/34104cdel.html>

Plant thinning recovers fruiting of *Myrciaria dubia* in the Peruvian Amazon

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Abstract

Camu camu (*Myrciaria dubia*) is a fruit tree native to the Peruvian Amazon. The first plantations were grown at high densities. However, after 20 years of cultivation, the trees exhibit low flowering and fruiting. The objective of this study was to determine the effect of different thinning densities (3 x 3 m; 6 x 3 m; 4.24 x 4.24 x 6 m, and 6 x 6 m) and fruiting pruning on fruit production in 20-year-old *Myrciaria dubia* plants. The study evaluated several variables, including the number of flower buds, green and harvested fruits, as well as the mass (g) and equatorial diameter (mm) of the harvested fruits, fruit yield (t ha⁻¹), and light intensity (lux). The best results were observed in *Myrciaria dubia* plants that were influenced by a thinning density of 6 x 3 m and were not pruned. These plants had the highest number of flower buds, green and harvested fruits, fruit yield, and light intensity, with values of 18805, 7522, 2820.75, 13.3 t ha⁻¹, and 57395.00 lux, respectively. The spacing of 6 x 3 m resulted in favorable conditions for space and light, allowing the productive characteristics of 20-year-old *Myrciaria dubia* plants to recover. The plants were in a state of ecodormancy due to the suspension of their physiological activities caused by the absence of agronomic management.

Enlace: <https://doi.org/10.5039/agraria.v18i4a3220>

Potencial antidiabético de plantas medicinales de la amazonía peruana: Una revisión

Antidiabetic potential of medicinal plants from the Peruvian Amazon: A review

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Resumen

La diabetes mellitus es un trastorno metabólico caracterizado por la presencia de hiperglucemia crónica acompañada, en mayor o menor medida, de alteraciones en el metabolismo de carbohidratos, proteínas y lípidos, es la principal causa de muerte en los países desarrollados. Los tratamientos actuales con fármacos anti-diabéticos presentan varios efectos adversos, por lo que se ha iniciado una búsqueda de nuevos hipoglucemiantes orales a partir de especies vegetales. Esta revisión presenta las plantas medicinales de la amazonia peruana utilizadas en el tratamiento de la diabetes y una revisión sistemática de sus propiedades hipoglucémicas reportadas en la literatura en los últimos veinte años utilizando bases de datos bibliográficas. Se reportan 77 plantas medicinales utilizadas para el tratamiento de la diabetes por pobladores amazónicos, de las cuales el 46.75% reporta actividad hipoglucémica, evidenciando que el conocimiento tradicional es una fuente para la búsqueda de fármacos antidiabéticos y una alternativa para futuras investigaciones.

Abstract

Diabetes mellitus is a metabolic disorder characterized by the presence of chronic hyperglycemia that is accompanied, to a greater or lesser extent, by alterations in the metabolism of carbohydrates, proteins and lipids. It is the leading cause of death in developed countries. Current antidiabetic drug treatments present several adverse effects for which it has started searching for new oral hypoglycemic agents from vegetal species. This review presents the medicinal plants from the Peruvian Amazon used in the treatment of diabetes and a systematic review of their hypoglycemic properties reported in the literature in the last twenty years used in different bibliographic databases. Seventy seven medicinal plants are reported as being used for the treatment of diabetes by Amazonian indigenous people, which 46.75% of species report hypoglycemic activity, evidencing that traditional knowledge is a great source for to searching antidiabetic drugs and also an alternative for future research.

Enlace: <https://doi.org/10.37360/blacpma.23.22.3.21>

**Primer registro de *Dianema urostriatum* (Miranda Ribeiro, 1912)
(Siluriformes: Callychthidae), en el río Putumayo, cuenca del
Amazonas, Perú**

**First record of *Dianema urostriatum* (Miranda Ribeiro, 1912)
(Siluriformes: Callychthidae), in the Putumayo river, Amazon basin,
Peru**

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Resumen

Se reporta formalmente la presencia de *Dianema urostriatum* (Miranda Ribeiro, 1912), en afluentes del río Putumayo, ampliando de esta forma su distribución geográfica en la cuenca Amazónica. Este registro enriquece la ictiofauna continental peruana.

Abstract

The presence of *Dianema urostriatum* (Miranda Ribeiro, 1912), is formally reported in tributaries of the Putumayo River, Perú, expanding its geographic distribution of the Amazon basin. This record enriches the Peruvian continental ichthyofauna.

Enlace: <https://doi.org/10.24841/fa.v31i2.608>

Primer registro de la moniliasis (*Moniliophthora roreri* Evans et al.) del *Theobroma cacao* L. en la región de la triple frontera, Loreto, Perú

First record of moniliasis (*Moniliophthora roreri* Evans et al.) of *Theobroma cacao* in the Triple Frontier region, Loreto, Peru

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Resumen

La moniliasis, es una de las principales enfermedades que ataca al cultivo del *Theobroma cacao* L., por lo que genera un efecto socioeconómico muy importante en la industria del cacao. En diciembre del 2021 fueron muestreados 11 parcelas de cacao en las comunidades de Cushillococha y San Pedro de Palo Seco, en la provincia Mariscal Ramón Castilla (Loreto, Perú), con el objetivo de monitorear la presencia del hongo *Moniliophthora roreri* Evans et al. en las plantaciones de cacao. La moniliasis fue encontrada en las dos comunidades, en la estación de mayor precipitación en la región. En el momento del muestreo las parcelas estaban abandonadas o con manejo inadecuado. Se reporta por primera vez a la moniliasis del cacao para el departamento de Loreto, y se recomienda algunas medidas para limitar el desarrollo de la enfermedad y la expansión a otras áreas.

Abstract

Moniliasis is one of the main diseases that attacks cacao crops. The disease causes a very important/detrimental socioeconomic effect on the cocoa industry. In December 2021, 11 cacao plots were sampled in the communities of Cushillococha and San Pedro de Palo Seco, in the province of Mariscal Ramón Castilla. The goal of this study was to monitor the presence of the fungus *Moniliophthora roreri* Evans et al. in cacao plantations. Moniliasis was found in both communities during the season with the highest rainfall in the region. At the time of sampling, the plots were abandoned or improperly managed. Frosty cacao pod rot is reported for the first time for Loreto, and some measures are recommended to limit the development of the disease and its expansion to other areas.

Enlace: <https://doi.org/10.22386/ca.v9i2.343>

Productivity, adaptability, and stability in *Guazuma crinita* progeny tests across three environments in the Aguaytia River Basin, Ucayali, Perú

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Abstract

Guazuma crinita is a fast-growing tree with potential for use in agroforestry systems, due to its rapid wood production, which can contribute significantly to the livelihoods of small-scale farmers in the Peruvian Amazon. However, indiscriminate logging due to high demand is leading to the disappearance of natural forests. As such, the International Council for Research in Agroforestry (ICRAF) began a domestication program to reduce pressure on natural populations of the species. The objective of the present study was to use analyses of genetic parameters, adaptability (PRVG), productivity (MHPRVG), and stability (MHVG), to select *G. crinita* genotypes from a three-year-old progeny test established in the Aguaytía River Basin, in Ucayali, Peru. The test was established in three different sites, with three blocks, 200 progeny per block, and two individuals per plot. The measured traits were diameter at breast height (DBH), total height (H), and total aerial biomass (B). Significant differences in traits between progenies were detected, but with no genotype x environment interaction (GxE). However, the genotypic correlation among sites was important (> 0.702), suggesting that genetic improvement is possible by selecting the same progeny across sites. The mean heritability among progenies was moderate for all traits (0.34–0.369) and selective precision through combined site analysis was relatively high (0.583–0.608). Based on selection for DBH through combined analysis, MHVG, PRVG, and MHPRVG, 50 superior progenies (25.9 %) were identified for all environments. These should be prioritized in breeding programs as they can offer stable genetic variability for future selection cycles.

Enlace: <https://doi.org/10.2478/sg-2022-0009>

Propiedades físicas y mecánicas de *Guadua lynnclarkiae*, *Guadua weberbaueri* y *Guadua superba* en Ucayali, Perú

Physical and mechanical properties of *Guadua lynnclarkiae*, *Guadua weberbaueri* and *Guadua superba* in Ucayali, Peru

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Resumen

El objetivo fue determinar las propiedades físicas y mecánicas de *Guadua lynnclarkiae*, *Guadua weberbaueri* y *Guadua superba*. De cada especie fueron colectados tres culmos, posteriormente fueron seccionados en tres niveles: cepa (C), basa (B) y sobrebasa (SB). El experimento fue conducido en diseño de completamente al azar (DCA) en esquema factorial (3E x 3N), siendo el factor E: especies de bambú con tres niveles: a) *Guadua lynnclarkiae*, b) *Guadua weberbaueri* y c) *Guadua superba*; y el factor N: nivel de culmo con tres secciones a) cepa, b) basa y c) sobrebasa, todos distribuidos en tres repeticiones y 4 probetas para las propiedades físicas. Para las propiedades mecánicas fue utilizado el mismo diseño experimental y número de repeticiones, no obstante, fueron utilizados 5 probetas por parcela experimental. Así, la mayor contracción de la pared de culmo fue de 23,0% en *Guadua lynnclarkiae* en el nivel basa. La densidad básica en las tres especies fue de 0,71 g cm⁻³. En flexión, el mayor módulo de ruptura fue registrado en *Guadua superba* en cepa, basa y sobrebasa con 55,15; 84,49 y 73,97 MPa, respectivamente. En compresión paralela el MoE y MoR fue de 11454.35 MPa y 39,50 MPa en las tres especies y niveles. Por ello, *Guadua lynnclarkiae* y *Guadua weberbaueri* poseen propiedades físicas y mecánicas adecuadas para diferentes usos incluyendo la construcción civil. No obstante, en *Guadua superba* se recomienda realizar estudios posteriores de rigidez y resistencia para su uso en la construcción de viviendas en zonas rurales y urbanas.

Abstract

The objective was to determine the physical and mechanical properties of *Guadua lynnclarkiae*, *Guadua weberbaueri* and *Guadua superba*. Three culms were collected from each species, later they were sectioned into three levels: stump (S), base (B) and over base (O). The experiment was conducted in a completely randomized design (DCA) in a factorial scheme (3E x 3N), being factor E: bamboo species with three levels: a) *Guadua lynnclarkiae*, b) *Guadua weberbaueri* and c) *Guadua superba*; and the N factor: culm level with three sections a) stump, b) base and c) over base, all distributed in three repetitions and 4 test tubes for physical properties. For the mechanical properties, the same experimental design and number of repetitions were used, however, 5 test tubes were used per experimental plot. Thus, the greatest contraction of the culm wall was 23.0% in *Guadua lynnclarkiae* at the base level. The basic density in the three species was 0.71 g cm⁻³. In bending, the highest modulus of rupture was recorded in *Guadua superba* in stump, base and over base with 55.15; 84.49 and 73.97 MPa, respectively. In parallel compression, the MoE and MoR were 11454.35 MPa and 39.50 MPa in the three species and levels. Therefore, *Guadua lynnclarkiae* and *Guadua weberbaueri* have adequate physical and mechanical properties for different uses, including civil construction. However, in *Guadua superba* it is recommended to carry out subsequent studies of rigidity and resistance for its use in the construction of houses in rural and urban areas.

Recambio de especies de aves en la transición de bosque sobre arena blanca y arcilla en la Reserva Nacional Allpahuayo Mishana, Loreto, Perú

Turnover of bird species in a white sand-clay forest transition in the Allpahuayo Mishana National Reserve, Loreto, Peru

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Resumen

En las transiciones de bosques los patrones de diversidad pueden variar gradualmente observándose un recambio de especies con algunas limitaciones de distribución a escala local. En la presente investigación tuvimos como objetivo evaluar los cambios de diversidad y composición de aves en la transición de bosque sobre arena blanca y arcilla al noreste de Perú, entre el 14 de mayo al 13 de agosto del 2015. Establecimos tres transectos que atravesaron el bosque sobre arena blanca y arcilla, donde realizamos censos auditivos y visuales. Diferenciamos tres grupos de aves para nuestros análisis: (1) especialistas de suelos pobres, (2) generalistas y (3) recuento total de aves. Registramos un total de 104 especies y 1324 individuos, con diferencias en la riqueza y número de individuos de especialistas y generalistas por tipo de bosque; sin embargo, no registramos diferencias con el recuento total de especies, pero sí con el número total de individuos. Nuestro análisis de disimilitud mostró una mayor semejanza en la comunidad por tipo hábitat; adicionalmente, el índice de recambio de especies fue mayor al pasar de un hábitat a otro. Resaltamos una influencia marcada de nuestros resultados por el tipo de hábitat.

Abstract

In forest transitions, the patterns of diversity may vary gradually, observing the turnover of species with some distribution limitations at the local scale. In the present investigation we aimed to evaluate the changes in diversity and composition of birds in the transition from white sand forest and clay forest in northeastern Peru, between May 14 to August 13, 2015. We established three transects, where we conducted auditory and visual surveys. We differentiate three groups of birds for our analyzes: (1) poor soil specialists, (2) generalists, and (3) total bird count. We cataloged a total of 104 species and 1324 individuals with differences in richness and number of individuals of specialists and generalists by type of forest. Furthermore, we do not register differences with the total count of species, but with the total number of individuals. Our dissimilarity analysis showed association of the bird community by habitat type, with higher species turnover values when changing from white sand forest to clay forest. We emphasize a marked influence of our results by the type of habitat.

Enlace: <https://doi.org/10.22386/ca.v9i2.340>

Rediscovery of *Rhyacoglanis pulcher* (Boulenger, 1887) (Siluriformes: Pseudopimelodidae), a rare rheophilic bumblebee catfish from Ecuadorian Amazon

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Abstract

Rhyacoglanis pulcher is a rare Neotropical rheophilic bumblebee catfish known only from the type locality in the Cis-Andean Amazon region, Ecuador, and the type-species of the genus. So far, the three syntypes collected in 1880 were the only specimens unambiguously associated to the name *R. pulcher* available in scientific collections. Recently, a specimen was discovered in a fast-flowing stretch of the Villano river, a tributary of the Curaray river, Napo river basin, Ecuador, representing a new record after nearly 140 years. Here, we present this new record, identified by morphology, provide the DNA barcode sequence of the specimen, and propose why the species of *Rhyacoglanis* are scarce in zoological collections. Additionally, we discuss the intraspecific variation in the color pattern observed in *R. pulcher*.

Enlace: <https://doi.org/10.1371/journal.pone.0287120>

Reemplazo de la harina de pescado por harina de *Tenebrio molitor* en dietas para crustáceos: efectos en el crecimiento y la respuesta inmune

Replacement of fishmeal with *Tenebrio molitor* meal in diets for crustaceans: Effects on growth and immune response

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Resumen

El uso de harina de pescado (FM) como fuente proteica en la acuicultura es una de las principales críticas sobre esta industria. Aumentar la producción de un modo más sostenible es un imperativo actual para este sector. Por otra parte, la cría de insectos se ha tornado en una alternativa prometedora para la alimentación acuícola, ya que varias especies pueden producirse usando residuos orgánicos. Los insectos son organismos ricos en nutrientes, alta energía, y un perfil equilibrado de aminoácidos, a diferencia de las fuentes proteicas vegetales que son deficientes en ciertos aminoácidos esenciales. El objetivo del manuscrito es presentar una revisión de las investigaciones recientes sobre la sustitución de la FM por la harina de larvas de *Tenebrio molitor* (TMM), un coleóptero que se ha vuelto popular como alternativa en dietas acuícolas y sus efectos en el crecimiento y la respuesta inmune en crustáceos. Los estudios indican que la TMM puede sustituir completamente a la FM en *Litopenaeus vannamei*, mientras que los niveles de sustitución que funcionaron mejor para *Macrobrachium rosenbergii* y el cangrejo de río van desde 12 a 50%. No se encontraron estudios en crustáceos amazónicos ni sudamericanos, lo que abre oportunidades para nuevas líneas de investigación.

Abstract

The use of fishmeal (FM) as a protein source in aquaculture is one of the main criticisms of this industry. Increasing production more sustainably is a current imperative for this sector. On the other hand, insect farming has become a promising alternative for aquafeeds, since several species can be produced using organic waste. Insects are organisms rich in nutrients, they contain high amounts of energy, and they have a balanced amino acid profile, unlike protein sources of plant origin that are generally deficient in certain essential amino acids. The objective of the manuscript is to present a review of recent research on the replacement of FM by *Tenebrio molitor* larvae meal (TMM), a beetle that has become popular as an alternative in aquaculture diets, and its effects on crustaceans' growth and immune response. Studies indicate that TMM can completely substitute FM in *Litopenaeus vannamei*, while the substitution levels that worked best for *Macrobrachium rosenbergii* and crayfish range from 12 to 50%. No studies were found in Amazonian crustaceans or even in South American freshwater prawns, which opens a window of opportunities for the development of new lines of research.

Enlace: <https://doi.org/10.56926/repia.v2i2.51>

Registros inesperados de herpetofauna en un parche periurbano de la ciudad de Iquitos

Unexpected records of herpetofauna in a peri-urban patch of the city of Iquitos

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Resumen

La diversidad de la herpetofauna en la Amazonía peruana tiene un potencial considerable para la conservación, investigación y ecoturismo. Especialmente cuando la pérdida de especies ha aumentado debido al incremento de las actividades antropogénicas. La falta de conocimientos sobre especies de anfibios y reptiles en zonas periurbanas nos motivó a realizar esta investigación en el Centro de Investigación Fernando Alcántara Bocanegra (CIFAB), en Iquitos, Perú, realizamos muestreos cortos y esporádicos de transectos y trampas de caída entre los meses de junio y septiembre de 2021 en pequeños parches de bosque de arena blanca. Reportamos la presencia de especies raras de anfibios (tres especies) y ofidios (una especie): *Pristimantis padiali*, *Ranitomeya amazonica*, *Synapturanus* sp. "nanay" y *Micrurus filiformis*. Estos registros son importantes por su rareza en las colecciones herpetológicas del país, particularmente el de *Synapturanus* sp. "nanay" por sus hábitos fosoriales y por ser una especie aún no descrita, y *M. filiformis* representa el segundo registro para Iquitos después de 45 años. La diversidad de especies raras en el parche periurbano del CIFAB demuestra que a pesar de su ubicación y de la presión antropogénica del medio, este tipo de parche en la Amazonía es de vital importancia para la preservación de especies.

Abstract

The herpetofauna diversity of the Peruvian Amazon has considerable potential for conservation, research, and ecotourism. The lack of knowledge about amphibian and reptile species in peri-urban areas motivated us for this research in the Fernando Alcántara Bocanegra Research Center - CIFAB, in Iquitos, Peru, we conducted short and sporadic transect and pitfall trap sampling between June and September 2021 in small patches of white sand forest. We report the presence of four rare species of herpetozoa, three amphibians, and one ophidian: *Pristimantis padiali*, *Ranitomeya amazonica*, *Synapturanus* sp. "nanay" and *Micrurus filiformis*. These records are important because of their rarity in the herpetological collections of the country, particularly *Synapturanus* sp. "nanay" because of its fossorial habits and representing a species not yet described, and *M. filiformis* represents the second record for Iquitos after 45 years. The diversity of rare species in the peri-urban patch of CIFAB demonstrates that despite its location and the anthropogenic pressure on the environment, this type of patch in the Amazon is of vital importance for the preservation of these species.

Enlace: <https://doi.org/10.24841/FA.V31I2.624>

Reporte de *Cichlidogyrus tilapiae* (Monogenoidea: Dactylogyridae) en *Oreochromis niloticus* «tilapia» (Cichliformes: Cichlidae) colectados en un estanque piscícola en la Amazonía peruana

Report of *Cichlidogyrus tilapiae* (Monogenoidea: Dactylogyridae) in *Oreochromis niloticus* «tilapia» (Cichliformes: Cichlidae) collected in a fishpond in the Peruvian Amazon

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Resumen

Las tilapias son peces introducidos a América Latina y son considerados como perjudiciales para los ecosistemas naturales. Se ha detectado la presencia de estos peces en cuerpos de agua naturales y en estanques de cría en la Región de Loreto, Perú. En el presente estudio se analizaron las branquias de *Oreochromis niloticus* “tilapia” procedentes de un estanque de cultivo del eje carretero Iquitos-Nauta, pudiendo identificar al monogenoideo *Cichlidogyrus tilapiae* parasitando a *O. niloticus*. Este sería el primer reporte en la región de una especie de Monogenoidea colectada de las branquias de un pez exótico.

Abstract

Tilapias are fish introduced to Latin America and are considered harmful to natural ecosystems. The presence of these fish has been detected in natural water bodies and inbreeding ponds in the Loreto Region, Peru. In the present study, the gills of *Oreochromis niloticus* «tilapia» from a culture pond on the Iquitos-Nauta highway were analysed, and the monogenoid *Cichlidogyrus tilapiae* parasitizing *O. niloticus* was identified. This would be the first report in the region of a species of Monogenoidea collected from the gills of an exotic fish.

Enlace: <https://doi.org/10.15381/rivep.v33i6.22743>

Revision of *Prodontocharax* and revalidation of *Amblystilbe* (Teleostei: Characidae: Cheirodontinae), with description of a new species

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Abstract

Prodontocharax species are revised and the genus *Amblystilbe* is revalidated based on analysis of type-material and additional specimens. Both genera are diagnosed based on unique synapomorphies among members of the Cheirodontinae related to shape, size, number and arrangement of teeth in the jaw bones. *Prodontocharax melanotus*, from the upper rio Madeira basin, Brazil and Bolivia, is redescribed, and a new species is described from the rio Huallaga basin, Peru. The genus *Amblystilbe* and its type-species, *A. howesi*, are redescribed from the Amazonas River basin, Bolivia, Brazil, and Peru, and *Prodontocharax alleni* is considered a junior synonym of *A. howesi*. The two species of *Prodontocharax* are distinguished by the color pattern, number of lamellae of the olfactory rosette in male and female and number of gill rakers, and differ from *A. howesi* by the number and shape of teeth, color pattern and number of branched anal-fin rays. According to recent studies, the species of *Prodontocharax* and *A. howesi* cluster into two distinct clades among the cheirodontines.

Enlace: <https://doi.org/10.1590/1982-0224-2023-0031>

***Sebekia* sp. (Pentastomidae) en *Astronotus ocellatus* (Agassiz, 1831) “Acarahuazú” colectados en el Mercado Belén, Iquitos, Perú**

***Sebekia* sp. (Pentastomidae) in *Astronotus ocellatus* (agassiz, 1831) “oscar” collected in the Belén Market, Iquitos, Peru**

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Resumen

El presente trabajo tuvo como objetivo principal reportar la presencia del pentastómido *Sebekia* sp. colectados en *Astronotus ocellatus* (Agassiz, 1831) “Acarahuazu” adquiridos del mercado Belén, Iquitos, Perú, durante el mes de junio 2021. El trabajo se realizó mediante la observación, búsqueda, identificación, medición y cálculo de los índices parasitarios de *Sebekia* sp. colectados de la musculatura y del estómago de 30 ejemplares adultos de *A. ocellatus* analizados. De acuerdo a los resultados obtenidos del cálculo de los índices parasitarios, se reportó una prevalencia de 20%, intensidad media de 1,5 y una abundancia media de 0,3 de *Sebekia* sp. Las medidas morfométricas obtenidas muestran a ejemplares de *Sebekia* sp. con una longitud promedio del cuerpo de 156,29 µm y 65,78 µm de ancho. La presencia de este parásito en la musculatura de *A. ocellatus* despierta un llamado de alerta ante la posibilidad de su ingesta accidental debido al consumo de su carne en preparaciones que utilicen la carne cruda o mal cocida.

Abstract

The main objective of this work was to report the presence of the pentastomid *Sebekia* sp. collected in *Astronotus ocellatus* (Agassiz, 1831) "Oscar" acquired in the Belén market, in Iquitos, Peru during the month of June 2021. The work was carried out through the observation, search, identification, measurement and calculation of the parasitological indices of *Sebekia* sp. collected from the musculature and stomach of 30 adult specimens of *A. ocellatus* analyzed. According to the results obtained from the calculation of the parasitological indices, it was recorded a prevalence of 20 %, mean intensity of 1.5 and a mean abundance of 0.3 of *Sebekia* sp. The morphometric measurements obtained show specimens of *Sebekia* sp. with a mean body length of 156.29 µm and 65.78 µm width. The presence of this parasite in the musculature of *A. ocellatus* raises an alert to the possibility of its accidental ingestion due to the consumption of its meat in preparations that use raw or undercooked meat.

Enlace: <https://repositorio.iiap.gob.pe/handle/20.500.12921/662>

Seedlings quality of *Bertholletia excelsa* Bonpl. (Lecythidaceae) produced in forest nursery

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Abstract

In this study, the quality of *Bertholletia excelsa* seedlings was evaluated in relation to the transplanted seedling's size. Thirty days after transplanting the seedlings to the forest nursery, the first height measurement was performed. From the 30th day onwards, evaluations were carried out every 15 days, being nine in total. The Dickson Quality Index (DQI) was evaluated to determine the seedlings quality, where all seedlings had their root pruned. The experimental design, totaling 160 individuals, was completely randomized with four treatments and four replications, including the shoot cut and three seedling sizes with no shoot cut. Shoot cut seedlings presented a DQI of 0.66 ± 0.23 , significantly higher than the large seedlings (≤ 17 cm in height) with no shoot cut ($F_{3,76} = 2.762$, $p = 0.047$). Transplanting had significant effects over the development, growth, and quality of *Bertholletia excelsa* seedlings during the first 165 days of seedling production. Therefore, shoot pruning resulted in better performance of *B. excelsa* seedlings to be planted in the field.

Enlace: <https://doi.org/10.17707/AgricultForest.68.1.14>

Selección de clones de *Myrciaria dubia* en condiciones de transición sabana/bosque en Roraima mediante análisis multivariado

Selection of *Myrciaria dubia* clones under conditions of the savanna/forest transition of Roraima through multivariate analysis

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Resumen

El camu-camu (*Myrciaria dubia*) es una fruta de la región amazónica que ha recibido atención debido a su alto contenido de compuestos antioxidantes, como el ácido ascórbico y los polifenoles. El objetivo del estudio fue seleccionar clones de camu-camu según sus características morfológicas mediante análisis multivariados. Se evaluaron 56 clones de camu-camu distribuidos en tres bloques con dos plantas por parcela experimental. Las variables medidas fueron altura de la planta (H), número de ramas basales (NRB), número de brotes terminales (NBT), diámetro basal del tallo (DT), clorofila a (Chl a) y b (Chl b) y clorofila total (Chl a + b). Los análisis de agrupamiento de componentes principales (PCA) y multivariados se realizaron utilizando la media de enlace y los algoritmos de distancia de Mahalanobis. Después de 24 meses, los resultados mostraron que la característica que menos contribuyó a la selección del clon fue el NRB. La altura de la planta, número de ramas basales (NRB), diámetro basal del tallo (DBT), clorofila a (Chl a) y b (Chl b) y clorofila total (Chl a + b) tuvieron la contribución más positiva hacia la selección inicial de clones de camu-camu a los dos años de edad. Veintidós clones de camu-camu presentaron la mayor tasa de desarrollo vegetativo o índice de calidad de la vegetación (ICV) en la sabana de transición/área forestal del norte del Amazonas, Brasil, después de dos años de trasplante.

Abstract

Camu-camu (*Myrciaria dubia*), a fruit from the Amazon region, has received attention due to its high content of antioxidant compounds such as ascorbic acid and polyphenols. This study's objective was to select camu-camu clones according to their morphological characteristics using multivariate analyses. We evaluated 56 camu-camu clones distributed in three blocks with two plants per experimental plot. The variables measured were plant height (H), number of basal branches (NBB), number of terminal buds (NTB), basal stem diameter (BSD), chlorophylls a (Chl a) and b (Chl b), and total chlorophyll (Chl a + b). Principal component (PCA) and multivariate clustering analyses were performed using the average linkage mean and Mahalanobis distance algorithms. After 24 months, results showed that the characteristic that least contributed to clone selection was NBB. The plant height (H), number of terminal buds (NTB), basal stem diameter (BSD), chlorophylls a (Chl a) and b (Chl b), and total chlorophyll (Chl a + b) had the most positive contribution towards the initial selection of camu-camu clones at two years of age. The 22 camu-camu clones showed the highest rate of vegetative development or vegetative quality index (VQI) in the transitional savanna/forest area of the northern Amazon, Brazil, after two years of transplanting.

Enlace: <https://doi.org/10.15446/agron.colomb.v40n1.100319>

Sensitivity of South American tropical forests to an extreme climate anomaly

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Abstract

The tropical forest carbon sink is known to be drought sensitive, but it is unclear which forests are the most vulnerable to extreme events. Forests with hotter and drier baseline conditions may be protected by prior adaptation, or more vulnerable because they operate closer to physiological limits. Here we report that forests in drier South American climates experienced the greatest impacts of the 2015–2016 El Niño, indicating greater vulnerability to extreme temperatures and drought. The long-term, ground-measured tree-by-tree responses of 123 forest plots across tropical South America show that the biomass carbon sink ceased during the event with carbon balance becoming indistinguishable from zero ($-0.02 \pm 0.37 \text{ Mg C ha}^{-1}$ per year). However, intact tropical South American forests overall were no more sensitive to the extreme 2015–2016 El Niño than to previous less intense events, remaining a key defence against climate change as long as they are protected.

Enlace: <https://doi.org/10.1038/s41558-023-01776-4>

Spatial distribution and effective depth of roots of camu-camu with and without mulch

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Abstract

In South America, the camu-camu has been domesticated, however, for its cultivation there is still little technical information to guarantee its adaptability and productivity in places with a well-defined dry season. The objective of this study was to characterize the spatial distribution of the root system and determine the effective depth (EP) of roots in camu-camu plants with and without mulch (WM) in uplands conditions. In an orchard, 3 plants with 3, 5 and 7 years each were chosen at random. Then mulch composed of grass (*Trachypogon plumosus*) was placed on a plant of each age in the canopy projection. After 12 months, the volume and EP of the roots in the 3-year-old plants with mulch was 200 mm³ and 0.3 m, and without mulch it was 500 mm³ and 0.48 m, respectively. In 5-year-old plants it was 4000 mm³ and 0.43 m with mulch, and without mulch it was 6000 mm³ and 0.64 m; and in plants with 7 years old, the volume and PE of the roots with mulch were 12000 mm³ and 0.58 m, and without mulch of 10000 mm³ and 0.71 m, respectively. The effective depth equivalent to 80% of the root concentration was lower with the use of dead vegetation cover, which is very important for the camu-camu crop, as it allows the application of a more precise and efficient water layer through irrigation.

Enlace: <https://doi.org/10.17268/sci.agropecu.2023.042>

Species of Monogenoidea from fish species used in aquaculture in the Peruvian Amazonia

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Abstract

In the present study it is presented a list of species of Monogenoidea with their fish-hosts used in aquaculture in the Peruvian Amazonia. Fish species were obtained from April 2018 to April 2022 from different artificial fish ponds located in “Centro de Investigaciones Fernando Alcántara Bocanegra” (CIFAB) of the “Instituto de Investigaciones de la Amazonía Peruana (IIAP) in Loreto-Peru and from fish ponds of the “Centro de Investigación Carlos Miguel Castañeda Ruiz” from IIAP, San Martín- Peru. A total list of forty-eight species is presenting in the present study: one species from *Arapaima gigas* (Schinz); four species from *Colossoma macropomum* (Cuvier); five species from *Myloplus schomburgkii* (Jardine); two species from *Piaractus brachipomus* (Cuvier); 19 species from *Pygocentrus natterei* (Kner); one species from *Prochilodus nigricans* (Spix & Agassiz); five species from *Brycon amazonicus* (Spix & Agassiz); one species from *Chaetobranchius flavescens*; three species from *Astronotus ocellatus* (Agassiz); two species from *Cichla monoculus* (Agassiz); four species from *Pterigoplichthys pardalis* (Castelnau); three species from *Calophysus macropterus* (Lichtenstein); and three species from *Pseudoplatystoma punctifer* (Castelnau).

Enlace: <https://doi.org/10.1016/j.aquaculture.2022.738947>

Species-level ichthyoplankton dynamics for 97 fishes in two major river basins of the Amazon using quantitative metabarcoding

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Abstract

The Amazon basin holds the world's largest freshwater fish diversity. Information on the intensity and timing of reproductive ecology of Amazonian fish is scant. We use a metabarcoding method by capture using a single probe to quantify species-level ichthyoplankton dynamics. We sampled the Marañón and the Ucayali rivers in Peru monthly for 2 years. We identified 97 species that spawned mainly during the flood start, the flood end or the receding periods, although some species had spawning activity in more than one period. This information was new for 40 of the species in the Amazon basin and 80 species in Peru. Most species ceased spawning for a month during a strong hydrological anomaly in January 2016, demonstrating the rapidity with which they react to environmental modifications during the breeding season. We also document another unreported event in the Amazon basin, the inverse phenology of species belonging to one genus (*Triportheus*). Overall larval flow in the Marañón was more than twice that of the Ucayali, including for most commercial species (between two and 20 times higher), whereas the Ucayali accounts for ~80% of the fisheries landings in the region. Our results are discussed in the light of the main anthropogenic threats to fishes, hydropower dam construction and the Hidrovía Amazónica, and should serve as a pre-impact baseline.

Enlace: <https://doi.org/10.1111/mec.15944>

Survey of Lichenized Fungi DNA Barcodes on King George Island (Antarctica): An Aid to Species Discovery

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Abstract

DNA barcoding is a powerful method for the identification of lichenized fungi groups for which the diversity is already well-represented in nucleotide databases, and an accurate, robust taxonomy has been established. However, the effectiveness of DNA barcoding for identification is expected to be limited for understudied taxa or regions. One such region is Antarctica, where, despite the importance of lichens and lichenized fungi identification, their genetic diversity is far from characterized. The aim of this exploratory study was to survey the lichenized fungi diversity of King George Island using a fungal barcode marker as an initial identification tool. Samples were collected unrestricted to specific taxa in coastal areas near Admiralty Bay. Most samples were identified using the barcode marker and verified up to the species or genus level with a high degree of similarity. A posterior morphological evaluation focused on samples with novel barcodes allowed for the identification of unknown *Austrolecia*, *Buellia*, and *Lecidea* s.l. species. These results contribute to better represent the lichenized fungi diversity in understudied regions such as Antarctica by increasing the richness of the nucleotide databases. Furthermore, the approach used in this study is valuable for exploratory surveys in understudied regions to guide taxonomic efforts towards species recognition and Discovery.

Enlace: <https://doi.org/10.3390/jof9050552>

The number of tree species on Earth

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Abstract

One of the most fundamental questions in ecology is how many species inhabit the Earth. However, due to massive logistical and financial challenges and taxonomic difficulties connected to the species concept definition, the global numbers of species, including those of important and well-studied life forms such as trees, still remain largely unknown. Here, based on global ground-sourced data, we estimate the total tree species richness at global, continental, and biome levels. Our results indicate that there are ~73,000 tree species globally, among which ~9,000 tree species are yet to be discovered. Roughly 40% of undiscovered tree species are in South America. Moreover, almost one-third of all tree species to be discovered may be rare, with very low populations and limited spatial distribution (likely in remote tropical lowlands and mountains). These findings highlight the vulnerability of global forest biodiversity to anthropogenic changes in land use and climate, which disproportionately threaten rare species and thus, global tree richness.

Enlace: <https://doi.org/10.1073/pnas.2115329119>

¿Tiene influencia el sustrato sobre la germinación de *Cinchona pubescens* Vahl. (Rubiaceae)?

Does substrate influence germination of *Cinchona pubescens* Vahl. (Rubiaceae)?

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Resumen

Cinchona pubescens es una especie icónica de Perú ya que fue usada como único tratamiento efectivo contra la malaria por más de tres siglos. Esta especie está amenazada por diversas actividades antropogénicas y su propagación está supeditada a la dispersión de semillas cuyo poder de germinación es bajo, por ende, es necesario conservarla y propagarla. El objetivo del estudio fue evaluar el efecto del sustrato sobre la germinación de *C. pubescens*. Se aplicó un diseño completamente aleatorio con cinco tratamientos según el tipo de sustrato T1 (25% tierra de bosque+75% arena), T2 (50% tierra de bosque+50% arena), T3 (75% tierra de bosque+25% arena), T4 (100% Tierra de bosque) y T5 (100% arena), la tierra de bosque fue extraída de zonas donde *C. pubescens* está presente de forma natural. En los tratamientos se utilizaron tres réplicas y 100 semillas por cada réplica. La germinación de *C. pubescens* inició 12 días después de la siembra hasta el día 42. El T4 tuvo un mejor efecto sobre el índice ($14,23 \pm 0,41$), tiempo ($24,18 \pm 0,69$) y porcentaje de germinación ($88,3 \pm 2,88\%$); seguido por los tratamientos T3 y T2. Mientras que el T5 fue el tratamiento con menor efecto sobre la germinación de *C. pubescens*. El estudio indicó que el tipo de sustrato empleado influye significativamente en la germinación de las semillas de *C. pubescens*, por lo que se sugiere emplear el sustrato procedente de bosque natural sin combinación para alcanzar índices altos de germinación y propagar esta especie.

Abstract

Cinchona pubescens is an emblematic species of Peru, as it was used as the only effective treatment against malaria for three centuries. This species is threatened by various anthropogenic activities and its propagation depends on the dispersal of seeds whose germination power is low, therefore, it is necessary to conserve and propagate it. The objective of the study was to evaluate the effect of substrate on the germination of *C. pubescens*. A completely randomized design was applied with five treatments according to the type of substrate T1 (25% forest soil+75% sand), T2 (50% forest soil+50% sand), T3 (75% forest soil+25% sand), T4 (100% forest soil) and T5 (100% sand), the forest soil was extracted from areas where *C. pubescens* is naturally present. Three replicates and 100 seeds per replicate were used in the treatments. Germination of *C. pubescens* started 12 days after sowing until day 42. T4 had a better effect on the index (14.23 ± 0.41), time (24.18 ± 0.69) and germination percentage ($88.3 \pm 2.88\%$); followed by treatments T3 and T2. While T5 was the treatment with the least effect on *C. pubescens* germination. The study indicated that the type of substrate used significantly influences the germination of *C. pubescens* seeds, so it is suggested to use substrate from natural forest without combination to achieve high germination rates and propagation of this species.

Enlace: <https://doi.org/10.15446/rfnam.v75n3.100736>

Tropical South America Diatom Database: a tool for studying the macroecology of microorganisms

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Abstract

Determining the mechanisms of community assembly forms the foundation of biogeography and community ecology. Studies of the biodiversity and distribution of Neotropical macro-organisms have revealed the roles of environmental, spatial, and historical factors in structuring communities at different spatial and temporal scales. The role of these factors for species and communities of microorganisms are still poorly understood. Diatoms are a very species-rich group of algae, widely distributed, and sensitive to environmental variation because of their position at the base of aquatic food webs. Here, we present the Tropical South American Diatom Database (TSADB), which contains geographical and ecological information on diatom species across lentic and lotic environments, including predictors that describe local (limnological) and regional (geo-climatic) factors. The open access database can be used to ask fundamental questions in macroecology, including testing foundational theories of metacommunity ecology and biogeography, and evaluating the sensitivity of species and communities to the rapid environmental changes characteristic of tropical regions. The TSADB includes diatom taxa from 437 samples from 326 sites distributed across 26 regions (0–5,070 m a.s.l. and between 8°N–35°S; 58–90°W). In addition, long-term, diatom-based paleolimnological records are presented as a complementary tool for identifying geographically well-covered regions with modern and palaeo-datasets. We describe the TSADB structure and functionality, together with the R codes for data manipulation and visualization. Each of the 26 study regions is represented by three data matrices: sampling site information, environmental variables (limnology, climate, and landscape), and diatom community data (relative abundance or presence/absence). Access to data and future additions is through publicly available repositories and a guide to contributors, respectively. Thus, it offers ample opportunities to complement existing databases on diatoms, allowing optimal usage of TSADB by scientists including diatomists, limnologists, and aquatic ecologists.

Enlaces: <https://doi.org/10.1080/0269249X.2022.2078429>

<https://repositorio.inaigem.gob.pe/handle/16072021/414>

Two new surprising species of leaf-litter toad of the *Rhinella margaritifera* species group (Anura: Bufonidae) from the Peruvian Amazon, Loreto-Peru

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Abstract

We describe two new species of *Rhinella* (Anura: Bufonidae) from the department of Loreto, Peru. We integrate morphological and phylogenetic analyses to provide evidence of new species. *R. angeli* sp. nov. is diagnosable from all congeners by its pronounced fleshy proboscis and *R. unapensis* sp. nov. by the small size (mean snout-vent length=37.7 ± 4.1 mm) of adult males, snout pointed in dorsal view, nearly acute in lateral view, and small bony protrusion at the angle of jaws among other characters. The two species are allopatric, where the first species is known to be associated inhabits upland (=terra firme) forests, while the second white sand forests (=varillales) around Iquitos city. The two new species represent the 20th and 21st species of the *Rhinella margaritifera* species group.

Enlace: <https://doi.org/10.11646/zootaxa.5150.4.2>

UHPLC-MS Chemical Fingerprinting and Antioxidant, Enzyme Inhibition, Anti-Inflammatory In Silico and Cytoprotective Activities of *Cladonia chlorophaea* and *C. gracilis* (Cladoniaceae) from Antarctica

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Abstract

The lichen species *Cladonia chlorophaea* and *C. gracilis* (Cladoniaceae) are widely distributed in the island archipelago of maritime Antarctica and represent a natural resource of scientific interest. In this work, the metabolomic characterization of the ethanolic extracts of these species and the determination of the antioxidant activity, enzymatic inhibition and anti-inflammatory potential of selected compounds on the 5-lipoxygenase enzyme by molecular docking and cytoprotective activity in the SH-SY5Y cell line were carried out. Nineteen compounds were identified by liquid chromatography coupled with quadrupole-time-of-flight mass spectrometry (UHPLC-ESI-QTOF-MS) in each of the species. The contents of phenolic compounds, antioxidant activity, the inhibition of cholinesterases (acetylcholinesterase and butyrylcholinesterase) and digestive enzymes (α -glucosidase and pancreatic lipase) were variable among species, with better results in *C. chlorophaea*. Molecular docking evidenced significant binding affinities of some compounds for the 5-lipoxygenase enzyme, together with outstanding pharmacokinetic properties. Both extracts were shown to promote cell viability and a reduction in reactive oxygen species production in an H_2O_2 -induced oxidative stress model. This study contributes to the chemical knowledge of the *Cladonia* species and demonstrates the biological potential for the prevention and promising treatment of central nervous system pathologies, inflammatory disorders and metabolic alterations.

Enlace: <https://doi.org/10.3390/antiox12010010>

Ultrasound evaluation of fetal bone development in the collared (*Pecari tajacu*) and white-lipped peccary (*Tayassu pecari*)

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Abstract

The study of fetal development allows for evaluating the different strategies adopted by mammal species to maximize neonatal survival. Autonomous locomotion is fundamental for newborns to perform foraging activities and increases newborn survival from predation. In this study, we assess the gestational bone development of 53 collared (CP, *Pecari tajacu*) and 61 white-lipped (WLP, *Tayassu pecari*) peccaries, collected through the collaboration of subsistence hunters in the Amazon. The bone mineralization and biometry of the axial and appendicular skeleton were assessed by ultrasound examinations, and the timing of the main bone developmental events was calculated in relation to the total dorsal length (TDL) and the percentage of the total gestational period (GP). The first US signs of mineralization of the axial skeleton in CP and WLP were observed in fetuses with 3.4 cm (42 gestation days, 30% GP_{CP}) and 5.1 cm (51 gestation days, 32% GP_{WLP}). The early development of the appendicular skeleton was observed by the synchronic appearance of the mineralized scapula, humerus, radius, ulna, ilium, ischium, femur, tibia, and fibula at 36% GP_{CP} (50 gestation days), and 35% GP_{WLP} (56 gestation days). The pubis was mineralized in fetuses at 55% GP_{CP} (75 gestation days) and 59% GP_{WLP} (94 gestation days). The mineralization was observed in all autopod bones at 79% GP_{CP} (109 gestation days) and 67% GP_{WLP} (106 gestation days). All primary ossification centers in long bones of thoracic and pelvic limbs were mineralized in advanced fetuses (GP_{CP and WLP} ≥ 75%). The mineralized patella was not observed in advanced fetuses in either species. Secondary ossification centers first appeared at the distal epiphysis of the femur in the CP (99 gestation days, 72% GP_{CP}) and the distal epiphysis of the radius, femur, and tibia in the WLP (106 gestation days, 67% GP_{WLP}). Advanced fetuses of CP and WLP presented 60% (15/25) and 68% (17/25) of the total secondary ossification centers observed present in the adult domestic pig, while newborns from the domestic pig presented 52% (13/25). The early intrauterine development of the skeletal system in both peccary species suggests a precocial development strategy, which likely correlates with neonatal ability to escape predators and reduces the dependence on parental care.

Enlace: <https://doi.org/10.1111/joa.13724>

Ultrastructure, surface topography, morphology and histological observations of a new parasitic cnidarian of the marbled swamp eel from the world's largest tropical wetland area, Pantanal, Brazil

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Abstract

Myxosporeans are a diverse group of microscopic cnidarians of wide distribution that evolved into a parasitic lifestyle. A new myxosporean species, *Myxobolus* sp., is herein described infecting the mandible of wild specimens of *Synbranchus marmoratus*, caught in the world's largest tropical wetland area, Pantanal, Brazil. Light, scanning, transmission electron microscopy and histological observations unveiled detailed taxonomic information of the new myxosporean cnidarian. Ultrastructural analysis revealed a detailed description of plasmodia structures which can be used for comparison with plasmodia from other species of myxobolids. Both histological and ultrastructural observations evidenced a connective tissue capsule surrounding the plasmodia of *Myxobolus* sp. as a histopathological host reaction to the infection of this parasitic cnidarian. Histology showed that tissue tropism of the new myxosporean occurs in a well-defined part of the mandible, with development of plasmodia occurring in the epidermis layer. Mature myxospores from the valvular view featured an ovoid shape and had a short prolongation of the spore valves in the posterior end. Myxospores measured $22.7 \pm 1.2 \mu\text{m}$ (21.5–23.9 μm) in length, $12.5 \pm 0.4 \mu\text{m}$ (12.1–12.9 μm) in width and 11.3 ± 0.5 (10.8–11.8 μm) in thickness. Polar capsules were pyriform equally-sized and measuring $4.6 \pm 0.3 \mu\text{m}$ (3.9–4.3 μm) in length and $2.9 \pm 0.1 \mu\text{m}$ in width (2.8–3.0 μm). Finally, this study substantiates the still hidden myxosporean diversity from South America.

Enlace: <https://doi.org/10.1016/j.tice.2022.101909>

Unveiling biogeographical patterns of the ichthyofauna in the Tuichi basin, a biodiversity hotspot in the Bolivian Amazon, using environmental DNA

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Abstract

To date, more than 2400 valid fish species have been recorded in the Amazon basin. However, some regions remain poorly documented. This is the case in the Beni basin and in particular in one of its main sub-basins, the Tuichi, an Andean foothills rivers flowing through the Madidi National Park in the Bolivian Amazonia. The knowledge of its ichthyological diversity is, however, essential for the management and protection of aquatic ecosystems, which are threatened by the development of infrastructures (dams, factories and cities), mining and deforestation. Environmental DNA (eDNA) has been relatively little used so far in the Amazon basin. We sampled eDNA from water in 34 sites in lakes and rivers in the Beni basin including 22 sites in the Tuichi sub-basin, during the dry season. To assess the biogeographical patterns of the amazonian ichthyofauna, we implemented a metabarcoding approach using two pairs of specific primers designed and developed in our laboratory to amplify two partially overlapping CO1 fragments, one of 185bp and another of 285bp. We detected 252 fish taxa (207 at species level) among which 57 are newly identified for the Beni watershed. Species compositions are significantly different between lakes and rivers but also between rivers according to their hydrographic rank and altitude. Furthermore, the diversity patterns are related to the different hydro-ecoregions through which the Tuichi flows. The eDNA approach makes it possible to identify and complete the inventory of the ichthyofauna in this still poorly documented Amazon basin. However, taxonomic identification remains constrained by the lack of reference barcodes in public databases and does not allow the assignment of all OTUs. Our results can be taken into account in conservation and management strategies and could serve as a baseline for future studies, including on other Andean tributaries.

Enlace: <https://doi.org/10.1371/journal.pone.0262357>

Valor nutricional y capacidad antioxidante de cuatro frutos de palmeras nativas de la amazonía peruana

Nutritional value and antioxidants capacity of four fruits of native palm trees from the peruvian amazon

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Resumen

Actualmente existe una tendencia hacia el consumo de alimentos que proporcionen beneficios para la salud, como es el caso de los frutos de palmeras que tienen una gran importancia como fuente de alimento y por su uso como medicinal. En el presente estudio se evaluó y comparó el valor nutricional y la actividad antioxidante de ungurahui (*Oenocarpus bataua*), sinamillo (*Oenocarpus mapora*), asaí (*Euterpe oleracea*) y huasá (*Euterpe precatoria*), frutos de palmeras nativas de la Amazonía peruana. Se analizó la composición proximal y propiedades fisicoquímicas por métodos oficiales, los micro y macro nutrientes por espectroscopia de absorción atómica y la composición de ácidos grasos por cromatografía de gases. La evaluación de la actividad antioxidante se realizó mediante los métodos de DPPH y ABTS. Los cuatro frutos presentaron un buen contenido de proteínas y carbohidratos, así como un alto contenido de K, Cu y Mn. Los aceites extraídos de los frutos presentan un alto contenido de ácidos grasos saturados (70,78-83,27%), siendo el ácido oleico el mayoritario en todos los casos. Todos los frutos presentaron valores de actividad antioxidante superiores a los reportados para otros frutos exóticos, siendo el sinamillo el fruto que presentó mejor actividad en ambos ensayos (DPPH 116,58 $\mu\text{mol TE/g MF}$, ABTS 239,22 $\mu\text{mol TE/g MF}$). Estos resultados nos indican que los frutos de palmeras colectados en la Amazonía peruana poseen un alto valor nutricional y que pueden ser aprovechados para elaboración de alimentos funcionales o complementos alimenticios.

Abstract

Currently there is a trend towards the consumption of foods that provide health benefits, as is the case of palm fruits that are of great importance as a food source and for their medicinal use. In the present study the nutritional value and antioxidant activity of ungurahui (*Oenocarpus bataua*), sinamillo (*Oenocarpus mapora*), asaí (*Euterpe oleracea*) and huasá (*Euterpe precatoria*), palm fruits native to the Peruvian Amazon were evaluated. The proximal composition and physicochemical properties were analyzed by official methods, the micro and macro nutrients by atomic absorption spectroscopy and the composition of fatty acids by gas chromatography. The evaluation of the antioxidant activity was carried out using the DPPH, FRAP and ABTS methods. The four fruits have a good content of proteins and carbohydrates, as well as a high content of K, Cu and Mn. The oils extracted from the fruits have a high content of saturated fatty acids (70.78-83.27%), with oleic acid being the majority in all cases. All the fruits presented antioxidant activity values higher than those reported for other exotic fruits, with sinamillo being the fruit that presented the best activity in both tests (DPPH 116.58 $\mu\text{mol TE/g FS}$, FRAP 165,04 $\mu\text{mol TE/g FS}$, ABTS 239.22 $\mu\text{mol TE/g FS}$). These results indicate that the fruits of palm trees from the Peruvian Amazon have a high nutritional value and that they can be used for the production of functional foods or food supplements.

Enlace: <https://doi.org/10.24841/fa.v31i1.557>

Wild meat trade over the last 45 years in the Peruvian Amazon

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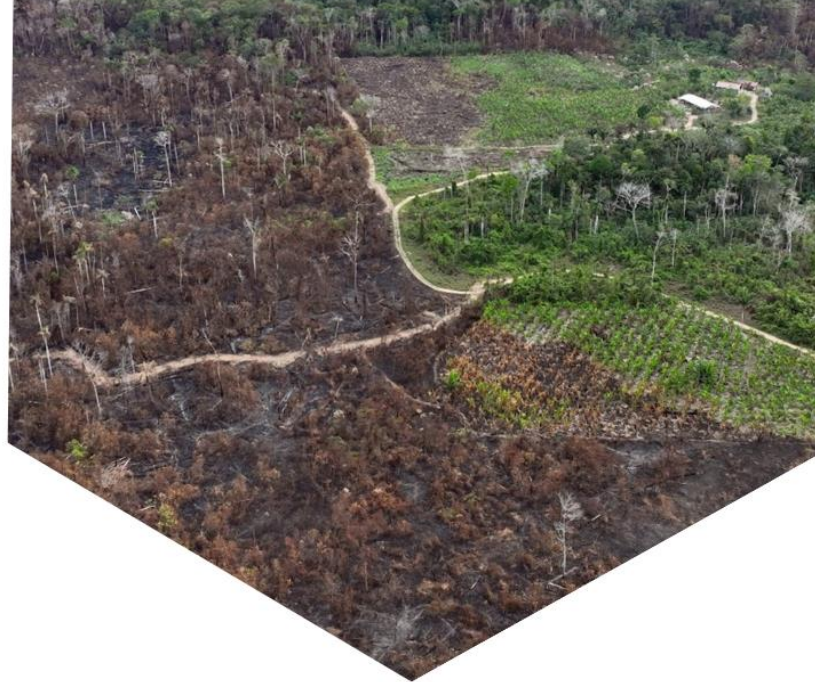
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Abstract

The trade in wild meat is an important economic component of rural people's livelihoods, but it has been perceived to be among the main causes of the decline of wildlife species. Recently, the COVID-19 pandemic has brought to light an additional concern of wildlife markets as a major human-health challenge. We analyzed data from the largest longitudinal monitoring (1973–2018) of the most important urban wild-meat markets in Iquitos, Peru, to examine the trends in and impacts of these markets on people's livelihoods. Over the last 45 years, wild meat sales increased at a rate of 6.4 t/year (SD 2.17), paralleling urban population growth. Wild meat sales were highest in 2018 (442 t), contributing US\$2.6 million (0.76%) to the regional gross domestic product. Five species of ungulates and rodents accounted for 88.5% of the amount of biomass traded. Vulnerable and Endangered species represented 7.0% and 0.4% of individuals sold, respectively. Despite growth in sales, the contribution of wild meat to overall urban diet was constant: 1–2%/year of total meat consumed. This result was due to greater availability and higher consumption of cheaper meats (e.g., in 2018, poultry was 45.8% cheaper and was the most consumed meat) coupled with the lack of economic incentives to harvest wild meat species in rural areas. Most wild meat was sold salted or smoked, reducing the likelihood of foodborne diseases. Community-based wildlife management plans and the continued trade bans on primates and threatened taxa may avoid biodiversity loss. Considering the recent COVID-19 pandemic, future management plans should include potential viral hosts and regulation and enforcement of hygiene practices in wild-meat markets.

Enlace: <https://doi.org/10.1111/cobi.13801>



Deforestación y degradación de ecosistemas

A Conceptual Model for Rehabilitation of Puna Grassland Social–Ecological Systems

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Abstract

The impacts of both climate change and socioeconomic processes are driving the degradation of mountains and the ecological services they provide worldwide. In the tropical Andes, compounding glacier retreat, altered hydrological and precipitation regimes (eg off-season alternation of extreme dry and wet periods), and expansion of mining and other land uses are modifying hydrological services. Although initiatives to restore ecosystems and their services are increasing, conceptual models emerging from experiences on the ground are scarce. Based upon the experience of Peru's National Institute for Research on Glaciers and Mountain Ecosystems (INAIGEM) in the Piuray Ccorimarca microbasin (Cusco) in combining participatory action research and experiments at the plot scale, this article elaborates a conceptual model for the rehabilitation of hydrological services on the social–ecological systems of puna grassland. The model proposes multiscale (plot–pilot–microbasin) rehabilitation. At each level, the actions proposed include designing plots, selecting sites, implementing restoration activities, and evaluating and monitoring the sites. Our inductive model from the ground and plot can inform rehabilitation of hydrological services on puna grasslands elsewhere.

Enlace: <https://doi.org/10.1659/mrd.2023.00019>

Hydrological Response Assessment of Land Cover Change in a Peruvian Amazonian Basin Impacted by Deforestation Using the SWAT Model

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Abstract

The watershed hydrologic conditions in the Madre de Dios (MDD) Basin in the Peruvian Amazon have been irreversibly impacted by deforestation and changes in land cover. These changes have also had detrimental effects on the geomorphology, water quality, and aquatic habitat within the basin. However, there is a scarcity of hydrological modeling studies in this area, primarily due to the limited availability of hydrometeorological data. The primary objective of this study was to examine how deforestation impacts the hydrological conditions in the MDD Basin. By implementing the Soil and Water Assessment Tool (SWAT) model, this study determined that replacing 12% of the evergreen broadleaf forest area with bare land resulted in a significant increase in surface runoff, by 38% monthly, a 1% annual reduction of evapotranspiration, and an average monthly streamflow increase of 12%. Changes in spatial patterns reveal that the primary impacted watershed is the Inambari River subbasin, a significant tributary of the Madre de Dios River. This area experiences an annual average surge of 187% in surface runoff generation while witnessing an annual average reduction of 8% in evapotranspiration. These findings have important implications, as they can contribute to instances of flooding and extreme inundation events, which have already occurred in the MDD region.

Enlaces: <https://doi.org/10.3390/rs15245774>

<https://hdl.handle.net/20.500.12542/3070>

Influence of Distance from Forest Edges on Spontaneous Vegetation Succession Following Small-Scale Gold Mining in the Southeast Peruvian Amazon

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Abstract

Few studies describe the factors that influence the natural regeneration in abandoned gold mining areas in the Amazon. Here we focus on the influence of the distance to the forest edge and abandonment time in a spontaneous succession of degraded areas by gold mining in the southeastern Peruvian Amazon. We assessed woody species composition (DBH ≥ 1 cm) and forest stand structure across a chronosequence (2–23 years). A total of 79 species belonging to 30 families were identified. The natural regeneration was dominated by Fabaceae, Malvaceae, and Urticaceae. Together, they represented 60% of the importance index. *Cecropia membranacea* and *Ochroma pyramidale* were the dominant pioneer species at the initial successional stage. The basal area and species diversity were directly related to time after abandonment and inversely related to the distance to forest edges. The distance-based redundancy analysis showed that more of the variation in species composition was explained by distance to the forest edge than the abandonment time. Our study revealed that regeneration was relatively slow and provided evidence that the distance to the forest edge is important for natural regeneration in areas degraded by gold mining.

Enlace: <https://doi.org/10.3390/d15060793>

Impacto futuro del cambio de cobertura y uso de la tierra en comunidades indígenas Yagua de la Amazonía peruana

Future impact of land cover and land use change in Yagua indigenous communities from peruvian Amazon

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Resumen

En los últimos diez años, la pérdida de bosque en las comunidades yagua de la cuenca del río Atacuari (CRA), Loreto, Perú, ha tenido a los cultivos migratorios (incluyendo a los de coca) como causas principales. En este contexto, se desconoce cómo será el impacto de los ecosistemas por actividades antrópicas. El objetivo fue evaluar el impacto en los ecosistemas debido a los cultivos legales o ilegales en la CRA, bajo un enfoque geoespacial. Se generó un escenario de cobertura vegetal al 2026 y se analizó espacialmente el impacto de los ecosistemas utilizando los índices de calidad del hábitat (CH) y de autocorrelación espacial. Al 2026, la pérdida del bosque sería 4935,80 ha (4,19 % de la superficie total, 89,55 % del cambio total y 4,42 % del bosque en 2019), la CH muy alta pasaría a niveles altos y moderados, conformando patrones de puntos fríos en mosaicos de cultivos y pastos, con una significancia ($p < 0,05$). El impacto futuro en los ecosistemas de la CRA aumentará y será negativo, disminuyendo la CH por el aumento de los cultivos legales e ilegales, impactando también en las estructuras, conocimientos, prácticas y valores tradicionales de uso de los recursos en las comunidades de la CRA.

Abstract

In the last ten years, the loss of forest in the Yagua communities of the Atacuari River Basin (ARB), Loreto, Peru, has had to the shifting crop (including coca) as the main causes. In this context, the impact on ecosystems by the antropic activities is unknown. The objective was to evaluate the impact on ecosystems due to legal or illegal crops in the ARB. A vegetation cover scenario was generated to 2026 and the impact of the ecosystems was spatially analyzed using the habitat quality (HQ) and spatial autocorrelation indices. By 2026, the loss of the forest would be 4935,80 ha (4,19 % of the total area, 89,55 % of the total change and 4,42 % of the forest in 2019), the quality habitat very high would change to high and moderate, and it would form patterns of cold spots in crop and pasture mosaics category with a significance ($p < 0,05$). The future impact on the ecosystems will increase and will be negative due to a decrease in the quality of the habitat and an increase in legal and illegal crops, also impacting the structures, knowledge, practices and traditional values of resource use in the communities of the ARB.

Enlace: <https://doi.org/10.24841/fa.v31i2.607>

More than 10,000 pre-Columbian earthworks are still hidden throughout Amazonia

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Abstract

Indigenous societies are known to have occupied the Amazon basin for more than 12,000 years, but the scale of their influence on Amazonian forests remains uncertain. We report the discovery, using LIDAR (light detection and ranging) information from across the basin, of 24 previously undetected pre-Columbian earthworks beneath the forest canopy. Modeled distribution and abundance of large-scale archaeological sites across Amazonia suggest that between 10,272 and 23,648 sites remain to be discovered and that most will be found in the southwest. We also identified 53 domesticated tree species significantly associated with earthwork occurrence probability, likely suggesting past management practices. Closed-canopy forests across Amazonia are likely to contain thousands of undiscovered archaeological sites around which pre-Columbian societies actively modified forests, a discovery that opens opportunities for better understanding the magnitude of ancient human influence on Amazonia and its current state.

Enlace: <https://doi.org/10.1126/science.ade2541>

Navigating shifting waters: Subjectivity, oil extraction, and Urarina territorial strategies in the Peruvian Amazon

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Abstract

This paper examines the relationships between extractive infrastructure, changing territorial strategies, and contemporary processes of subject formation among the Urarina, an indigenous people in the Peruvian Amazon. We first introduce the uneven and combined character of oil extraction in the Loreto region in north-eastern Peru, and how its racialised spatial contradictions are expressed in the ethnopolitical field that gives political form to regional extractive operations. The paper goes on to analyse the case of the Urarina people in the Chambira river basin, their particular place in the geography of extraction, and the case of the community of Nueva Union. We examine contemporary processes of subject formation in the community, which combine radical transformations in the role of money, territorial strategies, use and valuation of the environment, and changes in political structure, in non-linear ways. The paper closes by examining how the case of the community of Nueva Union sheds light on broader dynamics of subject formation, localised relations to the environment, and extraction as they play out in contemporary indigenous Amazonia.

Enlace: <https://doi.org/10.1016/j.geoforum.2023.103867>

Niche breadth of Amazonian trees increases with niche optimum across broad edaphic gradients

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Abstract

Understanding how biotic interactions and environmental filtering mediated by soil properties shape plant community assembly is a major challenge in ecology, especially when studying complex and hyperdiverse ecosystems like tropical forests. To shed light on the influence of both factors, we examined how the edaphic optimum of species (their niche position) related to their edaphic range (their niche breadth) along different environmental gradients and how this translates into functional strategies. Here we tested four scenarios describing the shape of the niche breadth—niche position relationship, including one neutral scenario and three scenarios proposing different relative influences of abiotic and biotic factors on community assembly along a soil resource gradient. To do so, we used soil concentration data for five key nutrients (N, P, Ca, Mg, and K), along with accurate measurements of 14 leaf, stem, and root traits for 246 tree species inventoried in 101 plots located across Eastern (French Guiana) and Western (Peru) Amazonia. We found that species niche breadth increased linearly with species niche position along each soil nutrient gradient. This increase was associated with more resource acquisitive traits in the leaves and the roots for soil N, Ca, Mg, and K concentration, while it was negatively associated with wood density for soil P concentration. These observations agreed with one of our hypothetical scenarios in which species with resource conservation traits are confined to the most nutrient-depleted soils (abiotic filter), but they are outperformed by faster-growing species in more fertile conditions (biotic filter). Our results refine and strengthen support for niche theories of species assembly while providing an integrated approach to improving forest management policies.

Enlace: <https://doi.org/10.1002/ecy.4053>

Payment for ecosystem services in Peru: Assessing the socio-ecological dimension of water services in the upper Santa River basin

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Abstract

Increasing pressures on ecosystems in the Latin American region, as well as the adoption of multilateral conservation commitments, have led to the implementation of instruments that are economic in nature but oriented towards the recovery, conservation, and functioning of ecosystems such as Payment for Ecosystem Services (PES). In the Peruvian Andes, hydro-climatic factors and land-use changes are affecting the capacity of the ecosystems of the glaciated Cordillera Blanca to provide water services, in terms of both quality and quantity, to the main users of the Santa River basin. Thus, this study analyses how the socio-ecological interactions affect, and are affected by, the planned introduction of water-related PES in the Quillcay sub-basin, the most populated sub-basins along the Santa River basin. We use a conceptual model based on the current evolution of the water metabolism approach to integrate into a common language of analysis the multiple dimensions of water: water as an ecological fund, as a service, and as a political asset. To explore the interface of these three domains of analysis we rely on a mixed-method data collection: primary data collection through a stakeholder survey and interviews and a review of information from secondary sources. The result of our case study shows that both the ecological dimension and the social dimension affect on the PES project and vice versa. These complex interactions could result in the design of a mechanism in which not all stakeholders benefit equally. This raises the need to recognise the multidimensional nature of water in the design and implementation of policies, and the importance of identifying processes and barriers which affect the success of these policies without making invisible the direct effect they also have on social-ecological systems.

Enlaces: <http://hdl.handle.net/20.500.12816/5369>

<https://doi.org/10.1016/j.ecoser.2022.101454>

Performance of heat spots obtained from satellite datasets to represent burned areas in Andean ecosystems of Cusco, Peru

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Abstract

The combustion of biomass is a prevalent practice in the Andes. Often, these burns escape control and escalate into wildfires. However, the investigation of unreported fire incidents has not received the same level of attention as reported wildfires. Satellite provide an alternative information source for studying wildfires. Given the scarcity of wildfire response tools, it is imperative to develop strategies to prevent burns in regions where human activity typically triggers wildfires. This study aims to assess the efficacy of heat spot data obtained from satellite datasets in identifying fire activity in the Peruvian Andes. The study utilized MODIS (MCD14DL product) and VIIRS (SUOMI and JPSS-1 products) satellite datasets to characterize fire activity through heat spot detection. Additionally, the study employed the normalized burned area index (NBR), a valuable indicator for mapping burned areas. Our findings indicate that MODIS and VIIRS heat spots demonstrate a high level of reliability in detecting active fires (commission errors of ~1%). However, the detection of burned areas not captured by MODIS or VIIRS heat spots was significantly high (omission errors of ~90%). Nevertheless, this detection deficiency decreased for larger burn areas (errors of omission between 10 and 30% for burned areas between 50 and 100 ha, using JPSS-1 VIIRS). These results suggest that satellite heat spots are inadequate for identifying burn practices, which encompass small-scale and short-duration fire activities (lasting only hours). The outcomes of this study enhance our understanding of the suitability of heat spot detection for wildfire prevention in the Peruvian Andes.

Enlaces: <http://hdl.handle.net/20.500.12816/5437>

<https://doi.org/10.1016/j.rsase.2023.101020>

Reliability of cross-regional applications of global fire danger models: a Peruvian case study

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Resumen

Antecedentes: Los índices de peligro de incendio (FDIs) son usados como indicadores del peligro de incendio para lugares específicos. Para propósitos prácticos, es común la extrapolación de cálculos previos para lugares sin datos previos, pero éstos son generalmente inciertos si las relaciones entre los FDIs y el peligro potencial del fuego en el ambiente en el cual el índice fue desarrollado es igualmente relevante que en otros. Por ejemplo, aunque el Perú es un lugar topográfica, ecológica, y climatológicamente complejo, el pronóstico de peligro de incendios usado a nivel país se basa en un conjunto de umbrales standard aplicando el índice de Peligro de incendios (FWI). En este estudio validamos las suposiciones de que las relaciones entre el tiempo meteorológico y el fuego son espacialmente uniformes dentro del Perú mediante 1) una comparación regional cruzada de las distribuciones de cuatro FDIs - índice de Quema, Componente de Liberación de Energía, el Fire Weather Index (FWI), y el índice de sequía de Keetch-Byram- y 2) mediante comparaciones regionales cruzadas obtenidas mediante percentiles del sensor de puntos calientes de MODIS condicionados sobre valores de FDI.

Resultados: Diferencias regionales significativas en la distribución diaria de los valores de FDI fueron observados en cada par de regiones dentro del Perú y, con la excepción de regiones pares dentro de la Amazonía, muy pocos datos (< 90 días) fueron necesarios para detectar esas diferencias. Después de controlar valores de FDI, efectos estacionales y anuales mediante regresiones, fueron notables las diferencias entre valores predichos y los puntos calientes, difiriendo en hasta 47 puntos porcentuales. Entre los pares de regiones, la magnitud de esas diferencias tendió a decrecer a medida que la similitud climática aumentaba, aunque algunos ejemplos contradictorios fueron también aparentes.

Conclusiones: Las diferencias notables en la distribución de los valores de FDI sugieren que un conjunto standard de valores críticos puede producir inferencias inciertas relativas al peligro de incendio. Encontramos también que aún cuando las condiciones climáticas fueran similares a través de todo el Perú, los mismos valores de FDI en dos lugares diferentes pueden producir predicciones substancialmente diferentes en la actividad del fuego. Esto sugiere que otros factores más allá de los valores del FDI pueden mediar en la actividad del fuego, y que mejores predicciones potenciales pueden ser producidas si esos factores fuesen considerados.

Abstract

Background: Fire danger indexes (FDIs) are used as proxies for fire potential and are often developed for specific locations. For practical purposes, the extrapolation of the underlying calculations into novel locations is common, but it is generally uncertain if the relationships between FDIs and fire potential observed in the environment in which the index was developed are equally relevant in others. For example, although a topographically, ecologically, and climatologically complex country, fire danger forecasts in Peru use a standard set of nationwide thresholds applied to the Fire Weather Index. In this study, we validate the underlying assumption that weather-fire relationships are spatially uniform within Peru by (1) making cross-regional comparisons of the statistical distributions of four FDIs—Burning Index, Energy Release Component, Fire Weather Index, and Keetch-Byram Drought Index, and (2) making cross-

regional comparisons of the expected daily MODIS hotspot count percentiles conditioned on FDI values.

Results: Significant regional differences in the distributions of daily FDI values were observed in every pair of regions within Peru, and with the exception of a pair of regions within the Amazon, little data (< 90 days) were necessary to detect these differences. After controlling for FDI values and seasonal and annual effects with regressions, differences in predicted hotspot percentiles were common, differing by as much as 47 percentage points. Across the pairs of regions, the magnitude of these differences tended to decrease as climatic similarity increased, but some counterexamples were also apparent.

Conclusions: The noticeable differences in the distributions of daily FDI values suggest that a standard set of breakpoints may produce unreliable inferences regarding fire potential. We also find that even if the climatic conditions were similar across Peru, the same FDI values in two locations can produce substantially differing predictions of wildfire activity. This suggests that other factors besides FDI values can strongly mediate wildfire activity and that better fire potential predictions could be produced if these factors are accounted for.

Enlaces: <https://doi.org/10.1186/s42408-022-00150-7>

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Soil macroinvertebrate communities: A world-wide assessment

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Abstract

Aim: Macroinvertebrates comprise a highly diverse set of taxa with great potential as indicators of soil quality. Communities were sampled at 3,694 sites distributed world-wide. We aimed to analyse the patterns of abundance, composition and network characteristics and their relationships to latitude, mean annual temperature and rainfall, land cover, soil texture and agricultural practices.

Location: Sites are distributed in 41 countries, ranging from 55° S to 57° N latitude, from 0 to 4,000 m in elevation, with annual rainfall ranging from 500 to >3,000 mm and mean temperatures of 5–32°C.

Time period: 1980–2018.

Major taxa studied: All soil macroinvertebrates: Haplotaxida; Coleoptera; Formicidae; Arachnida; Chilopoda; Diplopoda; Diptera; Isoptera; Isopoda; Homoptera; Hemiptera; Gastropoda; Blattaria; Orthoptera; Lepidoptera; Dermaptera; and “others”.

Methods: Standard ISO 23611-5 sampling protocol was applied at all sites. Data treatment used a set of multivariate analyses, principal components analysis (PCA) on macrofauna data transformed by Hellinger’s method, multiple correspondence analysis for environmental data (latitude, elevation, temperature and average annual rainfall, type of vegetation cover) transformed into discrete classes, coinertia analysis to compare these two data sets, and bias-corrected and accelerated bootstrap tests to evaluate the part of the variance of the macrofauna data attributable to each of the environmental factors. Network analysis was performed. Each pairwise association of taxonomic units was tested against a null model considering local and regional scales, in order to avoid spurious correlations.

Results: Communities were separated into five clusters reflecting their densities and taxonomic richness. They were significantly influenced by climatic conditions, soil texture and vegetation cover. Abundance and diversity, highest in tropical forests ($1,895 \pm 234$ individuals/m²) and savannahs ($1,796 \pm 72$ individuals/m²), progressively decreased in tropical cropping systems (tree-associated crops, $1,358 \pm 120$ individuals/m²; pastures, $1,178 \pm 154$ individuals/m²; and annual crops, 867 ± 62 individuals/m²), temperate grasslands (529 ± 60 individuals/m²), forests (232 ± 20 individuals/m²) and annual crops (231 ± 24 individuals/m²) and temperate dry forests and shrubs (195 ± 11 individuals/m²). Agricultural management decreased overall abundance by $\leq 54\%$ in tropical areas and 64% in temperate areas. Connectivity varied with taxa, with dominant positive connections in litter transformers and negative connections with ecosystem engineers and Arachnida. Connectivity and modularity were higher in communities with low abundance and taxonomic richness.

Main conclusions: Soil macroinvertebrate communities respond to climatic, soil and land-cover conditions. All taxa, except termites, are found everywhere, and communities from the five clusters cover a wide range of geographical and environmental conditions. Agricultural practices significantly decrease abundance, although the presence of tree components alleviates this effect.

Enlace: <https://doi.org/10.1111/geb.13492>

Supervivencia de especies de plantas en bosques estacionalmente inundables en la Amazonía Peruana

Survival of plants species in seasonally flooded forests of the Peruvian Amazonia

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Resumen

La supervivencia de especies en un bosque estacionalmente inundable abre paso a entender mejor las estrategias para fines de conservación y restauración ecológica. Este trabajo reporta especies tolerantes a áreas inundables, mediante la evaluación de supervivencia de especies sembradas para la restauración del bosque. De las diecisiete especies estudiadas, cinco mostraron alto potencial para ser utilizados en trabajos de restauración de bosques estacionalmente inundables. En general, las especies de *P. munguba*, *C. tapia*, *H. crepitans*, *S. reticulata* y *M. dubia* tuvieron un porcentaje de supervivencia mayor de 50%. Destacando *S. reticulata* que presentó mayor supervivencia con 91,1% en condiciones sin sumergencia. Sin embargo, *C. tapia* (65,6%) y *M. dubia* (52,8%) toleran mayor sumergencia. La supervivencia de plantas está directamente relacionada con las características de adaptación a periodos y niveles de inundación, lo que se ve condicionada también por la heterogénea microtopografía propias de los bosques inundables amazónicos.

Abstract

The survival of species in a seasonally flooded forest leads to a better understanding of strategies for conservation and ecological restoration. This paper reports species tolerant to flooded areas by evaluating the survival of species planted for forest restoration. Of the seventeen species studied, five showed high potential for use in seasonally flooded forest restoration. In general, the species *P. munguba*, *C. tapia*, *H. crepitans*, *S. reticulata* and *M. dubia* had a survival rate higher than 50%. *S. reticulata* had the highest survival with 91,1% in non-submergence conditions. However, *C. tapia* (65,6%) and *M. dubia* (52,8%) tolerated greater submergence. The survival of plants is directly related to characteristics of adaptation to periods and levels of flooding, which is also conditioned by the heterogeneous microtopography of Amazonian flooded forests.

Enlace: <https://doi.org/10.24841/fa.v32i1.627>

Sustainable palm fruit harvesting as a pathway to conserve Amazon peatland forests

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Abstract

Sustainable management of intact tropical peatlands is crucial for climate change mitigation, for biodiversity conservation and to support the livelihoods of local communities. Here, we explore whether sustainable fruit harvesting from *Mauritia flexuosa* palms could support these linked goals by increasing fruit production and incomes across the 2.8 million hectares of the most carbon-dense ecosystem in Amazonia: the lowland peatlands of northeastern Peru. *M. flexuosa* is dioecious, and fruits are typically harvested by felling female palms; the proportion of female palms therefore provides a good indicator of the health of a stand. Across 93 widely distributed sites, we found that the proportion of female palms increases with travel time to the urban market, and overall, fruit harvesting has halved the current potential production and income from this resource. However, significantly more female palms are found where fruit are harvested by climbing. We estimate that region-wide uptake of climbing could eventually increase potential fruit production by 51% and increase its gross value to US\$62 ± 28.2 million yr⁻¹. These findings demonstrate the high cost of unsustainable resource extraction in Neotropical forests and outline a practical path to conserve and sustainably exploit one of the most carbon-rich landscapes on the planet.

Enlace: <https://doi.org/10.1038/s41893-022-00858-z>

The presence of peat and variation in tree species composition are under different hydrological controls in Amazonian wetland forests

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Abstract

The peat-forming wetland forests of Amazonia are characterized by high below-ground carbon stocks and supply fruit, fibres and timber to local communities. Predicting the future of these ecosystem services requires understanding how hydrological conditions are related to tree species composition and the presence, or absence, of peat. Here, we use continuous measurements of water table depth over 2.5 years and manual measurements of pore-water pH and electrical conductivity to understand the ecohydrological controls of these variables across the large peatland complex in northern Peruvian Amazonia. Measurements were taken in permanent forest plots in four palm swamps, four seasonally flooded forests and four peatland pole forests. All trees ≥ 10 cm diameter were also measured and identified in the plots to assess floristic composition. Peat occurs in eight of these twelve sites; three seasonally flooded forests and one palm swamp are not associated with peat. Variation in tree species composition among forest types was linked to high flood levels (maximum flooding height) and pH: seasonally flooded forests experience high flood levels (up to 3.66 m from the ground surface) and have high pH values (6–7), palm swamps have intermediate flood levels (up to 1.34 m) and peatland pole forests experience shallow flooding (up to 0.28 m) and have low pH (4). In contrast, the presence of peat was linked to variation in maximum water table depth (i.e. the depth to which the water table drops below the ground surface). Surface peat is found in all forest types where maximum water table depth does not fall >0.55 m below the ground surface at any time. Peat formation and variation in tree species composition therefore have different ecohydrological controls. Predicted increases in the frequency and strength of flooding events may alter patterns of tree species composition, whereas increases in drought severity and declines in minimum river levels may pose a greater risk to the below-ground carbon stores of these peatland ecosystems.

Enlace: <https://doi.org/10.1002/hyp.14690>

Unraveling Amazon tree community assembly using Maximum Information Entropy: a quantitative analysis of tropical forest ecology

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Abstract

In a time of rapid global change, the question of what determines patterns in species abundance distribution remains a priority for understanding the complex dynamics of ecosystems. The constrained maximization of information entropy provides a framework for the understanding of such complex systems dynamics by a quantitative analysis of important constraints via predictions using least biased probability distributions. We apply it to over two thousand hectares of Amazonian tree inventories across seven forest types and thirteen functional traits, representing major global axes of plant strategies. Results show that constraints formed by regional relative abundances of genera explain eight times more of local relative abundances than constraints based on directional selection for specific functional traits, although the latter does show clear signals of environmental dependency. These results provide a quantitative insight by inference from large-scale data using cross-disciplinary methods, furthering our understanding of ecological dynamics.

Enlace: <https://doi.org/10.1038/s41598-023-28132-y>

Valoración económica de plantaciones de bolaina blanca (*Guazuma crinita* Mart.) en Ucayali, Perú

Economic evaluation of plantations of bolaina blanca (*Guazuma crinita* mart.) in Ucayali, Peru

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Resumen

Entre los años 2001 al 2006, se evaluaron plantaciones demostrativas de bolaina blanca (*Guazuma crinita* Mart.) en tres sectores de la cuenca del río Aguaytía que tenían como uso anterior un cultivo de yuca, purma de 3 años y cultivo de maíz en los sectores 1, 2 y 3 respectivamente. Utilizando modelos de predicción de volumen y biomasa en función a la edad de la plantación se determinó la viabilidad técnica-económica de plantaciones a los seis años de edad en un escenario de venta de tablillas, tucos y cantoneras (bienes) y captura de CO_{2eq} (servicios) actualizados al año 2022 con una TEA del 22%. Tuvieron un valor actual neto (VAN), tasa interna de retorno (TIR) y relación beneficio/costo (B/C), de S/. 8408,67; 60,9% y 1,58 para el sector 3; S/. 967,23; 26,5% y 1,07 para el sector 2 y S/. -7 945,28; 0,0% y 0,14 para el sector 1, los mismos que estuvieron influenciado principalmente por ingresos generados por la venta de tablillas de madera y la venta de flujos positivos de servicios de captura de carbono, los mismos que resultaron del establecimiento de plantaciones en suelos donde el uso anterior fue un cultivo anual. Por lo que las plantaciones del sector 3 y 2 fueron técnica-económicamente viables, mientras que las plantaciones del sector 1 no lo fueron.

Abstract

Between 2001 and 2006, demonstrative plantations of bolaina blanca (*Gauzuma crinita* Mart.) were evaluated in three sectors of the Aguaytía river basin that had as previous use cassava crop, 3-year purma and corn crop in sectors 1, 2 and 3 respectively. Using predictive models of volume and biomass in function of the plantation age, we determined the technical-economic viability of plantations in a six-years-old scenario of sale of slats, tucos and cantoneras (goods) and capture of CO_{2eq} (services) updated to the year 2022 with an annual effective rate of return of 22%. They had a net present value (NPV), in-ternal rate of return (IRR) and benefit/cost ratio (B/C) of S/. 8 408,67; 60,9% and 1,58 for sector 3; S/. 967,23; 26,5% and 1,07 for sector 2; and S/. -7 945,28; 0,0% and 0,14 for sector 1, which were mainly influenced by income generated by the sale of wood chips and the sale of positive flows of carbon se-questration services resulting from the establishment of plantations in soils where the previous use was an annual crop. Thus, the plantation in sectors 3 and 2 were technically and economically viable, while the plantations in sector 1 were not.

Enlace: <https://revistas.iiap.gob.pe/index.php/foliaamazonica/article/view/574>



IV

Economía circular y cadenas productivas sostenibles

Uso de cítricos como sustrato para la cría en semicautiverio de *Hermetia illucens* "mosca solado negra" en Loreto, Perú

Use of citrus as substrate for semi-captivity breeding of *Hermetia illucens* "black soldier fly" in Loreto, Peru

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Resumen

En la crianza de peces nativos de la Amazonía peruana como *Colossoma macropomum*, *Piaractus brachipomus*, *Brycon amazonicus*, *Prochilodus nigricans* y *Arapaima gigas* se utiliza alimento balanceado, en cuya formulación predomina la harina de pescado y otros insumos no locales. Esto, encarece y dificulta su adquisición, principalmente por los productores rurales amazónicos que se encuentran alejados del área urbana. Mundialmente, existen experiencias de alternativas para la crianza de peces en base al uso de vegetales, frutas e insectos, aprovechando la diversidad biológica del entorno. Así, el uso de larvas de insectos constituye una alternativa promisorio para el sector acuícola a escala global. El presente estudio muestra la cría en semicautiverio de *Hermetia illucens* "mosca soldado negra" utilizando residuos orgánicos (cítricos) colectados del área urbana y rural, destacando el uso de bagazo de naranjas y toronja. De esta forma utilizando, el principio de economía circular, se obtuvieron larvas vivas y harina de mosca soldado, las cuales podrán ser utilizadas para alimentar a peces de importancia comercial. Como producto final de la crianza de las larvas se obtuvo un compost orgánico ideal para sistemas agrofo-restales. Este estudio muestra una metodología barata, accesible y armónica con el ambiente para la crianza de mosca soldado negra en semicautiverio en la región de Loreto utilizando cítricos del área urbana y rural.

Abstract

In the rearing of native fish of the Peruvian Amazon such as *Colossoma macropomum*, *Piaractus brachipomus*, *Brycon amazonicus*, *Prochilodus nigricans* and *Arapaima gigas*, balanced feed is used, in whose formulation fishmeal and other non-local inputs predominate. This makes its acquisition more expensive and difficult, mainly by rural Amazonian producers who are far from the urban area. Worldwide, there are experiences of alternatives for raising fish based on the use of vegetables, fruits and insects, taking advantage of the biological diversity of the environment. Thus, the use of insect larvae constitutes a promising alternative for the aquaculture sector on a global scale. The present study shows the semi-captivity breeding of *Hermetia illucens* "black soldier fly" using organic waste (citrus) collected from urban and rural areas, highlighting the use of orange bagasse and grapefruit. In this way, using the circular economy principle, live larvae and soldier fly meal were obtained to be used as an alternative to feed commercially important fish. As a final product of the rearing of the larvae, an organic compost ideal for agroforestry systems was obtained. This study shows a cheap, accessible and environmentally friendly methodology for raising black soldier fly in semi-captivity in the region of Loreto by using citrus from the urban and rural area.

Enlace: <https://doi.org/10.24841/fa.v32i1.613>

UHPLC–MS Characterization, and Antioxidant and Nutritional Analysis of Cocoa Waste Flours from the Peruvian Amazon

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Abstract

Cocoa (*Theobroma cacao*) is a food product used worldwide and a key raw material for chocolate manufacturing. Cocoa possesses bioactive compounds such as methylxanthines, flavonoids, procyanidins, and related molecules with medicinal or health-promoting properties. Cocoa shell and pod husk have been proposed as a by-product with several interesting bioactivities, and the gummy residue or glue (a sticky, gluey by-product known as “mucilage” in Spanish) is used to produce liquors and is eaten as a food in Perú. However, little is known about the chemical composition and bioactivity of flours made from Peruvian cocoa ecotype wastes such as those from the vein and pod husk of the fruits. This study aimed to characterize the in vitro antioxidant properties and nutritional values of flours made from the waste from a special ecotype of cocoa (CCN-51). The chemical fingerprinting was performed using UHPLC–HESI orbitrap mass spectrometry and allowed the detection of 51 compounds. GC-FID was used for the determination of individual fatty acid contents, and the antioxidant activity was assessed by several assays (DPPH, FRAP, and ABTS). The flours obtained were composed of a good amount of dietary fiber, carbohydrates, and minerals, as well as several bioactive polyphenolic compounds, fatty acids, and amino acids with nutraceutical properties, making the flours a rich and promising food as well as a good source for the preparation of functional foods or nutraceuticals.

Enlace: <https://doi.org/10.3390/antiox11030595>



V

Gestión de riesgos y adaptación al cambio climático

160 glacial lake outburst floods (GLOFs) across the Tropical Andes since the Little Ice Age

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Abstract

Assessing the extent to which glacial lake outburst floods (GLOFs) are increasing in frequency in modern times and whether their incidence is driven by anthropogenic climate change requires historical context. However, progress on this issue is hampered by incomplete GLOF inventories, especially in remote mountain regions. Here, we exploit high-resolution, multi-temporal satellite and aerial imagery, and documentary data to identify GLOF events across the glacierized Cordilleras of Peru and Bolivia, using a set of diagnostic geomorphic features. A total of 160 GLOFs from 151 individual sites are characterised and analysed, tripling the number of previously reported events. We provide statistics on location, magnitude, timing and characteristics of these events with implications for regional GLOF hazard identification and assessment. Furthermore, we describe several cases in detail and document a wide range of process chains associated with Andean GLOFs.

Enlace: <https://doi.org/10.1016/j.gloplacha.2021.103722>

700,000 years of tropical Andean glaciation

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Abstract

Our understanding of the climatic teleconnections that drove ice-age cycles has been limited by a paucity of well-dated tropical records of glaciation that span several glacial–interglacial intervals. Glacial deposits offer discrete snapshots of glacier extent but cannot provide the continuous records required for detailed interhemispheric comparisons. By contrast, lakes located within glaciated catchments can provide continuous archives of upstream glacial activity, but few such records extend beyond the last glacial cycle. Here a piston core from Lake Junín in the uppermost Amazon basin provides the first, to our knowledge, continuous, independently dated archive of tropical glaciation spanning 700,000 years. We find that tropical glaciers tracked changes in global ice volume and followed a clear approximately 100,000-year periodicity. An enhancement in the extent of tropical Andean glaciers relative to global ice volume occurred between 200,000 and 400,000 years ago, during sustained intervals of regionally elevated hydrologic balance that modified the regular approximately 23,000-year pacing of monsoon-driven precipitation. Millennial-scale variations in the extent of tropical Andean glaciers during the last glacial cycle were driven by variations in regional monsoon strength that were linked to temperature perturbations in Greenland ice cores; these interhemispheric connections may have existed during previous glacial cycles.

Enlaces: <https://doi.org/10.1038/s41586-022-04873-0>

<https://repositorio.inaigem.gob.pe/handle/16072021/416>

A cold wave of winter 2021 in central South America: characteristics and impacts

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Abstract

During the austral winter (June–August) of 2021, the meteorological services of Brazil, Argentina, Peru, Paraguay, Bolivia, and Chile all issued forecasts for unusually cold conditions. Record-low minimum temperatures and cold spells were documented, including one strong *cold wave* episode that affected 5 countries. In this study, we define a cold wave as a period in which daily maximum and minimum air temperatures are below the corresponding climatological 10th percentile for three or more consecutive days. The intense cold wave event in the last week of June, 2021, resulted in record-breaking minimum daily temperatures in several places in central South America and Chile. Several locations had temperatures about 10 °C below average, central South America had freezing conditions, and southern Brazil even saw snow. The cold air surge was characterized by an intense upper-air trough located close to 35° S and 70° W. The southerly flow to the west of this trough brought very cold air northward into subtropical and tropical South America. A northward flow between the lower-level cyclonic and anticyclonic perturbations caused the intense southerly flow between the upper-level ridge and trough. This condition facilitated the inflow of near-surface cold air from southern Argentina into southeastern Brazil and tropical South America east of the Andes. In the city of São Paulo, the cold wave caused the death of 13 homeless people from hypothermia. Frost and snow across southern and southeastern Brazil caused significant damage to coffee, sugarcane, oranges, grapes, and other fruit and vegetable crops. Wine and coffee production fell, the latter by 30%, and prices of food and commodities in the region rose.

Enlaces: <https://doi.org/10.1007/s00382-023-06701-1>

<https://hdl.handle.net/20.500.12542/2893>

A future of extreme precipitation and droughts in the Peruvian Andes

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Abstract

Runoff from glacierised Andean river basins is essential for sustaining the livelihoods of millions of people. By running a high-resolution climate model over the two most glacierised regions of Peru we unravel past climatic trends in precipitation and temperature. Future changes are determined from an ensemble of statistically downscaled global climate models. Projections under the high emissions scenario suggest substantial increases in temperature of 3.6 °C and 4.1 °C in the two regions, accompanied by a 12% precipitation increase by the late 21st century. Crucially, significant increases in precipitation extremes (around 75% for total precipitation on very wet days) occur together with an intensification of meteorological droughts caused by increased evapotranspiration. Despite higher precipitation, glacier mass losses are enhanced under both the highest emission and stabilization emission scenarios. Our modelling provides a new projection of combined and contrasting risks, in a region already experiencing rapid environmental change.

Enlaces: <https://doi.org/10.1038/s41612-023-00409-z>

<https://hdl.handle.net/20.500.12542/2865>

A Novel High-Resolution Gridded Precipitation Dataset for Peruvian and Ecuadorian Watersheds: Development and Hydrological Evaluation

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Abstract

A novel approach for estimating precipitation patterns is developed here and applied to generate a new hydrologically corrected daily precipitation dataset, called RAIN4PE (Rain for Peru and Ecuador), at 0.1° spatial resolution for the period 1981–2015 covering Peru and Ecuador. It is based on the application of 1) the random forest method to merge multisource precipitation estimates (gauge, satellite, and reanalysis) with terrain elevation, and 2) observed and modeled streamflow data to first detect biases and second further adjust gridded precipitation by inversely applying the simulated results of the ecohydrological model SWAT (Soil and Water Assessment Tool). Hydrological results using RAIN4PE as input for the Peruvian and Ecuadorian catchments were compared against the ones when feeding other uncorrected (CHIRP and ERA5) and gauge-corrected (CHIRPS, MSWEP, and PISCO) precipitation datasets into the model. For that, SWAT was calibrated and validated at 72 river sections for each dataset using a range of performance metrics, including hydrograph goodness of fit and flow duration curve signatures. Results showed that gauge-corrected precipitation datasets outperformed uncorrected ones for streamflow simulation. However, CHIRPS, MSWEP, and PISCO showed limitations for streamflow simulation in several catchments draining into the Pacific Ocean and the Amazon River. RAIN4PE provided the best overall performance for streamflow simulation, including flow variability (low, high, and peak flows) and water budget closure. The overall good performance of RAIN4PE as input for hydrological modeling provides a valuable criterion of its applicability for robust countrywide hydrometeorological applications, including hydroclimatic extremes such as droughts and floods.

Enlaces: <https://doi.org/10.1175/JHM-D-20-0285.1>

<https://hdl.handle.net/20.500.12542/2006>

Advances in scientific understanding of the Central Volcanic Zone of the Andes: a review of contributing factors

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Abstract

The Central Volcanic Zone of the Andes (CVZA) has been the focus of volcanological research for decades, becoming a very important site to understand a number of volcanic processes. Despite most of the research in the CVZA being carried out by foreign scientists, the last two decades have seen a significant increase in contributions by regional researchers. This surge has been facilitated by the creation of new volcanic observatories, improvement of the monitoring networks, creation of postgraduate programs where new local volcanologists are trained, creation of specialized research nuclei or groups, and increasing investment in research. This article presents a review of the evolution of the contributions of the regional volcanological community to the knowledge of the CVZA in the last 20 years (2000–2019), both from research and monitoring institutions in Peru, Bolivia, Argentina, and Chile. Based on updates made by the regional groups, a new list of active/potentially active volcanoes of the CVZA is presented, as is a complete database for article published on the CVZA. We find that a significant motivator has been regional volcanic unrest that has triggered new investment. Perú is the country with the highest investment in monitoring and research and is the best instrumented, Argentina is the country with the highest number of local participation in published papers in the domain of volcanology and magmatic systems, and Chilean volcanoes are the focus of the highest number of articles published. The current situation and general projections for the next decade (2020–2030) are also presented for each country, where we believe that the over the next 10 years, will be increased the monitoring and research capabilities, improved the scientific knowledge with more participation of regional institutions, and strengthen the collaboration and integrated work between CVZA countries, especially in border volcanoes.

Enlaces: <http://hdl.handle.net/20.500.12816/5154>

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Ambient noise tomography of Misti volcano, Peru

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Abstract

To better understand the recent internal structure of Misti volcano, we determined a 3D S-wave velocity model applying Ambient Noise Tomography (ANT). We used data from 23 broadband and short-period seismic stations temporarily installed at Misti volcano between March and December 2011. This dataset allowed us to obtain empirical Green's functions by cross-correlating seismic ambient noise signals. Then, we retrieved 104 dispersion curves using the frequency-time analysis (FTAN) and, through a non-linear multiscale inversion, we obtained nine 2-D Rayleigh waves group velocity maps for periods in the range 0.7 s - 2 s. Finally, we carried out the depth inversion through a Bayesian transdimensional inversion to obtain a 3-D S-wave velocity model down to 3 km depth. Our study highlights five relevant seismic velocity anomalies. We observed the presence of three high-velocity zones located in the west-northwest, southwest and southeast parts of the crater, that could be related to intrusive bodies possibly associated with the formation of Misti volcano. We also observed two low-velocity anomalies in the volcano's western and central parts, which coincide with previous studies' findings and are related to fractured and weakened materials associated with the external caldera collapse and recent eruption episodes.

Enlaces: <http://hdl.handle.net/20.500.12816/5220>

<https://doi.org/10.1016/j.jvolgeores.2022.107538>

Apocalyptic urban surrealism in the city at the end of the world

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Abstract

This paper responds to calls for radical experimentation in urban theory in the context of the material and psychological upheavals of Anthropocene. It does so through the development of an *apocalyptic urban surrealism*, based on a set of principles drawn from surrealist attempts to simulate the experience of reality characteristic of psychotic breakdown. These principles are put to work in the psychogeographical exploration of an urban resettlement scheme on the outskirts of Iquitos in the Peruvian Amazon, and the flooded informal settlement that this scheme seeks to replace. Through the relinquishment of established modes of academic sense-making, and their replacement with a surrealist interpretive delirium, alternative meanings emerge within the entrails of cannibal capitalism and the wreckage of state-regulated reality.

Enlace: <https://doi.org/10.1177/00420980221118817>

Assessment of Bottom-Up Satellite Precipitation Products on River Streamflow Estimations in the Peruvian Pacific Drainage

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Abstract

In regions with limited precipitation information, like Peru, many studies rely on precipitation data derived from satellite products (SPP) and model reanalysis. These products provide near-real-time information and offer global spatial coverage, making them attractive for various applications. However, it is essential to consider their uncertainties when conducting hydrological simulations, especially in a key region like the Pacific drainage (Pd), where 56% of the Peruvian population resides (including the capital, Lima). This study, for the first time, assessed the performance of two bottom-up Satellite-based Precipitation Products (SPP), GPM + SM2RAIN and SM2RAIN-ASCAT, and one top-down approach SPP, ERA5-Land, for runoff simulation in the Pacific drainage of Peru. Hydrological modeling was conducted on 30 basins distributed across the Pd, which were grouped into 5 regions (I–V, ordered from south to north). The results showed that SM2RAIN-ASCAT performed well in regions I–III–IV, ERA5-Land in region II, and GPM + SM2RAIN in region V. The hydrological model GR4J was tested, and better efficiency criteria were obtained with SM2RAIN-ASCAT and GPM + SM2RAIN when comparing the simulated versus observed streamflows. The hydrological modeling using SM2RAIN-ASCAT and GPM + SM2RAIN demonstrated satisfactory efficiency metrics ($KGE > 0.75$; $NSE > 0.65$). Additionally, ten hydrological signatures were quantified to assess the variability of the simulated streamflows in each basin, with metrics such as Mean Flow (Q_{mean}), 5th Quantile Flow (Q_5), and 95th Quantile Flow (Q_{95}) showing an overall better performance. Finally, the results of this study demonstrate the reliability of using bottom-up satellite products in Pd basins.

Enlaces: <https://doi.org/10.3390/rs16010011>

<https://hdl.handle.net/20.500.12542/3028>

Assessment of Present and Future Water Security under Anthropogenic and Climate Changes Using WEAP Model in the Vilcanota-Urubamba Catchment, Cusco, Perú

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Abstract

Water is an essential resource for social and economic development. The availability of this resource is constantly threatened by the rapid increase in its demand. This research assesses current (2010–2016), short- (2017–2040), middle- (2041–2070), and long-term (2071–2099) levels of water security considering socio-economic and climate change scenarios using the Water Evaluation and Planning System (WEAP) in Vilcanota-Urubamba (VUB) catchment. The streamflow data of the Pisac hydrometric station were used to calibrate (1987–2006) and validate (2007–2016) the WEAP Model applied to the VUB region. The Nash Sutcliffe efficiency values were 0.60 and 0.84 for calibration and validation, respectively. Different scenarios were generated for socio-economic factors (population growth and increased irrigation efficiency) and the impact of climate change to evaluate their effect on the current water supply system. The results reveal that water availability is much higher than the current demand in the VUB for the period (2010–2016). For short-, middle- and long term, two scenarios were considered, “Scenario 1” (RCP 4.5) and “Scenario 2” (RCP 8.5). Climate change scenarios show that water availability will increase. However, this increase will not cover the future demands in all the sub-basins because water availability is not evenly distributed in all of the VUB. In both scenarios, an unmet demand was detected from 2050. For the period 2071–2099, an unmet demand of 477 hm³/year for “Scenario 1” and 446 hm³/year for “Scenario 2” were estimated. Because population and agricultural demands are the highest, the effects of reducing the growth rate and improving the irrigation structure were simulated. Therefore, two more scenarios were generated “Scenario 3” (RCP 4.5 with management) and “Scenario 4” (RCP 8.5 with management). This socio-economic management proved to be effective in reducing the unmet demand up to 50% in all sub-basins for the period 2071–2099.

Enlaces: <https://doi.org/10.3390/w15071439>

<https://hdl.handle.net/20.500.12542/2912>

Basin-wide variation in tree hydraulic safety margins predicts the carbon balance of Amazon forests

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Abstract

Tropical forests face increasing climate risk, yet our ability to predict their response to climate change is limited by poor understanding of their resistance to water stress. Although xylem embolism resistance thresholds (for example, Ψ_{50}) and hydraulic safety margins (for example, HSM_{50}) are important predictors of drought-induced mortality risk, little is known about how these vary across Earth's largest tropical forest. Here, we present a pan-Amazon, fully standardized hydraulic traits dataset and use it to assess regional variation in drought sensitivity and hydraulic trait ability to predict species distributions and long-term forest biomass accumulation. Parameters Ψ_{50} and HSM_{50} vary markedly across the Amazon and are related to average long-term rainfall characteristics. Both Ψ_{50} and HSM_{50} influence the biogeographical distribution of Amazon tree species. However, HSM_{50} was the only significant predictor of observed decadal-scale changes in forest biomass. Old-growth forests with wide HSM_{50} are gaining more biomass than are low HSM_{50} forests. We propose that this may be associated with a growth–mortality trade-off whereby trees in forests consisting of fast-growing species take greater hydraulic risks and face greater mortality risk. Moreover, in regions of more pronounced climatic change, we find evidence that forests are losing biomass, suggesting that species in these regions may be operating beyond their hydraulic limits. Continued climate change is likely to further reduce HSM_{50} in the Amazon, with strong implications for the Amazon carbon sink.

Enlace: <https://doi.org/10.1038/s41586-023-05971-3>

Behavior of the ITCZ second band near the Peruvian coast during the 2017 coastal El Niño

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Servicio Nacional de Meteorología e Hidrología del Perú

Resumen

En este estudio se analiza el comportamiento de la segunda banda de la Zona de Convergencia Intertropical (ZCIT) cerca de la costa peruana a inicios de 2017 usando precipitación, vientos superficiales, temperatura superficial del mar y variables atmosféricas en diferentes niveles isobáricos. Además, se propone un índice diario (Ia) para identificar de manera oportuna la formación de esta segunda banda y se considera el análisis de los términos de energía de Lorenz en la región. Esta banda estuvo presente desde los últimos días de enero hasta los primeros días de abril de 2017, asociada con un dipolo anómalo de presión reducida a nivel del mar hacia el este y el oeste del Pacífico Ecuatorial oriental, lo cual configuró vientos superficiales anómalos del norte y relajación de los vientos alisios del sur cerca de la costa peruana. En niveles medios de la troposfera, a inicios de marzo, se observó una anomalía positiva de relación de mezcla proveniente del este sobre la región de la segunda banda de la ZCIT, asociada con sistemas de precipitación intensos sobre la costa norte de Perú. En el mismo periodo se observaron anomalías positivas de divergencia en niveles altos. El índice diario Ia permitió la detección oportuna de la segunda banda de la ZCIT 11 días antes del máximo de precipitación en el norte de la costa peruana, y los términos de energía de Lorenz mostraron picos de energía cinética de las perturbaciones (K_E) en enero y febrero, así como contribución de la inestabilidad barotrópica en regiones ecuatoriales.

Abstract

The behavior of the second band of the Intertropical Convergence Zone (ITCZ) near the Peruvian coast during early 2017 is studied, using precipitation, surface winds, sea surface temperature (SST) and atmospheric variables in different isobaric levels. The proposal of a daily index (Ia) to identify opportunely the formation of this band and the Lorenz energy terms in the region is also considered. This band was present from late January to early April 2017, associated with an anomalous dipole of sea level pressure between the east and west eastern Equatorial Pacific that configured anomalously northerly surface winds and the release of southeasterly trade winds near Peru. In medium levels, a zonally oriented positive mixing ratio anomaly was observed in early March over the ITCZ second band, associated with heavy rain systems over the northern Peruvian coastal region. In the same period, positive anomalies of divergence in high tropospheric levels were observed. The daily Ia index allowed an effective detection of the ITCZ second band 11 days before the maximum coastal precipitation, and the Lorenz energy terms showed eddy kinetic energy (K_E) peaks in January and February and a contribution of barotropic instability in equatorial regions.

Enlaces: <https://doi.org/10.20937/ATM.53017>

<https://hdl.handle.net/20.500.12542/2565>

Characteristics of cloud properties over South America and over Andes observed using CloudSat and reanalysis data

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Abstract

CloudSat profile of attenuated corrected radar reflectivity (Z_e) and cloud mask data are used to investigate the cloud properties over South America (SA) during Austral Summer monsoon seasons. Deep convective core (DCC), deep & intense convective systems (DCSs & ICSs), and cloud clusters (CCs) are defined based on the Z_e and cloud mask values. The spatial distributions of DCCs show that land-dominated areas have higher frequency of DCCs and Atlantic Ocean has less DCCs. The Pacific Ocean does not consist of DCCs, whereas eastern flank of Andes has higher frequency of DCCs compared to western flank of the Andes. North La Plata basin (Sierra de Cordoba) has a higher fraction of deeper (shallower) DCCs. Deep convection over the Sierra de Cordoba and South La Plata Basin is characterized by precipitation-size particles compared to cloud-size particles, whereas deep convection over north La Plata Basin is dominated by mostly cloud-size particles. The horizontal span of DCSs and ICSs is higher over south La Plata Basin and Atlantic Oceans compared to other SA areas. Sierra de Cordoba (Atlantic Ocean) has the highest (lowest) frequency of small DCSs and vice versa. DCSs and ICSs show the opposite characteristic, as all the selected areas consist of a higher fraction of large (small) sized DCSs (ICSs). CCs develop more in horizontal than in vertical direction over the high latitude and vice versa over lower latitude. The CCs distribution reflects the orography and moisture flow pattern at the east and west side of Andes. The higher Z_e , which is the proxy for rainfall, occurs at the eastern flank/slope of the Andes, and related to easterly moisture loaded synoptic flow, transported from Amazon and upslope flow along the slope.

Enlaces: <https://doi.org/10.1080/01431161.2023.2193301>

<https://repositorio.inaigem.gob.pe/handle/16072021/493>

Climate Change Impacts on Eastern Boundary Upwelling Systems

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Abstract

The world's eastern boundary upwelling systems (EBUSs) contribute disproportionately to global ocean productivity and provide critical ecosystem services to human society. The impact of climate change on EBUSs and the ecosystems they support is thus a subject of considerable interest. Here, we review hypotheses of climate-driven change in the physics, biogeochemistry, and ecology of EBUSs; describe observed changes over recent decades; and present projected changes over the twenty-first century. Similarities in historical and projected change among EBUSs include a trend toward upwelling intensification in poleward regions, mitigated warming in near-coastal regions where upwelling intensifies, and enhanced water-column stratification and a shoaling mixed layer. However, there remains significant uncertainty in how EBUSs will evolve with climate change, particularly in how the sometimes competing changes in upwelling intensity, source-water chemistry, and stratification will affect productivity and ecosystem structure. We summarize the commonalities and differences in historical and projected change in EBUSs and conclude with an assessment of key remaining uncertainties and questions. Future studies will need to address these questions to better understand, project, and adapt to climate-driven changes in EBUSs.

Enlaces: <http://hdl.handle.net/20.500.12816/5388>

<https://doi.org/10.1146/annurev-marine-032122-021945>

Comparison between the Operational and Statistical Daily Maximum and Minimum Temperature Forecasts on the Central Coast of Peru

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Abstract

Multiple linear regression models were developed for 1-3-day lead forecasts of maximum and minimum temperature for two locations in the city of Lima, in the central coast of Peru (12°S), and contrasted with the operational forecasts issued by the National Meteorological and Hydrological Service - SENAMHI and the output of a regional numerical atmospheric model. We developed empirical models, fitted to data from the 2000-2013 period, and verified their skill for the 2014-2019 period. Since El Niño produces a strong low-frequency signal, the models focus on the high-frequency weather and subseasonal variability (60-day cutoff). The empirical models outperformed the operational forecasts and the numerical model. For instance, the high-frequency annual correlation coefficient and root mean square error (RMSE) for the 1-day lead forecasts were 0.37-0.53 and 0.74-1.76°C for the empirical model, respectively, but around -0.05-0.24 and 0.88-4.21°C in the operational case. Only three predictors were considered for the models, including persistence and large-scale atmospheric indices. Contrary to our belief, the model skill was lowest for the austral winter (June-August), when the extratropical influence is largest, suggesting an enhanced role of local effects. Including local specific humidity as a predictor for minimum temperature at the inland location substantially increased the skill and reduced its seasonality. There were cases in which both the operational and empirical forecast had similar strong errors and we suggest mesoscale circulations, such as the Low-Level Cyclonic Vortex over the ocean, as the culprit. Incorporating such information could be valuable for improving the forecasts.

Enlaces: <https://doi.org/10.1175/WAF-D-21-0094.1>

<https://hdl.handle.net/20.500.12542/2665>

Constraining Flood Forecasting Uncertainties through Streamflow Data Assimilation in the Tropical Andes of Peru: Case of the Vilcanota River Basin

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Abstract

Flood modeling and forecasting are crucial for managing and preparing for extreme flood events, such as those in the Tropical Andes. In this context, assimilating streamflow data is essential. Data Assimilation (DA) seeks to combine errors between forecasting models and discharge measurements through the updating of model states. This study aims to assess the applicability and performance of streamflow DA in a sub-daily forecasting system of the Peruvian Tropical Andes using the Ensemble Kalman Filter (EnKF) and Particle Filter (PF) algorithms. The study was conducted in a data-sparse Andean basin during the period February–March 2022. For this purpose, the lumped GR4H rainfall–runoff model was run forward with 100 ensemble members in four different DA experiments based on IMERG-E and GSMaP-NRT precipitation sources and assimilated real-time hourly discharges at the basin outlet. Ensemble modeling with EnKF and PF displayed that perturbation introduced by GSMaP-NRT'-driven experiments reduced the model uncertainties more than IMERG-E' ones, and the reduction in high-flow subestimation was more notable for the GSMaP-NRT'+EnKF configuration. The ensemble forecasting framework from 1 to 24 h proposed here showed that the updating of model states using DA techniques improved the accuracy of streamflow prediction at least during the first 6–8 h on average, especially for the GSMaP-NRT'+EnKF scheme. Finally, this study benchmarks the application of streamflow DA in data-sparse basins in the Tropical Andes and will support the development of more accurate climate services in Peru.

Enlaces: <https://doi.org/10.3390/w15223944>

<https://hdl.handle.net/20.500.12542/3120>

Construction of a daily streamflow dataset for Peru using a similarity-based regionalization approach and a hybrid hydrological modeling framework

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

Study region: A total of 11,913 sub-catchments in Peru and transboundary catchments with neighboring countries in South America.

Study focus: This paper aims to develop a national hydrological model using physiographic and climatic characteristics to identify donor and receptor sub-catchments (sub-zones). Therefore, we use the hydrometeorological PISCO dataset ($0.1^\circ \times 0.1^\circ$) to drive a sub-catchment conceptual rainfall-runoff (ARNO/VIC) model and a river-routing (RAPID) model in thousands of river reaches. We identify 43 hydrological zones (with 122 sub-zones) to run the hybrid hydrological modeling framework (ARNO/VIC+RAPID) with previously calibrated and validated parameters with 43 fluviometric stations for 1981–2020. Simulated flow series show a higher performance at daily scale ($KGE \geq 0.75$, $NSE_{sqr} \geq 0.65$, $MARE \leq 1$, and $-25\% \leq PBIAS \leq 25\%$) for catchments located at the Pacific coast and the Andes-Amazon transition, and good representation ($R \geq 0.75$) of seasonal and interannual variability.

New hydrological insights for the region: Increasing hydrological hazards such as floods highlight the importance of a systematic hydrological analysis and modeling at national level in gauged and ungauged catchments in Peru. This study introduces a new hydrological dataset of simulated daily flow series. The results are helpful for short-term flood risk scenario simulations and long-term water resource planning as the outcomes can provide valuable information for hydrologists and water resource managers in Peruvian regions with limited or no access to in-situ networks.

Enlaces: <https://doi.org/10.1016/j.ejrh.2023.101381>

<https://hdl.handle.net/20.500.12542/2894>

Datalogger for Low-Cost High Mountain Weather Stations: Design, Optimization and Testing of Power Consumption and Compatibility with Satellite Transmitter

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Abstract

This paper presents the design, optimization, and laboratory testing of a low-cost Datalogger for meteorological stations in high mountain environments. The lack of meteorological data in the high Andean basins hinders natural resource management and disaster prevention, therefore Low-Cost Weather Stations are presented as efficient solutions to collect such data and meet the demand for research in these areas. The Datalogger based on a ESP32 microcontroller was developed to capture, store, and transmit meteorological data, while also addressing the challenges of operating in remote and harsh conditions. The study focused on integrating essential functionalities, such as data transmission, with a strong emphasis on satellite communication for global coverage this by means of electronic components to obtain an RS485 output interface. The optimization process involved state-of-the-art review, careful selection of components and PCB design. Two versions of the Datalogger were fabricated and subjected to laboratory testing to assess their performance and reliability. The results showed that both versions exhibited satisfactory responses in terms of data acquisition, communication interfaces, and sensor integration. Overall, the Datalogger demonstrated promising results, showcasing its potential for scientific research and environmental monitoring in challenging high mountain environments. Future work will involve field testing to validate its performance under real-world conditions and further refine the design for optimal functionality.

Enlace: <https://ieeexplore.ieee.org/document/10326074>

Decadal variability in the austral summer precipitation over the Central Andes: Observations and the empirical-statistical downscaling model

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Abstract

The decadal variability in summer precipitation over the Central Andes (10°–30°S) is investigated from 1921 to 2010 using low-pass filtered time series of the central and eastern El Niño–Southern Oscillation (ENSO) Pacific (C and E) indices, the South Pacific Convergence Zone (SPCZ) index, the Atlantic SST indices, Atlantic Multidecadal Oscillation (AMO) index, North Atlantic Oscillation (NAO) index, and ERA-20C reanalysis. Additionally, an empirical-statistical downscaling (ESD) model was built. A rotated empirical orthogonal function (REOF) analysis shows that the first leading mode of precipitation (RPC1) represents 38.2% of the total decadal variance. RPC2, RPC3, and RPC4 represent 18.8, 12.8, and 9.7% of the total decadal variance, respectively. Furthermore, RPC1 features highest loadings over most of the region. RPC2 features a dipole of highest loadings over the southernmost Bolivian Altiplano and lowest loadings over the northwestern Argentinian Andes. Conversely, RPC3 presents highest loadings over the eastern-central Bolivian Altiplano and northwestern Argentinian Andes. RPC4 features highest loadings over the southern Bolivian Andes. RPC1 and RPC3 wet summers are associated with moisture transport from the Amazon basin, but RPC1 features the strengthening upper-level Bolivian high-Nordeste low system over South America. Conversely, RPC2 and RPC4 wet summers are associated with local processes induced by southward displacement of the South Atlantic Convergence Zone and warm sea surface temperature (SST) anomalies over the Indian Ocean, respectively. According to the ESD model, the decadal variability in the central and eastern Pacific (CP and EP) and Atlantic Ocean reproduces the decadal component of the DJF precipitation over most of the Central Andes.

Enlaces: <http://hdl.handle.net/20.500.12816/5312>

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Detecting hydrologic distinctions among Andean lakes using clumped and triple oxygen isotopes

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Abstract

Oxygen isotope distributions from lacustrine carbonates provide insights into climate and hydrological change, but it is difficult to isolate the influences of catchment precipitation $\delta^{18}\text{O}$, water temperature, and evaporation on lacustrine carbonate $\delta^{18}\text{O}$ values. Recent work shows the potential for using a combination of clumped (Δ_{47}) and triple oxygen isotope ($\Delta^{17}\text{O}$) measurements to identify the roles of temperature and evaporation on carbonate $\delta^{18}\text{O}$ values in lakes, allowing precipitation $\delta^{18}\text{O}$ values to be inferred and facilitating paleoclimate reconstructions. However, modern calibration of this approach has been mostly limited to arid regions with a high ratio of evaporative losses over inputs (X_E) and low relative humidity ($h < 0.7$). Developing this tool for paleoclimate and paleoelevation reconstructions requires expanding the modern calibrations to a greater range of climatic and hydrologic conditions. We sampled four lakes in different hydrologic states under a single, high humidity climate regime ($h = 0.7\text{--}0.9$) in the Lake Junín region of central Peru. Clumped isotope temperatures from lake carbonates reflect water temperatures during carbonate formation. Lake hydrology is the main control on the $\Delta^{17}\text{O}$ values of carbonates and waters: $\Delta^{17}\text{O}$ values are lowest in the larger lakes with higher X_E when compared to smaller, headwater lakes where evaporation is minimal and $\Delta^{17}\text{O}$ is indistinguishable from that of precipitation. Reconstructed unevaporated catchment precipitation $\delta^{18}\text{O}$ ($\delta^{18}\text{O}_{\text{rucp}}$) values from lake waters rely on accurate characterization of λ_{lake} , the triple oxygen isotope evaporation slope. We explore the influence of humidity on λ_{lake} using both new observations and modeled data. Accounting for local humidity improves λ_{lake} estimates, which allows for more accurate reconstructions of $\delta^{18}\text{O}_{\text{rucp}}$. We generate a $\delta^{18}\text{O}_{\text{rucp}}$ value of -15.2 ± 2.1 ‰ from modern carbonates and waters ($n = 15$) in the Lake Junín region, which is similar to amount weighted mean annual precipitation $-14.1 (\pm 2.2$ ‰). This study illustrates that (1) $\Delta^{17}\text{O}$ can be used to differentiate between lakes with differing X_E in humid climates, (2) lake carbonate $\Delta^{17}\text{O}$ and $\delta^{18}\text{O}$ values can be used to evaluate the influence of evaporation on lake water $\delta^{18}\text{O}$ values in a range of climates, and (3) modeling λ_{lake} under appropriate humidity conditions improves $\delta^{18}\text{O}_{\text{rucp}}$ estimates from lake carbonate $\Delta^{17}\text{O}$.

Enlace: <https://www.sciencedirect.com/science/article/pii/S0012821X22005635>

Determining the geodetic mass balance of the Znosko glacier (King George Island, Antarctica) using an unmanned aerial vehicle

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

In the last decade, unmanned aerial vehicles (UAVs) have been used for scientific research specially for glaciological applications in Antarctica. In the study an UAV was used to detect changes in Znosko glacier surface, map the glacier contour, snow line and estimate the geodetic mass balance. Znosko glacier (ZG) located in King George Island (KGI), Antarctic Peninsula has an estimated total area of 1.77 km² (January 2020), a length of 1.9 km and maximum elevation of 300 metres above sea level (m a.s.l.). The aerial photogrammetric survey was carried out in two field campaigns (austral summer 2019 and 2020) during the XXVI and XXVII Peruvian Antarctic Operation using a Quadcopter for image acquisition. Our findings reveal a negative geodetic mass balance for the periods 2019–2012, 2020–2019 and 2020–2012 with –15.25, –2.76 and –17.97 metre water equivalent (m w.e.) respectively. Analysis of these datasets confirm a mass loss with a heterogeneous pattern between accumulation and ablation zone. Furthermore, glacier outlines reveal that ZG front has lost approximately 3% of its area between 2012 and 2020 by calving effect.

Enlaces: <https://doi.org/10.1080/2150704X.2023.2165419>

<https://hdl.handle.net/20.500.12542/2608>

Diagnosis of the Extreme Climate Events of Temperature and Precipitation in Metropolitan Lima during 1965–2013

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Abstract

The most extreme precipitation event in Metropolitan Lima (ML) occurred on 15 January 1970 (16 mm), this event caused serious damage, and the real vulnerability of this city was evidenced; the population is still not prepared to resist events of this nature. This research describes the local climate variability and extreme climate indices of temperature and precipitation. In addition, the most extreme precipitation event in ML is analyzed. Extreme climate indices were identified based on the methodology proposed by the Expert Team on Climate Change Detection and Indices (ETCCDI). Some extreme temperature indices highlight an initial trend toward warm conditions (1965–1998); this trend has changed towards cold conditions since 1999, consistent with the thermal cooling during the last two decades in ML ($-0.5\text{ }^{\circ}\text{C/decade}$) and other coastal areas of Peru. The variations of extreme temperature indices are mainly modulated by sea-surface temperature (SST) alterations in the Niño 1 + 2 region (moderate to strong correlations were found). Extreme precipitation indices show trends toward wet conditions after the 1980s, the influence of the Pacific Ocean SST on the extreme precipitation indices in ML is weak and variable in sign. The most extreme precipitation event in ML is associated with a convergence process between moisture fluxes from the east (Amazon region) at high and mid levels and moisture fluxes from the west (Pacific Ocean) at low levels, and near the surface.

Enlaces: <http://hdl.handle.net/20.500.12816/5346>

<https://doi.org/10.3390/cli10080112>

Digital receiver modernization using FPGA and JESD204B interface for SDR applications

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Abstract

The latest data acquisition system running at the Jicamarca Radio Observatory (JRO) for the main radar has been used for more than seven years now. Although there are no major inconveniences on the performance, there have been some problems with internal interference which are related to the PCB design that uses old discrete components. A new design is proposed for the digital receivers, giving it more lifetime and flexibility for future modifications. The JESD204B protocol is ideal for radar applications, a JESD204B ADC together with an FPGA was proposed for the new design, making it capable of a wider bandwidth which could adapt the system to an SDR device in the future with the proper software. This paper will present the new PCB design, the IP cores implemented for the FPGA and some preliminary tests with development boards.

Enlaces: <http://hdl.handle.net/20.500.12816/5373>

<https://doi.org/10.23919/USNC-URSINRSM57470.2023.10043159>

Driving Influences of the Doppler Flash Observed by SuperDARN HF Radars in Response to Solar Flares

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Abstract

Sudden enhancement in high-frequency absorption is a well-known impact of solar flare-driven Short-Wave Fadeout (SWF). Less understood, is a perturbation of the radio wave frequency as it traverses the ionosphere in the early stages of SWF, also known as the Doppler flash. Investigations have suggested two possible sources that might contribute to its manifestation: first, enhancements of plasma density in the D- and lower E-regions; second, the lowering of the F-region reflection point. Our recent work investigated a solar flare event using first principles modeling and Super Dual Auroral Radar Network (SuperDARN) HF radar observations and found that change in the F-region refractive index is the primary driver of the Doppler flash. This study analyzes multiple solar flare events observed across different SuperDARN HF radars to determine how flare characteristics, properties of the traveling radio wave, and geophysical conditions impact the Doppler flash. In addition, we use incoherent scatter radar data and first-principles modeling to investigate physical mechanisms that drive the lowering of the F-region reflection points. We found, (a) on average, the change in E- and F-region refractive index is the primary driver of the Doppler flash, (b) solar zenith angle, ray's elevation angle, operating frequency, and location of the solar flare on the solar disk can alter the ionospheric regions of maximum contribution to the Doppler flash, (c) increased ionospheric Hall and Pedersen conductance causes a reduction of the daytime eastward electric field, and consequently reduces the vertical ion-drift in the lower and middle latitude ionosphere, which results in lowering of the F-region ray reflection point.

Enlaces: <http://hdl.handle.net/20.500.12816/5284>

<https://doi.org/10.1029/2022JA030342>

Earthquake Early Warning Starting From 3 s of Records on a Single Station With Machine Learning

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Abstract

We introduce the Ensemble Earthquake Early Warning System (E3WS), a set of Machine Learning (ML) algorithms designed to detect, locate, and estimate the magnitude of an earthquake starting from 3 s of *P*-waves recorded by a single station. The system is made of six Ensemble ML algorithms trained on attributes computed from ground acceleration time series in the temporal, spectral, and cepstral domains. The training set comprises data sets from Peru, Chile, Japan, and the STEAD global data set. E3WS consists of three sequential stages: detection, *P*-phase picking, and source characterization. The latter involves magnitude, epicentral distance, depth, and back azimuth estimation. E3WS achieves an overall success rate in the discrimination between earthquakes and noise of 99.9%, with no false positive (noise mis-classified as earthquakes) and very few false negatives (earthquakes mis-classified as noise). All false negatives correspond to $M \leq 4.3$ earthquakes, which are unlikely to cause any damage. For *P*-phase picking, the Mean Absolute Error is 0.14 s, small enough for earthquake early warning purposes. For source characterization, the E3WS estimates are virtually unbiased, have better accuracy for magnitude estimation than existing single-station algorithms, and slightly better accuracy for earthquake location. By updating estimates every second, the approach gives time-dependent magnitude estimates that follow the earthquake source time function. E3WS gives faster estimates than present alert systems relying on multiple stations, providing additional valuable seconds for potential protective actions.

Enlaces: <http://hdl.handle.net/20.500.12816/5488>

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Ecohydrology and ecosystem services of a natural and an artificial *bofedal* wetland in the central Andes

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Abstract

High-altitude wetlands of the Central Andes, locally known as *bofedales*, provide important ecosystem services, particularly carbon storage, forage provisioning, and water regulation. Local communities have artificially expanded *bofedales* by irrigating surrounding grasslands to maximise areas for alpaca grazing. Despite their importance, biophysical processes of both natural and artificial *bofedales* are still poorly studied, which hinders the development of adequate management and conservation strategies. We analyse and compare the vegetation composition, hydrological variables, groundwater chemistry, and soil characteristics of a natural and an artificial *bofedal* of at least 10 years old in southern Peru, to understand their interrelations and the consequences for ecosystem service provisioning. We do not find statistically significant differences in the soil, water, and vegetation characteristics. Soil organic carbon (SOC) content, which we use as a proxy for carbon storage, is negatively correlated to dissolved oxygen, pH, and soil water temperature. In addition, Non-Metric Multidimensional Scaling analysis shows a positive relation between plant community composition, SOC content, and water electric conductivity. Our results suggest a three-way interaction between hydrological, soil, and vegetation characteristics in the natural *bofedal*, which also holds for the artificial *bofedal*. Vegetation cover of two of the most highly nutritious species for alpaca, *Lachemilla diplophylla* and *Lilaeopsis macloviana* with 19–22% of crude protein, are weakly or not correlated to environmental variables, suggesting grazing might be obscuring these potential relationships. Given the high economic importance of alpaca breeding for local communities, expanding *bofedales* artificially appears an effective strategy to enhance their ecosystem services with minimal impact on the ecohydrological properties of *bofedales*.

Enlaces: <https://doi.org/10.1016/j.scitotenv.2022.155968>

<https://repositorio.inaigem.gob.pe/handle/16072021/418>

Efecto de los factores climáticos determinantes sobre la producción de *Myrciaria dubia* (Kunth) McVaught en Ucayali, Perú, 2009 - 2029

Effect of variability of temperature and rainfall on the production of *Myrciaria dubia* (Kunth) McVaugh, in ucayali, peru, 2009 - 2019

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Resumen

La producción agrícola es sensible a los factores climáticos y el estudio de sus relaciones es fundamental para comprender su comportamiento a futuro; por ello, el objetivo de este estudio fue determinar el efecto de los factores climáticos determinantes en la producción de *Myrciaria dubia* (Kunth) McVaugh, en Ucayali - Perú, 2009-2019; para ello, mediante la función de producción se cuantificó el efecto de los factores climáticos (temperatura y precipitación pluvial) determinantes sobre la producción del camu-camu en Ucayali; considerando para ello, como dimensiones de la producción: rendimiento por hectárea ($t \cdot ha^{-1}$), superficie cosechada (ha) y el valor bruto de la producción (soles) del periodo 2009 - 2019 y su proyección hasta el 2029, utilizando el método de Mínimos Cuadrados Ordinarios (MCO). Se pudo determinar que la precipitación pluvial es el factor climático con mayor importancia sobre el rendimiento con un 48,79%; y que, al 2029 la tendencia de su rendimiento es negativo, con una reducción de 1,12 $t \cdot ha^{-1}$. Por otro lado, la temperatura máxima es el factor climático determinante sobre la superficie cosechada del camu-camu en 68,82%; al 2029 su proyección es positiva con un incremento de 835,50 ha. Así también, la temperatura máxima es el factor climático determinante sobre el valor bruto de la producción de camu-camu a un 82,62% y al 2029, su proyección será positiva con un incremento de 3 546 843,95 soles.

Abstract

Agricultural production is sensitive to climatic factors and the study of their relationships is essential to understand their behavior in the future; for this reason, the objective of this study was to determine the effect of the determining climatic factors on the production of *Myrciaria dubia* (Kunth) McVaugh, in Ucayali - Peru, 2009-2019; to do this, through the production function, the effect of climatic factors (temperature and rainfall) determining the production of camu-camu in Ucayali was quantified; considering for this, as dimensions of production: yield per hectare, harvested area and the gross value of production for the period 2009 - 2019 and its projection until 2029, using the ordinary least square method (OLS). It was possible to determine that rainfall is the most important climatic factor on yield with 48.79%; and, by 2029, the yield trend is negative, with a reduction of 1.12 $t \cdot ha^{-1}$. On the other hand, the maximum temperature is the determining climatic factor on the harvested area of camu-camu in 68.82%; by 2029 its projection is positive with an increase of 835.50 ha. Likewise, the maximum temperature is the determining climatic factor on the gross value of camu-camu production at 82.62% and by 2029, its projection will be positive with an increase of 3,546,843.95 PEN.

Enlace: <https://doi.org/10.24841/fa.v32i1.645>

Efectos del Cambio Climático Sobre los Ecosistemas de Montaña en la Cordillera Carabaya - Perú

Effects of Climate Change on Mountain Ecosystems in the Carabaya Mountain Range - Peru

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Resumen

Entender como el cambio climático (CC) afectaría los ecosistemas de montaña, es clave para la planificación y gestión del territorio en los Andes. Se utilizó las zonas de vida de Holdridge (HLZ) para evaluar los efectos del CC sobre los ecosistemas de montaña en la cordillera Carabaya para un futuro centrado en el 2050 y 2070 bajo escenarios RCP-4.5 y RCP-8.5. Se utilizó el modelo bioclimático de Holdridge para obtener las HLZ de referencia (1961-1990) con información climática de WorldClim previa reducción de escala y validación con información observada. Se identificaron nueve HLZ, siendo las de mayor extensión el Páramo (41.2%), Bosque húmedo-Montano (20.3%) y Tundra (14.6%). Las HLZ y el mapa de ecosistemas del Perú presentaron un alto grado de concordancia (índice de Kappa de 0.83). Los ecosistemas más afectados por el CC serían los comprendidos en las HLZ Nival, Tundra y Páramo que se reducirían, bajo el escenario RCP-8.5, en -96.1, -92.7 y -33.9% para el 2050, y -98.8, -99.2 y -71.7% para el 2070 desplazándose a mayores altitudes; por otro lado, los ecosistemas comprendidos en el Bosque húmedo Montano aumentarían entre +86.8% y +131.6% para el escenario RCP-4.5 y RCP-8.5, respectivamente, desplazando a la Tundra y Páramo.

Abstract

Understanding how climate change (CC) would affect mountain ecosystems is key for planning and managing the territory in the Andes. Holdridge's life zones (HLZ) were used to evaluate the effects of CC on mountain ecosystems in the Carabaya mountain range for a future centered on 2050 and 2070 under RCP-4.5 and RCP-8.5 scenarios. Holdridge's bioclimatic model was used to obtain the reference HLZ (1961-1990) with climatic information from WorldClim after scaling down and validation with observed information. Nine HLZ were identified, with the highest extent being Paramo (41.2%), Humid-Montane Forest (20.3%), and Tundra (14.6%). The HLZ and the ecosystem map of Peru showed a high degree of concordance (Kappa index of 0.83). The ecosystems most affected by CC would be those within the Nival, Tundra, and Paramo HLZ, which would be reduced, under the RCP-8.5 scenario, by -96.1, -92.7, and -33.9% for 2050, and -98.8, -99.2, and -71.7% for 2070, moving to higher altitudes. On the other hand, ecosystems within the Humid-Montane Forest would increase by +86.8% and +131.6% for the RCP-4.5 and RCP-8.5 scenarios, respectively, displacing Tundra and Paramo.

Enlace: <https://doi.org/10.1590/0102-778638230088>

Estimation of persistence on glacial lakes in tropical Andes mountain-range with 2000-2020 period LANDSAT series images

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Abstract

Peruvian mountain-range glaciers are characterized by the presence of numerous lakes of glacial origin, whose dynamics show a great temporal-spatial variability due to factors such as glacial melting and precipitation of different types, seasons, and intensities, engaging also river flow, usually for the benefit of population settlements. Therefore, it is important to determine its continuity to consider them permanent resources of water. Previously, the evaluation of this parameter was made traditionally, by looking at optical satellite imagery. However, this process ends up being too long and complicated as there are up to 3000 lakes in some mountain ranges.

We propose a methodology with the objective of estimating the temporal persistence of glacial lakes mainly performed in Google Earth Engine, convenient for the flexibility, data-size issues, and quick computations of statistical approach. This process is based on LANDSAT 7 and 8 normalized difference water index (NDWI) time series data products, comprised of 252 images of the Ampato glacier mountain-range across the calendar years 2000-2020. Initially, we extract the NDWI values for each polygon -from the INAIGEM 2020 glacial lake Inventory- and image and apply different NDWI thresholds and ways to mean them. Finally, we get a representative conversion of the value to mark their existence and do the percentage calculations over the evaluation period.

NDWI threshold of 0.05 and median values were chosen to obey previous evaluations and have tight results. We observe that between 86 and 99% of images were available for the 518 polygons of this area, indicating suitability to support subsequent conclusions. The final persistence values vary between 50% and 99% for lakes greater than 5000 m², while lesser lakes present values between 25 and 75% of persistence during the evaluation period, corresponding to weather modulating factors in a shorter scale such as seasonality, ENSO events, extreme precipitation, etc. The presented investigation could have relevant applications from water management, ecology, tourism, to climate investigation, as a way to sophisticate the processes of a more exact and specific glacial lake Inventory in Peru or other parts of the sphere.

Enlace: <https://doi.org/10.5194/egusphere-egu23-16157>

Evaluación de Productos de Precipitación Satelital sobre la Cuenca del Lago Titicaca

Evaluation of Satellite Precipitation Products over the Lake Titicaca Basin

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Resumen

Los productos de precipitación satelital (PPS), proporcionan una fuente alternativa para aplicaciones hidrometeorológicas principalmente en áreas donde los datos de precipitación son limitados. Sin embargo, es necesario evaluar los PPS para cuantificar la incertidumbre en la estimación de la precipitación. Este estudio tuvo como objetivo evaluar el desempeño de los PPS GSMaP-G-NRT, PERSIANN-CCS, PERSIANN-CDR y PERSIANN sobre la cuenca del Lago Titicaca (CLT). Para la evaluación de los PPS se utilizaron tres métricas de desempeño que evaluaron la precisión (coeficiente de correlación, CC), error (raíz del error cuadrático medio, RMSE) y sesgo (sesgo porcentual, PBIAS). Los resultados indican que PERSIANN-CDR y PERSIANN-CCS son los productos que muestran una mayor concordancia con las mediciones de pluviómetros, pero con un gran sesgo para PERSIANN-CCS. Los hallazgos proporcionan una idea del rendimiento de PPS en la CLT que contribuye a posibles direcciones de mejora de los algoritmos para un mejor servicio en aplicaciones hidrometeorológicas.

Abstract

Satellite precipitation products (PPS) provide an alternative source for hydrometeorological applications mainly in areas where precipitation data is limited. However, it is necessary to evaluate the PPS to quantify the uncertainty in the precipitation estimate. This study aimed to evaluate the performance of the PPS GSMaP-G-NRT, PERSIANN-CCS, PERSIANN-CDR and PERSIANN over the Lake Titicaca basin (CLT). For the evaluation of the PPS, three performance metrics were used that evaluated the precision (correlation coefficient, CC), error (root mean square error, RMSE) and bias (percentage bias, PBIAS). The results indicate that PERSIANN-CDR and PERSIANN-CCS are the products that show a greater agreement with the measurements of rain gauges, but with a great bias for PERSIANN-CCS. The findings provide insight into the performance of PPS in the CLT that contributes to possible directions for improvement of the algorithms for better service in hydrometeorological applications.

Enlace: <http://dx.doi.org/10.1590/0102-778638220078>

Explained predictions of strong eastern Pacific El Niño events using deep learning

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Abstract

Global and regional impacts of El Niño-Southern Oscillation (ENSO) are sensitive to the details of the pattern of anomalous ocean warming and cooling, such as the contrasts between the eastern and central Pacific. However, skillful prediction of such ENSO diversity remains a challenge even a few months in advance. Here, we present an experimental forecast with a deep learning model (IGP-UHM AI model v1.0) for the *E* (eastern Pacific) and *C* (central Pacific) ENSO diversity indices, specialized on the onset of strong eastern Pacific El Niño events by including a classification output. We find that higher ENSO nonlinearity is associated with better skill, with potential implications for ENSO predictability in a warming climate. When initialized in May 2023, our model predicts the persistence of El Niño conditions in the eastern Pacific into 2024, but with decreasing strength, similar to 2015–2016 but much weaker than 1997–1998. In contrast to the more typical El Niño development in 1997 and 2015, in addition to the ongoing eastern Pacific warming, an eXplainable Artificial Intelligence analysis for 2023 identifies weak warm surface, increased sea level and westerly wind anomalies in the western Pacific as precursors, countered by warm surface and southerly wind anomalies in the northern Atlantic.

Enlaces: <http://hdl.handle.net/20.500.12816/5497>

<https://doi.org/10.1038/s41598-023-45739-3>

Field Campaign Evaluation of Sensors Lufft GMX500 and MaxiMet WS100 in Peruvian Central Andes

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Abstract

The research presents the inter-comparison of atmospheric variables measured by 9 automatic weather stations. This set of data was compared with the measurements of other weather stations in order to standardize the values that must be adjusted when taken to different areas. The data of a set of a total of 9 GMX500, which measures conventional meteorological variables, and 10 WS100 sensors, which measures precipitation parameters. The automatic stations were set up at the Huancayo Observatory (Geophysical Institute of Peru) for a period of 5 months. The data set of GMX500 were evaluated comparing with the average of the 9 sensors and the WS100 was compared with an optical disdrometer Parsivel². The temperature, pressure, relative humidity, wind speed, rainfall rate, and drop size distribution were evaluated. A pair of GMX500 sensors presented high data dispersion; it was found that the errors came from a bad configuration; once this problem was solved, good agreement was archived, with low RMSE and high correlation. It was found that the WS100 sensors overestimate the precipitation with a percentage bias close to 100% and the differences increase with the greater intensity of rain. The drop size distribution retrieved by WS100 have unrealistic behavior with higher concentrations in diameters of 1 mm and 5 mm, in addition to a flattened curve.

Enlaces: <http://hdl.handle.net/20.500.12816/5318>

<https://doi.org/10.3390/s22093219>

Flooding risk of cropland areas by *repiquetes* in the western Amazon basin: A case study of Peruvian Tamshiyacu City

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Abstract

Study region: The western Amazon basin at Tamshiyacu gauging station (near the Iquitos City) hosts floodplain agriculture that can be affected by the sudden reversal in direction of water levels known as “repiquetes” that produce intermittent flooding.

Study focus: This study assesses repiquete flooding risk in riparian crop areas based on statistical analyses of repiquete events registered from 1996 to 2018, hydraulic modeling to estimate flooded extension, and assessment of climatological characteristics during the formation of repiquetes.

New hydrological insights: Floods (≥ 20 cm) produced by repiquetes in riparian crop areas between 83.00 and 88.00 m above sea level (masl) occur 1.8 times per year. However, not all elevation ranges have the same flooding risk to crops. Terrain elevations between 85.31 and 87.00 masl have a reduced flooding risk of 0.35 per year. Likewise, areas with elevations between 87.00 and 88.00 masl (43% of the total area) were not affected by repiquetes. Extreme repiquetes (study cases of 2002 and 2008) have been influenced by the increase of atmospheric moisture flux convergence and precipitation over both the northern Ucayali and Marañón basins through the six previous days. Flood impacts from the extreme event of 2002 (2008) could have reached 40% (25%) of the available area for agriculture at the initiation of the repiquete.

Enlaces: <http://hdl.handle.net/20.500.12816/5404>

<https://doi.org/10.1016/j.ejrh.2023.101428>

Glaciological Mass balance of Znosko Glacier, King George Island

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Abstract

The present article objective is to determine the net mass balance of the glacier Znosko for periods 2018-2019 and 2019-2020. It is situated on King George Island which belongs to the groups Shetland of the South, Antarctic Peninsula region. For this objective, during February 2018 a net of 19 stakes (which were controlled once during February 2019 and 2020) were installed on the glacier ablation zone, drilling in the accumulation zone and about flights using unmanned aerial vehicles (UAV) to control the glacier zone and geomorphological changes. For the year 2020, it was determined a glacier area of $1.71 \pm 0.02 \text{ km}^2$, moreover, using five different methods of interpolation, it was obtained on average, as a result, a specific net balance of $-590.7 \pm 46.6 \text{ mm w.e}$ (in water equivalent) for 2018-2019 and $-686.7 \pm 28.2 \text{ mm w.e}$ for 2019-2020, being the ELA altitude $146.5 \pm 18.2 \text{ m}$ and $144.2 \pm 8.3 \text{ m}$ respectively. The two consecutive years represent negative net mass balances which are in accordance with other similar studies on this region, also glacier data were obtained on a zone that is characterized by its difficult access.

Enlaces: <https://doi.org/10.1590/0001-3765202320220821>

<https://hdl.handle.net/20.500.12542/3027>

Heatwaves and fire in Pantanal: Historical and future perspectives from CORDEX-CORE

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Abstract

The Pantanal biome, at the confluence of Brazil, Bolivia and Paraguay, is the largest continental wetland on the planet and an invaluable reserve of biodiversity. The exceptional 2020 fire season in Pantanal drew particular attention due to the severe wildfires and the catastrophic natural and socio-economic impacts witnessed within the biome. So far, little progress has been made in order to better understand the influence of climate extremes on fire occurrence in Pantanal. Here, we evaluate how extreme hot conditions, through heatwave events, are related to the occurrence and the exacerbation of fires in this region. A historical analysis using a statistical regression model found that heatwaves during the dry season explained 82% of the interannual variability of burned area during the fire season. In a future perspective, an ensemble of CORDEX-CORE simulations assuming different Representative Concentration Pathways (RCP2.6 and RCP8.5), reveal a significant increasing trend in heatwave occurrence over Pantanal. Compared to historical levels, the RCP2.6 scenario leads to more than a doubling in the Pantanal heatwave incidence during the dry season by the second half of the 21st century, followed by a plateauing. Alternatively, RCP8.5 projects a steady increase of heatwave incidence until the end of the century, pointing to a very severe scenario in which heatwave conditions would be observed nearly over all the Pantanal area and during practically all the days of the dry season. Accordingly, favorable conditions for fire spread and consequent large burned areas are expected to occur more often in the future, posing a dramatic short-term threat to the ecosystem if no preservation action is undertaken.

Enlaces: <https://doi.org/10.1016/j.jenvman.2022.116193>

<https://hdl.handle.net/20.500.12542/3005>

High-resolution gridded hourly precipitation dataset for Peru (PISCOp_h)

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Abstract

This article introduces a high-resolution (0.1°) gridded dataset of hourly precipitation across Peru for the period 2015–2020, called PISCOp_h. The product was developed using a temporal disaggregation technique based on the gridded daily precipitation dataset PISCOp and additional data from 309 automatic weather stations and three satellite precipitation products (IMERG-Early, PERSIANN-CCS, and GSMaP_NRT). The workflow of PISCOp_h involved the spatial interpolation of hourly precipitation and a bias correction of the diurnal rainfall cycle. Based on a technical validation, we demonstrated that PISCOp_h provides moderate to high efficiency in characterizing the frequency, intensity, and temporal coherence of hourly precipitation, particularly in central and southern Peru. PISCOp_h represents an important advance to construct gridded hourly precipitation products under challenging environmental conditions in, e.g., mountain regions with complex terrain. This new dataset provides a useful baseline for future studies in hydrology, climatology, and meteorology. The data collection described is available on figshare: <https://doi.org/10.6084/m9.figshare.c.5743166>

Enlace: <https://doi.org/10.1016/j.dib.2022.108570>

High-resolution grids of daily air temperature for Peru - the new PISCOt v1.2 dataset

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Abstract

Gridded high-resolution climate datasets are increasingly important for a wide range of modelling applications. Here we present PISCOt (v1.2), a novel high spatial resolution (0.01°) dataset of daily air temperature for entire Peru (1981–2020). The dataset development involves four main steps: (i) quality control; (ii) gap-filling; (iii) homogenisation of weather stations, and (iv) spatial interpolation using additional data, a revised calculation sequence and an enhanced version control. This improved methodological framework enables capturing complex spatial variability of maximum and minimum air temperature at a more accurate scale compared to other existing datasets (e.g. PISCOt v1.1, ERA5-Land, TerraClimate, CHIRTS). PISCOt performs well with mean absolute errors of 1.4 °C and 1.2 °C for maximum and minimum air temperature, respectively. For the first time, PISCOt v1.2 adequately captures complex climatology at high spatiotemporal resolution and therefore provides a substantial improvement for numerous applications at local-regional level. This is particularly useful in view of data scarcity and urgently needed model-based decision making for climate change, water balance and ecosystem assessment studies in Peru.

Enlaces: <https://doi.org/10.1038/s41597-023-02777-w>

<https://hdl.handle.net/20.500.12542/3050>

Hydrological impacts of dam regulation for hydropower production: The case of Lake Sibinacocha, Southern Peru

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Servicio Nacional de Meteorología e Hidrología del Perú

Abstract

Study region: Vilcanota-Urubamba river basin, Southern Peru.

Study focus: Hydraulic infrastructure plays a fundamental role for energy production, drinking and irrigation water storage and flood control in regions with seasonal river flow. The high-Andean Lake Sibinacocha has been regulated since 1988 to increase energy production of the Machupicchu hydropower plant. In this study, river streamflow changes are evaluated by analyzing precipitation and discharge trends using indicators of hydrologic alteration and ecoflow for natural (1965–1987) and altered (1988–2016) flow regimes.

New hydrological insights for the region: For the altered flow regime, an ecodeficit of about 20% (compared to natural river flow) and an ecosurplus > 30% were found during the wet season (December-February) and dry season (June-August), respectively. These changes have reduced the risk of water shortage (dry season) and flood (wet season) and contribute to increasing water use including hydropower production, irrigation and drinking water. However, river alteration might lead to considerable impacts on riverine ecosystems.

Despite major limitations related to data scarcity and complex environmental processes in the basin, our results highlight the usefulness of combined methods of hydrological alteration and ecoflow to effectively evaluate water regime changes in regulated basins. An integrated scientific approach is necessary to address uncertainties and develop meaningful future water availability scenarios that guide hydropower projects with improved water and energy security considering minimal impacts on human and natural systems.

Enlaces: <https://doi.org/10.1016/j.ejrh.2023.101319>

<https://hdl.handle.net/20.500.12542/2609>

Hydrological modeling based on the KNN algorithm: An application for the forecast of daily flows of the Ramis river, Peru

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Resumen

El pronóstico de caudales de un río es de gran importancia para el desarrollo de sistemas de alerta temprana. Los algoritmos de inteligencia artificial han demostrado ser una herramienta eficaz en la modelación hidrológica basado en datos, pues permiten establecer relaciones entre los datos de entrada y salida de una cuenca hidrográfica, y así tomar decisiones basadas en datos. Este artículo investiga la aplicabilidad del algoritmo k vecino más cercano (KNN) para el pronóstico de caudales medios diarios del río Ramis en la estación hidrométrica Ramis. Como insumo de entrada al algoritmo de aprendizaje automático KNN utilizamos un conjunto de datos de precipitación media de la cuenca y caudal medio diario de estaciones hidrometeorológicas con varios rezagos. El rendimiento del algoritmo KNN se evaluó cuantitativamente con métricas de habilidad hidrológica, como el error porcentual absoluto medio (MAPE), anomalía del coeficiente de correlación (ACC), eficiencia de Nash-Sutcliffe (NSE), eficiencia de Kling-Gupta (KGE') y ángulo espectral (SA). Los resultados para realizar pronóstico de caudales del río Ramis con el algoritmo de aprendizaje automático KNN alcanzaron altos niveles de confiabilidad, sobre todo con rezagos de caudales de uno y dos días, y precipitación con tres días. El algoritmo utilizado es simple, pero robusto para efectuar pronósticos de caudales a corto plazo, y puede ser integrado como una alternativa para el fortalecimiento del pronóstico hidrológico diario del río Ramis.

Abstract

The forecast of river stream flows is of significant importance for the development of early warning systems. Artificial intelligence algorithms have proven to be an effective tool in hydrological modeling data-driven, since they allow establishing relationships between input and output data of a watershed and thus make decisions data-driven. This article investigates the applicability of the k-nearest neighbor (KNN) algorithm for forecasting the mean daily flows of the Ramis river, at the Ramis hydrometric station. As input to the KNN machine learning algorithm, we used a data set of mean basin precipitation and mean daily flow from hydrometeorological stations with various lags. The performance of the KNN algorithm was quantitatively evaluated with hydrological ability metrics such as mean absolute percentage error (MAPE), anomaly correlation coefficient (ACC), Nash-Sutcliffe efficiency (NSE), Kling-Gupta efficiency (KGE') and the spectral angle (SA). The results for forecasting the flows of the Ramis river with the k-nearest neighbor machine learning algorithm reached high levels of reliability with flow lags of one and two days and precipitation with three days. The algorithm used is simple but robust to make short-term flow forecasts and can be integrated as an alternative to strengthen the daily hydrological forecast of the Ramis river.

Enlaces: <https://doi.org/10.24850/j-tyca-14-02-05>

<https://hdl.handle.net/20.500.12542/3019>

Hydro-Morphological Disturbance and Suitability for Temporary Agriculture of Riverine Islands in a Tropical Wandering River

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Abstract

Fluvial islands define fundamental interfaces between the aquatic and terrestrial environment in river corridors, have unique environmental value, and represent a place of interest for human communities worldwide. Temporary agriculture occurs in many riverine islands in tropical regions of the planet, but this has received little attention so far. By integrating remote sensing, field and laboratory investigations, hydrological and hydraulic analysis, we quantified controls on their agricultural suitability in terms of fluvial disturbance, morphological stability, soils characteristics, and selection of flood-resistant crops. A highly dynamic foothill reach of the wandering Huallaga River (Peruvian Amazon) where temporary agriculture is practiced by local farmers is used as a case study. Islands show rapid turnover rates, with their number and total area tripling in the 1986-2019 period, in association with recent river corridor widening. Simulated disturbance-free windows of opportunity can be long enough (up to 230 days, for plantain) to cultivate on the most elevated portions of the largest islands, about 3 m above the thalweg. A gradient of increasing agricultural suitability paralleled that of decreasing fluvial disturbance from the most recently developed island (e.g., organic matter 0.2%–1.2%) to the more stable one (0.1%–2.6%) to the established floodplain (0.5%–3.5%). While the floodplain is more suitable for farming, we quantified how suitable islands are for temporary food production. Our results are generalized through a conceptual model for fluvial islands' agricultural suitability, thus filling an important knowledge gap about the characteristics of those highly sensitive environments within floodplains still moderately affected by human activities.

Enlace: <https://doi.org/10.1029/2021WR030674>

Influence of flooding variability on the development of an Amazonian peatland

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Abstract

Peat in the Pastaza–Marañón Foreland Basin (PMFB), northern Peru, forms beneath open wetlands, palm swamps, pole forests and seasonally flooded forests. These vegetation communities may represent different successional stages of peatlands, but the spatiotemporal patterns of peatland development in Amazonia are still poorly understood. We present a new geochemical and palaeoecological record spanning the last c. 4330 years from an open peatland (San Roque, core SAR_T3_03_B). Our results suggest the persistence of predominantly herbaceous vegetation communities at the core site since the start of peat accumulation (c. 3180 cal a BP). Micro-X-ray fluorescence core scanning provides evidence for episodes of fluvially derived minerogenic input and simultaneous increases in flood-tolerant taxa relating to intervals of increased frequency and depth of riverine flooding. The establishment of *Mauritia flexuosa* palms from around 440 cal a BP coincided with a shift to lower flooding depth and frequency which continues to the present day. This study reveals the role of flooding variability in shaping peatland development and influencing vegetation succession in the PMFB, underlining the need to understand natural environmental variability for the conservation of these ecosystems due to their vital contributions to ecosystem services and carbon storage.

Enlace: <https://doi.org/10.1002/jqs.3587>

Interdecadal variability of the austral summer precipitation over the Central Andes

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Instituto Geofísico del Perú



Abstract

The impacts of the interdecadal variability of the Pacific and the Atlantic Oceans on precipitation over the Central Andes during the austral summer (December January-February, DJF) are investigated for the 1921–2010 period based on monthly gridded precipitation data and low-pass filtered time series of the Niño 4 index (IN4), the Niño 1 + 2 index with Niño 3.4 index removed (IN1+2*), Atlantic Multidecadal Oscillation (AMO), and Interdecadal Pacific Oscillation (IPO) indices, and the three first rotated principal components of the interdecadal component of the sea surface temperature (SST) anomalies over the Atlantic Ocean. A rotated empirical orthogonal function (REOF) analysis of precipitation in the Central Andes (10°S–30°S) yields two leading modes, RPC1 and RPC2, which represent 40.4% and 18.6% of the total variance, respectively. REOF1 features a precipitation dipole between the northern Bolivian and the Chilean Altiplano. REOF2 also features a precipitation dipole, with highest negative loading over the southern Peruvian Andes. The REOF1 positive phase is associated with moisture transport from the lowlands toward the Bolivian Altiplano, induced by upper-level easterly wind anomalies over the Central Andes. At the same time conditions tend to be dry over the southern Peruvian Andes. The positive phase of REOF2 is related to weakened moisture transport, induced by upper-level westerly wind anomalies over Peru. The IPO warm phase induces significant dry anomalies over the Bolivian Altiplano, albeit weaker than during the IN4 warm phase, via upper-level westerly wind anomalies over the Central Andes. No significant relationship was found between Central Andean precipitation and the AMO on interdecadal timescales.

Enlaces: <http://hdl.handle.net/20.500.12816/5285>

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Landslide hazard assessment and risk reduction in the rural community of Rampac Grande, Cordillera Negra, Peru

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Abstract

This article describes the landslide risk assessment of the Rampac Grande rural community in the Peruvian Andes, where an unexpectedly fast-moving landslide claimed fatalities in 2009. The study site represents a socially, culturally, and geologically challenging environment that limits applicable technical solutions for landslide risk reduction and demands a high level of community participation in all risk reduction steps. The performed landslide surface movement monitoring and slope stability calculations showed that the studied slopes are very close to failure. Therefore, the detailed hazard assessment was combined with field investigations of household vulnerabilities to perform a qualitative risk assessment in the zone around the 2009 catastrophic landslide. Results show that the high vulnerability, rather than the very high hazard, is responsible for assigning houses to the high-risk classes and education or improvement of the households' income is key for further risk reduction. This underlines the importance of vulnerability reduction through the collaboration of the community members with external actors (e.g., Peruvian experts), which was interrupted by the COVID-19 pandemic restrictions. The context of the performed landslide risk assessment provides a summary of the 12-year-long involvement of different actors in the landslide risk reduction effort and the evaluation of the effectiveness of the previously adopted mitigation measures. It suggests that the community perspective on the mitigation measures and its risk perception changes determine the long-term risk reduction outcomes.

Enlace: <https://doi.org/10.1007/s12665-023-11307-1>

Landsystem analysis of a tropical moraine-dammed supraglacial lake, Llaca Lake, Cordillera Blanca, Perú

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Abstract

Tropical glaciers of the Cordillera Blanca, Perú are rapidly thinning and retreating as a result of climate warming. The retreat of these glaciers along narrow linear bedrock valleys has increased the number and size of moraine-dammed glacial lakes formed in the valleys. This study aims to identify the geomorphological and sedimentological characteristics of an enlarging moraine-dammed supraglacial lake (Llaca Lake) in the Cordillera Blanca. Field-based sedimentological observations and geomorphological mapping were combined with remotely sensed data and a photogrammetric model derived from aerial surveys by an uncrewed aerial vehicle to identify landform-sediment assemblages. The geomorphological and sedimentological characteristics of Llaca Lake are synthesized into three landsystem zones: Zone 1: distal portions of Llaca Lake and the latero-frontal moraine; Zone 2: the central zone of ice-cored hummocks; and Zone 3: the active glacier margin. These zones are differentiated based on the spatial distribution of landforms, sediments, and active geomorphological processes. This is the first study to describe the landform-sediment assemblages in a tropical moraine-dammed supraglacial lake system and provides a framework for further landsystem element analysis of these growing supraglacial lakes in rapidly deglaciating high-altitude environments.

Enlace: <http://doi.org/10.1111/bor.12611>

Local hydrological conditions influence tree diversity and composition across the Amazon basin

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Abstract

Tree diversity and composition in Amazonia are known to be strongly determined by the water supplied by precipitation. Nevertheless, within the same climatic regime, water availability is modulated by local topography and soil characteristics (hereafter referred to as local hydrological conditions), varying from saturated and poorly drained to well-drained and potentially dry areas. While these conditions may be expected to influence species distribution, the impacts of local hydrological conditions on tree diversity and composition remain poorly understood at the whole Amazon basin scale. Using a dataset of 443 1-ha non-flooded forest plots distributed across the basin, we investigate how local hydrological conditions influence 1) tree alpha diversity, 2) the community-weighted wood density mean (CWM-wd) – a proxy for hydraulic resistance and 3) tree species composition. We find that the effect of local hydrological conditions on tree diversity depends on climate, being more evident in wetter forests, where diversity increases towards locations with well-drained soils. CWM-wd increased towards better drained soils in Southern and Western Amazonia. Tree species composition changed along local soil hydrological gradients in Central-Eastern, Western and Southern Amazonia, and those changes were correlated with changes in the mean wood density of plots. Our results suggest that local hydrological gradients filter species, influencing the diversity and composition of Amazonian forests. Overall, this study shows that the effect of local hydrological conditions is pervasive, extending over wide Amazonian regions, and reinforces the importance of accounting for local topography and hydrology to better understand the likely response and resilience of forests to increased frequency of extreme climate events and rising temperatures.

Enlace: <https://doi.org/10.1111/ecog.06125>

Modeling tephra fall and sediment-water flows to assess their impacts on a vulnerable building stock in the city of Arequipa, Peru

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Abstract

Arequipa, Peru's second economic center hosting c. 1,110,000 inhabitants, is the largest South American city exposed to a large variety of natural hazards. At least 200,000 live in areas likely to be affected by hazards from El Misti volcano, located 17 km to the NE. A multidisciplinary project aims to address the impacts of tephra fall and frequent mass flows on the vulnerable building stock and roofs along two ravines that cross the city, enabling decision-makers to undertake retrofitting projects and improve urban risk planning. Two recent eruptions, that is, the 1440–1470 CE Vulcanian event and c. 2070 years BP Plinian eruption, were chosen as references for probable scenarios of potential tephra fall impacts from El Misti on the building roofs. Tephra fall impacts on the city depend on the eruptive style, column height, and patterns of wind directions and velocities over south Peru and roof mechanical resistance. Estimates of potential damage levels and cost range values rely on nine structural types and four classes of vulnerable roofs. Simulation runs of hyperconcentrated flows (HCF) and debris flows (DF), using three depth-averaged flow models (Titan2F, VolcFlow, and Flo-2D) along two drainage basins on the SW flank of El Misti and across Arequipa, examined three scenarios from a database of 39 recent events and other historical lahars. Simulation results showcase the extent toward the city, inundation depths ≤ 4.6 m, flow velocities ≤ 9 m/s, and dynamic pressure up to 100 kPa from three different magnitude HCFs and DFs. In both ravines, overbank flows occurred in key urban areas due to channel sinuosity and constrictions near bridges. Potential impacts on habitat stem from ranges of flow dynamic pressure and measurements of construction material. We estimated the monetary loss of buildings according to hyperconcentrated flows and debris flows scenarios to contribute to retrofitting procedure, implementation of defense work, and relocation policy.

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Moisture Sources and Rainfall $\delta^{18}\text{O}$ Variability over the Central Andes of Peru-A Case Study from the Mantaro River Basin

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Abstract

The Mantaro River Basin is one of the most important regions in the central Peruvian Andes in terms of hydropower generation and agricultural production. Contributions to better understanding of the climate and hydrological dynamics are vital for this region and constitute key information to support regional water security and socioeconomic resilience. This study presents eight years of monthly isotopic precipitation information ($\delta^{18}\text{O}$, Dxs) collected in the Mantaro River Basin. The isotopic signals were evaluated in terms of moisture sources, including local and regional climatic parameters, to interpret their variability at monthly and interannual timescales. It is proposed that the degree of rainout upstream and the transport history of air masses, also related to regional atmospheric features, are the main factors influencing the $\delta^{18}\text{O}$ variability. Moreover, significant correlations with precipitation amount and relative humidity imply that local processes in this region of the Andes also exert important control over isotopic variability. Two extreme regional climate events (the 2010 drought and the 2017 coastal El Niño) were evaluated to determine how regional atmospheric circulation affects the rainfall isotope variability. Based on these results, recommendations for hydroclimate studies and paleoclimate reconstructions are proposed in the context of the Mantaro River Basin. This study intends to encourage new applications considering geochemical evidence for hydrological studies over the central Andean region.

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On new two-dimensional UHF radar observations of equatorial spread *F* at the Jicamarca Radio Observatory

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Abstract

We describe a mode for two-dimensional UHF (445 MHz) radar observations of *F*-region irregularities using the 14-panel version of the advanced modular incoherent scatter radar (AMISR-14). We also present and discuss examples of observations made by this mode. AMISR-14 is installed at the Jicamarca Radio Observatory (JRO, 11.95°S, 76.87°W, ~ 0.5° dip latitude) in Peru and, therefore, allows studies of ionospheric irregularities at the magnetic equator. The new mode takes advantage of the electronic beam-steering capability of the system to scan the equatorial *F*-region in the east–west direction. Therefore, it produces two-dimensional views of the spatial distribution of sub-meter field-aligned density irregularities in the magnetic equatorial plane. The scans have a temporal resolution of 20 s and allow observations over a zonal distance of approximately 400 km at main *F*-region heights. While the system has a lower angular and range resolution than interferometric in-beam VHF radar imaging observations available at Jicamarca, it allows a wider field-of-view than that allowed with the VHF system. Here, we describe the mode, and present and discuss examples of observations made with the system. We also discuss implications of these observations for studies of ESF at the JRO.

Enlaces: <http://hdl.handle.net/20.500.12816/5447>

<https://doi.org/10.1186/s40623-023-01876-7>

On the interpretation of changes in the subtropical oxygen minimum zone volume off Chile during two La Niña events (2001 and 2007)

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Abstract

Oxygen minimum zones (OMZs) are extended oceanic regions for which dissolved oxygen concentration is extremely low. They are suspected to be expanding in response to global warming. However, currently, the mechanisms by which OMZ varies in response to climate variability are still uncertain. Here, the variability of the subtropical OMZ off central Chile of a regional coupled physical–biogeochemical regional model simulation was analyzed for the period 2000–2008, noting that its fluctuations were significant despite the relatively weak amplitude of the El Niño/Southern Oscillation (ENSO). In particular, the interannual variability in the OMZ volume (OMZ_{VOL} , defined as the volume with dissolved oxygen concentration (DO) $\leq 45\mu M$) was approximately 38% larger than that of the seasonal cycle, with maximum and minimum anomalies of OMZ_{VOL} taking place during two cold La Niña (LN) years (2001 and 2007). The model analyses further reveal that these anomalies resulted from a combined effect of changes in (1) the oxygen-poor waters poleward transport by the Peru–Chile undercurrent (PCUC), (2) the intensity of quasi-zonal jets influencing the transport of water to and from the OMZ, and (3) the zonal DO transport related to mesoscale eddy activity. Specifically, the interannual variability of the PCUC modulated primarily the DO contents of the OMZ core [(DO) $\leq 20\mu M$] and secondarily the OMZ_{VOL} , while cross-shore DO transport by the zonal jets and the eddy fluxes played a major role in ventilating and shaping the offshore extent of the OMZ. When the OMZ_{VOL} was maximum (minimum), the PCUC transport was slightly increased (reduced), which was associated with a reduction (increase) in the ventilation of the OMZ through negative (positive) anomalies of zonal advection and DO eddy fluxes. Our results demonstrate that significant natural interannual variability in the subtropical OMZ off Chile originates from the interplay between oceanic equatorial teleconnection (PCUC transport) and local non-linear dynamics (the zonal jets and mesoscale eddies).

Enlaces: <http://hdl.handle.net/20.500.12816/5436>

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Panta Rhei benchmark dataset: socio-hydrological data of paired events of floods and droughts

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Abstract

As the adverse impacts of hydrological extremes increase in many regions of the world, a better understanding of the drivers of changes in risk and impacts is essential for effective flood and drought risk management and climate adaptation. However, there is currently a lack of comprehensive, empirical data about the processes, interactions, and feedbacks in complex human–water systems leading to flood and drought impacts. Here we present a benchmark dataset containing socio-hydrological data of paired events, i.e. two floods or two droughts that occurred in the same area. The 45 paired events occurred in 42 different study areas and cover a wide range of socio-economic and hydro-climatic conditions. The dataset is unique in covering both floods and droughts, in the number of cases assessed and in the quantity of socio-hydrological data. The benchmark dataset comprises (1) detailed review-style reports about the events and key processes between the two events of a pair; (2) the key data table containing variables that assess the indicators which characterize management shortcomings, hazard, exposure, vulnerability, and impacts of all events; and (3) a table of the indicators of change that indicate the differences between the first and second event of a pair. The advantages of the dataset are that it enables comparative analyses across all the paired events based on the indicators of change and allows for detailed context- and location-specific assessments based on the extensive data and reports of the individual study areas. The dataset can be used by the scientific community for exploratory data analyses, e.g. focused on causal links between risk management; changes in hazard, exposure and vulnerability; and flood or drought impacts. The data can also be used for the development, calibration, and validation of socio-hydrological models. The dataset is available to the public through the GFZ Data Services (Kreibich et al., 2023, <https://doi.org/10.5880/GFZ.4.4.2023.001>).

Enlaces: <https://doi.org/10.5194/essd-15-2009-2023>

<https://hdl.handle.net/20.500.12542/2895>

Petrological and geochemical constraints on the magmatic evolution at the Ampato-Sabancaya compound volcano (Peru)

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Abstract

In order to gain insights into continental arc magmatic processes, we have conducted a petrological and geochemical study of major and trace elements and Sr, Nd, and Pb isotopes of the Ampato-Sabancaya compound volcano, which belongs to the Andean Central Volcanic Zone (CVZ). Whole-rock compositions for Ampato and Sabancaya range from andesites to dacites (56.7–69.3 wt% SiO₂) and both belong to a medium- to high-K calc-alkaline magmatic series. Ampato-Sabancaya samples are characterized by high contents of large-ion lithophile elements (LILE; e.g., K, Rb, Ba, Th), low concentrations of high field strength elements (HFSE; e.g., Nb, Zr) and heavy rare earth elements (HREE; e.g., Yb), with consequently high La/Yb and Sr/Y ratios. An increase in these ratios is usually interpreted as a result of magmatic differentiation in the presence of garnet in the deep crust. A detailed analysis reveals that the rocks of Ampato-Sabancaya display three different compositional groups. (1) The first, composed mainly of andesites (56.7–59.8 wt% SiO₂), corresponds to lavas from the early stage of the Ampato Basal edifice, as well as pyroclastic deposits from the Ampato Upper edifice. (2) The second group corresponds to andesitic and dacitic compositions (60.0–67.3 wt% SiO₂) from the Ampato Basal edifice (Moldepampa stage), the Ampato Upper edifice, and the Sabancaya edifice. (3) The third group corresponds to dacitic compositions (65.0–69.3 wt% SiO₂) associated with the Corinta Plinian fallout and pyroclastic flow deposits from the Ampato Upper edifice. This last group of dacites, erupted during the Ampato Upper edifice stage, have drastically different compositions from the other groups with Sr/Y (<27) and Sm/Yb (<4.7) ratios lower than other lavas and lacking evidence of amphibole and/or garnet fractionation during their genesis. As a whole, Sr, Nd, Pd isotopic ratios suggest that mantle-derived magmas are significantly affected by assimilation processes during their evolution, due to the thick (65–70 km) continental crust beneath the CVZ in southern Peru. In summary, the magmatic evolution of group 1 and 2 can be explained by a two-step model in which primitive magmas evolved in the deep crust in the so-called melting-assimilation-storage-homogenization (MASH)-type reservoirs by assimilation-fractional crystallization (AFC) processes involving garnet and/or amphibole. Then, amphibole-dominated upper crustal AFC processes and magma mixing are responsible for the geochemical diversity of the main ASCV trend. In contrast, the group 3 dacites followed an upper crustal AFC process (without amphibole) from a different primitive magma, which did not suffer the high pressure, garnet-dominated AFC processes. This evolution highlights the complexities associated to magma genesis and differentiation at continental arcs constructed on a thick crust.

Enlaces: <http://hdl.handle.net/20.500.12816/5474>

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PISCOeo_pm, a reference evapotranspiration gridded database based on FAO Penman-Monteith in Peru

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

A new FAO Penman-Monteith reference evapotranspiration gridded dataset is introduced, called PISCOeo_pm. PISCOeo_pm has been developed for the 1981–2016 period at ~1 km (0.01°) spatial resolution for the entire continental Peruvian territory. The framework for the development of PISCOeo_pm is based on previously generated gridded data of meteorological subvariables such as air temperature (maximum and minimum), sunshine duration, dew point temperature, and wind speed. Different steps, i.e., (i) quality control, (ii) gap-filling, (iii) homogenization, and (iv) spatial interpolation, were applied to the subvariables. Based on the results of an independent validation, on average, PISCOeo_pm exhibits better precision than three existing gridded products (CRU_TS, TerraClimate, and ERA5-Land) because it presents a predictive capacity above the average observed using daily and monthly data and has a higher spatial resolution. Therefore, PISCOeo_pm is useful for better understanding the terrestrial water and energy balances in Peru as well as for its application in fields such as climatology, hydrology, and agronomy, among others.

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<https://hdl.handle.net/20.500.12542/2254>

Probing the hidden magmatic evolution of El Misti volcano (Peru) with the Pb isotope composition of fumaroles

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Abstract

This work proposes a new method to probe the hidden magmatic evolution of quiescent Andean volcanoes from the Pb isotope composition of gases. The method is based on an assimilation-fractional crystallisation-degassing model linking the Pb isotope composition of gases with the SiO₂ content of their magmatic source. The model is applied to El Misti volcano that threatens Arequipa, the second most densely populated city of Peru. Gas condensates and Pb-rich solid deposits (PbS, PbCl₂, PbSO₄) collected in 2018 in the bottom of El Misti crater at 260–150°C fumarole vents were used to reconstruct the mean composition of degassing magmas (60.8–61.8 wt% SiO₂). These compositions are slightly more evolved than the lavas from the last AD 1440–1470 eruption, suggesting either the secular differentiation of the main magma reservoir, or the contribution of more evolved magmas to volcanic gases. On the other hand, the slight but significant difference between the instantaneous composition recorded in gas condensates and the time-integrated composition recorded in solid deposits points to the degassing of less evolved magmas over the last decades. This trend is ascribed to a recent recharge of El Misti reservoir with hot mafic magmas, in agreement with the evolution of fumarolic deposit mineralogy in the last half a century. The Pb isotope composition of gas appears to be a promising tool for probing the hidden magmatic evolution of quiescent volcanoes where assimilation-fractional crystallisation operates.

Enlaces: <http://hdl.handle.net/20.500.12816/5076>

<https://doi.org/10.1007/s00445-021-01521-9>

Proposed algorithm for the identification of glacier cover from Sentinel-2A images

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Abstract

In Peru, there are 20 glacial mountain ranges that in almost 60 years have lost 54% of their glacial coverage. The accelerated glacial recession due to climate change raises the need to know the levels of retraction of the glacier surface efficiently and reliably. During the preparation of the last inventory by the National Institute for Research in Glaciers and Mountain Ecosystems (INAIGEM), it was identified that carrying out the inventory faces challenges, such as differentiating between temporary snow and glacier ice, especially in areas with complex meteorological characteristics, like the Cordillera Blanca (Peru). Due to the Peruvian Andes' geographical and climatic complexity, satellite images usually show cloudiness and temporary snow, even in the dry season (April to November). In this way, the objective is to obtain an ideal image with annual glacier coverage with minimal snow reflecting the current glacier surface. For this, the script "Normalized Differentiated Snow Index - minimum NDSI" was developed, which analyzed the Sentinel-2A image catalog of the year 2020 and delimited the glaciers of the Huascarán and Huandoy systems in the Cordillera Blanca.

The proposed methodology aims to evaluate the techniques for generating glacier cover, which allows the proposed objective to get the minimum glacier area. Three glacier cover generation techniques were evaluated: mosaic, medium, and minimum. For the mosaic and average reductions, the algorithm applied a cloud filter to the Sentinel-2A image set and calculated the NDSI for the month that was lowest in the historical average from Landsat 5, 7, and 8 images (1990-2020), applying a threshold of 0.4 and exporting the results with mean and mosaic reduction, respectively. While the minimum NDSI was calculated annually (2020) from Sentinel-2A images, with a cloud filter to which the reduction by minimums is applied, within the same area of interest, applying the threshold of 0.4 and exporting the results in raster format. Finally, the three results were evaluated in terms of the percentage of overestimation concerning glacier coverage in 2016.

The results reveal that the Huascarán and Huandoy glacier systems present a lower NDSI value during August and October, with standard deviations of 0.12 and 0.14, respectively. The glacier cover generated by the minimum NDSI was compared in the percentage of overestimation (m2) concerning 2016 with the average and mosaic NDSI, finding as a result that the minimum glacier cover, for the year 2020, evidences a lower percentage of temporal snow in the Huascarán system between 157.12% and 76.84% less than the filtering methods: average and mosaic. Likewise, in the Huandoy system, there is evidence of a lower percentage of temporary snow between 205.91% and 191.65% less than the average and mosaic methods. Finally, it is necessary to indicate that the developed algorithm has improved the obtaining of glacier coverage from the inventory developed by INAIGEM and reduces the overestimation of glacier coverage due to temporary snow.

Enlace: <https://doi.org/10.5194/egusphere-egu23-11201>

Rainfall Erosivity in Peru: A New Gridded Dataset Based on GPM-IMERG and Comprehensive Assessment (2000–2020)

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Abstract

In soil erosion estimation models, the variables with the greatest impact are rainfall erosivity (*RE*), which is the measurement of precipitation energy and its potential capacity to cause erosion, and erosivity density (*ED*), which relates *RE* to precipitation. The *RE* requires high temporal resolution records for its estimation. However, due to the limited observed information and the increasing availability of rainfall estimates based on remote sensing, recent research has shown the usefulness of using observed-corrected satellite data for *RE* estimation. This study evaluates the performance of a new gridded dataset of *RE* and *ED* in Peru (PISCO_reed) by merging data from the IMERG v06 product, through a new calibration approach with hourly records of automatic weather stations, during the period of 2000–2020. By using this method, a correlation of 0.94 was found between PISCO_reed and *RE* obtained by the observed data. An average annual *RE* for Peru of $7840 \text{ MJ} \cdot \text{mm} \cdot \text{ha}^{-1} \cdot \text{h}^{-1}$ was estimated with a general increase towards the lowland Amazon regions, and high values were found on the North Pacific Coast area of Peru. The spatial identification of the most at risk areas of erosion was evaluated through a relationship between the *ED* and rainfall. Both erosivity datasets will allow us to expand our fundamental understanding and quantify soil erosion with greater precision.

Enlaces: <https://doi.org/10.3390/rs15225432>

<https://hdl.handle.net/20.500.12542/3068>

Rainfall thresholds estimation for shallow landslides in Peru from gridded daily data

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Abstract

This work aims to generate and evaluate regional rainfall thresholds obtained from a combination of high-resolution gridded rainfall data, developed by the National Service of Meteorology and Hydrology of Peru, and information from observed shallow landslide events. The landslide data were associated with rainfall data, determining triggering and non-triggering rainfall events with rainfall properties from which rainfall thresholds are determined. The validation of the performance of the thresholds is carried out with events that occurred during 2020 and focuses on evaluating the operability of these thresholds in landslide warning systems in Peru. The thresholds are determined for 11 rainfall regions. The method of determining the thresholds is based on an empirical–statistical approach, and the predictive performance of the thresholds is evaluated with true skill statistics. The best predictive performance is the mean daily intensity–duration ($I_{\text{mean}}-D$) threshold curve, followed by accumulated rainfall E . This work is the first estimation of regional thresholds on a country scale to better understand landslides in Peru, and the results obtained reveal the potential of using thresholds in the monitoring and forecasting of shallow landslides caused by intense rainfall and in supporting the actions of disaster risk management.

Enlaces: <https://doi.org/10.5194/nhess-23-1191-2023>

<https://repositorio.senamhi.gob.pe/handle/20.500.12542/2715>

Recent Deoxygenation of Patagonian Fjord Subsurface Waters Connected to the Peru–Chile Undercurrent and Equatorial Subsurface Water Variability

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Abstract

In recent decades, global dissolved oxygen (DO) measurements have registered a decrease of ~1%–2% in oxygen content, raising concerns regarding the negative impacts of ocean deoxygenation on marine life and the greenhouse gas cycle. By combining in situ data from 2016 to 2022, satellite remote sensing, and outputs from a physical-biogeochemical model, we revealed the deoxygenation process in the Patagonian fjords for the first time. Deoxygenation was associated with the advection of equatorial subsurface water (ESSW) mass into the northern region of Patagonia. An analysis of the circulation regime using the Mercator-Ocean global high-resolution model confirmed the importance of the Peru–Chile undercurrent (PCUC) in transporting the ESSW poleward, contributing to the entrance of ESSW into the northern Patagonian fjords. A mooring system installed in the water interchange area between the Pacific Ocean and Patagonian fjords detected a decreasing DO of $-21.66 \mu\text{mol L}^{-1}$ over 7 years, which was explained by the increase in PCUC transport of 1.46 Sv. Inside the Puyuhuapi fjord system, a second DO time series exhibited more marked deoxygenation with $-88.6 \mu\text{mol L}^{-1}$ over 3 years linked with the influence of ESSW and local processes, such as DO consumption by the organic matter degradation. The recent deoxygenation registered in the northern Patagonian fjords demonstrates the significance of studying DO in the context of reducing the global oxygen content, further warranting the quantification of the impacts of deoxygenation on life cycles of marine organisms that inhabit the Patagonian fjords and channels and the Humboldt current system.

Enlaces: <http://hdl.handle.net/20.500.12816/5435>

<https://doi.org/10.1029/2022GB007688>

Reflections on the impact and response to the Peruvian 2017 Coastal El Niño event: Looking to the past to prepare for the future

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Abstract

Climate-related phenomena in Peru have been slowly but continuously changing in recent years beyond historical variability. These include sea surface temperature increases, irregular precipitation patterns and reduction of glacier-covered areas. In addition, climate scenarios show amplification in rainfall variability related to the warmer conditions associated with El Niño events. Extreme weather can affect human health, increase shocks and stresses to the health systems, and cause large economic losses. In this article, we study the characteristics of El Niño events in Peru, its health and economic impacts and we discuss government preparedness for this kind of event, identify gaps in response, and provide evidence to inform adequate planning for future events and mitigating impacts on highly vulnerable regions and populations. This is the first case study to review the impact of a Coastal El Niño event on Peru's economy, public health, and governance. The 2017 event was the third strongest El Niño event according to literature, in terms of precipitation and river flooding and caused important economic losses and health impacts. At a national level, these findings expose a need for careful consideration of the potential limitations of policies linked to disaster prevention and preparedness when dealing with El Niño events. El Niño-related policies should be based on local-level risk analysis and efficient preparedness measures in the face of emergencies.

Enlaces: <http://hdl.handle.net/20.500.12816/5475>

<https://doi.org/10.1371/journal.pone.0290767>

Seeing measurements at OAUNI on 2016 and 2017 campaigns

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Abstract

We present seeing measurements at OAUNI site gathered on 2016 and 2017 campaigns using *V* and *R* broadband filters. In order to quantify the seeing we used the full-width-at-half-maximum from stellar profiles on photometric sequences during the observational windows of our supernovae program. A typical median seeing of 1".8 was found on 2016 and a worst value of 2".0 on 2017. The last one was probably affected by anomalous conditions related to the 2017 extreme climatic event. The monthly first quartile analysis indicates that best seeing conditions can be achieved at a level of 1".5. In general, our results indicate a reasonable sky quality for the OAUNI site.

Enlaces: <http://hdl.handle.net/20.500.12816/5320>

<https://doi.org/10.1088/1742-6596/2372/1/012001>

Spatial and Temporal Distribution of Black Carbon in Peru from the Analysis of Biomass Burning Sources and the Use of Numerical Models

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Abstract

The spatial and temporal distribution of biomass burning in Peru and neighboring countries was analyzed during the 2018–2020 period, with emphasis on 2019. To determine the glaciers most affected by BC as a consequence of vegetation burning, simulations were carried out with the WRF-CHEM model, and to diagnose the origin of BC particles received by the Huaytapallana glacier, backward trajectories were built with the HYSPLIT model. It was found that, during the studied period, the burning of biomass emitted large amounts of BC into the atmosphere, while the number of fires in Peru began its most notable increase in the month of July, with maxima between August and September. Comparisons of the number of outbreaks with the Aerosol Optical Depth (AOD) measured at the Huancayo observatory showed a significant correlation. The Ucayali region is the one that contributes the greatest number of outbreaks and the greatest emissions are produced in the south of Loreto. The WRF model showed that the concentrations in July are still low in relation to the August–October period. The mountain ranges that received the greatest impact from BC emissions were Huaytapallana, Huagoruncho, and Vilcabamba. BC transport is mainly oriented from north to south, moving the particles from the areas of greatest burning to the glaciers located in the center and south of the country. BC concentrations over the Cordillera Blanca were lower. The diagnosis of the backward trajectories corroborated the results of WRF-CHEM and showed trajectories mostly from the north.

Enlaces: <http://hdl.handle.net/20.500.12816/5473>

<https://doi.org/10.1007/s41748-023-00342-4>

Spatial Distribution of Droughts in the Titicaca Lake Basin

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Servicio Nacional de Meteorología e Hidrología del Perú

Abstract

The present research has assessed the spatial distribution of drought risk in the Titicaca Lake Basin located in Peruvian territory for a district scale, based on hazard and vulnerability. Drought hazard has been quantified with the deficit of precipitation using the Standardized Precipitation Index (SPI) for a time scale of 3-months, and the vulnerability has been obtained according to the socio-economic and physical indicators of the Basin. The results show that the drought is strongly modulated by anomalous SST conditions of the surrounding Oceans, mainly by the Pacific region. Over the Titicaca Lake Basin was identified that about 50% of districts present a high to very high risk of drought mainly, in the northwestern, central-east, and central-south of the Basin. These districts have a larger deficit of precipitation and showed indicators that are more vulnerable to the drought hazard due to that economically depends on precarious rainfed agriculture and an extensive and mixed livestock system. Within this area are the most important provinces of the high-Andean region, such as Puno, San Roman, Azángaro, Melgar, and Carabaya, and outstanding districts as Puno and Juliaca, considered the economic capital of the department of Puno.

Enlaces: <https://doi.org/10.1590/0102-77863730054>

<https://hdl.handle.net/20.500.12542/2461>

Spatiotemporal Changes in Land Use and Ecosystem Service Values Under the Influence of Glacier Retreat in a High-Andean Environment

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Abstract

Glaciers supply multiple ecosystem services that are threatened by climate change. The retreat and disappearance of tropical glaciers is an important dynamic that affects ecosystems and local communities. The knowledge of the impacts of this land-change dynamics on the supply of ecosystem services is lacking. In that sense, the assessment developed can provide evidence about the costs and benefits of promoting conservation and human well-being at the same time. Then, the main objective of this research is to determine the spatial-temporal changes and their effects on the economic value of ecosystem services in a glacial retreat environment. We selected the Marangani district as a study area. It comprises the La Raya Mountain range in the Andes. The assessments were carried out across two scales of observation: the municipality and the watershed level. Here, we process spectral information from Landsat Sensor using the Random Forest algorithm in the Google Earth Engine platform to classify 10 biomes. It was carried out over more than 30 years (from 1986 to 2019). After that, ecosystem services provided by the biomes were valued using the transfer method. This research shows that at the municipality level, almost all the LULCs faced variations over time, and the glaciers had the highest change, accumulating a ratio of -85.51% , whereas at the watershed level, a higher tendency of land changes is observed in the areas without glaciers, and those with glacier areas count on permanent larger bofedales. At the municipality level, the economic value of ecosystems shows that bofedales and water surfaces are the LULCs that supply the highest ecosystem services ($\sim 33,000$ USD $\text{ha}^{-1} \text{yr}^{-1}$ each). In addition, without the inflation adjustment, the total ESV is on a trajectory of losing ESV ($-\$9.67 \times 10^6$). In the watersheds with glacier retreat, significant quantity of bofedales and natural grasslands controls the fluctuations of ESV. These high-mountain watersheds play an essential role in providing benefits and value to local communities. In general, the municipality level indicates the trajectory of changes in the district, whereas the watershed scale shows the urgency for implementing spatial conservation actions.

Enlaces: <https://doi.org/10.3389/fenvs.2022.941887>

<https://repositorio.inaigem.gob.pe/handle/16072021/420>

Summertime precipitation extremes and the influence of atmospheric flows on the western slopes of the southern Andes of Perú

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Abstract

Although climatologically dry, the western slopes of the southern Andes of Peru (WSA) can experience precipitation extremes (PEs) during the summer (December–February) resulting in great economic and human losses. Generally, WSA has a positive upslope gradient in precipitation, meaning more rain falls at higher elevations, but observations have shown this gradient can become negative with higher rainfall near the coastal cities. In this study we analyse 2000–2019 regional atmospheric patterns associated with different upslope precipitation gradients and PEs in WSA using principal component analysis methods and surface station observations. Results show important changes in the atmospheric circulation patterns during the occurrence of PE events. A prevailing pattern of negative southerly wind anomalies and regional warming of the southeastern Pacific Ocean leads to significant increases in moisture along the coast of WSA. Eastern moisture flows associated with the presence of the Bolivian High are observed at upper levels of the atmosphere and transport water vapour from the Amazon to the western side of the Andes. Additionally, there is a blocking effect aloft in response to an intense gradient of geopotential height that attenuates the easterly circulations. These large-scale mechanisms act to concentrate high precipitable water amounts and high levels of convective available potential energy in the troposphere which favours the vertical velocities essential to trigger PEs. These results increase our knowledge of the large-scale characteristics of PEs to help with forecasting these impactful events and protecting the more than 1.8 million people living in WSA.

Enlaces: <http://hdl.handle.net/20.500.12816/5319>

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Temporal dynamics of glacier retreat and its relationship with local climate in Cordillera Apolobamba, Peru

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Abstract

Glaciers play a pivotal role as essential water sources, and monitoring their dynamics is crucial for understanding the profound impacts of climate change. This study presents a comprehensive assessment of the temporal dynamics of glacier retreat and its relationship with the local climate in Cordillera Apolobamba, Peru, spanning 1986 to 2015. Using Landsat satellite imagery and the Normalized Difference Snow Index (NDSI), we quantify changes in glacial cover at five-year intervals, starting in 1986. Additionally, we explore the climate drivers associated with these changes by analyzing local climatic data. The results reveal a remarkable and concerning trend in the temporal evolution of glacial areas in the CA. By 2015, the extent of glacial retreat had reached approximately 51.84% of the surface area estimated in 1986, with an average annual loss rate of $0.79 \text{ km}^2/\text{year}$. This retreat corresponds to a substantial reduction in glacial volume over the study period. This study unveils direct and inverse relationships between precipitation, temperature, and the glacier retreat rate. This discerns that temperature predominantly drives the loss of glacier area, while the glacier retreat rate is conditioned by precipitation. The results provide crucial data for policymakers, stakeholders, and researchers striving to understand the intricate interplay between climate variables and glacial dynamics and their broader implications for water resource management in high-altitude regions.

Enlaces: <http://hdl.handle.net/20.500.12816/5484>

<https://doi.org/10.1007/s40808-023-01865-5>

The 2013–2020 seismic activity at Sabancaya Volcano (Peru): Long lasting unrest and eruption

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Abstract

Sabancaya volcano is the youngest and second most active volcano in Peru. It is part of the Ampato-Sabancaya volcanic complex which sits to the south of the ancient Hualca Hualca volcano and several frequently active faults, thus resulting in complex volcano-tectonic interactions. After 15 years of repose, in 2013, a series of 4 earthquakes with magnitude >4.5 occurred within 24 h, marking the beginning of a new episode of unrest. Several additional swarms of earthquakes occurred in the following years until magmatic eruptive activity started on 6 November 2016. This activity is ongoing as of this writing, with an average of 50 explosions per day. In this study, we present results of multiparametric monitoring of Sabancaya's activity observed during 2013–2020. Seismic data are used to create a one-dimensional seismic velocity model, to catalog, locate, and characterize earthquakes, to detect repeating earthquake families, and to monitor seismic velocity variations by ambient noise cross-correlation. These analyses are complemented by visual and remote sensing observations and ground deformation measurements. All monitored parameters showed significant changes on 6 November 2016, the day of eruption onset, thus dividing the eruptive activity into pre-eruptive and eruptive stages.

The unrest is characterized by high levels of seismic activity with hundreds of events detected per day. Volcano-tectonic (VT) earthquakes were dominant during the pre-eruptive period while long-period (LP) events and explosions have been most numerous since the eruption onset. Earthquake locations highlight long-lasting seismogenic zones along multiple previously active regional faults, as well as along newly identified faults. This VT seismicity is mainly distributed in a sector from the northwest to the east of the volcanic complex at distances of up to 30 km from the crater. We focus our analysis on two eruptive episodes: the eruption onset and subsequent crater migration from south to north, and the increase of lava dome extrusion rate in 2019. Both episodes are accompanied by seismic velocity decreases of up to 0.2% and are preceded by a few weeks by bursts of distal VT activity, including numerous repeating earthquakes. These repeated events were located on several remote tectonic faults (5–25 km from the vent). We suggest that these phenomena could be due to the injection of a batch of magma in the deep reservoir and/or conduit, which would generate 1) a pressure wave propagating in the hydrothermal system, triggering the bursts of seismic activity and 2) slow rising of magma by melting old material filling the conduit that eventually produced the eruptive and dome growth acceleration events.

Enlaces: <http://hdl.handle.net/20.500.12816/5361>

<https://doi.org/10.1016/j.jvolgeores.2023.107767>

The challenge of unprecedented floods and droughts in risk management

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Abstract

Risk management has reduced vulnerability to floods and droughts globally, yet their impacts are still increasing. An improved understanding of the causes of changing impacts is therefore needed, but has been hampered by a lack of empirical data. On the basis of a global dataset of 45 pairs of events that occurred within the same area, we show that risk management generally reduces the impacts of floods and droughts but faces difficulties in reducing the impacts of unprecedented events of a magnitude not previously experienced. If the second event was much more hazardous than the first, its impact was almost always higher. This is because management was not designed to deal with such extreme events: for example, they exceeded the design levels of levees and reservoirs. In two success stories, the impact of the second, more hazardous, event was lower, as a result of improved risk management governance and high investment in integrated management. The observed difficulty of managing unprecedented events is alarming, given that more extreme hydrological events are projected owing to climate change.

Enlaces: <https://doi.org/10.1038/s41586-022-04917-5>

<https://hdl.handle.net/20.500.12542/2352>

The global biogeography of tree leaf form and habit

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Abstract

Understanding what controls global leaf type variation in trees is crucial for comprehending their role in terrestrial ecosystems, including carbon, water and nutrient dynamics. Yet our understanding of the factors influencing forest leaf types remains incomplete, leaving us uncertain about the global proportions of needle-leaved, broadleaved, evergreen and deciduous trees. To address these gaps, we conducted a global, ground-sourced assessment of forest leaf-type variation by integrating forest inventory data with comprehensive leaf form (broadleaf vs needle-leaf) and habit (evergreen vs deciduous) records. We found that global variation in leaf habit is primarily driven by isothermality and soil characteristics, while leaf form is predominantly driven by temperature. Given these relationships, we estimate that 38% of global tree individuals are needle-leaved evergreen, 29% are broadleaved evergreen, 27% are broadleaved deciduous and 5% are needle-leaved deciduous. The aboveground biomass distribution among these tree types is approximately 21% (126.4 Gt), 54% (335.7 Gt), 22% (136.2 Gt) and 3% (18.7 Gt), respectively. We further project that, depending on future emissions pathways, 17–34% of forested areas will experience climate conditions by the end of the century that currently support a different forest type, highlighting the intensification of climatic stress on existing forests. By quantifying the distribution of tree leaf types and their corresponding biomass, and identifying regions where climate change will exert greatest pressure on current leaf types, our results can help improve predictions of future terrestrial ecosystem functioning and carbon cycling.

Enlace: <https://doi.org/10.1038/s41477-023-01543-5>

The GPM-DPR Blind Zone Effect on Satellite-Based Radar Estimation of Precipitation over the Andes from a Ground-Based Ka-band Profiler Perspective

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Abstract

A vertically pointing Ka-band radar (Metek MIRA-35C) installed at the Instituto Geofísico del Perú, Atmospheric Microphysics and Radiation Laboratory (LAMAR) Huancayo Observatory, which is located at an elevation of 3.3 km MSL in the Andes Mountains of Peru, is used to investigate the effects of terrain on satellite-based precipitation measurement in the Andes. We compare the vertical structure of precipitation observed by the MIRA-35C with Ka-band radar measurements from the Dual-Frequency Precipitation Radar (DPR) on board the Global Precipitation Measurement (GPM) mission core satellite using an approach based on Taylor's hypothesis of frozen turbulence that attempts to reduce the impact of spatiotemporal offsets between these two radar measurements. From 3 April 2014 to 20 May 2018, the DPR measured precipitation near LAMAR during 15 of its 157 coincident overpasses. There were six simultaneous observations with MIRA-35C. We found that the average of the DPR's lowest clutter-free bin is 1.62 km AGL, but the presence of precipitation worsens the situation, causing a 0.4-km-deeper algorithm-detected blind zone for the DPR at the Huancayo Observatory. In the study area, the depth of the clutter layer observed with DPR often extends above the melting layer but can be highly variable, extending even as high as 5 km AGL. These results suggest that DPR estimates of stratiform precipitation over the Andes Mountains are likely underestimated because of the terrain effects on the satellite measurements and problems in its blind zone detection algorithms, highlighting the difficulty in estimating precipitation in mountainous terrain from spaceborne radar.

Enlaces: <http://hdl.handle.net/20.500.12816/5317>

<https://doi.org/10.1175/JAMC-D-20-0211.1>

The late Pleistocene Sacarosa tephra-fall deposit, Misti Volcano, Arequipa, Peru: its magma, eruption, and implications for past and future activity

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Abstract

Between 38.5 ka cal BP and 32.4 ka cal BP, a dacitic Volcanic Explosivity Index 5 eruption at Misti volcano emplaced the Sacarosa tephra-fall deposit. Its biotite phenocrysts, fine grain size, scarce lithics, and abundant loose crystals characterize the deposit at locations sampled. The eruption's $\sim 800^\circ\text{C}$ magma rose rapidly from ~ 10 km depth, culminating in a Plinian eruption which reached a mass eruption rate of 7.7×10^6 – 4.1×10^7 kg/s and emplaced about 3 km^3 of tephra within tens of hours. The unit comprises two layers of subequal thickness separated by a diffuse contact with the upper distinguished by being slightly coarser and less well sorted than the lower. The deposit's coarser upper layer indicates either climactic conditions or a lesser degree of fragmentation during the latter half of the eruption. Strong winds distributed the deposit southwest of Misti, where it crops out over at least 800 km^2 and drapes the present site of Arequipa with up to 100 cm of tephra. The Sacarosa deposit is the first among the Cayma stage deposits, a distinctive group of felsic, biotite-bearing units, to be carefully described and its eruption characterized. Several Cayma stage deposits were emplaced by voluminous explosive eruptions similar to the Sacarosa eruption, representing a ~ 8.9 – 15.5 ky interval of powerful eruptions. Such an explosive eruption today would threaten Arequipa's over 1,100,000 residents, many of whom live within the Sacarosa deposit's distribution.

Enlaces: <http://hdl.handle.net/20.500.12816/5453>

<https://doi.org/10.1007/s00445-023-01654-z>

The rainy season in the Southern Peruvian Andes: A climatological analysis based on the new Climandes index

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Abstract

The rainy season is of high importance for livelihoods in the Southern Peruvian Andes (SPA), especially for agriculture, which is mainly rain fed and one of the main income sources in the region. Therefore, knowledge and predictions of the rainy season such as its onset and ending are crucial for planning purposes. However, such information is currently not readily available for the local population. Moreover, an evaluation of existing rainy season indices shows that they are not optimally suited for the SPA and may not be directly applicable in a forecasting context. Therefore, we develop a new index, named Climandes index, which is tailored to the SPA and designed to be of use for operational monitoring and forecasting purposes. Using this index, we analyse the climatology and trends of the rainy season in the SPA. We find that the rainy season starts roughly between September and January with durations between 3 and 8 months. Both onset and duration show a pronounced northeast-southwest gradient, regions closer to the Amazon Basin have a considerably longer rainy season. The inter-annual variability of the onset is very high, that is, 2–5 months depending on the station, while the end of the rainy season shows a much lower variability (i.e., 1.5–3 months). The spatial patterns of total precipitation amount and dry spells within the rainy season are only weakly related to its timing. Trends in rainy season characteristics since 1965 are mostly weak and not significant, but generally indicate a tendency towards a shortening of the rainy season in the whole study area due to a later onset and an increase in precipitation sums during the rainy season in the northwestern study area.

Enlace: <https://doi.org/10.1002/joc.8013>

The role of drought conditions on the recent increase in wildfire occurrence in the high Andean regions of Peru

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Abstract

Wildfire occurrence has increased sharply in the last two decades in the Peruvian Andes. There is, however, little research on wildfires and their impacts. This study explores the conditions conducive to wildfire during 2020. MODIS images were collected to estimate the development of vegetation. In addition, ground-based monthly and satellite-based daily precipitation data were collected. Daily precipitation regularity was evaluated using a concentration index (CI), while monthly precipitation was used to estimate the Standard Precipitation Index (SPI). We used also the Global Vegetation Moisture Index (GVMI), which is a useful indicator of vegetation dynamics based on vegetation moisture. Our results do not indicate a direct link between rainfall regularity (lowest CI values) and development of vegetation. Although the SPI drought analysis using seasonal rainfall indicated nearly normal conditions during 2019–2020, analysis of dry-day frequency (DDF) suggests that the dry period played an important role between September and November 2020, producing conditions similar to the droughts of 2005, 2010 and 2016. GVMI also showed below-average values from April to November. We corroborate the usefulness of DDF for monitoring the potential increase in wildfire conditions. A controlled burn policy could offer a more useful way to reduce the impacts of wildfire.

Enlaces: <http://hdl.handle.net/20.500.12816/5385>

<https://doi.org/10.1071/WF21129>

The Rotting City: Surrealist Arts of Noticing the Urban Anthropocene

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Abstract

This article develops a surrealist approach to researching and writing about the urban Anthropocene, as a critical contribution to existing literatures on “arts of noticing” and “staying with the trouble.” Drawing on psychogeographical explorations of the city of Iquitos in the Peruvian Amazon and distancing itself from conventional modes of academic writing, the article presents a montage of surrealist images of this (post)apocalyptic metropolis. Iquitos emerges as a palimpsest of the wreckage of repeated resource booms, strewn with the ruins of a stillborn modernity and incubating an uncanny fusion of apocalyptic and utopian elements observable in the everyday practices of its subaltern inhabitants. Just as Paris was the capital of the 19th century for Walter Benjamin’s *Arcades Project*, so the interpretation of Iquitos as an extreme metaphor for our combined and uneven apocalypse designates it as the capital of the Anthropocene.

Enlace: <https://doi.org/10.1177/12063312231159202>

Trends and space–time patterns of near-surface temperatures on Maxwell Bay, King George Island, Antarctica

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Servicio Nacional de Meteorología e Hidrología del Perú

Abstract

There is growing interest in the international scientific community in characterizing climate variability in Antarctica because of the continent's fundamental role in regulating the world's climate. Researchers have intensively studied the Antarctic Peninsula since the warming that began in the mid-1950s. This was followed by a subsequent cooling period over the last decades. For this paper, using the available data, we analysed the variability in surface air temperatures at five meteorological stations located on King George Island (KGI) (a subantarctic island that is part of the South Shetland Islands); we also investigated the relationships between the air temperatures and large-scale atmospheric patterns from 1968 to 2019. In this study we found that summer temperatures are above 0°C from December to March and close to melting temperatures (extreme values) in spring and autumn; consequently, a small increase in temperature can have a significant impact on the cryosphere. The statistical analysis of the mean temperatures confirmed a trend toward cooling during the summer and in the mean monthly maximum temperatures over the 1990s at most of the weather stations whose data we analysed. Analysing the teleconnection patterns showed that the Southern Annular Mode (SAM) had strong, direct, and positive correlations during the autumn and less strong connections in spring, winter, and on an annual scale. Furthermore, we observed a lesser influence of El Niño–Southern Oscillation (ENSO).

Enlaces: <https://doi.org/10.1002/joc.7661>

<https://hdl.handle.net/20.500.12542/1974>

Understanding upper water mass dynamics in the Gulf of Mexico by linking physical and biogeochemical features

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Abstract

In the Gulf of Mexico (GoM), the upper 300 m of the water column contains a mixture of water types derived from water masses from the North Atlantic and the Caribbean Sea, namely Caribbean Surface Water (CSW), Subtropical Underwater (SUW), Gulf Common Water (GCW), and Tropical Atlantic Central Water (TACW). These are mainly altered by mesoscale processes and local evaporation, which modulate biogeochemical cycles. In this study, we improve our understanding of water mass dynamics by including biogeochemical data when evaluating the T-S relationship to define water-mass boundaries, particularly when the observed thermohaline characteristics overlap. The variables considered were apparent oxygen utilization (AOU), nitrate, and dissolved inorganic carbon (DIC). The data were obtained from eight cruises carried out in the central and southern regions of the GoM and an additional cruise that covered the entire coastal-ocean region. The new proposed boundaries were instrumental in clarifying the dynamics of surface waters. Of note, GCW on the western side of the GoM is not formed from the mixing of CSW and SUW but by the mixing of remnant CSW with TACW. In winter, a remnant of CSW mixed with GCW, and the biogeochemical composition of surface waters was affected, as observed from an increase in nitrate and DIC concentrations and positive AOU values. CSW was mainly detected at the surface during summer with negative AOU values, low DIC values, and almost undetectable nitrate concentrations. The presence or absence of CSW modulated the depth of the nitracline and likely influenced primary productivity.

Enlaces: <http://hdl.handle.net/20.500.12816/5072>

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Volcanic risk management practice evolution between vulnerability and resilience: The case of Arequipa in Peru

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Abstract

This paper proposes a new way of understanding the debate between vulnerability and resilience. We mobilize on the theoretical level the notion of “paradigm” in the sense of Kuhn and, on the methodological level, Foucault’s notion of “apparatus” to understand volcanic risk management practices. Through an interdisciplinary approach, combining management, geography and Earth sciences, we study the evolution of volcanic risk management practice in Arequipa (Peru) from the 1990s to the present. To do this, we look at the history of volcanic risk management in Arequipa, using a qualitative interview methodology based on six in-depth centered interviews from the main actors of this history, supported by a 2-month ethnography which allowed access to large institutional documentation (reports, studies, archives, maps, pictures...). Management practices in Arequipa appear to be centered on the paradigm of vulnerability since the 1990s. Some operations since 2015 named as resilient emerge but they are still inscribed in the vulnerability paradigm. The results show the relevance of the theoretical and methodological framework chosen for Arequipa but also the possibility of using it in a more general way.

Enlaces: <http://hdl.handle.net/20.500.12816/5308>

<https://doi.org/10.3389/feart.2022.877161>

Water table depth modulates productivity and biomass across Amazonian forests

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Abstract

Aim: Water availability is the major driver of tropical forest structure and dynamics. Most research has focused on the impacts of climatic water availability, whereas remarkably little is known about the influence of water table depth and excess soil water on forest processes. Nevertheless, given that plants take up water from the soil, the impacts of climatic water supply on plants are likely to be modulated by soil water conditions.

Location: Lowland Amazonian forests.

Time period: 1971–2019.

Methods: We used 344 long-term inventory plots distributed across Amazonia to analyse the effects of long-term climatic and edaphic water supply on forest functioning. We modelled forest structure and dynamics as a function of climatic, soil-water and edaphic properties.

Results: Water supplied by both precipitation and groundwater affects forest structure and dynamics, but in different ways. Forests with a shallow water table (depth <5 m) had 18% less above-ground woody productivity and 23% less biomass stock than forests with a deep water table. Forests in drier climates (maximum cumulative water deficit < -160 mm) had 21% less productivity and 24% less biomass than those in wetter climates. Productivity was affected by the interaction between climatic water deficit and water table depth. On average, in drier climates the forests with a shallow water table had lower productivity than those with a deep water table, with this difference decreasing within wet climates, where lower productivity was confined to a very shallow water table.

Main conclusions: We show that the two extremes of water availability (excess and deficit) both reduce productivity in Amazon upland (terra-firme) forests. Biomass and productivity across Amazonia respond not simply to regional climate, but rather to its interaction with water table conditions, exhibiting high local differentiation. Our study disentangles the relative contribution of those factors, helping to improve understanding of the functioning of tropical ecosystems and how they are likely to respond to climate change.

Enlace: <https://doi.org/10.1111/geb.1353>



VI

Gobernanza ambiental

Cumplimiento de la regulación y gobernanza de la fiscalización ambiental: Análisis del derrame de petróleo en la bahía de Ventanilla, Perú

Regulatory compliance and governance of environmental enforcement: Analysis of the oil spill in Ventanilla Bay, Peru

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Organismo de Evaluación y Fiscalización Ambiental

Resumen

La gobernanza de la fiscalización ambiental procura asegurar que los procesos de evaluación, supervisión y fiscalización ambiental, en sentido estricto, verifiquen el cumplimiento de la regulación y los compromisos ambientales que las empresas asumen; para garantizar una mejor calidad de vida para el ciudadano y acciones responsables en el marco del desarrollo sostenible. A raíz de la emergencia ambiental producto del derrame de hidrocarburos en la zona costera del distrito de Ventanilla en Perú, el artículo evalúa si las acciones hechas por el Organismo de Evaluación y Fiscalización Ambiental (OEFA) del Perú cuentan con las condiciones óptimas, según el marco internacional, para que se concreten los objetivos de una entidad fiscalizadora. Para ello, desde la gobernanza de la fiscalización ambiental se tienen en cuenta tres objetivos a cumplir: i) garantizar que se adopten medidas inmediatas para hacer frente a los graves riesgos; ii) mantener el cumplimiento sostenido de la ley; y iii) garantizar el procesamiento adecuado de quienes infrinjan las normas. El análisis del caso nos permite examinar con detalle una situación concreta e identificar lecciones aprendidas, como el incidir sobre la imposición de medidas inmediatas ante riesgos graves; dimensionar la magnitud de la emergencia; intervenir con un enfoque de articulación interinstitucional e intersectorial y procesar a quienes infrinjan las normas. De esa manera se espera fortalecer la gobernanza de la fiscalización ambiental en el Perú.

Abstract

The governance of environmental enforcement seeks to ensure that the processes of environmental evaluation, supervision and enforcement, in the strict sense, verify compliance with the regulations and environmental commitments assumed by companies, to guarantee a better quality of life for citizens and responsible actions within the framework of sustainable development. As a result of the environmental emergency caused by the oil spill in the coastal area of the district of Ventanilla in Peru, the article evaluates whether the actions carried out by the Peruvian Environmental Evaluation and Enforcement Agency (OEFA, by its Spanish acronym) have the optimal conditions, according to the international framework, to achieve the objectives of an enforcement agency. To this end, three objectives are taken into account in the governance of environmental oversight: (i) to ensure that immediate measures are taken to address serious risks; (ii) to maintain sustained compliance with the law; and (iii) to ensure adequate prosecution of those who violate the rules. The case analysis discussed in the article allows us to examine a specific situation in detail and identify learned lessons, such as influencing the imposition of immediate measures in the face of serious risks, assessing the magnitude of the emergency, intervening with a focus on inter-institutional and inter-sectoral coordination, and prosecute those who violate legal norms; thereby, strengthening the governance of environmental enforcement in Peru.

Enlace: <https://doi.org/10.5354/0719-4633.2022.67948>

Mapa de publicaciones científicas y análisis bibliométrico de la Revista Folia Amazónica en Loreto, Perú

Map of scientific publications and bibliometric analysis of the journal Folia Amazonica in Loreto, Peru

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Resumen

Objetivo: Elaborar un mapa de publicaciones donde se visualicen las investigaciones científicas espacializadas a través de puntos de coordenadas geográficas en el departamento de Loreto, de forma preliminar con publicaciones de la revista Folia Amazónica.

Método: Se aplicaron técnicas cartográficas y bibliométricas para analizar 255 artículos científicos publicados entre los años 1988 y 2016 en la revista Folia Amazónica.

Resultados: Las publicaciones estuvieron centralizadas en el área de influencia de la carretera Iquitos – Nauta, Jenaro Herrera, cuenca baja y media del río Nanay y sector izquierdo de la cuenca del río Marañón. La red científica generada a través de la revista Folia Amazónica evidenció una figura “no conexa”. Las afiliaciones institucionales correspondieron a 71 entidades, 12 países y 386 autores, donde Perú y Francia tuvieron mayor producción científica, en tanto Estados Unidos tuvo mayor cantidad de instituciones afiliadas a la revista Folia Amazónica después del Perú.

Conclusiones: El mapa de publicaciones representa una gran herramienta de investigación con proyección de desarrollo y gestión científica. La integración con otras revistas permitirá orientar proyectos que coadyuven al desarrollo del departamento de Loreto y en un futuro en el ámbito amazónicos.

Abstract

Objective: Develop a map of publications showing spatialized scientific research through geographic coordinate points in the Loreto region, preliminary with publications from the journal Amazon Folia.

Method: Cartographic and bibliometric techniques were applied to analyze 255 scientific articles published between 1988 and 2016 in the journal Amazon Folia.

Results: The publications were centralized in the area of influence of the Iquitos –Nauta, Jenaro Herrera, low and middlebasin of the Nanay river and left sector of the Marañón river basin. The scientific network generated through the journal Amazonian Folia showed a "non-related" figure. Institutional affiliations corresponded to 71 entities, 12 countries and 386 authors, where Peru and France had the highest scientific output, inso day as the United States had more institutions affiliated with the journal Amazonian Folia after Peru.

Conclusion: The publication map represents a great research tool with projection of development and scientific management. Integration with other journals will allow to guide projects that contribute to the development of the Loreto region and in thefutureintheAmazonian field.

Enlace: <https://doi.org/10.5195/biblios.2021.767>

The contributions of transboundary networks to environmental governance: The legacy of the MAP initiative

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Abstract

Because many environmental threats span national boundaries, transboundary networks have emerged as a form of multi-stakeholder platform to support environmental governance (EG). There are transboundary networks in various ecologically important regions of the world such as the Amazon. However, there remains a need for systematic analyses to adequately evaluate the contributions of transboundary networks to EG. This paper takes up the case of the “MAP Initiative”, a transboundary network in the tri-national frontier of the southwestern Amazon that sought to support EG. We examine three key questions: 1) how do transboundary networks motivate participants to engage in collaboration across boundaries for EG, 2) how do transboundary networks evolve structurally as well as strategically to increase their impact on EG, and 3) can transboundary networks generate outcomes beyond information sharing for EG? The analysis draws on historical documents, participant observation, and key informant interviews about the MAP Initiative. The findings confirm that transboundary networks motivate cross-border exchanges in multiple ways, they evolve structurally in multiple ways that increase their capacity, and that evolution supports multiple forms of activities and outcomes that support EG. We conclude with a discussion of the contributions and challenges of transboundary networks regarding EG.

Enlaces: <https://doi.org/10.1016/j.geoforum.2021.11.021>

<https://hdl.handle.net/20.500.12542/3008>

The CosmoAmautas project for equitable scientific education in Peru

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Abstract

We all live under the same sky. This accessibility places astronomy in a unique position to inspire awe and connect people from a variety of backgrounds. Astronomy thus has the potential to promote equity and diversity in society, while providing the technical basis for the inclusion of the scientific method in education. Peru is a country with an astronomical tradition that goes back millennia to the most ancient cultures in the Americas. This heritage, in conjunction with the under-exploited world-class quality of the Peruvian skies, makes astronomy a highly applicable tool for scientific and socioeconomic development, as defined by the United Nations Sustainable Development Goals. Such a contribution is timely and urgent as countries in Latin America are experiencing the worst educational crisis in their history due to the COVID-19 pandemic. The case of Peru has been particularly critical, with more than 85% of schools closed throughout 2020 and 2021, and the public education system in a declared state of emergency until 2022. Even before the pandemic, Peru had one of the lowest scores in Latin America in the areas of science and maths based on Programme for International Student Assessment (PISA) evaluations. In particular, the most striking gaps are found between rural and urban female students as evidenced by an illiteracy rate of 21.2% for the female rural population over 15 years old compared with the average national illiteracy rate of 5.5% (ref.), reflecting severe inequalities in education.

Enlaces: <http://hdl.handle.net/20.500.12816/5166>

<https://doi.org/10.1038/s41550-022-01605-2>



VII

Reducción de emisiones de gases de efecto invernadero

Aboveground forest biomass varies across continents, ecological zones and successional stages: refined IPCC default values for tropical and subtropical forests

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Abstract

For monitoring and reporting forest carbon stocks and fluxes, many countries in the tropics and subtropics rely on default values of forest aboveground biomass (AGB) from the Intergovernmental Panel on Climate Change (IPCC) guidelines for National Greenhouse Gas (GHG) Inventories. Default IPCC forest AGB values originated from 2006, and are relatively crude estimates of average values per continent and ecological zone. The 2006 default values were based on limited plot data available at the time, methods for their derivation were not fully clear, and no distinction between successional stages was made. As part of the 2019 Refinement to the 2006 IPCC Guidelines for GHG Inventories, we updated the default AGB values for tropical and subtropical forests based on AGB data from >25 000 plots in natural forests and a global AGB map where no plot data were available. We calculated refined AGB default values per continent, ecological zone, and successional stage, and provided a measure of uncertainty. AGB in tropical and subtropical forests varies by an order of magnitude across continents, ecological zones, and successional stage. Our refined default values generally reflect the climatic gradients in the tropics, with more AGB in wetter areas. AGB is generally higher in old-growth than in secondary forests, and higher in older secondary (regrowth >20 years old and degraded/logged forests) than in young secondary forests (≤ 20 years old). While refined default values for tropical old-growth forest are largely similar to the previous 2006 default values, the new default values are 4.0–7.7-fold lower for young secondary forests. Thus, the refined values will strongly alter estimated carbon stocks and fluxes, and emphasize the critical importance of old-growth forest conservation. We provide a reproducible approach to facilitate future refinements and encourage targeted efforts to establish permanent plots in areas with data gaps.

Enlace: <https://doi.org/10.1088/1748-9326/ac45b3>

Coupled abiotic-biotic cycling of nitrous oxide in tropical peatlands

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Abstract

Atmospheric nitrous oxide (N₂O) is a potent greenhouse gas thought to be mainly derived from microbial metabolism as part of the denitrification pathway. Here we report that in unexplored peat soils of Central and South America, N₂O production can be driven by abiotic reactions ($\leq 98\%$) highly competitive to their enzymatic counterparts. Extracted soil iron positively correlated with in situ abiotic N₂O production determined by isotopic tracers. Moreover, we found that microbial N₂O reduction accompanied abiotic production, essentially closing a coupled abiotic-biotic N₂O cycle. Anaerobic N₂O consumption occurred ubiquitously (pH 6.4–3.7), with proportions of diverse clade II N₂O reducers increasing with consumption rates. Our findings show that denitrification in tropical peat soils is not a purely biological process but rather a ‘mosaic’ of abiotic and biotic reduction reactions. We predict that hydrological and temperature fluctuations differentially affect abiotic and biotic drivers and further contribute to the high N₂O flux variation in the region.

Enlace: <https://doi.org/10.1038/s41559-022-01892-y>

Effects of Water Table Fluctuation on Greenhouse Gas Emissions from Wetland Soils in the Peruvian Amazon

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Abstract

Amazonian swamp forests remove large amounts of carbon dioxide (CO₂) but produce methane (CH₄). Both are important greenhouse gases (GHG). Drought and cultivation cut the CH₄ emissions but may release CO₂. Varying oxygen content in nitrogen-rich soil produces nitrous oxide (N₂O), which is the third most important GHG. Despite the potentially tremendous changes, GHG emissions from wetland soils under different land uses and environmental conditions have rarely been compared in the Amazon. We measured environmental characteristics, and CO₂, CH₄ and N₂O emissions from the soil surface with manual opaque chambers in three sites near Iquitos, Peru from September 2019 to March 2020: a pristine peat swamp forest, a young forest and a slash-and-burn manioc field. The manioc field showed moderate soil respiration and N₂O emission. The peat swamp forests under slight water table drawdown emitted large amounts of CO₂ and CH₄. A heavy post-drought shower created a hot moment of N₂O in the pristine swamp forest, likely produced by nitrifiers. All in all, even small changes in soil moisture can create hot moments of GHG emissions from Amazonian wetland soils, and should therefore be carefully monitored.

Enlace: <https://doi.org/10.1007/s13157-023-01709-z>

Evaluation and improvement of the E3SM land model for simulating energy and carbon fluxes in an Amazonian peatland

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Abstract

Tropical peatlands are one of the largest natural sources of atmospheric methane (CH_4) and play a significant role in regional and global carbon budgets. However, large uncertainties persist regarding their feedbacks to climate variations. The Energy Exascale Earth System Model (E3SM) Land Model (ELM) is an ongoing state-of-the-science model, which has developed new representations of soil hydrology and biogeochemistry and includes a new microbial-functional-group-based CH_4 module. This model has been tested in boreal forest peatlands, but has not yet been evaluated for simulating energy and carbon exchange for tropical peatlands. Here, we evaluated the ELM performance in simulating energy, carbon dioxide (CO_2) and CH_4 fluxes of an Amazonian palm swamp peatland in Iquitos, Peru. ELM simulations using default parameter values resulted in poor performance of seasonal carbon dynamics. Several algorithms were improved according to site-specific characteristics and key parameters were optimized using an objective surrogate-assisted Bayesian approach. The modified algorithms included the soil water retention curve, a water coverage scalar function for CH_4 processes, and a seasonally varying leaf carbon-to-nitrogen ratio function. The revised tropics-specific model better simulated the diel and seasonal patterns of energy and carbon fluxes of the palm swamp peatland. Global sensitivity analyses indicated that the strong controls on energy and carbon fluxes were mainly attributed to the parameters associated with vegetation activities, such as plant carbon distribution, stomatal regulation, photosynthetic capacity, and leaf phenology. Parameter relative importance depended on biogeochemical processes and shifted significantly between wet and dry seasons. This modeling study advanced the understanding of biotic controls on the energy and carbon exchange in Amazonian palm swamp peatlands and identified knowledge gaps that need to be addressed for better prediction of carbon cycle processes and budgets for tropical peatlands.

Enlace: <https://doi.org/10.1016/j.agrformet.2023.109364>

Genes and genome-resolved metagenomics reveal the microbial functional make up of Amazon peatlands under geochemical gradients

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Abstract

The Pastaza-Marañón Foreland Basin (PMFB) holds the most extensive tropical peatland area in South America. PMFB peatlands store ~7.07 Gt of organic carbon interacting with multiple microbial heterotrophic, methanogenic, and other aerobic/anaerobic respirations. Little is understood about the contribution of distinct microbial community members inhabiting tropical peatlands. Here, we studied the metagenomes of three geochemically distinct peatlands spanning minerotrophic, mixed, and ombrotrophic conditions. Using gene- and genome-centric approaches, we evaluate the functional potential of the underlying microbial communities. Abundance analyses show significant differences in C, N, P, and S acquisition genes. Furthermore, community interactions mediated by toxin–antitoxin and CRISPR-Cas systems were enriched in oligotrophic soils, suggesting that non-metabolic interactions may exert additional controls in low-nutrient environments. Additionally, we reconstructed 519 metagenome-assembled genomes spanning 28 phyla. Our analyses detail key differences across the geochemical gradient in the predicted microbial populations involved in degradation of organic matter, and the cycling of N and S. Notably, we observed differences in the nitric oxide (NO) reduction strategies between sites with high and low N₂O fluxes and found phyla putatively capable of both NO and sulfate reduction. Our findings detail how gene abundances and microbial populations are influenced by geochemical differences in tropical peatlands.

Enlace: <https://doi.org/10.1111/1462-2920.16469>

High Methane Emission From Palm Stems and Nitrous Oxide Emission From the Soil in a Peruvian Amazon Peat Swamp Forest

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Abstract

Tree stems in tropical peat swamp forests are known as considerable methane (CH₄) emitters; however, little is known about their carbon dioxide (CO₂) and nitrous oxide (N₂O) exchange. Differences between species, especially the role of palm stems in the exchange of greenhouse gasses, have remained largely unknown. We measured stem CO₂, CH₄, and N₂O fluxes from the different heights of widely spread aguaje palms (*Mauritia flexuosa*) and boarwoods (*Symphonia globulifera*) and the soil beneath the same trees in a Peruvian Amazon palm swamp using a static closed chamber technique from September 2019 to March 2020. The tree stems were the net emitters of CO₂ and CH₄ but occasionally showed low N₂O uptake. We found the highest stem CH₄ emissions (average ± SE) from palm stems of the height of 80 cm (1,601 ± 165.9 μg C m⁻² h⁻¹), which are more than 300 times greater compared to the highest fluxes from boarwood stems, at the height of 30 cm (5.12 ± 1.27 μg C m⁻² h⁻¹). The average soil CH₄ flux was 3,618 ± 465 μg C m⁻² h⁻¹. Whereas N₂O fluxes from the stems were negligible, the average N₂O fluxes from soils beneath the same trees were relatively high, ranging from 53.75 ± 24.04 (close to boarwood trees) to 143.4 ± 68.43 (close to palms) μg N m⁻² h⁻¹. While roughly upscaling tree-level fluxes to the stand level of 27,732 km² of palm swamp in the Pastaza-Marañon foreland basin, these forests are net annual emitters of CH₄ and N₂O (897 Gg C y⁻¹ and 24 Gg N y⁻¹, respectively). These results highlight the necessity to study this kind of ecosystem more intensely.

Enlace: <https://doi.org/10.3389/ffgc.2022.849186>

Integrated global assessment of the natural forest carbon potential

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Abstract

Forests are a substantial terrestrial carbon sink, but anthropogenic changes in land use and climate have considerably reduced the scale of this system. Remote-sensing estimates to quantify carbon losses from global forests are characterized by considerable uncertainty and we lack a comprehensive ground-sourced evaluation to benchmark these estimates. Here we combine several ground-sourced and satellite-derived approaches to evaluate the scale of the global forest carbon potential outside agricultural and urban lands. Despite regional variation, the predictions demonstrated remarkable consistency at a global scale, with only a 12% difference between the ground-sourced and satellite-derived estimates. At present, global forest carbon storage is markedly under the natural potential, with a total deficit of 226 Gt (model range = 151–363 Gt) in areas with low human footprint. Most (61%, 139 Gt C) of this potential is in areas with existing forests, in which ecosystem protection can allow forests to recover to maturity. The remaining 39% (87 Gt C) of potential lies in regions in which forests have been removed or fragmented. Although forests cannot be a substitute for emissions reductions, our results support the idea that the conservation, restoration and sustainable management of diverse forests offer valuable contributions to meeting global climate and biodiversity targets.

Enlace: <https://doi.org/10.1038/s41586-023-06723-z>

Latitude, Elevation, and Mean Annual Temperature Predict Peat Organic Matter Chemistry at a Global Scale

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Abstract

Peatlands contain a significant fraction of global soil carbon, but how these reservoirs will respond to the changing climate is still relatively unknown. A global picture of the variations in peat organic matter chemistry will aid our ability to gauge peatland soil response to climate. The goal of this research is to test the hypotheses that (a) peat carbohydrate content, an indicator of soil organic matter reactivity, will increase with latitude and decrease with mean annual temperatures, (b) while peat aromatic content, an indicator of recalcitrance, will vary inversely, and (c) elevation will have a similar effect to latitude. We used Fourier Transform Infrared Spectroscopy to examine variations in the organic matter functional groups of 1034 peat samples collected from 10 to 20, 30–40, and 60–70 cm depths at 165 individual sites across a latitudinal gradient of 79°N–65°S and from elevations of 0–4,773 m. Carbohydrate contents of high latitude peat were significantly greater than peat originating near the equator, while aromatic content showed the opposite trend. For peat from similar latitudes but different elevations, the carbohydrate content was greater and aromatic content was lower at higher elevations. Higher carbohydrate content at higher latitudes indicates a greater potential for mineralization, whereas the chemical composition of low latitude peat is consistent with their apparent relative stability in the face of warmer temperatures. The combination of low carbohydrates and high aromatics at warmer locations near the equator suggests the mineralization of high latitude peat until reaching recalcitrance under a new temperature regime.

Enlace: <https://doi.org/10.1029/2021GB007057>

Risks to carbon storage from land-use change revealed by peat thickness maps of Peru

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Abstract

Tropical peatlands are among the most carbon-dense ecosystems but land-use change has led to the loss of large peatland areas, associated with substantial greenhouse gas emissions. To design effective conservation and restoration policies, maps of the location and carbon storage of tropical peatlands are vital. This is especially so in countries such as Peru where the distribution of its large, hydrologically intact peatlands is poorly known. Here field and remote sensing data support the model development of peatland extent and thickness for lowland Peruvian Amazonia. We estimate a peatland area of 62,714 km² (5th and 95th confidence interval percentiles of 58,325 and 67,102 km², respectively) and carbon stock of 5.4 (2.6–10.6) PgC, a value approaching the entire above-ground carbon stock of Peru but contained within just 5% of its land area. Combining the map of peatland extent with national land-cover data we reveal small but growing areas of deforestation and associated CO₂ emissions from peat decomposition due to conversion to mining, urban areas and agriculture. The emissions from peatland areas classified as forest in 2000 represent 1–4% of Peruvian CO₂ forest emissions between 2000 and 2016. We suggest that bespoke monitoring, protection and sustainable management of tropical peatlands are required to avoid further degradation and CO₂ emissions.

Enlace: <https://doi.org/10.1038/s41561-022-00923-4>

Tropical Peatland Hydrology Simulated With a Global Land Surface Model

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Abstract

Tropical peatlands are among the most carbon-dense ecosystems on Earth, and their water storage dynamics strongly control these carbon stocks. The hydrological functioning of tropical peatlands differs from that of northern peatlands, which has not yet been accounted for in global land surface models (LSMs). Here, we integrated tropical peat-specific hydrology modules into a global LSM for the first time, by utilizing the peatland-specific model structure adaptation (PEATCLSM) of the NASA Catchment Land Surface Model (CLSM). We developed literature-based parameter sets for natural (PEATCLSM_{Trop,Nat}) and drained (PEATCLSM_{Trop,Drain}) tropical peatlands. Simulations with PEATCLSM_{Trop,Nat} were compared against those with the default CLSM version and the northern version of PEATCLSM (PEATCLSM_{North,Nat}) with tropical vegetation input. All simulations were forced with global meteorological reanalysis input data for the major tropical peatland regions in Central and South America, the Congo Basin, and Southeast Asia. The evaluation against a unique and extensive data set of in situ water level and eddy covariance-derived evapotranspiration showed an overall improvement in bias and correlation compared to the default CLSM version. Over Southeast Asia, an additional simulation with PEATCLSM_{Trop,Drain} was run to address the large fraction of drained tropical peatlands in this region. PEATCLSM_{Trop,Drain} outperformed CLSM, PEATCLSM_{North,Nat}, and PEATCLSM_{Trop,Nat} over drained sites. Despite the overall improvements of PEATCLSM_{Trop,Nat} over CLSM, there are strong differences in performance between the three study regions. We attribute these performance differences to regional differences in accuracy of meteorological forcing data, and differences in peatland hydrologic response that are not yet captured by our model.

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Variation in carbon and nitrogen concentrations among peatland categories at the global scale

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Abstract

Peatlands account for 15 to 30% of the world's soil carbon (C) stock and are important controls over global nitrogen (N) cycles. However, C and N concentrations are known to vary among peatlands contributing to the uncertainty of global C inventories, but there are few global studies that relate peatland classification to peat chemistry. We analyzed 436 peat cores sampled in 24 countries across six continents and measured C, N, and organic matter (OM) content at three depths down to 70 cm. Sites were distinguished between northern (387) and tropical (49) peatlands and assigned to one of six distinct broadly recognized peatland categories that vary primarily along a pH gradient. Peat C and N concentrations, OM content, and C:N ratios differed significantly among peatland categories, but few differences in chemistry with depth were found within each category. Across all peatlands C and N concentrations in the 10–20 cm layer, were $440 \pm 85.1 \text{ g kg}^{-1}$ and $13.9 \pm 7.4 \text{ g kg}^{-1}$, with an average C:N ratio of 30.1 ± 20.8 . Among peatland categories, median C concentrations were highest in bogs, poor fens and tropical swamps ($446\text{--}532 \text{ g kg}^{-1}$) and lowest in intermediate and extremely rich fens ($375\text{--}414 \text{ g kg}^{-1}$). The C:OM ratio in peat was similar across most peatland categories, except in deeper samples from ombrotrophic tropical peat swamps that were higher than other peatlands categories. Peat N concentrations and C:N ratios varied approximately two-fold among peatland categories and N concentrations tended to be higher (and C:N lower) in intermediate fens compared with other peatland types. This study reports on a unique data set and demonstrates that differences in peat C and OM concentrations among broadly classified peatland categories are predictable, which can aid future studies that use land cover assessments to refine global peatland C and N stocks.

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VIII

Gestión integrada de los recursos naturales

Mapping the benefits and the exchange values of provisioning ecosystem services using GIS and local ecological knowledge in a high-Andean community

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Abstract

Ecosystem services and their contribution to local economies and livelihoods still need to be fully understood and recognized by many policymakers. The primary purpose of this research is to integrate land use and land cover data and local ecological knowledge-based data with geographical information systems through a participatory approach to enhance natural resource management. We selected the Pariac-Rajucolta watershed as a study area because it is a typical landscape in the high-Andean mountains, with half of its territory inside a protected area. The methods involved a six-month participatory approach quantifying the benefits and exchange values of 33 provisioning ecosystem services, compiling the primary data from the locals and spectral information from Sentinel-2A. The results show that only agricultural and artificial areas delivered multiple benefits and offered the highest commercialization value of ecosystem services. The community mainly benefits from nutrition, materials, or energy from cultivated terrestrial plants, reared animals, wild plants, and surface water at the watershed level. At the same time, the services with high exchange proportions were mainly short -only meat of guinea pigs, manure, wild fruits, mushrooms, and wild plants for food. The abundance and the spatial distribution of benefits and exchange values of ecosystem services displayed a pattern of high quantity for the downstream and low in the basin's top and midstream of the watershed (inside the protected area). In conclusion, the study shows the importance of knowing ecosystem services benefits and exchange values as an initial approach to developing participatory strategies for managing and conserving natural resources.

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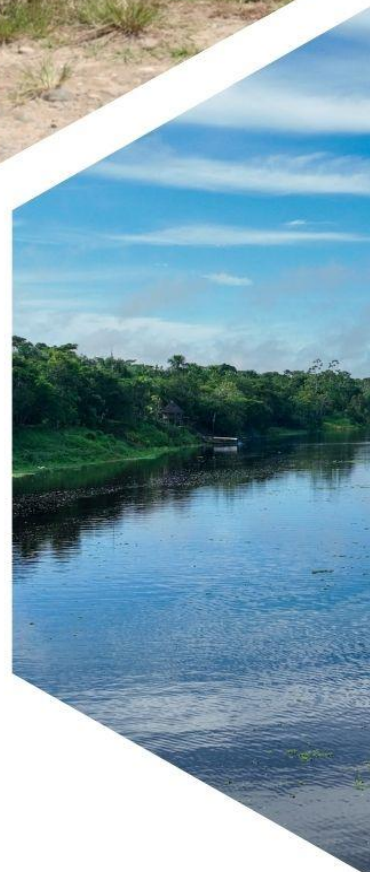
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