



Investigaciones Científicas Ambientales 2024:

aportes para la toma de decisiones

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Investigaciones científicas ambientales 2024: aportes para la toma de decisiones

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Este documento reúne un compendio de resúmenes y *abstracts* extraídos de diversas publicaciones científicas promovidas o desarrolladas por los organismos adscritos al Ministerio del Ambiente (MINAM). Cada texto ha sido reproducido íntegramente como copia fiel de los documentos originales o de sus respectivos repositorios institucionales, sin alteraciones, modificaciones ni interpretaciones, respetando el idioma en el que fue originalmente publicado. Se invita a los lectores interesados en profundizar en los temas abordados a consultar las publicaciones completas, las cuales están debidamente referenciadas en cada resumen.

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INTRODUCCIÓN

La sostenibilidad ambiental y el bienestar de la población requieren, hoy más que nunca, decisiones públicas respaldadas por conocimiento científico pertinente y actualizado. En este contexto, la generación, sistematización y uso de la evidencia se vuelve crucial para fortalecer la interfaz ciencia-política y responder con eficacia a los desafíos ambientales del país que plantea la Política Nacional del Ambiente al 2030.

La *Agenda de Investigación Ambiental al 2030* (AIA), impulsada por el Ministerio del Ambiente (MINAM), se presenta como un instrumento orientador para alinear los esfuerzos de investigación con las prioridades ambientales nacionales, promoviendo una cultura institucional basada en la evidencia, el aprendizaje continuo y la articulación interinstitucional.

En este marco, el MINAM presenta el compendio *Investigaciones científicas ambientales 2024: aportes para la toma de decisiones*, documento que reúne 135 publicaciones científicas desarrolladas o promovidas por los institutos públicos de investigación (IPI) adscritos al sector ambiente. Este esfuerzo involucra al Instituto de Investigaciones de la Amazonía Peruana (IIAP), el Instituto Geofísico del Perú (IGP), el Servicio Nacional de Meteorología e Hidrología del Perú (Senamhi), el Instituto Nacional de Investigación en Glaciares y Ecosistemas de Montaña (Inaigem), así como al Servicio Nacional de Áreas Naturales Protegidas por el Estado (Sernanp) y el Organismo de Evaluación y Fiscalización Ambiental (OEFA).

Las investigaciones están organizadas según los ejes temáticos de la AIA, reflejando el avance en la generación de conocimiento ambiental. Los temas abordados en esta edición corresponden a: Conservación de las especies y la diversidad genética (60 investigaciones), Gestión de riesgos y adaptación al cambio climático (47), Deforestación y degradación de ecosistemas (9), Calidad ambiental (8), Reducción de emisiones de gases de efecto invernadero (4), Gestión integrada de los recursos naturales (3), Gobernanza ambiental (3), y Gestión integral de residuos sólidos (1).

Este compendio no solo sistematiza y visibiliza los aportes científicos del sector ambiente, sino que también fortalece el acceso a la información para investigadores, tomadores de decisiones y el público en general. Constituye una herramienta clave para respaldar la formulación de políticas públicas y la implementación de acciones que contribuyan a enfrentar los desafíos ambientales del país desde una perspectiva basada en evidencia.

El MINAM agradece a los organismos adscritos por su valiosa contribución en la elaboración de este documento, que reafirma su compromiso con la producción de conocimiento al servicio del desarrollo sostenible del Perú.



Calidad ambiental

Assessment of Human Health Risk Indices Due to Metal Contamination in the Surface Water of the Negro River Sub-Basin, Áncash

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Abstract

The accelerated loss of glacial cover in the Cordillera Blanca in Áncash, Peru, exposes the underlying rocks with high concentrations of sulfides from the Chicama Formation to oxidation and leaching processes, generating acid rock drainage (ARD) in glacial and periglacial areas. These are transported by surface runoff, contaminating the surface water with high concentrations of metals and sulfates, as well as increasing the acidity, which poses a risk to human health and the ecosystem. Therefore, the risk indices for human health due to metal contamination were evaluated at 19 surface water sampling points distributed in the Río Negro sub-basin. Hydrochemical analyses revealed average metal concentrations in the following order: Fe (28.597 mg/L), Al (3.832 mg/L), Mn (1.085 mg/L), Zn (0.234 mg/L), Ni (0.085 mg/L), Co (0.053 mg/L), Li (0.036 mg/L), Cu (0.005 mg/L), and Pb (0.002 mg/L). The risk was determined by calculating the Heavy Metal Pollution Index (HPI) and the Hazard Index (HI). The average HPI value was 360.959, indicating a high level of contamination ($HPI \geq 150$). The human health risk assessment indicated that adverse effects caused by iron, lithium, and cobalt in children and adults should be considered. Through the use of Pearson correlation analysis, principal component analysis, and cluster analysis, it was identified that SO_4^{2-} , Fe, S, Al, Co, Mn, Ni, Zn, and Li originate from natural sources, associated with the generation of ARD in glacial and periglacial areas.

Enlace: <https://doi.org/10.3390/ijerph21060733>

Atmospheric aerosols and air quality in the 2022 dry season in Huancayo-Perú

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Abstract

This work presents results of Aerosol Optical Depth (AOD) and Direct Radiative Force (DRF) at the top of the atmosphere (TOA), obtained during monitoring campaigns carried out at the Huancayo Observatory of the Geophysical Institute of Peru (OH-IGP) in April and August 2022. In these campaigns, a Sun CIMEL photometer was used to measure the microphysical and optical properties of aerosols at wavelengths ranging from 340 to 1020 nm, and a low-cost Purple-air sensor to quantify the concentration of material particulate (PM), in fine and coarse modes. The AOD results indicated values in the range 0.06-0.22. The daily averages of PM_{2.5} and PM₁₀ did not exceed Peru's current Environmental Quality Standards (50 µg/m³ and 100 µg/m³). The air quality index (AQI) calculated for PM_{2.5} and PM₁₀ was classified as good. On some days during the campaigns, the air quality was classified as moderate. These results contribute to a better understanding of the current climatic conditions of the Peruvian Altiplano.

Enlaces: https://doi.org/10.11137/1982-3908_2024_47_56253

<http://hdl.handle.net/20.500.12816/5642>

Atmospheric black carbon observations and its valley-mountain dynamics: Eastern cordillera of the central Andes of Peru

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Abstract

Glacial bodies in the Peruvian Andes Mountains store and supply freshwater to hundreds of thousands of people in central Peru. Atmospheric black carbon (BC) is known to accelerate melting of snow and ice, in addition to contributing to air pollution and the health of people. Currently there is limited understanding on the sources and temporal variability of BC in valley and mountain environments in Peru. To address this problem, this study combined surface observations of BC collected during 2022–2023 with WRF model simulations and HYSPLIT trajectories to analyze the dispersion and sources of BC in valley and high elevation environments and the associated local atmospheric circulations. Results show high BC concentrations are associated with the valley-mountain wind system that occurs on both sides of the Huaytapallana mountain range. A pronounced circulation occurs on the western slopes of Huaytapallana when concentrations of BC increase during daylight hours, which transports atmospheric pollutants from cities in the Mantaro River Valley to the Huaytapallana mountain range. Low concentrations of BC are associated with circulations from the east that are channeled by the pronounced ravines of the Andes-Amazon transition. On average, during the season of highest BC concentrations (July–November), the relative contributions of fossil fuels are dominant to biomass burning at the valley observatory and are slightly lower at the Huaytapallana observatory. These results demonstrate the need to promote mitigation actions to reduce emissions of BC and air pollution associated with forest fires and local anthropogenic activity.

Enlace: <https://doi.org/10.1016/j.envpol.2024.124089>

Chemical composition and trajectories of atmospheric particles at the Machu Picchu Peruvian Antarctic scientific station (62.09° S, 58.47° W)

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Resumen

La Antártida es una región remota, pero con importante influencia de las regiones circundantes. El transporte de aerosoles desde distancias lejanas es una importante fuente de contaminación que puede impactar esta región, especialmente la Península Antártica. Es necesario caracterizar los aerosoles atmosféricos y analizar la contribución de sus fuentes de emisión. Para ello se analizó durante febrero de 2020 la composición química elemental de las partículas atmosféricas PM_{10} y $PM_{2.5}$, y se realizaron mediciones de tanto de éstas como de carbono negro con análisis de retrotrayectoria de masas de aire utilizando el modelo HYSPLIT. El objetivo fue caracterizar los elementos traza, analizar las fuentes de material particulado y comprender los orígenes de las masas de aire que contribuyen con partículas en la Estación Científica Antártica Peruana Machu Pichu (ECAMP), ubicada en la Isla Rey Jorge de la península Antártica. Se usaron colectores Partisol con filtros de teflón, perfilador contador de partículas y etalómetro. Los elementos químicos se analizaron por espectrometría de masas de plasma acoplada inductivamente (ICP-MS) y se aplicaron técnicas multivariadas y factor de enriquecimiento. Los elementos más abundantes en PM_{10} y $PM_{2.5}$ fueron Na, Fe, Mg y Si, siendo las fuentes locales más importantes las de origen marino (Na, Mg, Mn, Ca) y de la corteza (Fe, Al, P). Se registraron también fuentes de meteorización (Ba y Si) propias del descongelamiento de los glaciares y fuentes de quema ligadas al uso de petróleo (V) y carbono negro. El estudio de las masas de aire sugiere una contribución potencialmente importante de fuentes externas. En general, se demuestra el impacto de fuentes antrópicas distantes y locales en el continente blanco.

Abstract

Antarctica is a remote and relatively pristine region, but the regional transport of aerosols may be a source of pollution, especially in the Antarctic Peninsula. Few studies have characterized atmospheric aerosols and evaluated the contribution of their emission sources. The Peruvian Antarctic research station Machu Pichu (ECAMP, by its Spanish acronym) is located on King George Island in the Antarctic Peninsula. During February 2020, atmospheric particulate mass (PM_{10} and $PM_{2.5}$) was sampled and analyzed to characterize its elemental composition and was supplemented by measurements of equivalent black carbon and aerosol size distributions. Chemical elements were analyzed by inductively coupled plasma mass spectrometry (ICP-MS), multivariate techniques, and enrichment factors. The most abundant elements in PM_{10} and $PM_{2.5}$ were Na, Fe, Mg, and Si, with the most important local sources being marine (Na, Mg, Mn, Ca) and crustal (Fe, Al, P). Sources of weathering (Ba and Si) from glacial thawing and sources of combustion linked to the use of oil (V) and emission of black carbon were recorded. Air mass back-trajectory analysis using the HYSPLIT model helped identify external sources of particulate matter in the air masses reaching the ECAMP site. Overall, this study supports the growing evidence of the anthropogenic impact of distant and local sources on the white continent.

Enlaces: <https://doi.org/10.20937/ATM.53291>

<http://hdl.handle.net/20.500.12816/5622>

Comunidades de macroinvertebrados bentónicos de quebradas del área de influencia de la carretera Iquitos-Nauta, Loreto-Perú

Communities of benthic macroinvertebrates of streams in the area of influence of the Iquitos-Nauta highway, Loreto-Perú

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Resumen

La construcción de carreteras puede generar amenazas a la biodiversidad de una importante red hidrológica conformada por riachuelos conocidos comúnmente como quebradas en la amazonia peruana. El objetivo del estudio fue determinar la composición, riqueza, abundancia, diversidad, dominancia y similaridad de hábitats de comunidades de macroinvertebrados bentónicos de cinco quebradas ubicadas en el área de influencia del eje carretero Iquitos-Nauta (Loreto, Perú). Las colectas se realizaron en cuatro épocas (vaciente, seca, creciente y llena), usando una red tipo D-net. La comunidad de macroinvertebrados bentónicos estuvo compuesta por 68 taxones y 4 556 individuos, distribuidos en 4 filos (Arthropoda, Annelida, Mollusca y Nematoda). El análisis de similitud indica que hubo diferencias significativas ($p < 0.05$) entre las épocas de vaciante-seca con las de creciente-llena; siendo la época seca la de mayor valor de riqueza, abundancia y diversidad; y creciente la de mayor dominancia. Chironomidae, Leptophlebiidae, Elmidae y Palaemonidae; fueron los taxones más dominantes. El presente trabajo es un aporte al conocimiento de las comunidades de macroinvertebrados que habitan los pequeños ecosistemas lóticos de la selva baja peruana.

Abstract

The construction of roads can generate threats to the biodiversity of an important hydrological network made up of streams known as quebradas in the Peruvian Amazon. The objective of the study was to determine the composition, richness, abundance, diversity, dominance, and similarity of habitats of benthic macroinvertebrate communities of five streams located around the Iquitos-Nauta highway axis (Loreto, Peru). The collections were made in four periods (empty, dry, growing, and full), using a D-net type network. The benthic macroinvertebrate community was composed of 68 taxa and 4556 individuals, distributed in 4 phyla (Arthropoda, Annelida, Mollusca and Nematoda). The similarity analysis indicates that there were significant differences ($p < 0.05$) between the empty-dry seasons and the growing-full seasons; The dry season being the one with the greatest value of wealth, abundance, and diversity; and increasing the one with greater dominance. Chironomidae, Leptophlebiidae, Elmidae and Palaemonidae; were the most dominant taxa. The present work is a contribution to the knowledge of the macroinvertebrate communities that inhabit the small lotic ecosystems of the Peruvian lowland forest.

Enlace: <https://doi.org/10.21704/rea.v23i1.2164>

Ecological risk of metals in Andean water resources: A framework for early environmental assessment of mining projects in Peru

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Organismo de Evaluación y Fiscalización Ambiental



Abstract

Metallic contaminants in Andean water resources influenced by mining activities poses risks to aquatic ecosystems and a challenge to regulatory agencies responsible for environmental compliance. In this study, the Ecological Risk Assessment (ERA) framework was adapted to assess dissolved heavy metal concentrations at 283 surface water monitoring stations near to six mining projects during the dry and wet seasons. Reports from OEFA-Peru on Early Environmental Assessment (EEA) were used to apply various criteria and non-parametric statistical tests. They included ecological, ecotoxicological, chemical, and regulatory factors. The main goal of this research was to identify, analyze, characterize, and compare the risks present at different trophic levels. These levels were categorized as T1 (Microalgae), T2 (Zooplankton and Benthic invertebrates), and T3 (Fish). Individual risk (IR) was estimated using the quotient model, while total risk (TR) was assessed using the additive probability rule. Rainbow trout (*Oncorhynchus mykiss*), representing trophic level T3, showed the highest sensitivity to Fe and Cu. Statistical tests ranked the IR as $Fe > Cu > Zn > Mn > Pb$ ($p < 0.01$). The TR was more prevalent during the wet season compared to the dry season ($p < 0.01$). Notably, around 50 % of the monitoring stations ($n = 142$) were classified as high risk, and 9 % ($n = 13$) showed extremely high-risk values for Cu and Fe. The adapted ERA framework demonstrated great effectiveness in identifying critical points of metal contamination in high Andean aquatic ecosystems under mining influence. However, specialized studies are suggested that allow the sources of pollution to be associated with specific regulatory actions.

Enlace: <https://doi.org/10.1016/j.heliyon.2024.e30739>

Spatio-temporal trends of mercury levels in alluvial gold mining spoils areas monitored between rainy and dry seasons in the Peruvian Amazon

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Resumen

La minería de oro artesanal y en pequeña escala (MAPE) en la Amazonía ha degradado los bosques tropicales y ha escalado la contaminación por mercurio (Hg), afectando la biodiversidad, los procesos ecológicos y los medios de vida rurales. En la Amazonía peruana, la MAPE libera anualmente unas 181 toneladas de Hg al medio ambiente. A pesar de algunos avances recientes en la comprensión de la distribución espacial del Hg dentro de los desechos de las minas de oro y el paisaje circundante, las dinámicas temporales en el movimiento del Hg no están bien entendidas. Nuestro objetivo fue revelar tendencias espacio-temporales del Hg en el suelo en áreas degradadas por la MAPE. Analizamos muestras de suelo y sedimento durante las estaciones seca y lluviosa en 14 ha de sitios potencialmente contaminados y bosques naturales, en las cercanías de la comunidad nativa de San Jacinto en Madre de Dios, Perú. Los niveles de Hg en el suelo de áreas impactadas por la MAPE ($0.02 \pm 0.02 \text{ mg kg}^{-1}$) estuvieron generalmente por debajo de los estándares de calidad ambiental del suelo (6.60 mg kg^{-1}). Sin embargo, mostraron una alta variabilidad, principalmente explicada por el tipo de cobertura vegetal natural, la materia orgánica del suelo (SOM), las partículas de arcilla y arena. Las tendencias temporales en los niveles de Hg en el suelo entre estaciones diferían entre las unidades paisajísticas distinguibles en los desechos de las minas. Durante la estación lluviosa, los niveles de Hg disminuyeron hasta un 45.5% en suelos sin cobertura, mientras que en sedimentos de estanques artificiales el Hg aumentó hasta un 961%. Durante la estación seca, los suelos degradados sin cobertura fueron más propensos a perder Hg que los sitios cubiertos por vegetación, principalmente debido a las temperaturas del suelo más altas y a la volatilización concomitante. Los suelos de los bosques naturales y los suelos degradados cubiertos por vegetación en regeneración mostraron una alta capacidad para retener el Hg principalmente debido a la mayor biomasa vegetal, la mayor SOM y las concentraciones crecientes de partículas de arcilla. Alarmantemente, nuestros hallazgos sugieren una alta movilidad de Hg desde los desechos de las minas de oro hacia los materiales sedimentarios cercanos, principalmente en estanques artificiales a través de la deposición aluvial y la lixiviación pluvial. Por lo tanto, se necesita más investigación sobre el monitoreo y la remediación de sedimentos en estanques artificiales para diseñar estrategias sostenibles de uso de la tierra.

Abstract

Artisanal and small-scale gold mining (ASGM) in the Amazon has degraded tropical forests and escalated mercury (Hg) pollution, affecting biodiversity, ecological processes and rural livelihoods. In the Peruvian Amazon, ASGM annually releases some 181 tons of Hg into the environment. Despite some recent advances in understanding the spatial distribution of Hg within gold mine spoils and the surrounding landscape, temporal dynamics in Hg movement are not well

understood. We aimed to reveal spatio-temporal trends of soil Hg in areas degraded by ASGM.,. We analyzed soil and sediment samples during the dry and rainy seasons across 14 ha of potentially contaminated sites and natural forests, in the vicinities of the Native community of San Jacinto in Madre de Dios, Peru. Soil Hg levels of areas impacted by ASGM ($0.02 \pm 0.02 \text{ mg kg}^{-1}$) were generally below soil environmental quality standards (6.60 mg kg^{-1}). However, they showed high variability, mainly explained by the type of natural cover vegetation, soil organic matter (SOM), clay and sand particles. Temporal trends in Hg levels in soils between seasons differed between landscape units distinguished in the mine spoils. During the rainy season, Hg levels decreased up to 45.5% in uncovered soils, while in artificial pond sediments Hg increased by up to 961%. During the dry season, uncovered degraded soils were more prone to lose Hg than sites covered by vegetation, mainly due to higher soil temperatures and concomitantly increasing volatilization. Soils from natural forests and degraded soil covered by regenerating vegetation showed a high capacity to retain Hg mainly due to the higher plant biomass, higher SOM, and increasing concentrations of clay particles. Disturbingly, our findings suggest high Hg mobility from gold mine spoil to close by sedimentary materials, mainly in artificial ponds through alluvial deposition and pluvial lixiviation. Thus, further research is needed on monitoring, and remediation of sediments in artificial to design sustainable land use strategies.

Enlaces: <https://doi.org/10.1016/j.envres.2023.118073>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/743>

The predictive model of hydrobiological diversity in the Asana-Tumilaca basin, Peru based on water physicochemical parameters and sediment metal content

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Organismo de Evaluación y Fiscalización Ambiental



Abstract

The hydrobiological diversity in the basin depends on biotic and abiotic factors. A predictive model of hydrobiological diversity for periphyton and macrobenthos was developed through multiple linear regression analysis (MLRA) based on the physicochemical parameters of water (PPW) and metal content in sediments (MCS) from eight monitoring stations in the Asana-Tumilaca Basin during the dry and wet seasons. The electrical conductivity presented values between 47.9 and 3617 $\mu\text{S}/\text{cm}$, showing the highest value in the Capillune River due to the influence of geothermal waters. According to Piper's diagram, the water in the basin had a composition of calcium sulfate and calcium bicarbonate-sulfate. According to the Wilcox diagram, the water was found to be between good and very good quality, except for in the Capillune River. The Shannon–Wiener diversity indices (H') were 2.62 and 2.88 for periphyton, and 2.10 and 2.44 for macrobenthos, indicating moderate diversity; for the Pielou's evenness index (J'), they were 0.68 and 0.70 for periphyton, and 0.68 and 0.59 for macrobenthos, indicating similar equity, in the dry and wet seasons, respectively, for both indices. In the model there were three cases, where the first two cases only worked with PPW or MCS, and case 3 worked with PPW and MCS. For case 3, the predicted values for H' and J' of periphyton and macrobenthos concerning those observed presented correlation coefficients of 0.7437 and 0.6523 for periphyton and 0.9321 and 0.8570 for macrobenthos, respectively, which were better than those of cases 1 and 2. In addition, principal component analysis revealed that the As, Pb, and Zn contents in the sediments negatively influenced the diversity, uniformity, and richness of the macrobenthos. In contrast, Cu and Cr had positive impacts because of the adaptation processes.

Enlace: <https://doi.org/10.1016/j.heliyon.2024.e27916>



2

**Conservación de las
especies y la
diversidad genética**

A new masked *Corydoras* (Siluriformes: Callichthyidae) from the Itaya and Nanay river basins, Peruvian Amazon

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Resumen

Una nueva especie de *Corydoras* se describe de las cuencas de los Ríos Itaya y Nanay, tributarios del Río Amazonas en Perú. La nueva especie se puede distinguir de sus congéneres por las siguientes características: (I) rama del canal sensorial temporal en el esfenótico, que da origen al canal supraorbital, con dos poros, (II) placa dental superior del arco branquial con tres series de dientes, (III) área en la esquina de la boca, ventral a la barbilla maxilar, con una pequeña porción de tejido carnoso triangular, que puede presentar variaciones con una pequeña prolongación en su extremo posterior, formando una estructura semejante a una barbilla corta, (IV) una mancha conspicua de color marrón oscuro o negro que cruza transversalmente la órbita, formando una mancha con aspecto de máscara, (V) ausencia de un patrón de color distintivo a lo largo de la línea media del flanco, (VI) placas dorsolaterales del cuerpo solo con pequeñas manchas oscuras de color marrón oscuro o negro, irregulares, redondeadas o alargadas verticalmente; el color base de las placas típicamente es amarillo claro o beige, (VII) ausencia de una mancha oscura relativamente grande y conspicua en la porción anterior de la aleta dorsal, y (VIII) porción osificada del hipobranquial 2 que va desde moderadamente desarrollada hasta bien desarrollada.

Abstract

A new species of *Corydoras* is described from the Itaya and Nanay river basins, tributaries of the Río Amazonas in Peru. The new species can be distinguished from its congeners by the following features: (I) branch of the temporal sensory canal at sphenotic, which gives rise to the supraorbital canal, with two pores, (II) upper tooth plate of branchial arch with three series of teeth, (III) area at the corner of the mouth, ventral to the maxillary barbel, with a small, triangular fleshy flap, which may variably present a small prolongation at its posterior tip, forming a short barbel-like structure, (IV) a conspicuous dark brown or black patch transversally crossing the orbit, forming a mask-like blotch, (V) absence of a distinct color pattern along midline of flank, (VI) dorsolateral body plates only with small, irregular, rounded or vertically elongated dark brown or black blotches; ground color of plates typically light yellow or beige, (VII) absence of a relatively large, conspicuous dark blotch on anterior portion of dorsal fin, and (VIII) ossified portion of hypobranchial 2 ranging from moderately developed to well developed.

Enlace: <https://doi.org/10.1590/1982-0224-2024-0016>

A new species of the *Scinax cruentomma* group (Anura: Hylidae) from the Ucayali River basin of Loreto, Peru

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Resumen

Se describe una nueva especie del grupo de especies *Scinax cruentomma*, con una franja roja en el iris y un saco vocal débilmente bilobulado. Se conoce de suelos oligotróficos en la cuenca sedimentaria del río Ucayali cerca de Jenaro Herrera (provincia de Requena, Perú) y del Río Blanco (zona de amortiguamiento del territorio y reserva indígena Matses). La nueva especie puede distinguirse de las demás especies del grupo *S. cruentomma* por su pequeño tamaño del hocico a la cloaca, patrones de color del cuerpo y el iris, saco vocal débilmente bilobulado, caracteres miológicos, y el número de notas y pulsos del canto de anuncio. Es morfológicamente más similar a *S. strussmannae*, de la cual se puede diferenciar por el canto de anuncio, las fosas nasales, el canto rostralis y la región loreal.

Abstract

We describe a new species of the *Scinax cruentomma* species group, with a red streak in the iris and a weakly bilobate vocal sac. It is known from oligotrophic soils in the sedimentary basin of the Ucayali River near Jenaro Herrera (province of Requena, Peru) and Río Blanco (buffer zone of the Matses Indigenous territory and reserve). The new species can be distinguished from the other species of the *S. cruentomma* group by its small snout-vent length, body and iris color patterns, weakly bilobate vocal sac, myological characters, and the number of notes and pulses of the advertisement call. It is morphologically most similar to *S. strussmannae*, from which the advertisement call, nostril, canthus rostralis, and loreal region can distinguish it.

Enlaces: <https://doi.org/10.11646/zootaxa.5406.3.1>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/754>

Actualización de la lista oficial de aves del Perú

Update of the official list of the birds of Peru

Mauricio Ugarte, Fernando Angulo, Roberto Gutiérrez

Servicio Nacional de Áreas Naturales Protegidas por el Estado



Abstract

Esta publicación científica no cuenta con resumen disponible.

Enlace:

<https://boletinunop.weebly.com/uploads/6/2/2/6/62265985/actualizacio%CC%81nlistaoficial-avesdelperu%CC%81.pdf>

An Annotated Checklist of Monogeneans (Platyhelminthes, Monogenea) from Aquatic Vertebrates in Peru: A Review of Diversity, Hosts and Geographical Distribution

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Abstract

Monogeneans are flatworm parasites that infest fish gills primarily but can also infect various other vertebrates, including amphibians, aquatic reptiles, mammals like hippos, and occasionally invertebrates like copepods, isopods, and cephalopods. Despite their remarkable diversity, our knowledge of monogenean parasites in Peru remains significantly limited, resulting in substantial gaps in our comprehension of their taxonomic identities, host associations, and geographic distribution. To address these knowledge deficits, we present an extensively curated checklist of monogeneans associated with aquatic vertebrates in Peru. This comprehensive compilation is derived from meticulous literature surveys, the examination of specimens deposited in both international and national collections, and the inclusion of additional freshly collected specimens. The checklist offers a thorough repository of data encompassing the diversity, host associations, and geographical distribution of these parasites. Taxonomic discrepancies are addressed through a critical review of the existing literature, supplemented by the direct examination of specimens, including type or voucher specimens, deposited within scientific collections. Additionally, we provide data on the DNA sequences of individual taxa. The compiled list comprises records of 358 monogenean species, including 270 valid species and 88 taxa identified at the family or generic level, all reported across 145 host species in Peru. Predominantly, these parasitic species exhibit associations within fish, with 335 infecting teleosts and 20 affecting chondrichthyans. Three monogenean species have been documented as infecting amphibians, namely *Mesopolystoma samiriensis*, *Polistoma* sp. and *Wetapolystoma almae*. Among the monogeneans reported, 141 were found in marine environments and 214 in freshwater environments. The most diverse families were Dactylogyridae and Diplectanidae, comprising 217 and 24 species, respectively. The hosts that harbored the highest number of monogeneans were *Pygocentrus nattereri* (with 23 species), followed by *Stellifer minor* (13 spp.) and *Triportheus angulatus* (11 spp.). We detected many species that do not have any material deposited in a scientific collection due to the loss or deactivation of the collection. These findings represent only a fraction of the potential diversity, considering the wide variety of aquatic vertebrate hosts inhabiting the tropical and subtropical regions of Peru.

Enlaces: <https://doi.org/10.3390/ani14111542>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/761>

Análisis nutricional y huella química de la harina de larva de mosca soldado negra (*Hermetia illucens*) nativa de la amazonía peruana

Nutritional analysis and chemical fingerprinting of black soldier fly (*Hermetia illucens*) larvae meal native to the Peruvian amazon

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Resumen

La búsqueda de nuevas fuentes de proteínas para la formulación de alimentos es cada vez mayor. Las larvas de la mosca soldado negra (*Hermetia illucens*) tienen altos niveles de proteína, buen contenido de grasa y son ricas en aminoácidos esenciales, lo que las convierte en una fuente alternativa de proteína dietética. En este trabajo se evaluó las propiedades nutricionales mediante la composición proximal, contenido de minerales, perfil de ácidos grasos, aminoácidos y la caracterización metabolómica de harina de larvas de mosca soldado negra nativa de la amazonia peruana criadas en tres sustratos de residuos orgánicos. Las tres harinas presentaron un alto contenido de proteínas (38,90-44,68%), lípidos (26,96-31,01%), así como un alto contenido de potasio, calcio y bajo contenido en sodio. Las harinas de larvas alimentadas con el bagazo de naranja presentaron los mejores contenidos de hierro y manganeso. El perfil de ácidos grasos mostró un alto contenido los ácidos palmítico, oleico y linoleico para las tres harinas. Los amino ácidos esenciales más abundantes en las tres harinas fueron leucina, lisina y valina. Un total de 48 compuestos fueron identificados en la harina de larva alimentada con bagazo de naranja, 24 compuestos en la harina de larva alimentada con avena y 44 compuestos en la harina de larva alimentada con pulpa de plátano maduro. Estos resultados nos indican que las harinas de larva de mosca soldado negra nativa de la Amazonía peruana son una buena fuente de proteínas, minerales, aminoácidos esenciales y ácidos grasos insaturados con alto valor nutricional.

Abstract

The search for new protein sources for food formulation is increasing. Black soldier fly (*Hermetia illucens*) larvae have high levels of protein, good fat content and are rich in essential amino acids, making them an alternative source of dietary protein. In this work, the nutritional properties and metabolomic characterization of black soldier fly larvae meal native to the Peruvian Amazon reared on three organic waste substrates were carried out. The three meals had a high protein content (38.90-44.68%), lipids (26.96-31.01%), as well as a high potassium, calcium and low sodium content. The larvae meal fed with orange bagasse presented the best content of iron and manganese. The fatty acid profile showed a high content of palmitic, oleic and linoleic acids for the three flours. The most abundant essential amino acids in the three meals were leucine, lysine and valine. A total of 48 compounds were identified in the larvae meal fed with orange bagasse, 24 compounds in the larvae meal fed with oats and 44 compounds in the larvae meal fed with ripe banana pulp. These results indicate that black soldier fly larvae meals native to the Peruvian Amazon are a good source of proteins, minerals, essential amino acids and unsaturated fatty acids with high nutritional value.

Enlace: <https://doi.org/10.24841/fa.v33i1.719>

Breeding records of 325 bird species from Peru over 21 years based on citizen science data

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Abstract

Breeding is a key component of the life history of birds. Documenting diverse aspects of their breeding biology provides valuable natural history data that can be used to address questions of evolutionary, ecological, or conservation significance. Despite its importance, this information is scarce for most Neo-tropical species. We compiled 1180 breeding records corresponding to 325 bird species for the period 2000–2021, through an in-depth review of photo or video records from Peru, sourced from Macaulay Library and iNaturalist platforms. We determined the geographical distribution of the breeding records, described patterns of activity and nesting behavior (i.e., host plant preference and clutch size), and explored the timing of breeding. Our study represents one of the few efforts to provide nationwide data on breeding birds in the Neo-tropical region. We also offer broad taxonomic coverage for further studies interested in testing hypotheses on the variation of reproductive traits and timing at both local and regional scales. The complete data set for this abstract published in the Data Article section of the journal is available in electronic format in MetaCat in JaLTER at

<http://db.cger.nies.go.jp/JaLTER/metacat/metacat/ERDP-2024-07.1/jalter-en>.

Enlace: <https://doi.org/10.1111/1440-1703.12496>

Comportamiento vegetativo de quina (*Cinchona pubescens* Vahl.) con la aplicación de cuatro bioestimulantes orgánicos en invernadero en Perú

Vegetative behavior of cinchona (*Cinchona pubescens* Vahl.) with the application of four organic bio-stimulants in a greenhouse in Peru

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Instituto de Investigaciones de la Amazonía Peruana

Resumen

La quina (*Cinchona pubescens*) es una especie de importancia medicinal a nivel mundial, debido a su contenido de quinina, alcaloide utilizado en el tratamiento de la malaria; por lo que optimizar un paquete de quina en manejo silvícola y en invernadero con bioestimulantes orgánicos, podría representar una alternativa promisorio para su reproducción masiva. El objetivo de esta investigación fue determinar el comportamiento vegetativo de quina (*Cinchona pubescens*) con la aplicación de cuatro bioestimulantes orgánicos en invernadero, donde se utilizó un diseño completamente al azar con Big-Hor, Incentive, Agrostemin®-GL, biol nutritivo y un control; con tres repeticiones y 16 plantas por unidad experimental. Para el experimento, las plántulas de 1 cm de tamaño fueron obtenidas posgerminación en microtúneles y trasplantadas a un sustrato combinado de tierra agrícola y arena en proporción 2:1 (v/v). La fertilización foliar fue fraccionada en tres partes, para aplicaciones a los 15, 75 y 90 días después del repicado. En el estudio se reportó que Agrostemin®-GL tuvo influencia positiva en el tamaño de la planta (11,11 cm), el diámetro de tallo (3,21 mm), la materia seca foliar (0,43 g) y el área foliar (54,16 cm²); mientras que el biol nutritivo solamente influyó en el tamaño radicular (19,44 cm) y la biomasa seca radicular (0,14 g). Se concluye que el Agrostemin®-GL y el biol nutritivo mostraron una mayor eficiencia en el crecimiento y la ganancia de biomasa total de plantas de *C. pubescens*, sugiriendo utilizarlos como alternativa ecológica y promisorio para obtener plantones de quina vigorosos en invernadero.

Abstract

Cinchona (*Cinchona pubescens*) is a species of medicinal importance worldwide, due to its content of quinine, an alkaloid used in the treatment of malaria. Optimizing a greenhouse silvicultural management package with organic biostimulants could represent a promising alternative for mass reproduction. The objective was to determine the vegetative behavior of cinchona (*Cinchona pubescens*) with the application of four organic biostimulants in a greenhouse. A completely randomized design was used with Big-Hor, Incentive, Agrostemin®-GL, Biol nutritivo, and a control; with three repetitions and 16 plants per experimental unit. The seeds were collected from seed stands in the Conila montane forest and germinated in sand inside a micro-tunnel. Then, the 1 cm-sized seedlings were transplanted into a combined substrate of agricultural soil and sand in a 2:1 (v/v) ratio. Foliar fertilization was divided into three parts, for applications at 15, 75 and 90 days after picking. In the study, it was reported that Agrostemin®-GL had a positive influence on plant size (11.11 cm), stem diameter (3.21 mm), leaf dry matter (0.43 g), and leaf area (54.16 cm²). While Biol nutritivo only influenced root size (19.44 cm) and root dry biomass (0.14 g), both significantly exceeded the other treatments. It is concluded that Agrostemin®-GL and/or Biol nutritivo showed greater efficiency in the growth and gain of total

biomass of *C. pubescens* plants, suggesting its use as an ecological and promising alternative to obtain vigorous cinchona seedlings in the greenhouse.

Enlace: https://doi.org/10.21930/rcta.vol25_num2_art:3493

Consistent patterns of common species across tropical tree communities

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Abstract

Trees structure the Earth's most biodiverse ecosystem, tropical forests. The vast number of tree species presents a formidable challenge to understanding these forests, including their response to environmental change, as very little is known about most tropical tree species. A focus on the common species may circumvent this challenge. Here we investigate abundance patterns of common tree species using inventory data on 1,003,805 trees with trunk diameters of at least 10 cm across 1,568 locations in closed-canopy, structurally intact old-growth tropical forests in Africa, Amazonia and Southeast Asia. We estimate that 2.2%, 2.2% and 2.3% of species comprise 50% of the tropical trees in these regions, respectively. Extrapolating across all closed-canopy tropical forests, we estimate that just 1,053 species comprise half of Earth's 800 billion tropical trees with trunk diameters of at least 10 cm. Despite differing biogeographic, climatic and anthropogenic histories, we find notably consistent patterns of common species and species abundance distributions across the continents. This suggests that fundamental mechanisms of tree community assembly may apply to all tropical forests. Resampling analyses show that the most common species are likely to belong to a manageable list of known species, enabling targeted efforts to understand their ecology. Although they do not detract from the importance of rare species, our results open new opportunities to understand the world's most diverse forests, including modelling their response to environmental change, by focusing on the common species that constitute the majority of their trees.

Enlaces: <https://doi.org/10.1038/s41586-023-06820-z>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/745>

Contribución al conocimiento de los insectos inductores de agallas en el bosque Amazónico

Contribution to the knowledge of gall-inducing insects in the Amazon forest

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Resumen

Se conoce poco sobre los insectos agalladores en el bosque amazónico, a pesar de su fama como un ecosistema altamente biodiverso. En un esfuerzo por llenar esta brecha de conocimiento, compilamos datos de estudios existentes sobre insectos inductores de agallas y sus plantas hospederas en el bioma amazónico. Se evaluaron un total de 32 estudios que se enfocaban en agallas de insectos y sus plantas hospederas en la Amazonia. Taxonomía, inventario y ecología surgieron como las áreas de investigación más prominentemente representadas. Encontramos 31 especies de Cecidomyiidae, de siete tribus y 21 géneros, reportadas en el bosque amazónico. La riqueza de los insectos inductores de agallas exhibió una correlación positiva con el tamaño de sus familias de plantas asociadas, mientras que no mostró una correlación significativa con la edad de esas familias.

Abstract

Little is known about galling insects in the Amazonian rainforest, despite its renown as a highly biodiverse ecosystem. In an effort to fill this knowledge gap, we compiled data from existing studies of gall-inducing insects and their host plants in the Amazon biome. A total of 32 studies focusing on insect galls and their host plants in the Amazon were assessed. Taxonomy, inventory, and ecology emerged as the most prominently represented areas of investigation. We found 31 species of Cecidomyiidae, from seven tribes and 21 genera, reported in the Amazon Forest. The richness of gall-inducing insects exhibited a positive correlation with the size of their associated plant families, while showing no significant correlation with the age of those families.

Enlace: <https://doi.org/10.24841/fa.v33i1.734>

Correlaciones, parámetros genéticos y fenotípicos en rasgos cuantitativos y cualitativos de *Swietenia macrophylla* en Ucayali, Perú

Correlations, genetic and phenotypic parameters in quantitative and qualitative traits of *Swietenia macrophylla* in Ucayali, Peru

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Resumen

La velocidad de crecimiento en altura de *Swietenia macrophylla* destaca en términos de resistencia al ataque del barrenador *Hypsipyla grandella* y la selección de familias de rápido crecimiento puede viabilizar las plantaciones comerciales. Los caracteres altura, diámetro, número de hojas y forma del tronco de árboles de 4 familias de *S. macrophylla*, de 47,5 meses de edad, plantados en Ucayali, Perú, se utilizaron para investigar la posibilidad de seleccionar genotipos de rápido crecimiento. La heredabilidad promedio (h^2m) y la precisión selectiva (Acprog) entre familias fueron moderadas para la altura total (Ht: h^2m : 0,407; Acprog: 0,638) y la altura comercial (Hc: h^2m : 0.472; Acprog: 0.687), además de que Hc correlacionó positivamente con la susceptibilidad a el ataque del taladro. La forma del fuste mostró diferencias importantes entre las familias y alta h^2m (0,984) y Acprog (0,921). Las correlaciones genéticas (r_g) y fenotípicas (r_f) entre rasgos mostraron que una selección de individuos con mayores alturas generalmente resultará en un mayor crecimiento en diámetro, número de hojas y mejor forma del tallo. El estudio destaca la importancia de seleccionar familias con rápido crecimiento en altura y tallos rectos para posibilitar, mejorar la calidad y aumentar la productividad de las plantaciones comerciales con la especie.

Abstract

The speed of growth in height of *Swietenia macrophylla* stands out in terms of resistance to attack by the *Hypsipyla grandella* borer and the selection of fast-growing families can make commercial plantings viable. The characters height, diameter, number of leaves and stem form of trees from 4 families of *S. macrophylla*, aged 47.5 months, planted in Ucayali, Peru, were used to investigate the possibility of selecting fast-growing genotypes. The average heritability (h^2m) and selective accuracy (Acprog) between families were moderate for total height (Ht: h^2m : 0.407; Acprog: 0.638) and commercial height (Hc: h^2m : 0.472; Acprog: 0.687), in addition to Hc positively correlating with susceptibility to the drill attack. The stem form showed statistical differences between families and great h^2m (0.984) and Acprog (0.921). The genetic (r_g) and phenotypic (r_f) correlations between traits showed that a selection of individuals with greater heights will generally result in greater growth in diameter, number of leaves and better stem form. The study highlights the importance of selecting families with fast growth in height and straight stems to enable, improve the quality and increase the productivity of commercial plantations with the species.

Enlace: <https://doi.org/10.17268/sci.agropecu.2024.030>

Crecimiento vegetativo de *Cinchona officinalis* L. inoculado con hongos micorrízicos arbusculares nativos y abonado orgánico

Vegetative behavior of *Cinchona officinalis* L. inoculated with native arbuscular mycorrhizal fungi and organic fertilizer

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Resumen

La investigación tuvo por objetivo evaluar el efecto de hongos micorrízicos arbusculares (HMA) autóctonos y abonos orgánicos en el comportamiento vegetativo de la quina (*C. officinalis*) en invernadero. Se utilizó un diseño con arreglo factorial 4A x 3B (A: hongo micorrízico; B: abonos orgánicos), lo que resultó en un total de 12 tratamientos. Los HMA fueron colectados en los distritos Leymebamba, San Jerónimo y Conila, en la región Amazonas y fueron multiplicados en vivero con cultivos trampa de maíz durante 80 días. Simultáneamente, se llevó a cabo la germinación de semillas de quina por un periodo de 60 días. Las plántulas fueron trasplantadas e inoculadas con 40 g de HMA y 40 g de abono orgánico en contenedores de 1 L. El consorcio LEY-GALL produjo la mayor respuesta por planta en la altura (11,53 cm) y materia seca radicular (79,93 mg), el LEY-HUM mayor en número (45) y longitud de raíces (18,68 cm), y en materia seca radicular (75,83 mg), el SJ-HUM mayor en materia seca foliar (317,8 g), y el SJ-GALL mayor en área foliar (85,83 cm²), todos con superioridad estadística sobre el resto, o la mayoría de consorcios. Las plantas con el consorcio SMA-SA (sin micorriza y sin abono) presentaron los menores valores en todas las variables. Se concluye que la combinación de HMA con abonos orgánicos favorece el crecimiento vegetativo de la quina en invernadero.

Abstract

The objective of the research was to evaluate the effect of native arbuscular mycorrhizal fungi (AMF) and organic fertilizers on the vegetative growth of cinchona (*C. officinalis*) under greenhouse conditions. The study was carried out using a 4A x 3B factorial arrangement (A: mycorrhizal fungus; B: organic fertilizers), which resulted in 12 treatments. The AMF were collected in Leymebamba, San Jerónimo and Conila districts, in the Amazon region, and were multiplied in the nursery in corn trap crops for 80 days. At the same time, the germination of cinchona seeds was carried out for a period of 60 days. The seedlings were transplanted and inoculated with 40 g of AMF and 40 g of organic fertilizer in 1 L containers. The LEY-GALL consortium produced the highest response per plant in height (11.53 cm) and root dry matter (79.93 mg), the LEY-HUM highest in the number (45) and length of roots (18.68 cm), and in root dry matter (75.83 mg), the SJ-HUM highest in foliar dry matter (317.8 g), and the SJ-GALL highest in leaf area (85.83 cm²), all with statistical superiority over the rest, or the majority of consortia. The plants with the SMA-SA consortium (without mycorrhiza and without fertilizer) showed the lowest values in all the variables. It is concluded that the combination of native AMF with organic fertilizers favors the vegetative growth of cinchona in greenhouse conditions.

Enlaces: <https://doi.org/10.51372/bioagro362.6>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/763>

Description of two new species of dactylogirids (Monogeneoidea: Dactylogyridae) from *Mylossoma albiscopum* (Cope, 1872) (Characiformes: Serrasalminidae) from the Peruvian Amazonia

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Abstract

Introduction: Two new dactylogyrid monogeneans, *Anacanthorus cultro* n. sp. and *Notozothecium palometae* n. sp., are described based on specimens collected from the gill filaments of *Mylossoma albiscopum* (Cope, 1872) (Characiformes: Serrasalminidae), a pelagic and herbivore teleost collected in the Tigre river, Loreto, Peru.

Materials and methods: Some monogeneans were stained with Gomori's trichrome and mounted in Canada Balsam to determine internal soft structures. Others were cleared in Hoyer's medium for the study of sclerotized structures. Drawings were made using a drawing tube and a microprojector.

Results: *Anacanthorus cultro* n. sp. is characterized by the presence of a rod-shaped male copulatory organ (MCO) lacking featherlike structures, and a knife-shaped accessory piece with a submedial knob. *Notozothecium palometae* n. sp. can be distinguished from all congeners by its MCO with a subbasal spur and an accessory piece with inverted hammer shaped.

Conclusions: This is the first data on the parasites of *M. albiscopum*, a popular fish in local markets. *Anacanthorus cultro* n. sp. is the twenty-fifth documented species of the genus in Peru, while *N. palometae* n. sp. represents the seventh species of the genus known to infect freshwater fish species in Peru.

Enlace: <https://doi.org/10.1007/s11686-024-00795-1>

Diversidad de plantas usadas por el pueblo Urarina en el departamento de Loreto, Perú

Diversity of plants used by the Urarina people in the Loreto department, Peru

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Resumen

Las numerosas publicaciones científicas relacionadas con el uso de plantas por el pueblo urarina evidencian un conocimiento arraigado y valioso. Sin embargo, carece de una revisión integral que abarque este vasto conocimiento botánico. En ese sentido, nuestro objetivo fue conocer la diversidad de plantas usadas por los urarinas en el departamento de Loreto (Perú). Para ello, realizamos una revisión bibliográfica minuciosa de publicaciones científicas, donde encontramos 17 publicaciones con datos de uso de plantas relacionados con el pueblo urarina. Registramos 196 especies de plantas con flores incluidas en 56 familias. Las palmeras (Arecaceae) destacan como la familia con mayor variedad de usos, siendo diez las especies representativas: *Iriartea deltoidea*, *Bactris gasipaes*, *Mauritia flexuosa*, *Oenocarpus bataua*, *Euterpe precatoria*, *Socratea exorrhiza*, *Oenocarpus mapora*, *Attalea phalerata*, *Elaeis oleifera* y *Phytelephas tenuicaulis*. Este hallazgo resalta la importancia cultural de las palmeras en las prácticas tradicionales urarinas; además, proporciona una base sólida para futuras investigaciones etnobotánicas y estrategias de conservación.

Abstract

The numerous scientific publications related to the use of plants by the Urarina people demonstrate a deep-seated and valuable knowledge. However, it lacks a comprehensive review that encompasses this vast botanical knowledge. In this regard, our goal was to understand the diversity of plants used by the Urarinas in the Loreto region (Peru). To achieve this, we conducted a thorough literature review of scientific publications, where we found 17 publications with data on plant use related to the Urarina people. We recorded 196 species of flowering plants included in 56 families. The palm family (Arecaceae) stands out as the family with the greatest variety of uses, with its ten representative species: *Iriartea deltoidea*, *Bactris gasipaes*, *Mauritia flexuosa*, *Oenocarpus bataua*, *Euterpe precatoria*, *Socratea exorrhiza*, *Oenocarpus mapora*, *Attalea phalerata*, *Elaeis oleifera* and *Phytelephas tenuicaulis*. This finding highlights the cultural importance of palms in traditional Urarina practices; moreover, it provides a solid foundation for future ethnobotanical research and conservation strategies.

Enlace: <https://doi.org/10.24841/fa.v33i2.740>

Diversity in Lepidoptera: a case of cryptic species, with description of a new genus and thirteen new species of Apatelodidae (Lepidoptera, Bombycoidea)

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Servicio Nacional de Áreas Naturales Protegidas por el Estado



Abstract

Crastolliana n. gen. (Apatelodidae) is described as new, with *Crastolliana nina* (Stoll, [1780]) **n. comb.** as its type species. Investigation of specimens from various geographical localities revealed numerous cryptic species resulting in the recognition of the following new species: *C. belyiorum* **n. sp.**, *C. bonillai* **n. sp.**, *C. caucensis* **n. sp.**, *C. giulianae* **n. sp.**, *C. gortovannyi* **n. sp.**, *C. inca* **n. sp.**, *C. johannes* **n. sp.**, *C. kozlovi* **n. sp.**, *C. krutoae* **n. sp.**, *C. landryi* **n. sp.**, *C. otispa* **n. sp.**, *C. steigeri* **n. sp.** and *C. xirma* **n. sp.** The following species are transferred from *Apatelodes* Packard, 1864: *C. ardeola* (Druce, 1887) **n. comb.**, *C. damora* (Schaus, 1939) **n. comb.**, *C. moresca* (Schaus, 1905) **n. comb.**, *C. patagai* (Herbin, 2015) **n. comb.** and *C. rodrougi* (Herbin, 2022) **n. comb.** *Apatelodes vitrea* Schaus, 1910, currently treated as a subspecies of *C. ardeola* **n. comb.** and based on a male, is determined to be a junior synonym of *C. ardeola* **n. comb.**, which was based on a female. *Olceclostera mediana* Schaus, 1900, currently treated as *Apatelodes ardeola mediana* (Schaus, 1900), is re-established as a species and transferred to the new genus as *Crastolliana mediana* (Schaus, 1900) **n. comb., stat. rev.**

Enlace:

https://www.researchgate.net/publication/382441867_Diversity_in_Lepidoptera_a_case_of_cryptic_species_with_description_of_a_new_genus_and_thirteen_new_species_of_Apatelodidae_Lepidoptera_Bombycoidea

Dominance and rarity in tree communities across the globe: Patterns, predictors and threats

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Abstract

Aim: Ecological and anthropogenic factors shift the abundances of dominant and rare tree species within local forest communities, thus affecting species composition and ecosystem functioning. To inform forest and conservation management it is important to understand the drivers of dominance and rarity in local tree communities. We answer the following research questions: (1) What are the patterns of dominance and rarity in tree communities? (2) Which ecological and anthropogenic factors predict these patterns? And (3) what is the extinction risk of locally dominant and rare tree species?

Location: Global.

Time period: 1990–2017.

Major taxa studied: Trees.

Methods: We used 1.2 million forest plots and quantified local tree dominance as the relative plot basal area of the single most dominant species and local rarity as the percentage of species that contribute together to the least 10% of plot basal area. We mapped global community dominance and rarity using machine learning models and evaluated the ecological and anthropogenic predictors with linear models. Extinction risk, for example threatened status, of geographically widespread dominant and rare species was evaluated.

Results: Community dominance and rarity show contrasting latitudinal trends, with boreal forests having high levels of dominance and tropical forests having high levels of rarity. Increasing annual precipitation reduces community dominance, probably because precipitation is related to an increase in tree density and richness. Additionally, stand age is positively related to community dominance, due to stem diameter increase of the most dominant species. Surprisingly, we find that locally dominant and rare species, which are geographically widespread in our data, have an equally high rate of elevated extinction due to declining populations through large-scale land degradation.

Main conclusions: By linking patterns and predictors of community dominance and rarity to extinction risk, our results suggest that also widespread species should be considered in large-scale management and conservation practices.

Enlace: <https://doi.org/10.1111/geb.13889>

Effect of arbuscular mycorrhizae on the growth of *Cinchona officinalis* L. (rubiceae) in nursery

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Abstract

Cinchona officinalis, commonly called cascarilla or quina, has medicinal value; and is on Peru's national coat of arms representing its plant wealth (flora), however, it is threatened by anthropogenic activities. This study aimed to determine the effect of the commercial product Myco Grow® on the growth of *C. officinalis* in nursery. A randomized design was used with two treatments, one with Myco Grow® application (WM) and the other without incorporating this commercial product (NM). Each treatment had three replicates consisting of 30 plants each. Monthly evaluations were performed, during which the number of dead plants, plant height, and plant diameter were recorded. Additionally, at the end of the study, the anhydrous weight of leaves, stems, and roots; leaf area; mycorrhizal frequency; mycorrhizal colonization index; and the length of extra-radicular mycelia were determined. The WM treatment achieved 36.6% lower mortality, 38.01% greater height, and 48.52% greater diameter than the NM treatment. Additionally, inoculation with arbuscular mycorrhizae (AM) improved the anhydrous weights of the leaves, stems, roots, and leaf area by 84.31%, 84.28%, 70.85%, and 76.91%, respectively. Regarding the three fungal variables analyzed for the WM treatment; mycorrhizal frequency was 87%, AM application led to a mycorrhizal intensity of 7.7% and an extra-radicular mycelium length of 90.3 cm. This study confirmed that AM positively influences the growth of *C. officinalis* in the nursery and can be used to sustainably produce this species on a large scale.

Enlace: <https://doi.org/10.1080/21580103.2024.2350497>

Extracts of *Azadirachta indica*, *Tagetes erecta* and *Jatropha curcas* resin control the attack of *Carmenta foraseminis* on *Theobroma cacao* fruits

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Abstract

The aim of this work was to determine the effect of *Azadirachta indica* and *Tagetes erecta* leaf extract, as well as *Jatropha curcas* resin extract on the control of *Carmenta foraseminis* larvae in *Theobroma cacao* fruits. The study was conducted using a complete random block design (CRBD) with 6 treatments (T1:0%, T2:10%, T3:20%, T4:30%, T5:40% and T6:50%), 3 replicates and 10 fruits per experimental unit. The variables evaluated were: number of hatched larvae-NHL and number of attacked fruits. Extracts from, *Azadirachta indica*, *Tagetes erecta* leaves and *Jatropha curcas* resin at concentrations greater than 40% were efficient in the control of *Carmenta foraseminis* in *Theobroma cacao* fruits in the fruiting phase. Further studies should be carry out to determine the concentration of secondary metabolites in *Azadirachta indica*, *Tagetes erecta* leaves and *Jatropha curcas* resin at different maturation stages for a more efficient use in the control of the insect pest.

Enlace: <https://doi.org/10.1590/0100-29452024100>

Fishers' ecological knowledge points to fishing-induced changes in the Peruvian Amazon

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Resumen

Los científicos recurren cada vez más al conocimiento ecológico de los pescadores para comprender mejor la biología y la ecología de los peces y para brindar información sobre las opciones para la gestión de la pesca. Presentamos un estudio sobre el conocimiento ecológico de los pescadores a lo largo del río Ucayali en Perú, una región de productividad y diversidad excepcionales, que también es un importante proveedor de pescado para la ciudad más grande de la Amazonía peruana. Dada la falta de información científica disponible sobre el estado de las poblaciones, buscamos identificar cambios temporales en la composición y el tamaño de las especies explotadas entrevistando a pescadores de 18 comunidades que varían en años de experiencia pesquera desde mediados de la década de 1950. Desarrollamos cuatro indicadores basados en FEK para evaluar los cambios en el conjunto de peces y comparar los hallazgos con los datos de desembarques. Encontramos una intensificación de las artes de pesca utilizadas a lo largo del tiempo y cambios espacio-temporales en el conjunto de peces y disminuciones reportadas en el peso de las especies, que apuntan a un proceso de disminución de la pesca con disminuciones en múltiples especies. Este hallazgo se refleja en una línea de base cambiante entre nuestros participantes, según la cual las generaciones más jóvenes de pescadores tienen diferentes expectativas con respecto a la distribución y el tamaño de las especies. Nuestro estudio señala la importancia de los efectos indirectos de la cercana Reserva Nacional Pacaya-Samira y las iniciativas comunitarias para apoyar la pesca regional. La referencia al conocimiento de los pescadores también sugiere que es probable que la disminución de las especies no se registre en los datos agregados de desembarques. A pesar del dinamismo y la diversidad de las pesquerías de las llanuras aluviales amazónicas, los indicadores simples basados en FEK pueden proporcionar información útil para comprender los cambios inducidos por la pesca en el conjunto de peces. Los pescadores poseen un conocimiento valioso para las iniciativas de gestión y conservación de la pesca en la región.

Abstract

Scientists increasingly draw on fishers' ecological knowledge (FEK) to gain a better understanding of fish biology and ecology, and inform options for fisheries management. We report on a study of FEK among fishers along the Lower Ucayali River in Peru, a region of exceptional productivity and diversity, which is also a major supplier of fish to the largest city in the Peruvian Amazon. Given a lack of available scientific information on stock status, we sought to identify temporal changes in the composition and size of exploited species by interviewing fishers from 18 communities who vary in years of fishing experience since the mid-1950s. We develop four FEK-based indicators to assess changes in the fish assemblage and compare findings with landings data. We find an intensification of fishing gear deployed over time and spatiotemporal shifts in the fish assemblage and reported declines in species weight, which point to a fishing-down process with declines across multiple species. This finding is reflected in a shifting baseline among our participants, whereby younger generations of fishers have different expectations regarding the distribution and size of species. Our study points to the importance of spillover effects from the nearby Pacaya-Samira National Reserve and community initiatives to support the regional fishery. Reference to

fishers' knowledge also suggests that species decline is likely underreported in aggregated landings data. Despite the dynamism and diversity of Amazonian flood plain fisheries, simple FEK-based indicators can provide useful information for understanding fishing-induced changes in the fish assemblage. Fishers hold valuable knowledge for fishery management and conservation initiatives in the region.

Enlaces: <https://doi.org/10.1002/eap.2964>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/772>

Fresh vs. Preserved Specimens: Length-Weight Relationships of Fishes from the Western Amazon (Napo Basin, Ecuador)

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Abstract

Length-weight relationship (LWR) studies are important for fish taxonomical analysis, ecological assessments, management, and conservation practices. Although LWR studies can use measurements of either fresh or preserved specimens, few studies have directly compared these methods. This study analyzed the effect of preservation on LWR of ten small-sized freshwater fish species from the Curaray River basin (Napo Basin), eastern Ecuador. 255 wild specimens were measured, weighed, fixed in formalin, and finally preserved in 70% ethanol. 287 specimens from the same species batch were measured again after preservation. We estimated LWR curves with linear regressions and compared slopes and intercepts between fresh and preserved specimens. The preservation process altered weight significantly for all ten species and altered both weight and length for two species. The magnitude of change varied according to the morphology and maximum size of each species. Smaller individuals exhibited greater proportional weight losses. LWR estimates for eight of the species are new to science. These results present new evidence of the preservation effects in LWR studies as well as a compilation of the varying results reported in the literature. We conclude that measurements on fresh specimens should be encouraged for LWR studies. However, recognizing that this is not always feasible, studies using preserved specimens should consider the effects of preservation on body length and weight.

Enlace: <https://doi.org/10.1155/2024/2430326>

Geography and ecology shape the phylogenetic composition of Amazonian tree communities

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Abstract

Aim: Amazonia hosts more tree species from numerous evolutionary lineages, both young and ancient, than any other biogeographic region. Previous studies have shown that tree lineages colonized multiple edaphic environments and dispersed widely across Amazonia, leading to a hypothesis, which we test, that lineages should not be strongly associated with either geographic regions or edaphic forest types.

Location: Amazonia.

Taxon: Angiosperms (Magnoliids; Monocots; Eudicots).

Methods: Data for the abundance of 5082 tree species in 1989 plots were combined with a mega-phylogeny. We applied evolutionary ordination to assess how phylogenetic composition varies across Amazonia. We used variation partitioning and Moran's eigenvector maps (MEM) to test and quantify the separate and joint contributions of spatial and environmental variables to explain the phylogenetic composition of plots. We tested the indicator value of lineages for geographic regions and edaphic forest types and mapped associations onto the phylogeny.

Results: In the terra firme and várzea forest types, the phylogenetic composition varies by geographic region, but the igapó and white-sand forest types retain a unique evolutionary signature regardless of region. Overall, we find that soil chemistry, climate and topography explain 24% of the variation in phylogenetic composition, with 79% of that variation being spatially structured ($R^2 = 19\%$ overall for combined spatial/environmental effects). The phylogenetic composition also shows substantial spatial patterns not related to the environmental variables we quantified ($R^2 = 28\%$). A greater number of lineages were significant indicators of geographic regions than forest types.

Main Conclusion: Numerous tree lineages, including some ancient ones (>66 Ma), show strong associations with geographic regions and edaphic forest types of Amazonia. This shows that specialization in specific edaphic environments has played a long-standing role in the evolutionary assembly of Amazonian forests. Furthermore, many lineages, even those that have dispersed across Amazonia, dominate within a specific region, likely because of phylogenetically conserved niches for environmental conditions that are prevalent within regions.

Enlace: <https://doi.org/10.1111/jbi.14816>

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>

Histopathological lesions in *Corydoras* spp. (Siluriformes: Callichthyidae) caused by *Procamallanus* (*Spirocamallanus*) *pinto* (Nematoda: Camallanidae) from Iquitos, Peru

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Abstract

Callichthyidae is a family of armored catfishes commercially important in the Peruvian Amazon. Among these species, *Corydoras acutus*, *C. reticulatus*, and *C. virginiae* are stored for weeks or months and then exported to different countries worldwide, where they may present some sanitary problems along the way, such as parasitic infections. In the present study, it was reported the level of infection of *Procamallanus* (*Spirocamallanus*) *pinto* (Kohn and Fernandes, 1988), through the calculation of their parasitological indices and the description of their histopathological lesions in the intestinal tract. Sixty individuals of each species were acquired from fishermen of the District of Belén, in Iquitos, Peru. Fish were transported to the “Laboratorio de Parasitología y Sanidad Acuicola” from the “Instituto de Investigaciones de la Amazonía Peruana” (IIAP), in Iquitos-Peru. Parasitological examination allowed us to identify the nematode *P. pinto* infecting the intestinal tract of the fish. Histopathological analysis revealed: inflammatory cell infiltration (73.3%, 63.3%, and 60%), enterocyte hyperplasia (90%, 70%, and 63.3%), desquamation of epithelial cells (90%, 70%, and 63.3%), goblet cell hyperplasia (76.7%, 66.7%, and 50%) and necrosis (70%, 60%, and 66.7%), in *C. acutus*, *C. reticulatus*, and *C. virginiae* respectively for each lesion.

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Hongos formadores de micorrizas arbusculares y bacterias promotoras de crecimiento vegetal en uchuva (*Physalis peruviana* L.)

Arbuscular mycorrhizal-forming fungi and plant growth-promoting bacteria in cape gooseberry (*Physalis peruviana* L.)

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Resumen

El cultivo de la uchuva (*Physalis peruviana* L.) tiene una gran importancia en Colombia debido a la producción y exportación de frutos. Una de las principales limitantes en la productividad del cultivo está asociada a la susceptibilidad a la marchitez vascular causada por *Fusarium oxysporum* f. sp. *physali* (Foph). El objetivo de este estudio fue evaluar el uso de Hongos Formadores de Micorrizas Arbusculares (HFMA) de forma individual y en mezcla con un bioproducto basado en una Bacteria Promotora del Crecimiento Vegetal (BPCV), como estrategia para mitigar la enfermedad y a su vez mejorar la productividad. En un ensayo de validación en parcelas demostrativas con 9 tratamientos que corresponden a tres materiales (Agricultor, Comercial y Dorada) y tres inoculaciones (1. HFMA: *Rhizoglyphus irregularis* y *Acaulospora mellea*, 2. HFMA + BPCV: Natibac® - *Bacillus subtilis* y 3. Control: Sin inoculación), se realizaron evaluaciones de producción de frutos, incidencia y severidad de la marchitez vascular en parcelas de cultivo de uchuva en el municipio de Ubaté, Cundinamarca. Los resultados permitieron correlacionar las variables de producción del cultivo y la severidad de la enfermedad, obteniendo resultados promisorios con correlaciones positivas entre el uso de HFMA + BPCV en la producción y calidad del fruto (% exportación) y correlaciones negativas entre la severidad de la enfermedad y la inoculación con HFMA, lo que refleja el potencial de estos microorganismos para incrementar la tolerancia de las plantas de uchuva al ataque por *Fusarium oxysporum* sin afectar el rendimiento de cultivo.

Abstract

The cape gooseberry crop (*Physalis peruviana* L.) is significant in Colombia due to the production and export of fruit. One of the main limitations in crop productivity is associated with susceptibility to vascular wilt caused by *Fusarium oxysporum* f. sp. *physali* (Foph). This study aimed to evaluate using Arbuscular Mycorrhiza Forming Fungi (AMF) individually and in a mixture with a bioproduct based on Plant Growth-Promoting Bacteria (PGPB) to mitigate the disease and improve crop productivity. In a validation trial in demonstration plots with nine treatments corresponding to three materials (Agricultor, Comercial, and Dorada) and three inoculations (1. HFMA: *Rhizoglyphus irregularis* and *Acaulospora mellea*, 2. HFMA + PGPB: Natibac® - *Bacillus subtilis* and 3. Control: No inoculation), evaluations of fruit production, incidence and severity of vascular wilt were carried out in plots of cape gooseberry crop in the municipality of Ubaté, Cundinamarca. The results allowed correlating crop production variables and disease severity, obtaining promising results with positive correlations between the use of HFMA + BPCV on fruit production and quality (% export) and negative correlations between disease severity and inoculation with HFMA, which reflects the potential of these microorganisms to increase the tolerance of cape gooseberry plants to attack by *Fusarium oxysporum* without affecting yield.

Enlace: <https://doi.org/10.5377/rci.v33i2.17726>

Impact of vereda dryness on the insect herbivore diversity in adjacent cerrado areas in Brazilian Protected Areas

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Abstract

Unravelling the factors that influence plant-insect interactions remains a fundamental concern in terrestrial ecology. In the present study, we evaluated the impact of varying degrees of drying on cerrado areas adjacent to veredas on the species richness, abundance and composition of the insect herbivore fauna. Additionally, we examined differences in these impacts between various guilds (chewing and sucker insects) and developmental stages (adult and immature insects). The research has been performed in study areas located in three Protected Areas in Brazil. In total, we recorded 106 species of herbivorous insects across five orders (Coleoptera, Hemiptera, Hymenoptera, Lepidoptera, and Orthoptera). Hemiptera and Coleoptera stood out as the orders with the highest species diversity and individual numbers. Among the families, Cicadellidae and Curculionidae exhibited the highest richness in species and abundance of individuals. We found that richness of herbivorous insects was higher in wet zones (20.2 ± 6.5) of the veredas compared to dry zones (12.3 ± 7.5), as well as the abundance of herbivorous insects was higher in wet zones (49.4 ± 25.5) than in the dry zones (15.8 ± 7.9). Within insect guilds, the abundance of chewing insects was higher in wet zones (34.0 ± 13.6) than in dry zones (16.3 ± 14.8), but this difference was not observed for the diversity of sucking insects. Regarding developmental stage, immature insects exhibited higher species richness in wet zones (10.4 ± 5.0) compared to dry zones (5.3 ± 2.1), while adult insect diversity did not show differences between the studied zones. Furthermore, the species composition of herbivorous insects, various trophic guilds (chewers and suckers) and developmental stages (adults and immature insect) did not significantly differ among the zones studied within the veredas. According to our findings, herbivorous insects exhibit a preference for wet environments, which provide better conditions and higher-quality food resources for development and reproduction.

Enlace: <https://dx.doi.org/10.24189/ncr.2024.016>

Influencia de factores ambientales en la composición de macrofitas acuáticas en lagos (cochas) de la Amazonía sur del Perú

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Resumen

La riqueza y composición de macrofitas acuáticas está influenciada por la morfometría y las condiciones físicas y químicas del cuerpo acuático. Sin embargo, el efecto de estos factores en las comunidades vegetales no ha sido corroborado para los lagos con forma de herradura o comúnmente llamados como “cochas” de la Amazonía peruana. En el presente estudio se evaluó 10 cochas desconectadas del curso principal del río en la Amazonia Sur del Perú para conocer 1) la riqueza de macrofitas acuáticas, 2) su forma de vida y 3) la influencia del área y la profundidad del cuerpo acuático, la transparencia, pH, oxígeno disuelto, sólidos totales disueltos y la temperatura del agua en la riqueza y en los cambios de la composición de especies. Se reportó 68 taxones, donde Cyperaceae y Poaceae fueron las familias más diversas. Además, las formas de vida predominantes fueron las emergentes (47,1 %) y anfibias (36,8 %). Finalmente, se encontró que cochas con mayor área, pH y oxígeno disuelto, a la vez, con menor temperatura, abrigan una mayor riqueza de especies y favorecen el establecimiento de especies estrictamente acuáticas, indicando que existe un recambio de especies a lo largo de la gradiente conformada por la asociación de estas variables. Estos resultados demuestran que la Amazonía sur del Perú posee una importante riqueza de macrofitas acuáticas que está asociada al área, pH, oxígeno disuelto y temperatura del cuerpo acuático.

Abstract

Species richness and composition of aquatic macrophytes are influenced by morphometry and physical and chemical conditions of the aquatic body. However, the influence of these variables has not been confirmed for oxbow lakes or commonly called “cochas” in the Peruvian Amazon. 10 cochas disconnected from the main course of the river were investigated in the Southern Amazon of Peru to know 1) the species richness of aquatic macrophytes, 2) their life form, and 3) the influence of area and depth of the water body and, transparency, pH, dissolved oxygen, total dissolved solids, and temperature of the water on species richness and composition changes of aquatic macrophytes. 68 taxa were reported, where Cyperaceae and Poaceae were the most diverse families. Moreover, the predominant life forms were emergent (47,1 %) and amphibian (36,8 %). Finally, cochas with greater area, pH, and dissolved oxygen, at the same time, with lower temperature, shelter a higher species richness and favour strictly aquatic species establishment, indicating that exists a species turnover along the conformed gradient by the association of these variables. These results demonstrate that southern Amazon of Peru has an important aquatic macrophytes richness that is associated with area, pH, dissolved oxygen, and temperature of the aquatic body.

Enlace: <https://doi.org/10.14522/darwiniana.2024.121.1179>

Insectos visitantes florales de *Phytelephas macrocarpa* (Arecaceae), una palma dioica al noroeste de la Amazonia peruana

Insect floral visitors of *Phytelephas macrocarpa* (Arecaceae), a dioecious palm in the north-western Peruvian Amazon

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Resumen

Phytelephas macrocarpa es una palma dioica que carece de estudios sobre la entomofauna que visita sus flores en la zona de la Amazonia occidental. En este estudio se identificaron los insectos visitantes y su interacción con las inflorescencias de *P. macrocarpa* en dos localidades al noroeste de la Amazonia peruana. Adicionalmente, se determinó la riqueza y abundancia de estos insectos. Para ello, se recolectaron 6 inflorescencias por localidad (tres masculinas y tres femeninas). Durante las salidas de campo se observaron las interacciones de los insectos sobre las inflorescencias. Se registraron 28.106 insectos distribuidos en 27 especies, donde *Amazoncharis* sp., *Aleochara* sp. y *Anchylorhynchus* sp. fueron las más abundantes. También se reconoció que 12 especies actuaron como polinizadoras, 10 como polínivoros y 5 como saprófagos. La comunidad de visitantes florales se compone principalmente por insectos del orden Coleoptera, Hymenoptera y Diptera. Las familias Staphylinidae, Curculionidae y Nitidulidae son los principales visitantes relacionados con la polinización, que ayudan en la biología reproductiva de la palmera y, por lo tanto, contribuyen en la conservación de la especie.

Abstract

Phytelephas macrocarpa is a dioecious palm that lacks studies on the entomofauna that visit its flowers in western Amazonia. In this study we identified the insect visitors and their interaction with the inflorescences of *P. macrocarpa* in two localities in northwestern Peruvian Amazonia. Additionally, the richness and abundance of these insects was determined. For this purpose, six inflorescences were collected per locality (three male and three female). During field trips, the interactions of the insects on the inflorescences were observed. A total of 28 106 insects distributed in 27 species were recorded, where *Amazoncharis* sp., *Aleochara* sp. and *Anchylorhynchus* sp. were the most abundant. Twelve species were also recognized as pollinators, 10 as pollinivores and 5 as saprophagous. The floral visitor community is mainly composed of insects of the orders Coleoptera, Hymenoptera and Diptera. The families Staphylinidae, Curculionidae and Nitidulidae are the main pollination-related visitors, which help in the reproductive biology of the palm and, therefore, contribute to the conservation of the species.

Enlace: <https://doi.org/10.70186/baeeAWQQ9436>

Morfología de racimos, frutos y semillas de *Attalea moorei* en el Huallaga Central, Perú

Morphology of racemes, fruits and seeds of *Attalea moorei* in the Central Huallaga, Peru

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Resumen

Las especies del género *Attalea* no cuentan con estudios suficientes sobre variabilidad morfológica en la Amazonía occidental. El objetivo del presente estudio fue describir y determinar la variabilidad morfológica de los racimos, frutos y semillas de *Attalea moorei* de 3 poblaciones de bosques estacionalmente secos de la cuenca central del río Huallaga, Perú. Se evaluaron 20 características de interés que fueron analizadas y comparadas por medio de las pruebas de Anova y Kruskal-Wallis, se visualizaron gráficamente mediante el análisis de componentes principales y se estimó la asociación de las características a través del análisis de Spearman. De las 20 características, 16 presentaron diferencias significativas. El PCA demostró la alta variación de los caracteres y la variabilidad entre las poblaciones, donde Lamas fue la más diferenciada con racimos y semillas de mayores dimensiones, mientras que las de Pucacaca y San Pedro presentaron frutos de mayor tamaño y peso. Las correlaciones relevantes se dieron entre el número de frutos/peso del racimo (0.857), peso del fruto/longitud del fruto (0.824) y diámetro de semilla/longitud de semilla (0.358), las cuales podrían tener un potencial para la producción de biocombustibles y la extracción de aceites.

Abstract

The species of the genus *Attalea* do not have sufficient studies on morphological variability in the Western Amazonia. The aim of this study was to describe and determine the morphological variability of racemes, fruits and seeds of *Attalea moorei* of 3 populations of seasonally dry forests of the central basin of the Huallaga River, Peru. We evaluated 20 characteristics of interest that were analyzed and compared using the ANOVA and Kruskal-Wallis tests; they were graphically visualized by the principal component analysis and the association of characteristics was estimated through Spearman's analysis. Of the 20 characteristics, 16 showed significant differences. The PCA showed a high variation of characteristics and variability between populations, where Lamas was the most differentiated with racemes and seeds of greater dimensions, while Pucacaca and San Pedro presented fruits of greater size and weight. The most relevant correlations were between the number of fruits/weight of the racime (0.857), weight of the fruit/ length of the fruit (0.824) and seed diameter/seed length (0.358), which could have a potential for the production of biofuel and in the extraction of oils.

Enlaces: <https://doi.org/10.22201/ib.20078706e.2024.95.5295>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/759>

Morfología vegetativa de *Phytelephas macrocarpa* en el noroeste de la Amazonía peruana

Vegetative morphology of *Phytelephas macrocarpa* in the northwest of the Peruvian Amazon

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Resumen

El aprovechamiento incontrolado de los recursos de *Phytelephas macrocarpa* y la deforestación han disminuido las poblaciones naturales de la especie cercanas a los centros poblados. En este estudio nos propusimos evaluar la morfología vegetativa de *Phytelephas macrocarpa* para comprender la variabilidad de sus poblaciones al noroeste de la Amazonía peruana. Para ello, se tuvieron en cuenta 28 caracteres (18 cuantitativos y 10 cualitativos) de 180 individuos adultos, que se compararon mediante las pruebas ANOVA y Kruskal-Wallis y se sometieron a análisis multivariados de agrupamiento jerárquico y de componentes principales. Por último, con un análisis de correlación de Spearman se estimó la asociación entre caracteres, la mayoría de los cuales presentaron una gran variación (<20 %) y fueron significativamente diferentes ($p < 0,05$). Se formaron dos grupos con base en el hábito de la palmera: el primero incluyó los individuos acaulescentes, con hojas de mayor longitud, y el segundo, individuos con tallos decumbentes a erectos y hojas más cortas. El análisis de componentes principales (ACP) demostró que las poblaciones más variables fueron las de Andiviela, Caynarachi, Palestina y Shapaja. Las asociaciones más marcadas fueron las de la longitud de la hoja con la del raquis (0,94) y la del diámetro basal del raquis con el diámetro medio del peciolo (0,85). Estos datos demuestran la variabilidad de los caracteres vegetativos de *Phytelephas macrocarpa* y sirven como referencia para el aprovechamiento sostenible de las poblaciones con hojas de mayor tamaño.

Abstract

The uncontrolled use of *Phytelephas macrocarpa* resources and deforestation have decreased natural populations near populated centers. Here, we evaluated the vegetative morphology of *Phytelephas macrocarpa* to understand the variability of its populations in the northwest of the Peruvian Amazon by examining 28 characters (18 quantitative and 10 qualitative) from 180 adult palms, comparing them using ANOVA and Kruskal-Wallis tests, and visualizing them through a multivariate analysis of hierarchical clustering and principal components. Finally, we used Spearman's correlation analysis to estimate the association between characters, most of which showed a high variation (< 20%) and were all significantly different ($p < 0.05$). Two groups were formed based on the habit of the palm tree: the first was composed of acaulescent palms with longer leaves and the second, with decumbent to erect stems and shorter leaves. The principal components analysis (PCA) showed that Andiviela, Caynarachi, Palestina, and Shapaja had the most variable populations. The strongest associations were between leaf length and rachis length (0.94) and between basal rachis diameter and petiole diameter (0.85). This information demonstrates the variability of the vegetative characters of *Phytelephas macrocarpa* and serves as a reference for the sustainable use of populations with larger leaves.

Enlace: <https://doi.org/10.18257/raccefyn.2639>

Morphological and DNA Barcoding Evidence Confirms the Presence of *Semaprochilodus taeniurus* (Prochilodontidae) in the Peruvian Amazon Basin

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Instituto de Investigaciones de la Amazonía Peruana



Abstract

Semaprochilodus taeniurus (Valenciennes 1821) are known to inhabit the middle and lower regions of the Amazon basin. This study presents the first record of this species in the Peruvian Amazon, in the Lizardo stream, a tributary of the Putumayo River, Loreto region. The specimens were identified using meristic, morphological, and morphometric features as well as DNA barcodes based on the mitochondrial *COI* gene. This new species record contributes to enhancing our understanding of fish diversity in the Peruvian Amazon.

Enlaces: <https://doi.org/10.1134/S0032945224700206>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/755>

New record of *Youngomyia pouteriae* Maia, 2001 (Diptera, Cecidomyiidae) in *Pouteria caimito* (Ruiz & Pav.) Radlk. (Sapotaceae) in the Peruvian Amazon

Julio M. Grandez-Rios, Walter S. de Araújo, Valéria C. Maia

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Abstract

We report for the first time cylindrical galls of *Youngomyia pouteriae* Maia, 2001 (Diptera, Cecidomyiidae) on *Pouteria caimito* (Ruiz & Pav.) Radlk. (Sapotaceae) in Peru. *Youngomyia pouteriae* were exclusively found in the Atlantic Forest biome, in restinga areas of Rio de Janeiro state, Brazil. In this study, the geographic distribution of this galling species is extended to the western Amazon lowland rainforest in Peru.

Enlace: <https://doi.org/10.15560/20.6.1281>

New species of *Demidospermus* (Monogenoidea: Dactylogyridae) from the gills of *Pseudoplatystoma punctifer* (Siluriformes: Pimelodidae) collected in the Peruvian Amazonia

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Abstract

Pseudoplatystoma punctifer is a catfish species that occupies the first place in the statistics of fishing landings in the region of Loreto, being of economic importance in the Peruvian Amazonia. As an initiative to know the parasites present in the gills of *P. punctifer* from the Peruvian Amazonia, a study was carried out with fish collected in the Belén Market, in Loreto-Peru. Specimens were provided between June and October 2018 from local fishermen from the Belén Market, in Loreto-Peru and samples were processed and analyzed in the “Laboratorio de Parasitología y Sanidad Acuicola” from the “Instituto de Investigaciones de la Amazonía Peruana” (IIAP) in Iquitos, Loreto-Peru. The analyzes of the gills revealed the presence of two new species of Monogenoidea: *Demidospermus aureagarciae* **n. sp.** and *D. doncellae* **n. sp.** These species are unique among congeners by the morphology of the copulatory complex and vagina. *Demidospermus aureagarciae* **n. sp.** presents a male copulatory organ as a coiled tube, with a complete counterclockwise ring, with dilated base with a developed sclerotized margin, from which a flap projects; a concave accessory piece, with a tapered and curved distal part and a saculiform vaginal vestibule, connected to the vaginal canal. *Demidospermus doncellae* **n. sp.** presents a copulatory complex that is an elongated coiled tube, with approximately three clockwise rings, with dilated base with a developed sclerotized margin, from which a flap projects; an accessory piece sheath like, and a sclerotized vagina with dextral position, with saclike vaginal vestibule, connected to an elongated canal.

Enlace: <https://doi.org/10.1007/s11230-023-10136-x>

News records of *Dipsas welborni* Arteaga & Batista, 2023 in Cordillera Escalera, Peru

Sandro A. Ramírez-Castillo, Patricio Reátegui, Diego Deza, Giuseppe Gagliardi-Urrutia, Omar Rojas-Padilla

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Abstract

Esta publicación científica no cuenta con resumen disponible.

Enlace: <https://www.biotaxa.org/hn/article/view/85954>

One sixth of Amazonian tree diversity is dependent on river floodplains

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Resumen

El sistema de llanuras inundables de la Amazonia es considerado el más grande y biodiverso del planeta. A pesar de la importancia crucial de los bosques para la integridad ecológica de estas llanuras, aún se cuenta con una comprensión limitada de la composición de especies y de cómo esta puede diferir de los tipos de bosques circundantes. Esto es especialmente relevante dado que los regímenes cambiantes de inundación comienzan a modificar las comunidades de árboles de las llanuras inundables y las funciones ecosistémicas críticas que sustentan. En este estudio se aborda esta brecha al examinar de manera explícita y espacial los patrones de cambio de especies de árboles y la especialización ecológica de los bosques de llanuras inundables en toda la región amazónica. Los resultados muestran que la mayoría de las especies de árboles amazónicos pueden habitar las llanuras inundables, y aproximadamente una sexta parte de la diversidad de árboles amazónicos está especializada ecológicamente en estas áreas. La especialización de las comunidades de llanuras inundables está determinada por los patrones regionales de inundación, con los bosques de llanuras inundables más diferenciados en composición ubicados centralmente dentro de la red fluvial y condicionados por las magnitudes de inundación más extraordinarias a nivel regional. Estos hallazgos resaltan la importancia de mantener la integridad hidrológica de toda la cuenca para proteger la diversidad arbórea de la Amazonia y sus funciones ecológicas.

Abstract

Amazonia's floodplain system is the largest and most biodiverse on Earth. Although forests are crucial to the ecological integrity of floodplains, our understanding of their species composition and how this may differ from surrounding forest types is still far too limited, particularly as changing inundation regimes begin to reshape floodplain tree communities and the critical ecosystem functions they underpin. Here we address this gap by taking a spatially explicit look at Amazonia-wide patterns of tree-species turnover and ecological specialization of the region's floodplain forests. We show that the majority of Amazonian tree species can inhabit floodplains, and about a sixth of Amazonian tree diversity is ecologically specialized on floodplains. The degree of specialization in floodplain communities is driven by regional flood patterns, with the most compositionally differentiated floodplain forests located centrally within the fluvial network and contingent on the most extraordinary flood magnitudes regionally. Our results provide a spatially explicit view of ecological specialization of floodplain forest communities and expose the need for whole-basin hydrological integrity to protect the Amazon's tree diversity and its function.

Enlaces: <https://doi.org/10.1038/s41559-024-02364-1>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/746>

Peces de la quebrada Pintuyacu, cuenca del río Itaya, Amazonía peruana

Fish from the Pintuyacu stream, Itaya river basin, peruvian Amazon

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James R. García-Ayala

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Resumen

El presente trabajo corresponde a un inventario de peces, realizado entre agosto y setiembre del 2019, en tres sitios de muestreo en la quebrada Pintuyacu, tributario de la cuenca del río Itaya, en la Amazonía peruana. En base a 504 individuos analizados, se identificaron 117 especies, correspondientes a 33 familias y 8 órdenes. El orden más diverso fue Characiformes (65 especies, 55.6%), seguido de Siluriformes (31 especies, 26.5%). A nivel de familia Characidae presento la mayor riqueza de especies con 24 especies (20.5%). Las especies más abundantes fueron *Stethaprion erythrops* (13.1%, 66 individuos), *Knodus smithi* (13.1%, 66 individuos) y *Bujurquina peregrinabunda* (6.2%, 31 individuos). Se registraron especies de uso ornamental y de consumo. No se registraron especies amenazadas y la mayoría se clasificaron en preocupación menor (LC), según los criterios de la IUCN. El presente estudio es el primero en presentar una lista de la ictiofauna presente en la quebrada Pintuyacu y consecuentemente el primer inventario publicado para la cuenca del río Itaya. Lo cual pone en evidencia la necesidad de continuar realizando inventarios.

Abstract

The present work corresponds to a fish inventory, carried out between August and September 2019, in three sampling sites in the Pintuyacu stream, a tributary of the Itaya River basin, in the Peruvian Amazon. Based on 504 individuals analyzed, 117 species were identified, corresponding to 33 families and 8 orders. The most diverse order was Characiformes (65 species, 55.6%), followed by Siluriformes (31 species, 26.5%). At the Characidae family level, it presents the highest species richness with 24 species (20.5%). The most abundant species were *Stethaprion erythrops* (13.1%, 66 individuals), *Knodus smithi* (13.1%, 66 individuals) and *Bujurquina peregrinabunda* (6.2%, 31 individuals). Species for ornamental and consumer use were recorded. No threatened species were recorded and most were classified as Least Concern (LC), according to IUCN criteria. The present study is the first to present a list of the ichthyofauna present in the Pintuyacu stream and consequently the first inventory published for the Itaya River basin. Which highlights the need to continue carrying out ichthyological inventories, with the aim of enriching the knowledge of the freshwater ichthyofauna of the country and the Amazon region, as well as applying necessary measures for the conservation of our ichthyological resources.

Enlace: <https://doi.org/10.24841/fa.v33i1.764>

Plant species richness, not hygrothermal stress, is the main predictor of gall-inducing insect richness in Peruvian Amazon forests

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Resumen

Los patrones de diversidad de insectos inductores de agallas tienden a estar influenciados tanto por características relacionadas con el hábitat y las plantas. Investigamos los patrones de distribución de insectos inductores de agallas en cuatro tipos de vegetación (bosque de tierra firme, bosque seco de arena blanca, bosque húmedo de arena blanca y bosque de pantano de palmas) de la Amazonía peruana para evaluar si la diversidad de insectos inductores de agallas (1) difiere entre diferentes tipos de vegetación y (2) depende de la riqueza de las plantas hospederas. En total, encontramos 11,579 agallas pertenecientes a 249 morfotipos de insectos inductores de agallas, distribuidos en 30 familias botánicas y 75 especies de plantas. Entre las familias de plantas hospederas, Fabaceae mostró la mayor riqueza de morfotipos de insectos inductores de agallas. Encontramos que la riqueza de especies inductoras de agallas era menor en el bosque de pantano de palmas que en los bosques de arena blanca, lo cual puede explicarse por la menor riqueza de plantas en este tipo de vegetación. Sin embargo, no encontramos evidencia de una mayor riqueza en hábitats xéricos (por ejemplo, bosque seco de arena blanca) que en vegetación más mesica (bosque de tierra firme), contradiciendo la hipótesis del estrés higrotermal. También encontramos que la riqueza de especies de plantas fue positivamente influenciada por la riqueza y abundancia de especies inductoras de agallas, independientemente del tipo de vegetación. La composición de especies de insectos inductores de agallas difería significativamente entre los tipos de vegetación, de manera similar a la composición florística. Nuestros hallazgos muestran que la diversidad de insectos inductores de agallas en los bosques tropicales de la Amazonía peruana está principalmente influenciada por la composición y la riqueza de las plantas hospederas.

Abstract

Patterns of gall-inducing insect diversity tend to be influenced by both habitat-related and plant-related characteristics. We investigated the distribution patterns of galling insects in four vegetation types (*terra firme* forest, white-sand dry forest, white-sand wet forest and palm swamp forest) of the Peruvian Amazon to test if the insect gall diversity (1) differs among different types of vegetation and (2) depends on host plant richness. In total, we found 11,579 galls belonging to 249 insect gall morphotypes, distributed across 30 botanical families and 75 plant species. Among host plant families, Fabaceae showed the greatest richness of insect gall morphotypes. We found that galling species richness was lower in palm swamp forest than in white-sand forests, which can be explained by the lower richness of plants in this type of vegetation. However, we found no evidence of greater richness in xeric habitats (e.g., white-sand dry forest) than in more mesic vegetation (*terra firme* forest), contradicting the hypothesis of hygrothermal stress. We also found that plant species richness was positively influenced with the richness and abundance of galling species, regardless of vegetation type. Galling insect species composition differed significantly between vegetation types, similarly to the floristic composition. Our findings show

that the diversity of galling insects in the tropical rainforests of Peruvian Amazon are mainly influenced by host plant composition and host plant richness.

Enlace: <https://doi.org/10.1111/btp.13312>

Positive feedbacks and alternative stable states in forest leaf types

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Abstract

The emergence of alternative stable states in forest systems has significant implications for the functioning and structure of the terrestrial biosphere, yet empirical evidence remains scarce. Here, we combine global forest biodiversity observations and simulations to test for alternative stable states in the presence of evergreen and deciduous forest types. We reveal a bimodal distribution of forest leaf types across temperate regions of the Northern Hemisphere that cannot be explained by the environment alone, suggesting signatures of alternative forest states. Moreover, we empirically demonstrate the existence of positive feedbacks in tree growth, recruitment and mortality, with trees having 4-43% higher growth rates, 14-17% higher survival rates and 4-7 times higher recruitment rates when they are surrounded by trees of their own leaf type. Simulations show that the observed positive feedbacks are necessary and sufficient to generate alternative forest states, which also lead to dependency on history (hysteresis) during ecosystem transition from evergreen to deciduous forests and vice versa. We identify hotspots of bistable forest types in evergreen-deciduous ecotones, which are likely driven by soil-related positive feedbacks. These findings are integral to predicting the distribution of forest biomes, and aid to our understanding of biodiversity, carbon turnover, and terrestrial climate feedbacks.

Enlaces: <https://doi.org/10.1038/s41467-024-48676-5>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/757>

Predicting animal abundance through local ecological knowledge: An internal validation using consensus analysis

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Abstract

1. Given the ongoing environmental degradation from local to global scales, it is fundamental to develop more efficient means of gathering data on species and ecosystems. Local ecological knowledge, in which local communities can consistently provide information on the status of animal species over time, has been shown to be effective. Several studies demonstrate that data gathered using local ecological knowledge (LEK)-based methods are comparable with data obtained from conventional methods (such as line transects and camera traps).
2. Here, we employ a consensus analysis to validate and evaluate the accuracy of interview data on LEK. Additionally, we investigate the influence of social and bioecological variables on enhancing data quality. We interviewed 323 persons in 19 villages in the Western and Central Amazon to determine the level of consensus on the abundance of hunted and non-hunted forest species. These villages varied in size, socio-economic characteristics and in the experience with wildlife of their dwellers. Interviewees estimated the relative abundance of 101 species with a broad spectrum of bioecological characteristics using a four-point Likert scale.
3. High consensus was found for species population abundance in all sampled villages and for 79.6% of interviewees. The village consensus of all species abundance pooled was negatively correlated with village population size. The consensus level was high regardless of the interviewees' hunting experience. Species that are more frequently hunted or are more apparent had greater consensus values; only two species presented a low consensus level, which are rare and solitary species.
4. We show in our study in the Amazon that information gathered by local peoples, Indigenous as well as non-Indigenous, can be useful in understanding the status of animal species found within their environment. The high level of cultural consensus we describe likely arises from knowledge sharing and the strong connection between the persons interviewed and the forest. We suggest that consensus analysis can be used to validate LEK-generated data instead of comparing these types of data with information obtained by conventional methods.

Enlaces: <https://doi.org/10.1002/pan3.10587>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/764>

Presence of *Contracaecum* sp. larvae in two characiform fish from northeastern Brazil

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Abstract

Pygocentrus nattereri Kner, 1858 and *Serrasalmus rhombeus* (Linnaeus, 1766) are species of serrasalmids sold in open-air markets and market municipalities in Maranhão, Brazil. Fifty-two individuals of *P. nattereri* and 52 of *S. rhombeus* were acquired from a fish market in the Municipality of Pinheiro, Maranhão, Brazil, and transported to the laboratory of “Inmunohistoquímica” from “Universidade Estadual do Maranhão” (UEMA). The lateral musculature of the fish was analyzed by making fine cuts, internal organs were placed in Petri dishes with distilled water, and with the aid of tweezers and needles, the tissue was examined by making fine cuts that allowed observation inside them. The results of the study revealed the presence of nematode larvae L3 of *Contracaecum* sp. was found parasitizing the visceral cavity, intestines, pyloric cecum, and stomach of *P. nattereri* and *S. rhombeus*. This study alerts local authorities and the population to take the necessary measures to prevent the accidental ingestion of endoparasites with zoonotic potential.

Enlace: <https://doi.org/10.17420/ap7003.532>

**Primer registro del especialista de bambú Hormiguerito de Ihering
Myrmotherula iheringi oreni (Aves: Thamnophilidae) en el
departamento de Junín, Perú**

**First record of the bamboo specialist ihering's antbird *Myrmotherula
iheringi oreni* (Aves: Thamnophilidae), in the Junín department, Peru**

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Resumen

Myrmotherula iheringi oreni es una especie conocida por su asociación a bosque de bambú al sur de Perú. Su rango de distribución se encuentra restringido al departamento de Madre de Dios, Cusco, Puno y Ucayali; sin embargo, nuestro registro de *M. iheringi oreni* cerca del poblado de Poyeni es el primer registro para el departamento de Junín.

Abstract

Myrmotherula iheringi oreni is a species known for its association with bamboo forest in southern Peru. Its distribution range is restricted to the departments of Madre de Dios, Cusco, Puno, and Ucayali; however, our record of *M. iheringi oreni* near the town of Poyeni represents the first occurrence for the department of Junín.

Enlace: <https://doi.org/10.24841/fa.v33i1.766>

Propiedades fisicoquímicas, análisis metabolómico, actividad antioxidante e hipolipemiante de una bebida funcional a base de cocona (*Solanum sessiliflorum* Dunal)

Physicochemical properties, metabolomic analysis, antioxidant and lipid-lowering activity of a functional beverage based on cocona (*Solanum sessiliflorum* Dunal)

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Resumen

Se realizó el análisis fisicoquímico, microbiológico y metabolómico, efecto antioxidante e hipolipemiante, y vida útil de una bebida funcional a base de cocona ecotipo SRN9. De acuerdo a los resultados, la bebida cumple con las características de la norma técnica peruana para jugos, néctares y bebidas de frutas NTP 203.110:2009 y se encuentra dentro de los límites establecidos por la norma técnica sanitaria NTS N° 071-MINSA/DIGESA-V.01, con una vida útil de 4 meses y 1 día. Del perfil metabolómico se identificaron 30 compuestos, entre ellos varios flavonoles glicosilados, dos flavanoles y dos espermidinas. Asimismo, mostró un efecto hipolipemiante estadísticamente significativo ($p < 0,05$) sobre los niveles séricos de colesterol total y triglicéridos, con una reducción media de 41,52 mg/dL y de 130,80 mg/dL para los niveles de colesterol total y de triglicéridos, respectivamente. Esta bebida podría ser una alternativa para el tratamiento de la aterosclerosis y prevención de enfermedades cardiovasculares.

Abstract

The physicochemical, microbiological and metabolomics analysis, antioxidant and lipid-lowering effect, and shelf life prediction of a functional beverage based on cocona pulp of SRN9 ecotype was to carry out. According to the results obtained, the beverage complies with all the characteristics of the Peruvian technical standard for juices, nectars and fruit beverages NTP 203.110:2009 and is within the limits established by the sanitary technical standard NTS N° 071-MINSA/DIGESA-V.01, with a shelf-life period of 4 months and 1 day. The metabolome regarding bioactive compounds showed the presence of 30 compounds, including several glycosylated flavonols, two flavanols, and two spermidines. Likewise, showed a lipid-lowering effect statistically significant ($p < 0,05$) about the serum levels of total cholesterol and triglycerides, with a mean reduction of 41.52 mg/dL for total cholesterol levels and 130.80 mg/dL for triglyceride levels. This beverage could be an alternative for the treatment of atherosclerosis and prevention of cardiovascular diseases.

Enlace: <https://doi.org/10.37360/blacpma.24.23.2.21>

Quantitative impacts of hydroelectric dams on the trans-Amazonian migrations of goliath catfish

Marília Hauser, Carolina R. C. Doria, Christophe Pécheyrán, Emmanuel Ponzevera, Jacques Panfili, Gislene Torrente-Vilara, Jean-François Renno, Carlos Edward Freitas, Carmen García-Dávila, Fabrice Duponchelle

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Abstract

Hydropower expansion is increasingly responsible for connectivity and biodiversity loss in freshwater ecosystems. The Amazon basin, which supports the highest level of freshwater biodiversity globally, faces such unplanned expansion. Here, we demonstrate and quantify the impacts of two major hydroelectric dams on the Madeira River on the trans-Amazonian movements of one apex predatory catfish (*Brachyplatystoma rousseauxii*) performing the longest migration known in freshwaters. Using otolith microchemistry, we show that above the dams, the former basin-wide homing migration between the breeding grounds in the upper Madeira and the nursery in the Amazon estuary has now been replaced by residency. We found evidence suggesting downstream migration of juvenile fish past dams into the Amazon estuary and that some of them home back to the Madeira. However, we did not find evidence that the fish homing back from the estuary can access their breeding grounds in the upper Madeira; they remain blocked below the dams. Our results provide undisputable evidence that the conservation of the species primarily requires the reestablishment of connectivity with the construction of efficient fishways.

Enlace: <https://doi.org/10.1111/conl.13046>

River Geomorphology and Fish Diversity Around the Manseriche Gorge, the Last Andean Crossing Is in Peril

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Resumen

La transición de los Andes a la Amazonía alberga una alta biodiversidad y actualmente enfrenta varias actividades antropogénicas, incluyendo proyectos de infraestructura hidroeléctrica. Poco se sabe sobre la geomorfología de las gargantas andinas, los ríos y la interacción con la diversidad de peces aguas arriba y aguas abajo de las gargantas. El río Marañón es un río importante que conecta los Andes con la Amazonía y transporta el 40% de la carga de sedimentos que llega a Brasil. El río Santiago es el último afluente del río Marañón antes de la última garganta (Manseriche). Los planes actuales para embalses hidroeléctricos incluyen la construcción de varias represas a lo largo del río Marañón, siendo la más grande con una capacidad de 4.500 MW en la garganta Manseriche (MG). Este estudio busca caracterizar los procesos de referencia de la hidrogeomorfología y la diversidad de peces. Los resultados muestran que el río Santiago se encuentra bajo un régimen morfodinámico de transición, mientras que el río Marañón es un río anaromificado completamente desarrollado. Este estudio revela una clara diferencia en la riqueza y abundancia de especies de peces entre las regiones de aguas arriba y aguas abajo del Marañón, con algunas especies que solo se encuentran en regiones específicas. El Marañón actúa como una condición límite natural para la hidrogeomorfología y la diversidad de peces. Si se construyera la represa hidroeléctrica en el Marañón, el embalse en el tramo de aguas arriba produciría la desaparición del río Santiago y la sedimentación, modificando en consecuencia las condiciones límite del transporte de sedimentos para el bajo río Marañón. Aguas abajo de la posible represa se produciría una incisión, lo que reduciría la conectividad lateral, particularmente en sitios donde se encontraron especies únicas.

Abstract

The transition from the Andes to the Amazon lowland hosts a high biodiversity and currently is facing several anthropogenic activities, including hydropower infrastructure projects. Little is known about the geomorphology of the Andean gorges, rivers and the interaction with the fish diversity upstream and downstream of gorges. The Marañón River is a major river that connects the Andes to the Amazon lowland and it carries 40% of the sediment load arriving to Brazil. The Santiago River is the last tributary into the Marañón River before the last gorge (Manseriche). Current plans for hydropower reservoirs include the construction of several dams along the Marañón River, being the largest with a 4,500 MW capacity at the Manseriche Gorge (MG). This study seeks to characterize the baseline processes of the hydrogeomorphology and fish diversity. Results show that the Santiago River is under transitional morphodynamic regime while the Marañón River is a fully developed anabranching river. This study reveals a clear difference in fish species richness and abundance between the upstream and downstream regions of the MG, with some species only found in specific regions. The MG acts as a natural boundary condition for the hydrogeomorphology and fish diversity. If the hydropower dam at MG was built, the reservoir in the upstream reach will produce the Santiago River to disappear and sedimentation to occur, consequently modifying sediment transport boundary conditions for the lower Marañón River. Downstream of the potential dam incision will occur, reducing lateral connectivity, particularly at sites where unique species were found.

Enlaces: <https://doi.org/10.1029/2024WR037322>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/770>

Similar looking sisters: A new sibling species in the *Pristimantis danae* group from the southwestern Amazon basin (Anura, Strabomantidae)

Jörn Köhler, Frank Glaw, César Aguilar-Puntriano, Santiago Castroviejo-Fisher, Juan C. Chaparro, Ignacio De la Riva, Giuseppe Gagliardi-Urrutia, Roberto Gutiérrez, Miguel Vences, José M. Padial

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Resumen

Se describe una nueva especie de rana que es hermana de *Pristimantis reichlei*. Estas dos especies hermanas habitan las tierras bajas amazónicas y las estribaciones adyacentes de los Andes, desde el centro de Bolivia hasta el centro de Perú. *Pristimantis reichlei* se encuentra desde el centro de Bolivia hasta el sur de Perú (Parque Nacional Alto Purús), mientras que la nueva especie se encuentra desde el norte de Bolivia (Departamento de Pando) hasta Panguana en el centro de Perú (Departamento de Huánuco), a elevaciones entre 220 y 470 m s.n.m. A pesar de su cripsis morfológica, estas especies hermanas ocurren en sintopía sin evidencia de entrecruzamiento (en el área de Alto Purús) y se recuperan como monofiléticas recíprocas. Sus distancias genéticas sin corregir en el gen 16S rRNA varían del 9.5 al 13.5%, y sus llamados de anuncio difieren tanto en rasgos cualitativos como cuantitativos. Además, el estudio encontró distancias sin corregir dentro de la nueva especie de hasta 5.0% y hasta 9.3% dentro de *P. reichlei*. Por lo tanto, no se puede descartar la posible existencia de híbridos o linajes adicionales a nivel de especie ocultos en este complejo. Además, se encuentra otro posible par de especies hermanas compuesto por *P. danae* y un linaje no nombrado, con divergencias del 9.4% en el gen 16S, cuyo análisis en profundidad y tratamiento taxonómico están pendientes de revisión futura. Con la nueva especie nominal, el grupo de especies *Pristimantis danae* ahora incluye 20 especies, distribuidas a lo largo de la cuenca alta del Amazonas y en los Andes orientales, desde el oeste de Brasil hasta Bolivia y Perú. Este estudio, junto con un número creciente de otros estudios, indica que las especies hermanas están lejos de ser raras entre los anfibios amazónicos y que la resolución de especies sigue siendo baja incluso para grupos que han recibido considerable atención en los últimos años.

Abstract

We describe a new frog species that is the sibling of *Pristimantis reichlei*. These two sister species inhabit the Amazonian lowlands and adjacent foothills of the Andes, from central Bolivia to central Peru. *Pristimantis reichlei* occurs from central Bolivia to southern Peru (Alto Purús National Park), while the new species occurs from northern Bolivia (Departamento Pando) to Panguana in central Peru (Departamento Huánuco), at elevations between 220 and 470 m a.s.l. In spite of their morphological crypsis, these siblings occur in syntopy without evidence of interbreeding (in the Alto Purús area) and are recovered as reciprocally monophyletic. Their uncorrected pairwise genetic distances in the 16S rRNA gene range from 9.5–13.5%, and their advertisement calls differ in both qualitative and quantitative traits. Moreover, our study found uncorrected pairwise distances within the new species of up to 5.0% and up to 9.3% within *P. reichlei*. We therefore cannot rule out the possible existence of hybrids or additional species-level lineages hidden in this complex. Furthermore, we found another potential pair of sibling species composed of *P. danae* and an unnamed lineage, with divergences of 9.4% in the 16S gene, whose in-depth analysis and taxonomic treatment are pending future revision. With the new nominal species, the *Pristimantis danae* species group now includes 20 species, distributed across the upper Amazon basin and in the eastern Andes, from western Brazil to Bolivia and Peru. Our study,

together with an increasing number of other studies, indicates that sibling species are far from being rare among Amazonian amphibians and that species resolution remains low even for groups that have received considerable attention in recent years.

Enlaces: <https://doi.org/10.3897/zse.100.119143>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/753>

Spatiotemporal Impacts of Drug Crop and Commodity Agriculture on Cultural Ecosystem Services: The Case of *Ischnosiphon* in Ticuna Communities of Loreto, Peru

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Abstract

In recent decades, drug crop eradication and drug trafficking interdiction have pushed drug crop cultivation into new areas of the Amazonian rain forest. The presence of the drug industries in these regions—followed by alternative development programs that aim to substitute illicit drug crops with commodity crops like cacao—has transformed forest ecologies, risking loss to both biodiversity and cultural ecosystem services (CES) for surrounding communities. In the last ten years, forest loss linked to the increase in cultivation of commodity crops—both licit and illicit—has been monitored, generating extensive geospatial data. However, the spatiotemporal impacts on key plant species utilized by indigenous communities who have recently shifted to drug crop and commodity agricultural production remains poorly understood. In this paper, we use geospatial modeling to explore potential impacts of drug crop cultivation and alternative development programs on the CES of Ticuna indigenous communities of the Peruvian Amazon. We analyze the spatiotemporal impact of drug and commodity crop cultivation on three culturally significant species of the genus *Ischnosiphon*, known locally as *dexpe* or *huarumá*, by generating a model of potential distribution of the three species. The rate of increase of legal and illegal agricultural crops was also calculated and the spatiotemporal impact was measured and represented using spatial analysis techniques. Our analysis finds that, between 2010 and 2020, the increase in both illicit and licit commodity crop cultivation is correlated with changes in the distribution of *huarumá* species, which in turn affects the cultural ecosystem services of Ticuna communities.

Enlace: <https://doi.org/10.31389/jied.219>

Susceptibility of the cultured Amazonian fish, *Colossoma macropomum*, to experimental infection with *Aeromonas* species from ornamental fish

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Resumen

El comercio mundial de peces ornamentales conlleva importantes factores de riesgo de propagación de patógenos entre distintos países y regiones, no sólo para los peces ornamentales sino también para los peces de cultivo e incluso otras especies animales. En el presente estudio, informamos de la capacidad de *Aeromonas veronii* y *A. hydrophila* aisladas de peces ornamentales para infectar experimentalmente al pez amazónico de cría *Colossoma macropomum*. Para ello, se identificaron dichas bacterias y se realizó una caracterización primaria. Los peces fueron inoculados con 0,1 mL de concentraciones crecientes de *A. hydrophila* o *A. veronii* ($C1 = 1 \times 10^2$; $C2 = 1,8 \times 10^4$; $C3 = 2,1 \times 10^6$; $C4 = 2,4 \times 10^8$ células bacterianas por mL) en la cavidad celómica. En el grupo de control, los peces recibieron el mismo volumen de solución salina estéril (0,9%). Los peces presentaron Petequias, sufusiones cutáneas y tasas de mortalidad de hasta el 100 % según la concentración del inóculo. Histopatológicamente, los peces presentaron necrosis con cariólisis, pérdida de la delimitación citoplasmática de las células de los túbulos renales y los hepatocitos, hemorragia, edema celular y presencia de células bacterianas. La LD_{50-96h} de *A. veronii* sobre *C. macropomum* se estimó en $2,4 \times 10^6$ UFC mL⁻¹ y la de *A. hydrophila* en $1,408 \times 10^5$ UFC mL⁻¹. Los resultados demostraron que es posible que las especies de *Aeromonas* aisladas de peces ornamentales afecten a *C. macropomum*, causando signos clínicos y lesiones similares. Esto demuestra la importancia de promover medidas de control de riesgos en todo el mundo en relación con el comercio de peces ornamentales.

Abstract

The global ornamental fish trade carries important risk factors for spreading pathogens between different countries and regions, not only for ornamental fish but also for cultured fish and even other animal species. In the current study, we reported the capacity of *Aeromonas veronii* and *A. hydrophila* isolated from ornamental fish to experimentally infect the reared Amazonian fish *Colossoma macropomum*. For this, those bacteria were identified, and a primary characterization was performed. Fish were inoculated with 0.1 mL of increasing concentrations of *A. hydrophila* or *A. veronii* ($C1 = 1 \times 10^2$; $C2 = 1.8 \times 10^4$; $C3 = 2.1 \times 10^6$; $C4 = 2.4 \times 10^8$ bacterial cells per mL) in the coelomic cavity. In the control group, fish received the same volume of sterile saline solution (0.9%). Fish presented petechiae, skin suffusions, and mortality rates up to 100 % according to the inoculum concentration. Histopathologically, fish presented necrosis with karyolysis, loss of the cytoplasmic delimitation of cells of the renal tubules and hepatocytes, hemorrhage, cellular edema, and the presence of bacterial cells. The LD_{50-96h} of *A. veronii* on *C. macropomum* was estimated at 2.4×10^6 CFU mL⁻¹ and of *A. hydrophila* at 1.408×10^5 CFU mL⁻¹. The results demonstrated that it is possible that *Aeromonas* species isolated from ornamental fish affect *C. macropomum*, causing similar clinical signs and lesions. This shows the importance of promoting risk control measures worldwide regarding the trade of ornamental fish.

Enlaces: <https://doi.org/10.1016/j.micpath.2023.106461>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/735>

Tarántulas (Aranae: Theraphosidae) reportadas del departamento Loreto, Perú

Tarantulas (Aranae: Theraphosidae) reported from Loreto department, Peru

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Resumen

Las tarántulas desempeñan un papel fundamental como reguladores de poblaciones de animales pequeños, y son esenciales para estudios de biodiversidad, biogeografía, comportamiento animal y comercio ilícito de especies. A pesar de su importancia, existe una carencia significativa de información sobre tarántulas en la Amazonía oriental del Perú. Con el objetivo de abordar esta brecha de conocimiento, hemos elaborado una lista exhaustiva de especies de tarántulas reportadas para el departamento de Loreto, utilizamos datos bibliográficos de publicaciones como artículos científicos, libros, tesis y resúmenes de congresos. Se reporta un total de 42 especies de tarántulas, correspondientes a cinco subfamilias: Theraphosinae (con 30 especies), Aviculariinae (con 6 especies), Psalmopoeinae (4 especies), Schismatothelinae (1 especie) e Ischnocolinae (1 especie), ninguna de estas se encuentra amenazada en categorías de conservación. De las ocho provincias del departamento de Loreto, Maynas reportó la mayor riqueza (con 21 especies), seguido de Putumayo (con 10 especies), ambos sectores fueron los más estudiados en Loreto. Mientras que la provincia Datén del Marañón tiene al menos dos especies de tarántulas. Esta información será sustancial para el desarrollo de estrategias efectivas de conservación y manejo de este importante grupo de invertebrados terrestres.

Abstract

Tarantulas play a fundamental role as regulators of small animal populations, and are essential in studies of biodiversity, biogeography, animal behavior, and species trade. Despite their importance, there is a significant lack of information on tarantulas in the eastern Peruvian Amazon. To address this knowledge gap, we have compiled an exhaustive list of tarantula species present in the department of Loreto, using bibliographic data from publications such as scientific articles, books, theses, and conference abstracts. We reported a total of 42 tarantula species, corresponding to five subfamilies: Theraphosinae (with 30 species), Aviculariinae (with 6 species), Psalmopoeinae (with 4 species), Schismatothelinae (with 1 species) and Ischnocolinae (with 1 species), none of which are threatened in any conservation category. Of the eight provinces of the department of Loreto, Maynas reported the highest richness (with 21 species), followed by Putumayo (with 10 species), both sectors were the most studied in Loreto. Meanwhile, the Datén del Marañón province with at least 2 species. This information will be substantial for the development of effective conservation and management strategies for this important group of terrestrial invertebrates.

Enlace: <https://doi.org/10.24841/fa.v33i1.761>

Tarántulas (Araneae: Theraphosidae) de la cuenca media del Putumayo, Loreto, Perú

Tarantulas (Araneae: Theraphosidae) from the middle Putumayo basin, Loreto, Peru

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Resumen

Los Theraphosidae son la familia con mayor diversidad en los Mygalomorphae, pero la escasez de estudios en la Amazonía peruana ha generado una incertidumbre sobre ellos, por lo que tuvimos el objetivo de determinar las especies de tarántulas que se encuentra en la cuenca media del Putumayo (Perú). El muestreo se realizó en dos comunidades: Puerto Arturo y Bobona, a través de recorridos en transectos preestablecidos y encuentros ocasionales fuera de los transectos; los especímenes se identificaron mediante claves taxonómicas especializadas, descripciones e información disponible en catálogos en línea. Se registraron 10 individuos, distribuidas en 7 especies, 3 pertenecientes a la subfamilia Theraphosinae, 2 a Aviculariinae, 1 a Ischnocolinae y 1 a Psalmopoeinae. Este trabajo presenta la primera aproximación sobre la diversidad de tarántulas para la cuenca del Putumayo en Perú. Demostrando la presencia de 7 especies en 4 subfamilias.

Abstract

Theraphosidae represent the family with the greatest diversity in the Mygalomorphae suborder, but the scarcity of studies in the Peruvian Amazon has generate uncertainty about its richness, reason that encourages to determine the species of tarantulas located the middle basin of the Putumayo river (Peru). Sampling was carried out in two communities: Puerto Arturo and Bobona, riparian populations, along pre-established transects and occasional manual collecting outside the transects; all specimens were identified using taxonomic keys, descriptions and information available on web pages. Ten individuals were recorded, distributed in seven species, three belonging to the subfamily Theraphosinae, two to Avicularinae, one to Ischnocolinae and one to Psalmopoeinae. This work aims to presents preliminary results of the diversity of tarantulas in the Putumayo river basin in indicating. The presence of least seven species in four subfamilies.

Enlace: <https://doi.org/10.24841/fa.v33i1.754>

The biogeography of the Amazonian tree flora

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Abstract

We describe the geographical variation in tree species composition across Amazonian forests and show how environmental conditions are associated with species turnover. Our analyses are based on 2023 forest inventory plots (1 ha) that provide abundance data for a total of 5188 tree species. Within-plot species composition reflected both local environmental conditions (especially soil nutrients and hydrology) and geographical regions. A broader-scale view of species turnover was obtained by interpolating the relative tree species abundances over Amazonia into 47,441 0.1-degree grid cells. Two main dimensions of spatial change in tree species composition were identified. The first was a gradient between western Amazonia at the Andean forelands (with young geology and relatively nutrient-rich soils) and central-eastern Amazonia associated with the Guiana and Brazilian Shields (with more ancient geology and poor soils). The second gradient was between the wet forests of the northwest and the drier forests in southern Amazonia. Isolines linking cells of similar composition crossed major Amazonian rivers, suggesting that tree species distributions are not limited by rivers. Even though some areas of relatively sharp species turnover were identified, mostly the tree species composition changed gradually over large extents, which does not support delimiting clear discrete biogeographic regions within Amazonia.

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The complete chloroplast genome of Marupa (*Simarouba amara* Aubl., Simaroubaceae)

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Abstract

Marupa (*Simarouba amara* Aublet 1775) is a tropical tree of the family Simaroubaceae. It is commonly used for its wood in the Amazonian forest, and it is an important species for restoring degraded environments. Yet, very little genetic resources are available to study this plant. In this paper, we sequenced for the first time the complete chloroplast genome of Marupa, using Oxford Nanopore long-read technology. The genome is 159,838 bp, includes 131 genes in total and presents a classic quadripartite structure. Its length and structure are similar to those of sister species of the Simaroubaceae family. A maximum likelihood phylogeny of the order Sapindale reveals that *Simarouba amara* is well positioned in its family. This complete plastome is a first step towards a better analysis of Marupa future evolution.

Enlace: <https://doi.org/10.1002/ece3.11688>

The first record of *Dolops carvalhoi* (Crustacea: Branchiura) parasitizing three farmed fish species of the Peruvian Amazon

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Resumen

Branchiura es un parásito de crustáceos ampliamente conocido en todo el mundo como piojo de los peces. En América del Sur, se ha estudiado más en Brasil, ya que con altos niveles de infestación, los parásitos pueden ser perjudiciales para la salud de los peces y causar pérdidas económicas en las piscifactorías. El objetivo del presente estudio es proporcionar, por primera vez, información significativa sobre los índices parasitarios, los sitios de infestación y la morfología de *Dolops carvalhoi*, e informar la aparición de un nuevo huésped en la región amazónica del Perú. Se analizaron individualmente un total de 24 especímenes de *Colossoma macropomum*, *Piaractus brachypomus* y *Calophysus macropterus* de piscifactorías para identificar la presencia de los ectoparásitos. Los Branchiura recolectados de las superficies corporales de los peces se separaron según el sexo, se calcularon los índices parasitarios y los parásitos se clarificaron en ácido láctico al 90% para su identificación taxonómica. También se conservaron en glutaraldehído al 2,5% y se aplicaron procedimientos de deshidratación y punto crítico mediante microscopía electrónica de barrido para visualizar las estructuras detalladas. El taxón identificado fue *D. carvalhoi*, que tuvo una prevalencia de 64,7%, una intensidad media de 1,6 y una abundancia media de 1 parásito/pez en *C. macropterus*; una prevalencia de 100%, una intensidad media y abundancia media de 2,8 parásitos/pez en *P. brachypomus*; y una prevalencia de 100%, pero una intensidad media y abundancia media de 15 parásitos/pez en *C. macropomum*. Las aletas pectorales y dorsales y la abertura urogenital tuvieron la mayor ocurrencia de *D. carvalhoi* en el hospedador. *Dolops carvalhoi* tiene dimorfismo sexual, y reportamos por primera vez la infestación de este parásito en el pez cuero *C. macropterus*.

Abstract

Branchiura are a crustacean parasite widely known around the world as fish lice. In South America, they have been most studied in Brazil as with high levels of infestation, the parasites can be harmful to the health of fish and cause economic losses in fish farms. The objective of the present study is to provide, for the first time, significant information about the parasitic indices, infestation sites, and morphology of *Dolops carvalhoi*, and to report the appearance of a new host in the Amazon region of Peru. A total of 24 specimens of *Colossoma macropomum*, *Piaractus brachypomus*, and *Calophysus macropterus* from fish farms were individually analyzed to identify the presence of the ectoparasites. The Branchiura collected from the body surfaces of the fish were separated according to sex, the parasitic indices were calculated, and the parasites were clarified in 90% lactic acid for taxonomic identification. They were also preserved in 2.5% glutaraldehyde, and dehydration and critical point procedures were applied by scanning electron microscopy to visualize the detailed structures. The taxa identified was *D. carvalhoi*, which had a prevalence of 64.7%, a mean intensity of 1.6, and a mean abundance of 1 parasite/fish in *C. macropterus*; a prevalence of 100%, a mean intensity, and mean abundance of 2.8 parasites/fish in *P. brachypomus*; and a prevalence of 100%, but a mean intensity and mean abundance of 15 parasites/fish in *C. macropomum*. The pectoral and dorsal fins and the urogenital opening had

the highest occurrence of *D. carvalhoi* in the host. *Dolops carvalhoi* has sexual dimorphism, and we reported for the first time the infestation of this parasite in leather fish *C. macropterus*.

Enlaces: <https://doi.org/10.1007/s10499-024-01551-y>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/773>

Three New Species of *Sciadicleithrum* (Monogenoidea, Dactylogyridae) Parasitizing Cichlid Fishes (Cichliformes: Cichlidae) in the Northeastern Peru

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Abstract

Introduction: The present study describes three new dactylogyrid species infecting the gill filaments of cichlid fishes (Cichliformes: Cichlidae) from the Amazon basin, Peru: *Sciadicleithrum amazoniensis* n. sp. on *Biotodoma cupido* (Heckel, 1840), and *Sciadicleithrum feliciajaramae* n. sp. and *Sciadicleithrum souzatecci* n. sp. on *Bujurquina peregrinabunda* Kullander, 1986.

Materials and methods: Some monogeneans were stained with Gomori's trichrome and mounted in Canada Balsam to determine internal soft structures. Others were cleared in Hoyer's medium for the study of sclerotized structures. Drawings were made using a drawing tube and a microprojector.

Results: *Sciadicleithrum amazoniensis* n. sp. is characterized by the presence of a male copulatory organ (MCO) with a coil of approximately 2 counterclockwise rings, an accessory piece articulated to base of the MCO with an expanded proximal end and a bifurcated distal end, and a sinistral vaginal aperture. *Sciadicleithrum feliciajaramae* n. sp. can be differentiated from all its congeners by its J-shaped MCO with about half a counterclockwise loop and a rod-shaped accessory piece articulated to the base of the MCO, with the distal end bent. *Sciadicleithrum souzatecci* n. sp. differs from all other members of *Sciadicleithrum* by having an elongated MCO with about a clockwise loop and a funnel-shaped base. Additionally, *Sciadicleithrum souzatecci* n. sp. is characterized by its weakly sclerotized, C-shaped accessory piece with a robust middle process.

Conclusions: Present findings are added to the other 26 species previously known in *Sciadicleithrum*. This is the first data on the parasites of *B. peregrinabunda*.

Enlace: <https://doi.org/10.1007/s11686-024-00895-y>

Timber Tracking of *Jacaranda copaia* from the Amazon Forest Using DNA Fingerprinting

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Abstract

We investigated the utility of nuclear and cytoplasmic single nucleotide polymorphism (SNP) markers for timber tracking of the intensively logged and commercialized Amazonian tree *Jacaranda copaia*. Eight hundred and thirty-two trees were sampled (cambium or leaves) from 38 sampling sites in Bolivia, Brazil, French Guiana, and Peru. A total of 128 SNP markers (113 nuclear, 11 chloroplastic, and 4 mitochondrial) were used for genotyping the samples. Bayesian cluster analyses were carried out to group individuals into homogeneous genetic groups for tests to self-assign groups of individuals or individuals to their population of origin. Cluster analysis based on all the SNP markers detected seven main genetic groups. Genetic differentiation was high among populations (0.484) and among genetic groups (0.415), and populations showed a strong isolation-by-distance pattern. Self-assignment testing of the groups of individuals for all loci was able to determine the population origin of all the samples (accuracy = 100%). Self-assignment tests of individuals were able to assign the origin of 94.5%–100% of individuals (accuracy: 91.7%–100%). Our results show that the use of the 128 SNP markers is suitable to correctly determine the origin of *J. copaia* timber, and they should be considered a useful tool for customs and local and international police.

Enlaces: <https://doi.org/10.3390/f15081478>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/758>

Trends in Urban Wild Meat Trade of Chelonians (Turtles and Tortoises) in the Peruvian Amazon

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Abstract

Culturally, chelonians are important sources of nutrition and income for rural and urban people in tropical rainforests, but urban trade can cause declines in wild populations. This study analyses the urban chelonian trade and its trends to better understand the impact on free-living populations in the Northern Peruvian Amazon. We studied the urban trade of wild chelonians by conducting 526 days of participant observation and structured questionnaires with the main chelonian vendors in the wet markets of Iquitos between 2006 and 2018. The trade of chelonians decreased by -161.6%, from 22,694 individuals in 2006/07 to 8657 individuals in 2017/18. *Chelonoidis denticulatus* was the species sold the most (86.3%), followed by *Podocnemis unifilis* (13.6%). *Podocnemis expansa* was only sold in 2006/07. River turtle sales increased in the dry season, while sales of *Chelonoidis denticulatus* decreased. Turtles were the most expensive meat sold in urban markets: 49.7% more expensive than the most frequently consumed fish, *Prochilodus nigricans*, and 48.4% more expensive than poultry. Turtles represented only 0.19% (SD 0.23) of the index of domestic meat and fish consumption per capita. River turtle eggs are sold by a different set of vendors, and in 2017/18, 570,229 eggs were traded in the market of Belén in Iquitos, equivalent to an approximate lay of 10,418 *P. unifilis* and 1178 *P. expansa* females. The high magnitude of the trade of river turtle eggs together with the reduction in their meat trade suggests a prioritization of egg sales, which should improve the conservation of adults, since meat sales can be detrimental to chelonian populations.

Enlace: <https://doi.org/10.3390/ani14223205>

Two new dactylogyrid species (Dactylogyroidea: Dactylogyridae), gill parasites of freshwater fishes from the Peruvian Amazon, including the proposal of *Peruanella* n. gen.

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Abstract

A new genus of dactylogyrid, *Peruanella* n. gen., is proposed to accommodate *Peruanella madrede Diosensis* n. sp. from *Brachyplatystoma tigrinum* (Britski) (Siluriformes: Pimelodidae) from the Madre de Dios River, in Puerto Maldonado City, Madre de Dios region, Peru. The new genus differs from Neotropical dactylogyrids by possessing a combination of the following features: (1) tandem gonads, (2) a tubular J-shaped MCO, (3) an accessory piece connected to the base of the MCO via a filament, (4) a midventral vaginal aperture, (5) anchors similar in shape, each with short roots, (6) straight and robust bars, and (7) equal hook, each with undilated shanks and a depressed thumb. A previously described species, *Demidospermus aureagarciae* Morey, Rojas, Dávila, Chu & De Pina, 2023 exhibits characteristics that are compatible with the diagnosis of the new genus; therefore, this species is transferred to the *Peruanella* n. gen. In addition, *Jainus peruensis* n. sp. is described from *Brycon amazonicus* (Spix & Agassiz) (Characiformes: Bryconidae). This new species, which is the first species of the genus described in Peru and the third species infecting a bryconid host, can be differentiated from all congeneric species due to: (1) a slender MCO forming a counterclockwise loop at the proximal end, (2) an unarticulated accessory piece with a scythe-shaped distal end, (3) a rod-shaped ventral bar with a medial projection, and (4) a V-shaped and grooved dorsal bar.

Enlace: <https://doi.org/10.11646/zootaxa.5443.4.7>

Two new *Themistoclesia* (Ericaceae: Vaccinieae) from Peru

James L. Luteyn, Edgardo M. Ortiz, Paola Pedraza-Peñalosa

Servicio Nacional de Áreas Naturales Protegidas por el Estado



Abstract

Themistoclesia david-smithii and *T. gigantiflora* (Ericaceae: Vaccinieae), from the Yanachaga-Chemillén National Park located in central Peru, are described and illustrated.

Enlace: <https://doi.org/10.11646/phytotaxa.671.3.6>

**Una nueva especie de *Cosmetocleithrum* (Monogenea, Dactylogyridae)
de las branquias de *Auchenipterichthys coracoideus* (Siluriformes,
Auchenipteridae) de la Amazonía peruana**

**A new species of *Cosmetocleithrum* (Monogenea, Dactylogyridae) from
the gills of *Auchenipterichthys coracoideus* (Siluriformes:
Auchenipteridae) from the Peruvian Amazonia**

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Resumen

En este trabajo se registra una nueva especie de Monogenoidea, *Cosmetocleithrum amazonensis* n. sp., parasitando las branquias del silurido *Auchenipterichthys coracoideus* (Eigenmann & Allen, 1942). *Cosmetocleithrum amazonensis* n. sp. se distingue de todas las demás especies congéneres por poseer un órgano copulador masculino (OCM) tubo alargado, esclerotizado y sinuoso, con espirales poco definidos, base con borde esclerotizado y con la región distal apoyada sobre la pieza accesoria. La pieza accesoria es una placa única, robusta y no articulada con el OCM. En este estudio se presenta el tercer registro de una especie de Monogenoidea en un hospedero Auchenipteridae (Siluriformes) del Perú.

Abstract

In this study, a new species of Monogenoidea, *Cosmetocleithrum amazonensis* n. sp., parasitizing the gills of the silurid *Auchenipterichthys coracoideus* (Eigenmann & Allen, 1942), is documented. *Cosmetocleithrum amazonensis* n. sp. is distinguished from all other congeners by possessing an elongated, sclerotized, and sinuous male copulatory organ (MCO) with poorly defined spirals, a sclerotized border at the base, and the distal region supported by the accessory piece. The accessory piece is a single, robust, and non-articulated plate with the MCO. This study presents the third record of a Monogenoidea species in an Auchenipteridae (Siluriformes) host from Peru.

Enlace: <https://dx.doi.org/10.15381/rpb.v31i1.26253>

Understanding different dominance patterns in western Amazonian forests

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Abstract

Dominance of neotropical tree communities by a few species is widely documented, but dominant trees show a variety of distributional patterns still poorly understood. Here, we used 503 forest inventory plots (93,719 individuals ≥ 2.5 cm diameter, 2609 species) to explore the relationships between local abundance, regional frequency and spatial aggregation of dominant species in four main habitat types in western Amazonia. Although the abundance-occupancy relationship is positive for the full dataset, we found that among dominant Amazonian tree species, there is a strong negative relationship between local abundance and regional frequency and/or spatial aggregation across habitat types. Our findings suggest an ecological trade-off whereby dominant species can be locally abundant (*local dominants*) or regionally widespread (*widespread dominants*), but rarely both (*oligarchs*). Given the importance of dominant species as drivers of diversity and ecosystem functioning, unravelling different dominance patterns is a research priority to direct conservation efforts in Amazonian forests.

Enlace: <https://doi.org/10.1111/ele.14351>

Unveiling the above-ground eukaryotic diversity supported by individual large old trees: the “Life on Trees” integrative protocol

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Servicio Nacional de Áreas Naturales Protegidas por el Estado



Abstract

Large tropical trees are rightly perceived as supporting a plethora of organisms. However, baseline data about the variety of taxa coexisting on single large tropical trees are lacking and prevent a full understanding of both the magnitude of biodiversity and the complexity of interactions among organisms in tropical rainforests. The two main aims of the research program “Life on Trees” (LOT) are (1) to establish baseline knowledge on the number of eukaryote species supported/hosted by the above-ground part of a single tropical tree and (2) to understand how these communities of organisms are assembled and distributed on or inside the tree. To achieve the first goal, we integrated a set of 36 methods for comprehensively sampling eukaryotes (plants, fungi, animals, protists) present on a tropical tree. The resulting LOT protocol was conceived and implemented during projects in the Andean Amazon region and is proposed here as a guideline for future projects of a similar nature. To address the second objective, we evaluated the microclimatic differences between tree zones and tested state-of-the-art terrestrial laser scanning (TLS) and positioning technologies incorporating satellite and fixed base station signals (dGNSS). A marked variation in temperature and relative humidity was detected along a 6-zones Johansson scheme, a tree structure subdivision system commonly used to study the stratification of epiphytic plants. Samples were collected from these six zones, including three along the trunk and three in the canopy. To better understand how different tree components (e.g., bark, leaves, fruits, flowers, dead wood) contribute to overall tree biodiversity, we categorized observations into communities based on Johansson zones and microhabitats. TLS was an essential aid in understanding the complex tree architecture. By contrast, the accuracy of positioning samples in the tree with dGNSS was low. Comprehensively sampling the biota of individual trees offers an alternative to assessing the biodiversity of fewer groups of organisms at the forest scale. Large old tropical trees provide a wealth of microhabitats that encompass a wide range of ecological conditions, thereby capturing a broad spectrum of biodiversity.

Enlace: <https://doi.org/10.3389/ffgc.2024.1425492>

Usos tradicionales de la manchinga (Géneros *Brosimum* y *Sorocea*) en una comunidad kichwa de San Martín, Perú

Traditional uses of manchinga (genus *Brosimum* and *Sorocea*) in one kichwa communities of San Martín, Peru

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Resumen

El estudio documenta los usos tradicionales de especies conocidas localmente como manchinga por la comunidad kichwa de San Juan de Miraflores, en el departamento de San Martín, Perú. Se realizaron 20 entrevistas e inventarios botánicos de 13 árboles. Se identificaron tres especies de Moraceae: *Brosimum alicastrum* Sw., *Brosimum guianense* Huber ex Ducke y *Sorocea briquetii* J.F.Macbr, con diez usos específicos en las categorías de construcción, alimentación y medicina. Las semillas enteras cocinadas de estas tres especies son utilizadas para la alimentación; *B. alicastrum* y *B. guianense* tienen usos maderables, son utilizadas en la construcción y fabricación de muebles; y *B. alicastrum* también tiene uso medicinal. Las especies de manchingas tienen importancia sociocultural y económica.

Abstract

The study documents the traditional uses of species known as manchinga by the Kichwa community of San Juan de Miraflores, in the department of San Martín, Peru. Twenty interviews and botanical inventories of 13 trees were conducted. Three species of Moraceae were identified: *Brosimum alicastrum* Sw., *Brosimum guianense* Huber ex Ducke, and *Sorocea briquetii* J.F.Macbr, with ten specific uses in the categories of construction, food, and medicine. The whole cooked seeds of these three species are used for food; *B. alicastrum* and *B. guianense* have timber uses, being used in construction and furniture making; and *B. alicastrum* also has medicinal use. The manchinga species have cultural and economic importance.

Enlace: <https://doi.org/10.24841/fa.v33i1.755>

Wildlife trade at Belén and Modelo market, Peru: defining a baseline for conservation monitoring

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Abstract

Introduction: Domestic wildlife markets have important nutritional, medicinal, cultural, and financial significance for local communities, but the scale and diversity of wildlife trade that passes through them is also associated with negative impacts on biodiversity, poor animal welfare, and potential human health risk. To design, and monitor the effectiveness of, interventions to ameliorate such impacts, an understanding of the species sold at the markets and their purpose is required, together with a robust (and potentially flexible) baseline. Here we focus on Belén (the largest open wildlife market in the Peruvian Amazon) and Modelo market, in Iquitos, Peru.

Methods: We surveyed wildlife products for sale at both markets approximately weekly over a year, using two different survey methods (open and discreet). To provide a baseline to support future conservation monitoring, we estimated a number of different market metrics (including indices of product availability, volume (observed per survey), and price), for the most frequently observed species 'groups', and compared indices of trade volume with daily river water levels. To provide a complete understanding of the range of species involved, we also described all threatened species recorded at the markets, the products sold, and their uses, including those that were only observed occasionally.

Results: Both markets sold predominantly wild meat, and some pets; at Belén Market >30% observations were of decorative, spiritual, or medicinal products. At least 71 unique species (including mammals, reptiles, birds, and invertebrates) were observed in total. The most frequently observed species 'groups' were: lowland paca, peccaries, caiman, river turtles, boas, yellow footed tortoise, parrots, and brocket deer. 27.7% of species were threatened or Near Threatened globally or nationally but there was no evidence that discreet surveys increased their detection. Daily river water levels were positively correlated with indices of trade volume for lowland paca, caiman, and yellow-footed tortoise, and negatively correlated with indices of trade volume for parrots and river turtle eggs.

Discussion: Beyond providing a comparative dataset, and insights regarding the apparent availability and value of a diversity of products (including food items, live pets, and other decorative, spiritual, and medicinal items), we suggest that simulations using these data could be used to optimize future monitoring efforts. Finally, our observations of correlations of per survey trade volumes of some species with daily river water levels in Iquitos may inform optimal time of year for species- specific surveys.

Enlace: <https://doi.org/10.3389/fcosc.2024.1464332>



3

Deforestación y degradación de ecosistemas

A new data-driven map predicts substantial undocumented peatland areas in Amazonia

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Abstract

Tropical peatlands are among the most carbon-dense terrestrial ecosystems yet recorded. Collectively, they comprise a large but highly uncertain reservoir of the global carbon cycle, with wide-ranging estimates of their global area (441 025-1700 000 km²) and below-ground carbon storage (105-288 Pg C). Substantial gaps remain in our understanding of peatland distribution in some key regions, including most of tropical South America. Here we compile 2413 ground reference points in and around Amazonian peatlands and use them alongside a stack of remote sensing products in a random forest model to generate the first field-data-driven model of peatland distribution across the Amazon basin. Our model predicts a total Amazonian peatland extent of 251 015 km² (95th percentile confidence interval: 128 671-373 359), greater than that of the Congo basin, but around 30% smaller than a recent model-derived estimate of peatland area across Amazonia. The model performs relatively well against point observations but spatial gaps in the ground reference dataset mean that model uncertainty remains high, particularly in parts of Brazil and Bolivia. For example, we predict significant peatland areas in northern Peru with relatively high confidence, while peatland areas in the Rio Negro basin and adjacent south-western Orinoco basin which have previously been predicted to hold *Campinarana* or white sand forests, are predicted with greater uncertainty. Similarly, we predict large areas of peatlands in Bolivia, surprisingly given the strong climatic seasonality found over most of the country. Very little field data exists with which to quantitatively assess the accuracy of our map in these regions. Data gaps such as these should be a high priority for new field sampling. This new map can facilitate future research into the vulnerability of peatlands to climate change and anthropogenic impacts, which is likely to vary spatially across the Amazon basin.

Enlace: <https://doi.org/10.1088/1748-9326/ad677b>

Cedrelinga catenaeformis (Tornillo) in natural and agroforestry systems: Dendrometry, soil and macrofauna

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Abstract

Agroforestry and protected areas are alternatives to mitigate the adverse impacts generated by human activities in the tropical forests of the Peruvian Amazon. The aim of this study was to determine the influence of natural and agroforestry systems of *Cedrelinga catenaeformis* (Tornillo) on soil properties. The physical, chemical, and soil macrofauna properties, as well as dendrometric variables of Tornillo aged 140 and 180 years in natural systems and 7, 17 and 37 years in agroforestry systems, were examined. Results revealed variability in soil properties depending on their origin; however, no marked differences were observed due to tree age or natural versus agroforestry condition. Regarding soil macrofauna, greater diversity was noted in the older agroforestry system, while dendrometric variables exhibited a sigmoidal behavior, except for wood volume, which showed a linear increase. Agroforestry systems of Tornillo associated with *Centrosema macrocarpum* (*Centrosema*) maintain soil properties similarly compared to natural systems; however, the soil of the oldest agroforestry system showed higher activity of earthworms *Rhinodrilus lavellei*, *Rhinodrilus pashanasii*, Diptera orders, and Julidae, compared to soils of more recent agroforestry systems and natural systems. It was estimated that dendrometric variables of Tornillo show stagnation in the increase of total height at 150 years, commercial height at 165 years, and DBH at 70 years. Meanwhile, total height and DBH showed very strong and strong positive correlations ($p < 0.05$) with soil N content and CEC in agroforestry systems with 17 and 37 years. Estimating dendrometric variables and understanding the nutritional requirements in the growth and development of Tornillo will contribute to its more effective management in natural and agroforestry ecosystems in the Amazon region.

Enlaces: <https://doi.org/10.1016/j.tfp.2024.100577>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/760>

Influence of flooding variability on the development of an Amazonian peatland

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Resumen

En la Cuenca de Antepaís Pastaza–Marañón (PMFB), al norte de Perú, la turba se desarrolla en humedales abiertos, pantanos de palmeras, bosques de varillales y bosques que se inundan estacionalmente. Estas comunidades vegetales podrían representar distintas etapas sucesionales de las turberas, aunque los patrones espacio-temporales de su evolución en la Amazonía aún son poco conocidos. Este estudio presenta un nuevo registro geoquímico y paleoecológico que abarca los últimos 4330 años, obtenido de una turbera abierta en San Roque (núcleo SAR_T3_03_B). Los resultados indican la persistencia de comunidades vegetales mayormente herbáceas desde el inicio de la acumulación de turba, alrededor de 3180 años antes del presente. El análisis mediante fluorescencia de rayos X (micro-XRF) revela episodios de aporte mineral de origen fluvial, acompañados de un aumento en taxones tolerantes a las inundaciones, relacionados con periodos de mayor frecuencia y profundidad de las crecidas fluviales. La aparición de palmeras *Mauritia flexuosa*, hace aproximadamente 440 años antes del presente, coincidió con una reducción en la profundidad y frecuencia de las inundaciones, una tendencia que continúa hasta hoy. Este estudio resalta la influencia de la variabilidad de las inundaciones en el desarrollo de las turberas y la sucesión vegetal en la PMFB, destacando que comprender esta variabilidad ambiental es clave para conservar estos ecosistemas.

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.

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

<https://repositorio.iiap.gob.pe/handle/20.500.12921/766>

Pre-Columbian vegetational and fire history in western Amazonia: Terrestrial soil phytolith and charcoal evidence from three regions

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Abstract

The extent to which pre-Columbian human societies occupied and significantly impacted Amazonian environments have been long-standing questions and are currently under active discussion. Data are particularly limited from *terra firme* forests, formations away from watercourses that occupy over 90 % of the Amazon Basin. This paper investigates pre-Columbian influences on fire and vegetation in three regions of the western Peruvian Amazon through phytolith and charcoal analysis of terrestrial soils. One region in the Tapiche-Blanco watersheds was not previously studied. In the other two regions, the Los Amigos Biological Station and between the towns of Iquitos and Nauta, previous phytolith research was expanded to study in more detail forest composition and cultural palm usage through time. Our results indicate the diverse forests in these regions remained intact and were little affected by human forest clearing and agriculture with annual seed and root crops during the past 2000–5000 years of prehistory. Cultural palm enrichment is indicated in limited areas within each region studied, and usually occurred in riverine environments. The accumulated evidence from a number of different proxies indicates the persistence of diverse, forest-dominated pre-Columbian landscapes in western and parts of central Amazonia studied to date.

Enlace: <https://doi.org/10.1016/j.quaint.2024.01.011>

Some notes on the divergence and transformed divergence formulae in the remote sensing literature

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Abstract

Divergence, and particularly Transformed Divergence, are key separability metrics in remote sensing, predominantly utilized for digital image classification to achieve thematic mapping. Despite the widespread use of Transformed Divergence, the mathematical expression of Divergence – essential for calculating Transformed Divergence – appears in the literature in two different formulations, leading to inconsistent results and confusion within the remote sensing community. This study addresses the original source of Divergence, clarifies its correct formulation, and examines implementations that calculate Divergence and/or Transformed Divergence based on the original formula. Additionally, it provides data to verify the accuracy of future implementations and quantitatively shows the erratic implications of incorrect calculations.

Enlace: <https://doi.org/10.1080/2150704X.2024.2420286>

Erosión, sedimentación y dinámica lateral del río Amazonas entre la confluencia de los ríos Marañón-Ucayali y la localidad de Indiana - Loreto, Amazonía peruana

Erosion, sedimentation and lateral migration of the Amazon River between the confluence of the Marañón-Ucayali rivers and the town of Indiana - Loreto, Peruvian Amazon

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Resumen

La dinámica fluvial se caracteriza por diversos fenómenos que ocurren a lo largo del cauce de un río, entre estos los procesos de erosión, sedimentación y movimiento lateral que afectan la vida de los ribereños asentados en los márgenes de los ríos de las regiones tropicales. En este estudio evaluamos los índices de erosión, sedimentación y migración lateral del canal principal en tres sectores de la cuenca media del río Amazonas en la Amazonía peruana. Los resultados muestran una gran vulnerabilidad a la erosión y migración lateral en el sector “Samaria” y en parte del sector “Iquitos”. El sector “Muyuy” en la margen izquierda presenta un escenario de probable avulsión o incursión del río Amazonas sobre el río Itaya. Los procesos analizados han sido interpretados e ilustrados mediante el uso de procedimientos y técnicas proporcionados por la Teledetección y los Sistemas de Información Geográfica.

Abstract

Fluvial dynamics are characterized by various phenomena that occur along the course of a river, among these processes of erosion, sedimentation, and lateral movement that affect the lives of riversiders settled on the banks of rivers in tropical regions. In this study we evaluated the indices of erosion, sedimentation and lateral migration of the main channel in three sectors of the middle basin of the Amazon River in the Peruvian Amazon. The results show great vulnerability to erosion and lateral migration in the "Samaria" sector and in part of the "Iquitos" sector. The "Muyuy" sector on the left bank presents a scenario of probable avulsion or incursion of the Amazon River on the Itaya River. The analyzed processes have been interpreted and illustrated through the use of procedures and techniques provided by Remote Sensing and Geographic Information Systems.

Enlaces: <https://doi.org/10.4995/raet.2024.20142>

<https://repositorio.iiap.gob.pe/handle/20.500.12921/744>

Seasonal Effects of Wildfires on the Physical and Chemical Properties of Soil in Andean Grassland Ecosystems in Cusco, Peru: Pending Challenges

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Abstract

Soils are a valuable renewable resource on human timescales, and they interact with distinctive grassland ecosystems characterized by unique biodiversity and essential provision of ecosystem services, such as water supply and carbon sequestration. However, knowledge of the effects of wildfires on soil properties and nutrient availability in the Andes remains limited. Andean grasslands are currently one of the ecosystems of the Peruvian Andes most affected by wildfires. Our objective is to analyze the effect of fire activity on the physicochemical properties of soil and analyze its social context in Cusco, in the southern Andes of Peru. Soil samples were collected during five periods, spanning both the dry and rainy seasons, to characterize changes in soil properties and monitor vegetation recovery post-fire in two local communities dedicated to livestock activities. The vegetation restored after the wildfire was measured by the “step transect” method. Post-fire changes in soil properties indicate slight increases in pH, electrical conductivity, organic matter, nitrogen, phosphorus, and potassium during the onset of the rainy season; thereafter, a gradual reduction in these values was observed. This reduction can be attributed to leaching associated with the seasonal rainfall and runoff regime. Our findings indicate that one-year post-fire, the biomass in burned areas is reduced to 30–46% of the biomass in unburned areas. A complete regeneration is likely to occur in up to 4 years; this assertion is supported by the perceptions of the affected population, as expressed in interviews conducted in the two farming communities. These results are significant for decision-makers formulation of policies and regulations regarding grasslands and their seasonal restoration.

Enlaces: <https://doi.org/10.3390/fire7070259>

<http://hdl.handle.net/20.500.12816/5582>

Use of the SWAT Model to Simulate the Hydrological Response to LULC in a Binational Basin between Ecuador and Peru

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Abstract

Land use change has played a crucial role in altering the hydrological behavior, making detailed assessments essential to ensure sustainable water resource management and the conservation of natural ecosystems. This study focuses on simulating the impact of different Land Use and Land Cover (LULC) scenarios for the years 1985, 1995, 2005, and 2015 on the water balance in the Puyango-Tumbes River basin, which spans across Ecuador and Peru, during the period 1981-2015. The results indicated an 18.3% increase in the grassland areas and a significant 38.2% reduction in the savanna zones, contributing to an annual 2.1% increase in the Evapotranspiration (PET) rates. These land use changes led to a 29.2% decrease in the Percolation (PERC), a 20.7% decrease in the Surface Runoff (SURQ), a 33% reduction in the Groundwater Flow (GW_Q), and a 26.6% decrease in the Annual Water Yield (WYLD), as well as a slight reduction of 0.9% in the Lateral flow (LAT_Q). These findings highlight the importance of considering land use changes to ascertain the sustainable management of natural resources, particularly in a transboundary basin.

Enlace: <https://doi.org/10.48084/etasr.8646>

Identification of the Marine Coast Area Affected by Oil Spill Using Multispectral Satellite and UAV Images in Ventanilla - Callao, Perú

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Organismo de Evaluación y Fiscalización Ambiental



Abstract

The primary objective of this research was to identify the sea and coastal areas affected by the oil spill that occurred on January 15, 2022, near the La Pampilla refinery in Ventanilla, Callao, Peru. High-resolution multispectral satellite images from the Peruvian Satellite System (PSS) and satellite images from the International Charter activation were utilized. Additionally, aerial images were collected using remotely piloted aircraft systems (RPAS) over the coastal zone from Ventanilla beach in Callao to Punta Salinas in Huacho, Huara-Lima. The satellite images were processed at the surface reflectance level, and a classification technique based on object detection was applied to enhance image interpretation by analyzing shapes, sizes, textures, and other features. This method improved the identification of the affected marine areas. For the aerial images, photointerpretation was employed to determine the extent of the area impacted by the oil spill in the coastal zones. The results from the multispectral images revealed estimated affected areas of 10669.90 ha, 7049.19 ha, 1732.10 ha, 502.03 ha, and 972.78 ha on January 18, 19, 25, 27, and February 4, 2022, respectively. For the RPAS images, an estimated littoral area of 390.41 ha was affected by the oil spill from Ventanilla-Callao beach to Cascajo-Chancay beach in Huaral-Lima on January 17 and 26, 2022. The results were validated using data collected during field campaigns conducted by the Environmental Evaluation and Supervision Organization (OEFA), achieving an overall accuracy of 97.98% and a kappa index of 0.56. The information obtained from this study has contributed to the environmental evaluation and monitoring processes carried out by the Ministry of Environment (MINAM) and the supervisory organization (OEFA).

Enlace: <https://doi.org/10.1109/ARGENCON62399.2024.10735911>



4

Gestión de riesgos y adaptación al cambio climático

A multiple linear regression model for the prediction of summer rainfall in the northwestern Peruvian Amazon using large-scale indices

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Abstract

The northwestern Peruvian Amazon (NWPB) basin (78.4–75.8° W, 7.9–5.4° S) is an important region for coffee and rice production in Peru. Currently, no prediction models are available for estimating rainfall in advance during the wet season (January–February–March, JFM). Hence, we developed multiple linear regression (MLR) models using predictors derived from sea surface temperature (SST) indices of the Pacific, Atlantic, and Indian Oceans, including central El Niño (C), eastern El Niño (E), tropical South Atlantic (tSATL), tropical North Atlantic (tNATL), extratropical North Atlantic (eNATL), and Indian Ocean basin-wide with E and C removed (IOBW*) indices. Additionally, we utilized large-scale convection indices, namely, the eastern Pacific intertropical convergence zone (ITCZe) and South American Monsoon System (SAMSi) indices, for the 1981–2018 period. Rainfall in the lowland NWPB exhibits a bimodal annual cycle, whereas rainfall in the highland NWPB exhibits a unimodal annual cycle. The MLR model can be used to accurately capture the interannual variability during the wet season in the highland NWPB by utilizing predictors derived from the C and SAMSi indices. In contrast, regarding rainfall in the lowland NWPB, the Pacific SST variability, SAMS and tropical North Atlantic index were relevant. For long lead times, the MLR model provided reliable forecasts of JFM rainfall anomalies in the highlands (R3, approximately 2700 m asl) as these regions are governed by Pacific variability. However, the MLR model exhibited limitations in accurately estimating the wettest JFM season in the highlands due to the absence of a predictor for the amplified effect of the Madden–Julian Oscillation on rainfall.

Enlaces: <https://doi.org/10.1007/s00382-023-07044-7>

<http://hdl.handle.net/20.500.12816/5504>

A storm-time global electron density reconstruction model in three-dimensions based on artificial neural networks

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Abstract

We present results of a dedicated global storm-time model for the reconstruction of ionospheric electron density in three-dimensions. Using the storm criterion of $|Dst| \geq 50$ nT and $Kp \geq 4$, the model is constructed using a combination of radio occultation and ionosonde data during the periods of 2006–2021 and 2000–2020, respectively. From the ionosonde data, only the bottomside electron density profiles up to the maximum height of the F2 layer (hmF2) are considered. In addition to the selection of storm-time data only for the model development, we have investigated the inclusion of time history for the geomagnetic storm indicator Kp at 9 and 33 h in an attempt to take into account the delay of physical processes related to atmospheric gravity waves or traveling ionospheric disturbances and thermospheric composition changes which drive varying ionospheric storm effects during storm conditions. Based on incoherent scatter radar data and in comparison with the IRI 2020 model, the developed storm-time model provides foF2 modelling improvement of above 50% during the storm main phase over Millstone Hill (42.6°N, 71.5°W) and Troms3 (69.6°N, 19.2°E) for the storm periods of 3–6 November 2021 and 23–25 March 2023, respectively. Modelled results for Jicamarca (11.8°S, 77.2°W) show that the storm-time model estimates foF2 by an improvement of over 20% during the main phase of the 07–10 September 2017 storm period. As the ionospheric conditions return to quiet time levels, the IRI 2020 model perform better than the constructed storm -time model.

Enlaces: <https://doi.org/10.1016/j.asr.2024.02.014>

<http://hdl.handle.net/20.500.12816/5534>

Advancing South American Water and Climate Science through Multidecadal Convection-Permitting Modeling

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

Esta publicación científica no cuenta con resumen disponible.

Enlaces: <https://doi.org/10.1175/BAMS-D-22-0226.1>

<https://hdl.handle.net/20.500.12542/3171>

Analysis and Evaluation of Recent Deformation on the Huaytapallana Fault (Central Region of Peru) Based on Data Obtained from a Local Seismic Network

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Abstract

In the central region of Peru, two earthquakes with magnitudes of M_s 5.6 and 6.2 occurred in 1969, originating from the Huaytapallana fault. As a result, two fault scarps formed on the surface: the first measuring 4 km and the second one 9.5 km in length, separated by a 4 km section without a surface scarp. A three-year seismic campaign (2015–2018) conducted around the Huaytapallana fault has provided insights into its current dynamics. The 172 microearthquakes recorded, with magnitudes ranging from M_w 0.6 to 3.1, are distributed along the northeastern flank of the fault and extend over 40 km, including segments without visible surface scarps. The Huaytapallana fault is estimated to have a depth of around 15 km with a dip of 60° toward the northeast. The composite focal mechanisms indicate a deformation process due to compression, with a fault plane oriented in the north-northwest–south-southeast direction and dipping toward the northeast at angles between 55° and 60°. The M_w 4.7 earthquake in 2022 and its series of aftershocks exhibit a similar deformation pattern associated with the Huaytapallana fault. These results are consistent with the regional tectonics, which control the deformation processes in the Mantaro basin, originating from the convergence of the Nazca and South American plates. We consider that the significant microseismic activity occurring in areas without visible surface scarps suggests the accumulation of substantial deformation, which could lead to future earthquakes of greater magnitude that may cause significant surface displacements.

Enlaces: <https://doi.org/10.1785/0220240257>

<http://hdl.handle.net/20.500.12816/5649>

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

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Servicio Nacional de Meteorología e Hidrología del Perú



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>

Benefits of the coupling in the downscaling the South American climate

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Abstract

We evaluate the benefits of the use of a regional coupled model over its stand-alone atmospheric component when forced by reanalysis data in the simulation of the South American climate. We find that the coupling allows for a better simulation of important features of the atmospheric circulation and surface temperature. The simulated 2 meters air temperature is improved over most of the continent, the sea level pressure over the South Pacific Anticyclone area is better represented in the coupled simulation and the location of the ITCZ is improved during the austral winter. The precipitation, especially over the Andes, benefits less from the coupling, although a more realistic humidity transport leads to a reduction of the precipitation biases over extensive regions. The austral summer precipitation bias is reduced in areas such as eastern Colombia, northern Bolivia, eastern Brazil and central Argentina. For austral winter, the coupled model has a better performance in a large part of the Amazon region, in areas such as east of Peru, west Brazil, north Bolivia and south Argentina. Moreover, the regionally coupled model not only improves the simulation of important features of the observed atmospheric fields but also demonstrates good skills in reproducing the Humboldt upwelling system. Therefore, our study highlights the advantages of regional coupled models for the simulation of the South American climate, as the ocean-atmosphere interaction is of utmost importance for the circulation mechanisms that determine the climate of the region.

Enlaces: <https://doi.org/10.1016/j.atmosres.2024.107447>

<https://hdl.handle.net/20.500.12542/3634>

Central South America

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

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Characteristics of Precipitation and Mesoscale Convective Systems Over the Peruvian Central Andes in Multi 5-Year Convection-Permitting Simulations

Yongjie Huang, Ming Xue, Xiao-Ming Hu, Elinor Martin, Hector Mayol Novoa, Renee A. McPherson, Changhai Liu, Kyoko Ikeda, Roy Rasmussen, Andreas F. Prein, Andres Vitaliano Perez, Isaac Yanqui Morales, José Luis Ticona Jara, Auria Julieta Flores Luna

Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

Using the Weather Research and Forecasting model with two planetary boundary layer schemes, ACM2 and MYNN, convection-permitting model (CPM) regional climate simulations were conducted for a 6-year period, including a one-year spin-up period, at a 15-km grid spacing covering entire South America and a nested convection-permitting 3-km grid spacing covering the Peruvian central Andes region. These two CPM simulations along with a 4-km simulation covering South America produced by National Center for Atmospheric Research (NCAR), three gridded precipitation products, and rain gauge data in Peru and Brazil, are used to document the characteristics of precipitation and mesoscale convective systems (MCSs) in the Peruvian central Andes region. Results show that all km-scale simulations generally capture the spatiotemporal patterns of precipitation and MCSs at both seasonal and diurnal scales, although biases exist in aspects such as precipitation intensity and MCS frequency, size, propagation speed, and associated precipitation intensity. The 3-km simulation using MYNN scheme generally outperforms the other simulations in capturing seasonal and diurnal precipitation over the mountain, while both it and the 4-km simulation demonstrate superior performance in the western Amazon Basin, based on the comparison to the gridded precipitation products and gauge data. Dynamic factors, primarily low-level jet and terrain-induced uplift, are the key drivers for precipitation and MCS genesis along the east slope of the Andes, while thermodynamic factors control the precipitation and MCS activity in the western Amazon Basin and over elevated mountainous regions. The study suggests model improvements and better model configurations for future regional climate projections.

Enlaces: <https://doi.org/10.1029/2023JD040394>

<https://hdl.handle.net/20.500.12542/3779>

Comparison between rupture parameters of intermediate and deep earthquakes at the Peru–Brazil–Bolivia border and northern Chile

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Abstract

We determined the main parameters of the source rupture process of intermediate- and deep-depth earthquakes occurring in the Peru–Brazil–Bolivia border region and northern Chile. The parameters of depth, fault-plane orientation, scalar seismic moment, slip distribution, and radiated seismic energy are obtained from seismograms. We selected 15 intermediate-depth earthquakes ($100 \text{ km} < h < 300 \text{ km}$) and 10 very deep earthquakes ($h > 500 \text{ km}$) with magnitudes $M_w \geq 6.0$. For most events, the slip distribution over the rupture plane shows a single asperity, and the source time function presents a simple pulse. There are differences between intermediate-depth and deep earthquakes. The rupture areas, maximum slip and source time function (STF) duration are larger for intermediate-depth events than for deep events. Additionally, the STF's show a sharper increase for deep earthquakes. The scaled radiated seismic energy shows larger values for deep depth events. The stress regime pattern derived from the obtained focal mechanism agrees with the geometry of the subduction of the Nazca plate. At intermediate depths, in the northern area up to 12°S , the stress pattern corresponds to a horizontal extension, while in the southern area, the tension axes dip at an angle of 30° . At deep depths, the stress regime corresponds to vertical compression in the north and dips of approximately 45° in the south.

Enlaces: <https://doi.org/10.1007/s10950-024-10229-0>

<http://hdl.handle.net/20.500.12816/5575>

Dynamic atmospheric mechanisms associated with the diurnal cycle of hydrometeors and precipitation in the Andes–Amazon transition zone of central Peru during the summer season

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Abstract

The diurnal cycle of total hydrometeor availability and its associated patterns of atmospheric circulation is studied over a connected Andes–Amazon (A–A) system in the central region of Peru during the summer season. Surface precipitation depends on the amount of hydrometeors that occur in the atmosphere and its atmospheric dynamics. Hydrometeors and the precipitation efficiency index were estimated using radar of the core satellite of the GPM system (N-GPM) for the period 2014–2022. The atmospheric dynamics were analyzed using the regional Weather Research and Forecasting (WRF) model. According to the results, the Andes mountain range produces precipitation at a surface level more efficiently during the afternoon and early evening hours (12–19 LT) due to the convergence of the thermal mesoscale circulations transporting moisture fluxes from the east and west. Both generate convective multicells along the Andes mountain range. The circulation from the west intensifies during the day, causing the displacement of the chain of convective multicells towards the east and producing hydrometeors and intense precipitations in the inter-Andean valleys. The A–A transition zone is more efficient in producing precipitation during the early hours of the day (00–07 LT) due to an increase in the northern circulation associated with the low-level jets and a change in the magnitude of the horizontal winds. Northerly winds enter the A–A transition zone with increased intensity and leave with reduced intensity. This mechanism is driven by the effect of the topographical barrier and the masses of cold air located in high areas on the eastern flank of the Andes. These factors generate significant updrafts and, therefore, the formation of storm clouds with high concentrations of hydrometeors and precipitation on the surface.

Enlaces: <https://doi.org/10.1007/s12040-024-02278-3>

<http://hdl.handle.net/20.500.12816/5615>

Emergent constraint on oxygenation of the upper South Eastern Pacific oxygen minimum zone in the twenty-first century

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Abstract

As a consequence of on-going global warming, the ocean is losing oxygen, which has implications not only in terms of marine resources management and food supply but also in terms of the potentially important feedback on the global carbon cycle and climate. Of particular scrutiny are the extended zones of already low levels of oxygen called the oxygen minimum zones (OMZs) embedded in the subsurface waters of the productive Eastern Boundary Upwelling Systems (EBUS). These OMZs are currently diversely simulated by state-of-the-art Earth System Models (ESM) hampering a reliable projection of ocean deoxygenation on marine ecosystem services in these regions. Here we focus on the most emblematic EBUS OMZs of the planet, that of the South Eastern Pacific (SEP), which is under the direct influence of the El Niño Southern Oscillation (ENSO), the main climate mode on interannual timescales at global scale. We show that, despite the low consensus among ESM long-term projections of oxygen levels, the sensitivity of the depth of the upper margin (oxycline) of the SEP OMZ to El Niño events in an ensemble of ESMs can be used as a predictor of its long-term trend, which establishes an emergent constraint for the SEP OMZ. Because the oxycline along the coast of Peru and Chile deepens during El Niño events, the upper bound of the SEP OMZ is thus likely to deepen in the future climate, therefore oxygenating the SEP OMZ. This has implications not only for understanding the nitrogen and carbon cycles at global scale but also for designing adaptation strategies for regional upper-ocean ecosystem services.

Enlaces: <https://doi.org/10.1038/s43247-024-01427-2>

<http://hdl.handle.net/20.500.12816/5597>

Estimación de lluvias extremas mediante un enfoque de análisis regional y datos satelitales en Cusco, Perú

Estimation of extreme rainfall through a regional analysis and satellite data approach in Cusco, Peru

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Resumen

La frecuencia y magnitud de los eventos climáticos extremos de precipitación han aumentado significativamente en varios países del mundo, incluido Perú. Estos hechos causan pérdidas económicas y humanas, especialmente en países en vías de desarrollo. La información y metodologías que permitan prevenir o diseñar estrategias para afrontarlas son escasas o inexistentes. El objetivo de esta investigación fue analizar la capacidad del producto satelital IMERG (Integrated Multi-satellite Retrievals) del satélite GPM (Global Precipitation Measurement) y datos observados a partir de estaciones meteorológicas mediante un enfoque mixto para estimar la distribución de lluvias extremas en la región del Cusco ubicado al sur del Perú. Este enfoque mixto aprovechó las ventajas que ofrecen ambas fuentes de información como es la solidez de los datos observados a lo largo de varios años y la resolución temporal horaria del producto satelital. La metodología se basó en una curva de crecimiento de cada región homogénea, factor de corrección y parámetros que estiman la función intensidad y duración para toda la región Cusco. Los resultados se evaluaron mediante validación cruzada entre los valores de precipitación diaria obtenidos del producto IMERG, enfoque mixto y precipitación observada para periodos de retorno de 2, 5, 10, 20, 50, 100, 200, 500 y 1 000 años. Los resultados sugieren que la combinación de datos observados de lluvia y del satélite IMERG puede ser una alternativa para estimar lluvias extremas en la región Cusco.

Abstract

The frequency and magnitude of extreme climatic precipitation events have increased significantly in several countries of the world, including Peru. These events cause economic and human losses, especially in developing countries. Information and methodologies to prevent or design strategies to deal with them are scarce or non-existent. The aim of this research was to analyze the capacity of the IMERG (Integrated Multi-satellite Retrievals) satellite product of the GPM (Global Precipitation Measurement) and observed data from meteorological stations using a mixed approach to estimate the distribution of extreme rainfall in Cusco region located in southern Peru. This mixed approach took advantage of both sources of information, such as the strength of the data observed over many years and hourly temporal resolution of the satellite product. The methodology was based on a growth curve for each homogeneous region, correction factor and parameters that estimate the intensity and duration function for the entire Cusco region. The results were evaluated by cross-validation between daily precipitation values obtained from the IMERG product, mixed approach and observed precipitation for return periods of 10, 20, 100, 500 and 1 000 years. The results suggest that the combination of observed and rainfall data from the IMERG satellite may be an alternative to estimate extreme rainfall in the Cusco region.

Enlaces: <https://doi.org/10.24850/j-tyca-2024-05-01>

<https://hdl.handle.net/20.500.12542/3140>

Evaluación de la respuesta hidrológica a cambios de precipitación y temperatura en el altiplano peruano

Assessment of the hydrological response to precipitation and temperature changes in the Peruvian Altiplano

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Resumen

Las cuencas de montaña son consideradas como los sistemas hidrológicos de mayor afectación por el cambio climático, estimándose impactos significativos en los recursos hídricos y las demandas de agua. Este estudio evalúa la respuesta hidrológica de una cuenca del altiplano peruano frente a cambios de los patrones de precipitación y temperatura. El conocer con anticipación el efecto del cambio climático sobre la oferta hídrica toma relevante importancia para la toma de decisiones en la planificación a corto, mediano y largo plazos del uso del agua y la gestión de los recursos hídricos. A partir de la implementación del Modelo Integrado de Cambio Climático y Recursos Hídricos (HydroBID) se evaluaron 30 escenarios climáticos que consideraron cambios en la precipitación entre -20 y +20 %, temperatura entre 0 y 6 °C, y combinaciones de éstos formulados según las proyecciones para el área de estudio disponibles en la literatura. Los resultados mostraron que por cada 10 % de incremento de la precipitación se produjo un aumento promedio de 23.4 % en el caudal; mientras que por cada 10 % de disminución de la precipitación se generó una reducción promedio del caudal de 16 %. Asimismo, se evidenció que por cada 1 °C de subida de la temperatura se generó en promedio un 5 % de reducción del caudal. Se determinó que la variación de las tasas de precipitación, temperatura y su interacción entre ellas generarían cambios en los caudales futuros, mostrando efectos en la variación temporal y espacial de la cuenca.

Abstract

Mountain basins are considered the hydrologic systems most affected by climate change, estimating significant impacts on water resources and water demands. This study evaluates the hydrological response of a Peruvian Altiplano basin to changes in precipitation and temperature patterns. Knowing in advance the effect of climate change on water supply takes on relevant importance for decision-making in short, medium and long-term planning of water use and management of water resources. From the implementation of the Integrated Model of Climate Change and Water Resources (HydroBID), 30 climate scenarios were evaluated that considered changes in precipitation between -20 and +20 %, temperature between 0 and 6 °C, and combinations of these were formulated according to the projections for the study area available in the literature. The results showed that for every 10 % increase in precipitation there was an average increase of 23.4 % in flow; while for every 10 % decrease in precipitation, an average reduction in flow of 16 % was generated. Likewise, it was evidenced that for every 1 °C increase in temperature, an average 5 % reduction in flow was generated. It was determined that the variation of the precipitation rates, temperature and their interaction between them generate changes in the flows, showing effects on the temporal and spatial variation of the basin.

Enlaces: <https://doi.org/10.24850/j-tyca-15-01-01>

<http://hdl.handle.net/20.500.12816/5595>

Evaluación de la cinemática del deslizamiento de Cuenca en los Andes de Perú central mediante técnicas fotogramétricas y geodésicas

Assessment of the Kinematics of the Cuenca landslide in the central Peruvian Andes using photogrammetry and geodetic techniques

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Resumen

Los deslizamientos de tierra representan un peligro importante en muchas regiones montañosas, incluidos los valles interandinos del Perú. En este estudio evaluamos la dinámica del deslizamiento de Cuenca, ubicado en Huancavelica en el centro de Perú, empleando fotogrametría y mediciones GNSS. Se ejecutaron mediciones interanuales en ocho zonas entre 2016 y 2023 para GNSS y dos campañas de levantamiento fotogramétrico en 2023 para comparar los cambios de la superficie en el tiempo. Los resultados mostraron desplazamientos del orden de los 3,7 a 11,7 cm con la técnica de nube de puntos y 2,7 a 15 cm con el análisis de los ortomosaicos, siendo concordantes entre sí. Los desplazamientos en los puntos donde se han realizado mediciones GNSS son similares en magnitud, sin embargo, difieren parcialmente en dirección. El estudio concluye que las técnicas fotogramétricas son aplicables para analizar la dinámica de deslizamientos.

Abstract

Landslides represent a significant hazard in many mountainous regions, including the inter-Andean valleys of Peru. In this study, we evaluate the dynamics of the Cuenca landslide located in Huancavelica, central Peru, using photogrammetry and GNSS measurements. Interannual measurements were conducted at eight sites between 2016 and 2023 for GNSS, and two photogrammetric survey campaigns in 2023 to compare surface changes over time. The results show displacements ranging from 3.7 to 11.7 cm using the point cloud technique and from 2.7 to 15 cm through orthomosaic analysis, with both methods yielding consistent results. Displacements at points where GNSS measurements were taken are similar in magnitude but differ partially in direction. The study concludes that UAV techniques are applicable for analyzing landslide dynamics.

Enlaces: <https://doi.org/10.4995/raet.2024.21785>

<http://hdl.handle.net/20.500.12816/5600>

First climatology of F-region UHF echoes observed by the AMISR-14 system at the Jicamarca radio observatory and comparison with the climatology of VHF echoes observed by the collocated JULIA radar

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Abstract

Coherent backscatter radar observations made at the Jicamarca Radio Observatory (JRO) have contributed significantly to our understanding of equatorial F-region irregularities. Radar observations, however, have been made predominantly at the Very-High Frequency (VHF) band (50 MHz), which corresponds to measurements of 3-m field-aligned irregularities. The deployment of the 14-panel version of the Advanced Modular Incoherent Scatter Radar (AMISR-14) at Jicamarca provided an opportunity for observations of Ultra-High Frequency (UHF - 445 MHz) echoes which correspond to measurements of irregularities with 0.34 m scale sizes. Here, we present what we believe to be the first report describing the quiet-time climatology of sub-meter equatorial F-region irregularities derived from UHF radar measurements. The measurements were made between August 2021 and February 2023 using a 10-beam AMISR-14 mode that scanned the F-region in the magnetic equatorial plane. The results show how F-region sub-meter irregularities respond to variations in season and solar flux conditions. The results also confirm, experimentally, that the occurrence of UHF F-region echoes is controlled by the occurrence of equatorial spread F (ESF). Higher occurrence rates were observed during pre-midnight hours and during Equinox and December solstice. Reduced occurrence rates were observed during June solstice. The results show that an increase in solar flux was followed by an increase in the altitude where noticeable occurrence rates start and in the maximum altitude of these occurrence rates. The observations also show that occurrence rates lasted longer (in local time) during low solar flux conditions. Comparisons with collocated VHF radar observations showed that, despite differences in radar parameters, observation days, and the scale size (one order of magnitude) of the scattering irregularities, the two systems show similar climatological variations with only minor differences in the absolute occurrence rates. Finally, the analysis of the occurrence rates for different beams did not show substantial climatological variations over local (within a few 100s of km) zonal distances around JRO. We point out, however, that observations on a single day can show strong local variations in echo detection and intensity within the AMISR-14 field of view due to the intrinsic development and decay of ESF structures.

Enlaces: <https://doi.org/10.1016/j.jastp.2024.106328>

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Future changes of precipitation types in the Peruvian Andes

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Abstract

In high-altitude regions, such as the Peruvian Andes, understanding the transformation of precipitation types under climate change is critical to the sustainability of water resources and the survival of glaciers. In this study, we investigate the distribution and types of precipitation on a tropical glacier in the Peruvian Central Andes. We utilized data from an optical-laser disdrometer and compact weather station installed at 4709 m ASL, combined with future climate scenarios from the CMIP6 project, to model potential future changes in precipitation types. Our findings highlight that increasing temperatures could lead to significant reductions in solid-phase precipitation, including snow, graupel and hail, with implications for the mass balance of Andean glaciers. For instance, a 2 °C rise might result in less than 10% of precipitation as solid, in regard to the present day, transforming the hydrological processes of the region. The two future climate scenarios from the CMIP6 project, SSP2-4.5 and SSP5-8.5, offer a broad perspective on potential climate outcomes that could impact precipitation patterns in the Andes. Our study underscores the need to revisit and expand our understanding of high-altitude precipitation in the face of climate change, paving the way for improved water resource management strategies and sustainable glacier preservation efforts in these fragile ecosystems.

Enlace: <https://doi.org/10.1038/s41598-024-71840-2>

Geological evidence of extensive N-fixation by volcanic lightning during very large explosive eruptions

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Abstract

Most of the nitrogen (N) accessible for life is trapped in dinitrogen (N₂), the most stable atmospheric molecule. In order to be metabolized by living organisms, N₂ has to be converted into biologically assimilable forms, so-called fixed N. Nowadays, nearly all the N-fixation is achieved through biological and anthropogenic processes. However, in early prebiotic environments of the Earth, N-fixation must have occurred via natural abiotic processes. One of the most invoked processes is electrical discharges, including from thunderstorms and lightning associated with volcanic eruptions. Despite the frequent occurrence of volcanic lightning during explosive eruptions and convincing laboratory experimentation, no evidence of substantial N-fixation has been found in any geological archive. Here, we report on the discovery of a significant amount of nitrate in volcanic deposits from Neogene caldera-forming eruptions, which are well correlated with the concentrations of species directly emitted by volcanoes (sulfur, chlorine). The multi-isotopic composition ($\delta^{18}\text{O}$, $\Delta^{17}\text{O}$) of the nitrates reveals that they originate from the atmospheric oxidation of nitrogen oxides formed by volcanic lightning. According to these first geological volcanic nitrate archive, we estimate that, on average, about 60 Tg of N can be fixed during a large explosive event. Our findings hint at a unique role potentially played by subaerial explosive eruptions in supplying essential ingredients for the emergence of life on Earth.

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Hailstorm events in the Central Andes of Peru: insights from historical data and radar microphysics

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Abstract

Hailstorms, while fascinating from a meteorological perspective, pose significant risks to communities, agriculture, and infrastructure. In regions such as the Central Andes of Peru, the characteristics and frequency of these extreme weather events remain largely uncharted. This study fills this gap by investigating the historical frequency and vertical structure of hailstorms in this region. We analyzed historical hailstorm records dating back to 1958 alongside 4 years of observations (2017–2021) from the Parsivel2 disdrometer and a cloud-profiling radar MIRA35c. Our findings indicate a trend of decreasing hail frequency (-0.5 events per decade). However, the p value of 0.07 suggests the need for further investigation, particularly in relation to environmental changes and reporting methods. The results show that hailstorms predominantly occur during the austral summer months, with peak frequency in December, and are most common during the afternoon and early evening hours. The analysis of radar variables such as reflectivity, radial velocity, spectral width, and linear depolarization ratio (LDR) reveals distinct vertical profiles for hail events. Two case studies highlight the diversity in the radar measurements of hailstorms, underscoring the complexity of accurate hail detection. This study suggests the need for refining the Parsivel2 algorithm and further understanding its classification of hydrometeors. Additionally, the limitations of conventional radar variables for hail detection are discussed, recommending the use of LDR and Doppler spectrum analysis for future research. Our findings lay the groundwork for the development of more efficient hail detection algorithms and improved understanding of hailstorms in the Central Andes of Peru.

Enlaces: <https://doi.org/10.5194/amt-17-2295-2024>

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Heterogeneous Locking and Earthquake Potential on the South Peru Megathrust From Dense GNSS Network

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Abstract

The Central Andes subduction has been the theater of numerous large earthquakes since the beginning of the 21st Century, notably the 2001 $M_w = 8.4$ Arequipa, 2007 $M_w = 8.0$ Pisco and 2014 $M_w = 8.1$ Iquique earthquakes. We present an analysis of 47 permanent and 26 survey global navigation satellite system (GNSS) measurements acquired in Central-South Peru between 2007 and 2022 to better understand the frictional properties of the megathrust interface. Using a trajectory model that mimics the different phases of the cycle, we extract a coherent interseismic GNSS field at the scale of the Central Andes from Lima to Arica (12–18.5°S). Interseismic models on a 3D slab geometry indicate that the locking level is relatively high and concentrated between 20 and 40-km depth. Locking distributions indicate a high spatial variability of the coupling along the trench, with the presence of many locked patches that spatially correlate with the seismotectonic segmentation. Our study confirms the presence of a creeping segment where the Nazca Ridge is subducting; we also observe a lighter apparent decrease of coupling related to the Nazca Fracture Zone (NFZ). However, since the Nazca Ridge appears to behave as a strong barrier, the NFZ is less efficient to arrest seismic rupture propagation. Considering various uncertainty factors, we discuss the implication of our coupling estimates with size and timing of large megathrust earthquakes considering both deterministic and probabilistic approaches. We estimate that the South Peru segment could have a $M_w = 8.4$ –9.0 earthquake potential depending principally on the considered seismic catalog and the seismic/aseismic slip ratio.

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Hydrometeors Distribution in Intense Precipitating Cloud Cells Over the Earth's During Two Rainfall Seasons

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Abstract

In the present study, we used attenuated corrected radar reflectivity factor (Z_e) and rain-drop size distribution (DSD) to investigate the hydrometeors distribution in the intense precipitating cloud cells (PCCs) from precipitation radar (PR) onboard on Global Precipitation Measurement (GPM). The DSD parameters consist of two variables, namely, mass-weighted mean diameter (D_m) in mm and normalized scaling parameters for hydrometeors concentration (N_w) in $\text{mm}^{-1} \text{m}^{-3}$. We defined two types of PCCs, which are the proxies for the intense rainfall events. First PCC is termed as Cumulonimbus Towers (CbTs), which consist of $Z_e > 20$ dBZ at 12 km altitude, and its base height must be less than 3 km altitude. We also defined intense convective clouds (ICCs), which consist of $Z_e > 30$ (40) dBZ at 8 km (3 km), respectively, and are termed as ICC8 and ICC3, respectively. The spatial distribution reveals that continental areas consist of a higher frequency of CbTs and ICC8s compared to oceanic areas, whereas ICC3s are uniformly distributed over tropical land and oceanic areas. The DSD parameters reveal that intense PCCs have larger hydrometeors (D_m), whereas weaker (less Z_e) vertical profiles consist of higher concentration (N_w) of smaller hydrometeors (D_m). Land consists of larger hydrometeors (D_m) compared to oceanic areas, and differences are higher in liquid phase regimes compared to mixed phase regimes. The vertical profiles of Z_e , D_m and N_w are showing the higher regional differences among the different land-based areas, compared to various tropical ocean basins. Western Himalaya Foothills and Sierra De Cordoba consist of the strongest vertical profiles with the largest D_m on the Earth's areas during JJAS and DJFM months, respectively.

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<http://hdl.handle.net/20.500.12816/5626>

Impacts of LULC and climate change on runoff and sediment production for the Puyango-Tumbes basin (Ecuador-Peru)

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Abstract

Climate change will cause alterations in the hydrological cycle, a topic of great relevance to the scientific community due to its impacts on water resources. Investigating changes in hydrological characteristics at the watershed level in the context of climate change is fundamental for developing mitigation and adaptation strategies against extreme hydrological events. This study aimed to analyze the impacts of climate change on flow and sediment production in the Puyango-Tumbes watershed. Projected climate data from CMIP6 were used, corrected through a bias adjustment process to minimize discrepancies between model data and historical observations, ensuring a more accurate representation of climate behavior. The analysis combined two representative climate change scenarios (SSP2-4.5 and SSP5-8.5) with two land use and land cover (LULC) scenarios: (a) an optimistic scenario with reduced anthropogenic effects (LULC_1985) and (b) a pessimistic scenario reflecting future impacts (LULC_2015). The SWAT model estimated future flow and sediment production for two periods (2035-2065 and 2070-2100), following model calibration and validation against the reference period 1981-2015 at three hydrometric stations: Pindo, Puyango, and El Tigre, located in Ecuador and Peru. The simulations revealed a significant increase in sediment generation under the pessimistic scenario SSP5-8.5, followed by SSP2-4.5, while lower sediment yields were observed in the optimistic scenarios. Even in the best-case scenario (optimistic SSP2-4.5), sediment yields remained substantially higher than the reference conditions. Additionally, higher flows were anticipated in some scenarios, with the El Tigre station in the lower watershed being the most affected area. These findings underscore the high probability of more frequent flooding events due to increased sediment yields and flow variability. The results highlight the urgent need for implementing adaptation measures, such as improved land use management and hydrological infrastructure, to enhance social resilience and mitigate the impacts of climate change in the watershed.

Enlaces: <https://doi.org/10.3389/frsen.2024.1471144>

<https://hdl.handle.net/20.500.12542/3785>

Implementation of a UAV-aided calibration method for a mobile dual-polarization weather radar

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Abstract

Weather radar calibration is a crucial factor to be considered for quantitative applications, such as QPE (Quantitative Precipitation Estimation), which is used as input for weather risks management. The present work proposes a novel approach to the end-to-end radar calibration method through the characterization of the radar weighting functions. These are Gaussian functions that model an additional attenuation factor to the radar received power. This approach, based on the inclusion these parameters, allow the obtainment of a calibrated equivalent reflectivity factor expression for a Doppler dual-polarization weather radar that operates in the X band. To calculate these parameters, a UAS (Unmanned Aircraft System) was implemented for suspending the calibration target with a well-defined cross-section and for measuring its inclination due to wind using an IMU (Inertial Measurement Unit). From its measurements, the position of the target can be estimated, which is essential to the characterization of the weighting functions. Their inclusion within the radar equation, alongside the implementation of the angular measurement system highlight the innovation to the traditional radar calibration methodology that does not contemplate them from the explored state-of-the-art. The reflectivity was compared with the measurements from a disdrometer for a moderate rain event. An average reflectivity difference of 0.75 dBZ and a percent bias of 3.3 % were obtained between the expected and estimated measurements when including these functions compared to the 1.51 dBZ and -62.7 % obtained when disregarding them. These experimental results point out that the proposed method can deliver superior accuracy in the reflectivity estimation.

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Implementation of the Peruvian Earthquake Early Warning System

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Abstract

We present the implementation and testing of the seismological components of the Peruvian earthquake early warning system (Sistema de Alerta Sísmica Peruano [SASPe]). SASPe is designed to send alert messages to areas located within a given distance from the epicenter of large (magnitude ≥ 6.0) subduction earthquakes, with a first alert based on data available 3 s after the arrival of the P wave on the nearest station. The system comprises a dedicated network of 111 strong motion stations installed along the Peruvian coast. During over 2 yr of testing, the magnitude estimates are virtually unbiased, with no false positives or false negatives. In the most critical virtual scenarios of earthquakes occurring within 57 km of populated areas, SASPe can provide user lead times of up to 8 s. For more distant areas (from 70 to 120 km), lead times range from 10 to 20 s. Once the construction of the alert broadcasting system by the civil defense authority is finalized, SASPe will provide warning to 18 million residents of the coast of Peru. We validate the algorithm of the system on recent major earthquakes in Peru and other regions, demonstrating its effectiveness and versatility for global deployment.

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Increasing frequency and precipitation intensity of convective storms in the Peruvian Central Andes: Projections from convection-permitting regional climate simulations

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Abstract

To explore the potential impacts of climate change on precipitation and mesoscale convective systems (MCSs) in the Peruvian Central Andes, a region with complex terrain, two future convection-permitting regional climate simulations and one historical one are conducted using the Weather Research and Forecasting (WRF) model. All simulations adopt consistent model configurations and two nested domains with grid spacings of 15 and 3 km covering the entire South America and the Peruvian Central Andes, respectively. The historical run, spanning 2014–2019, is driven by ERA5 reanalysis, and the future simulations, covering the period 2070–2080, are driven by a bias-corrected global dataset derived from the Coupled Model Intercomparison Project Phase 6 (CMIP6) ensemble under the SSP2-4.5 and SSP5-8.5 emission scenarios. Results show geographically dependent changes in annual precipitation, with a consistent rise in the frequency of intense hourly precipitation across all regions examined. The western Amazon Basin shows a decrease in annual precipitation, while increases exist in parts of the Peruvian west coast and the east slope of the Andes under both future scenarios. In the warming scenarios, there is an overall increase in the frequency, precipitation intensity, and size of MCSs east of the Andes, with MCS precipitation volume increasing by up to ~22.2%. Despite consistently enhanced synoptic-scale low-level jets in future scenarios, changes in low-level dynamic convergence are inhomogeneous and predominantly influence annual precipitation changes. The increased convective available potential energy (CAPE), convective inhibition (CIN), and precipitable water (PW) in a warming climate suppress weak convection, while fostering a more unstable and moisture-rich atmosphere, facilitating more intense convection and the formation and intensification of heavy precipitation-producing MCSs. The study highlights the value of convection-permitting climate simulations in projecting future severe weather hazards and informing climate adaptation strategies, especially in regions characterized by complex terrain.

Enlaces: <https://doi.org/10.1002/qj.4820>

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Ionospheric Disturbances Observed Over the Peruvian Sector During the Mother's Day Storm (G5-Level) on 10–12 May 2024

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Abstract

This article presents the recent extreme and rare G5-level geomagnetic storm (Mother's Day Storm) effects on the equatorial and low-latitude ionosphere observed at the Peruvian sector by the Jicamarca (11.9°S, 76.8°W, magnetic dip 1°N) incoherent scatter radar and associated instruments. This storm was produced by multiple Earth-directed coronal mass ejections, which generated significant modifications in the Earth's magnetic field, leading to the Sym-H of ~ -518 nT. On the dayside, due to the strong eastward penetration electric field, vertical plasma drift and equatorial electrojet (EEJ) enhanced for 2–3 hr and remained consistent at values of ~ 95 m/s and 260 nT between 1700 and 1900 UT (1200 and 1400 LT). At the same time, vertical $E \times B$ plasma drift uplifted the equatorial ionosphere, producing the dusk-side super plasma fountain and transferring electron density to higher latitudes. A huge increase ($\sim 1,325\%$) in electron density (from 11 to 142 TECu) is observed at low and mid-latitudes from $\sim 20^\circ\text{S}$ to 50°S between 2000 and 0400 UT (1500–2300 LT). The strong westward penetration electric field suppressed pre-reversal enhancement, leading to downward plasma drift (~ -96 m/s) at around 2400 UT (1900 LT). Overnight, vertical plasma drift fluctuated between ± 90 m/s, and the combined effect of penetration and disturbance dynamo electric fields caused a significant increase (~ 530 km) in ionospheric virtual height. In the main and early recovery phase, consistent short- and long-duration electric field disturbances persisted for approximately 30 hr, with periods of ~ 48 and 90 min.

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<http://hdl.handle.net/20.500.12816/5663>

Latitudinal and temporal distribution of aerosols and precipitable water vapor in the tropical Andes from AERONET, sounding, and MERRA-2 data

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Abstract

The aerosol and precipitable water vapor (PW) distribution over the tropical Andes region is characterized using Aerosol Robotic Network (AERONET) observations at stations in Medellín (Colombia), Quito (Ecuador), Huancayo (Peru), and La Paz (Bolivia). AERONET aerosol optical depth (AOD) is interpreted using $PM_{2.5}$ data when available. Columnar water vapor derived from ozone soundings at Quito is used to compare against AERONET PW. MERRA-2 data are used to complement analyses. Urban pollution and biomass burning smoke (BBS) dominate the regional aerosol composition. AOD and $PM_{2.5}$ yearly cycles for coincident measurements correlate linearly at Medellín and Quito. The Andes cordillera's orientation and elevation funnel or block BBS transport into valleys or highlands during the two fire seasons that systematically impact South America. The February–March season north of Colombia and the Colombian-Venezuelan border directly impacts Medellín. Possibly, the March aerosol signal over Quito has a long-range transport component. At Huancayo and La Paz, AOD increases in September due to the influence of BBS in the Amazon. AERONET PW and sounding data correlate linearly but a dry bias with respect to soundings was identified in AERONET. PW and rainfall progressively decrease from north to south due to increasing altitude. This regional diagnosis is an underlying basis to evaluate future changes in aerosol and PW given prevailing conditions of rapidly changing atmospheric composition.

Enlaces: <https://doi.org/10.1038/s41598-024-51247-9>

<http://hdl.handle.net/20.500.12816/5641>

Mesosphere and Lower Thermosphere Wind Perturbations Due To the 2022 Hunga Tonga-Hunga Ha'apai Eruption as Observed by Multistatic Specular Meteor Radars

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Abstract

Utilizing multistatic specular meteor radar (MSMR) observations, this study delves into global aspects of wind perturbations in the mesosphere and lower thermosphere (MLT) from the unprecedented 2022 eruption of the Hunga Tonga-Hunga Ha'apai (HTHH) submarine volcano. The combination of MSMR observations from different viewing angles over South America and Europe, and the decomposition of the horizontal wind in components along and transversal to the HTHH eruption's epicenter direction allow an unambiguous detection and identification of MLT perturbations related to the eruption. The performance of this decomposition is evaluated using Whole Atmosphere Community Climate Model with thermosphere/ionosphere extension (WACCM-X) simulations of the event. The approach shows that indeed the HTHH eruption signals are clearly identified, and other signals can be easily discarded. The winds in this decomposition display dominant Eastward soliton-like perturbations observed as far as 25,000 km from HTHH, and propagating at 242 m/s. A weaker perturbation observed only over Europe propagates faster (but slower than 300 m/s) in the Westward direction. These results suggest that we might be observing the so-called Pekeris mode, also consistent with the L_1 pseudomode, reproduced by WACCM-X simulations at MLT altitudes. They also rule out the previous hypothesis connecting the observations in South America to the Tsunami associated with the eruption because these perturbations are observed over Europe as well. Despite the progress, the L_0 pseudomode in the MLT reproduced by WACCM-X remains elusive to observations.

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Modern anthropogenic drought in Central Brazil unprecedented during last 700 years

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Abstract

A better understanding of the relative roles of internal climate variability and external contributions, from both natural (solar, volcanic) and anthropogenic greenhouse gas forcing, is important to better project future hydrologic changes. Changes in the evaporative demand play a central role in this context, particularly in tropical areas characterized by high precipitation seasonality, such as the tropical savannah and semi-desertic biomes. Here we present a set of geochemical proxies in speleothems from a well-ventilated cave located in central-eastern Brazil which shows that the evaporative demand is no longer being met by precipitation, leading to a hydrological deficit. A marked change in the hydrologic balance in central-eastern Brazil, caused by a severe warming trend, can be identified, starting in the 1970s. Our findings show that the current aridity has no analog over the last 720 years. A detection and attribution study indicates that this trend is mostly driven by anthropogenic forcing and cannot be explained by natural factors alone. These results reinforce the premise of a severe long-term drought in the subtropics of eastern South America that will likely be further exacerbated in the future given its apparent connection to increased greenhouse gas emissions.

Enlaces: <https://doi.org/10.1038/s41467-024-45469-8>

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Multi-process driven unusually large equatorial perturbation electric fields during the April 2023 geomagnetic storm

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Abstract

The low latitude ionosphere and thermosphere are strongly disturbed during and shortly after geomagnetic storms. We use novel Jicamarca radar measurements, ACE satellite solar wind, and SuperMAG geomagnetic field observations to study the electrodynamic response of the equatorial ionosphere to the 23, 24 April 2023 geomagnetic storm. We also compare our data with results from previous experimental and modeling studies of equatorial storm-time electrodynamics. We show, for the first time, unusually large equatorial vertical and zonal plasma drift (zonal and meridional electric field) perturbations driven simultaneously by multi storm-time electric field mechanisms during both the storm main and recovery phases. These include daytime undershielding and overshielding prompt penetration electric fields driven by solar wind electric fields and dynamic pressure changes, substorms, as well as disturbance dynamo electric fields, which are not well reproduced by current empirical models. Our nighttime measurements, over an extended period of large and slowly decreasing southward IMF B_z , show very large, substorm-driven, vertical and zonal drift fluctuations superposed on large undershield driven upward and westward drifts up to about 01 LT, and the occurrence of equatorial spread F irregularities with very strong spatial and temporal structuring. These nighttime observations cannot be explained by present models of equatorial storm-time electrodynamics.

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<http://hdl.handle.net/20.500.12816/5586>

Near-real-time multiparametric seismic and visual monitoring of explosive activity at Sabancaya volcano, Peru

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Abstract

This study presents the development of a multiparametric system that utilizes artificial intelligence techniques to identify and analyze volcanic explosions in near real-time. The study analyzed 1343 explosions recorded between 2019 and 2021, along with seismic, meteorological, and visible image data from the Sabancaya volcano. Deep learning algorithms like the U-Net convolutional neural network were used to segment and measure volcanic plumes in images, while boosting-based machine learning ensembles were used to classify seismic events related to ash plumes. The findings demonstrate that these approaches effectively handle large amounts of data generated during seismic and eruptive crises. The U-Net network achieved precise segmentation of volcanic plumes with over 98% accuracy and the ability to generalize to new data. The CatBoost classifier achieved an average accuracy of 94.5% in classifying seismic events. These approaches enable the real-time estimation of eruptive parameters without human intervention, contributing to the development of early warning systems for volcanic hazards. In conclusion, this study highlights the feasibility of using seismic signals and images to detect and characterize volcanic explosions in near real-time, making a significant contribution to the field of volcanic monitoring.

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New insights into the biennial-to-multidecadal variability of the water level fluctuation in Lake Titicaca in the 20th century

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Abstract

The water disponibility of Lake Titicaca is important for local ecosystems, domestic water, industry, fishing, agriculture, and tourism in Peru and Bolivia. However, the water level variability in Lake Titicaca (LTWL) still needs to be understood. The fluctuations of LTWL during the 1921–2018 period are investigated using continuous wavelet techniques on high- and low-pass filters of monthly time series, ERA-20C reanalysis, sea surface temperature (SST), and water level. We also built multiple linear regression (MLR) models based on SST indices to identify the main drivers of the LTWL variability. LTWL features annual (12 months), biennial (22–28 months), interannual (80–108 months), decadal (12.75–14.06 years), interdecadal (24.83–26.50 years), and multidecadal (30–65 years) signals. The high- and low-frequency components of the LTWL are triggered by the humidity transport from the lowland toward the Lake Titicaca basin, although different forcings could cause it. The biennial band is associated with SST anomalies over the southeastern tropical Atlantic Ocean that strengthen the Bolivian High-Nordeste Low system. The interannual band is associated with the southern South Atlantic SST anomalies, which modulate the position of the Bolivian High. According to the MLR models, the decadal and interdecadal components of the LTWL can be explained by the linear combination of the decadal and interdecadal variability of the Pacific and Atlantic SST anomalies ($r > 0.83$, $p < 0.05$). In contrast, the multidecadal component of the LTWL is driven by the multidecadal component of the North Atlantic SST anomalies (AMO) and the southern South Atlantic SST anomalies. Moreover, the monthly time series of LTWL exhibits four breakpoints. The signs of the first four trends follow the change of phases of the multidecadal component of LTWL, while the fifth trend is zero attributable to the diminished amplitude of the interdecadal component of LTWL.

Enlaces: <https://doi.org/10.3389/fclim.2023.1325224>

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Observational characterization and empirical modeling of global, direct and diffuse solar irradiances at the Peruvian central Andes

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Abstract

The present study aims to comprehensively assess the solar irradiance patterns in the western zone of the Mantaro Valley, a region of ecological and agricultural significance in the central Peruvian Andes. Leveraging radiation data from the Baseline surface Radiation Network (BSRN) sensors located in the Huancayo Geophysical Observatory (HYGO-12.04°S, 75.32°W, 3350 masl) spanning from 2017 to 2022, the research delves into the seasonal variations and trends in surface solar irradiance components. Actually, the study investigates the diurnal and seasonal variations of solar irradiance components, namely diffuse (E_{DF}), direct (E_{DR}), and global (E_G) irradiance. Results demonstrate distinct peaks and declines across seasons, with E_{DR} and E_{DF} exhibiting opposing seasonal trends, influencing the overall variability in E_G . Peaks of E_G occurred in spring ($3.32 \text{ MJ m}^{-2} \text{ h}^{-1}$ at noon), particularly during October ($24.14 \text{ MJ m}^{-2} \text{ day}^{-1}$), probably associated with biomass-burning periods and heightened aerosol optical depth (AOD). These findings highlight the impact of biomass-burning aerosols on solar radiation dynamics in the region. In general, the seasonal variability of E_G on the HYGO is lower than that observed in other regions of South America at higher latitudes and reach its maximums during spring months. Moreover, the research evaluates various irradiation models to establish correlations between sunshine hours, measured with a solid glass sphere heliograph, and E_G and E_{DF} at different time scales, showing acceptable accuracy to predict. In addition, the sigmoid logistic function emerges as the most effective in correlating the hourly diffuse fraction (K_D^h) and the hourly clearness index (K_T^h), showcasing superior performance compared to alternative functions and exhibiting strong statistical significance and providing valuable insights for future solar radiation forecasting and modeling efforts. This study offers valuable insights for solar radiation forecasting and modeling efforts, emphasizing the importance of interdisciplinary research for solar power generation, sustainable development and climate resilience in mountainous regions like the Peruvian Andes.

Enlaces: <https://doi.org/10.3389/feart.2024.1399971>

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On the Abnormally Strong Westward Phase of the Mesospheric Semiannual Oscillation at Low Latitudes During March Equinox 2023

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Abstract

Different meteor radars at low latitudes observed abnormally strong westward mesospheric winds around the March Equinox of 2023, that is, during the first phase of the Mesospheric Semiannual Oscillation. This event was the strongest of at least the last decade (2014–2023). The westward winds reached -80 m/s at 82 km of altitude in late March, and decreased with increasing altitude and latitude. A considerable increase in the diurnal tide amplitude was also observed. The Whole Atmosphere Community Climate Model with thermosphere-ionosphere eXtension constrained to meteorological reanalysis up to ~ 50 km does not capture the observed low-latitude behavior. Additionally, these strong mesospheric winds developed during the westerly phase of the Quasi-Biennial Oscillation, in accordance with the filtering mechanism of gravity waves in the stratosphere proposed in previous works. Finally, analysis of SABER temperatures strongly suggests that the breaking of the migrating diurnal tide may be the main driver of these strong winds.

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Performance of Regional Climate Model Precipitation Simulations Over the Terrain-Complex Andes-Amazon Transition Region

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Abstract

Regional climate models (RCMs) are widely used to assess future impacts associated with climate change at regional and local scales. RCMs must represent relevant climate variables in the present-day climate to be considered fit-for-purpose for impact assessment. This condition is particularly difficult to meet over complex regions such as the Andes-Amazon transition region, where the Andean topography and abundance of tropical rainfall regimes remain a challenge for numerical climate models. In this study, we evaluate the ability of 30 regional climate simulations (6 RCMs driven by 10 global climate models) to reproduce historical (1981–2005) rainfall climatology and temporal variability over the Andes-Amazon transition region. We assess spatio-temporal features such as spatial distribution of rainfall, focusing on the orographic effects over the Andes-Amazon “rainfall hotspots” region, and seasonal and interannual precipitation variability. The Eta RCM exhibits the highest spatial correlation (up to 0.6) and accurately reproduces mean annual precipitation and orographic precipitation patterns across the region, while some other RCMs have good performances at specific locations. Most RCMs simulate a wet bias over the highlands, particularly at the eastern Andean summits, as evidenced by the 100%–2,500% overestimations of precipitation in these regions. Annual cycles are well represented by most RCMs, but peak seasons are exaggerated, especially at equatorial locations. No RCM is particularly skillful in reproducing the interannual variability patterns. Results highlight skills and weaknesses of the different regional climate simulations, and can assist in the selection of regional climate simulations for impact studies in the Andes-Amazon transition zone.

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Present Variability and Future Change in Onset and Cessation of the Rainy Season Over Peru

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Abstract

Changes in patterns of accumulated rainfall, as well as the rainy season onset, cessation and duration, can impact the availability of water resources and sectors such as agriculture, affecting the livelihoods of the population. The knowledge of these changes is crucial for regions driven by strong precipitation variability such as the Andean countries. Therefore, the aim of this work is to determine the present and future spatio-temporal patterns of the onset, cessation and duration of the rainy season in Peru. For this purpose, we analysed in a first step the present variability and trends in 11 homogeneous regions using data from 377 ground stations for the period 1981–2019. The results showed significant trends (1981–2019) of earlier onset and increased duration only in the Southern Peruvian Amazon (Madre de Dios River basin). Furthermore, the accumulated rainfall has significant trends of increases in North East Andes, Northern and Southern Amazon. In a second step, we assessed future changes of the rainy season from an ensemble of statistically downscaled CMIP6 climate scenarios. A two-tailed Student t-test was used to evaluate the significance of changes. Two future time slices (2031–2060 and 2071–2100) relative to the reference period (1981–2010) were analysed. Future changes of the rainy season showed significant delays in the onset for the Central East Andes, South West Andes and Amazon regions in the period 2071–2100. Likewise, the rainy season duration presents future significant reductions in regions of the central and southern Andes under the SSP2-4.5 scenario. Moreover, the accumulated precipitation is projected to increase significantly in the Pacific slope and Andes regions, mainly under the SSP5-8.5 scenario. These findings are particularly important for sectors like agriculture, energy and water resources management.

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<https://hdl.handle.net/20.500.12542/3784>

Regional Frequency Analysis With L-Moments For The Determination Of Drought Event Maps In High Andean Basins In Peru

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Abstract

Droughts are extreme climatic phenomena that are difficult to quantify spatially and temporally, due to the effects of climate change impacting socio-economic development. In this context, the research aims to estimate and map the frequency of theoretical meteorological droughts at different return periods through the method of regional frequency analysis (ARF) based on L-moments (LM), using 97 virtual stations from the gridded PISCO product based on annual mean precipitation (PMA). Two homogeneous rainfall regions were identified using a combination of the Ward method and the LM approach. For ARF, the generalized normal distribution (GNO) was selected due to its best fit with the Z^{DIST} statistic, which allowed for the determination of the regional growth curve (quantiles). Finally, exponential predictive equations were obtained at a regional scale to relate LM and PMA, enabling the generation of meteorological drought maps.

Enlace: <https://migrationletters.com/index.php/ml/article/view/10749>

Short-term prediction of horizontal winds in the mesosphere and lower thermosphere over coastal Peru using a hybrid model

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Abstract

The mesosphere and lower thermosphere (MLT) are transitional regions between the lower and upper atmosphere. The MLT dynamics can be investigated using wind measurements conducted with meteor radars. Predicting MLT winds could help forecast ionospheric parameters, which has many implications for global communications and geo-location applications. Several literature sources have developed and compared predictive models for wind speed estimation. However, in recent years, hybrid models have been developed that significantly improve the accuracy of the estimates. These integrate time series decomposition and machine learning techniques to achieve more accurate short-term predictions. This research evaluates a hybrid model that is capable of making a short-term prediction of the horizontal winds between 80 and 95 km altitudes on the coast of Peru at two locations: Lima (12°S, 77°W) and Piura (5°S, 80°W). The model takes a window of 56 data points as input (corresponding to 7 days) and predicts 16 data points as output (corresponding to 2 days). First, the missing data problem was analyzed using the Expectation Maximization algorithm (EM). Then, variational mode decomposition (VMD) separates the components that dominate the winds. Each resulting component is processed separately in a Long short-term memory (LSTM) neural network whose hyperparameters were optimized using the Optuna tool. Then, the final prediction is the sum of the predicted components. The efficiency of the hybrid model is evaluated at different altitudes using the root mean square error (RMSE) and Spearman's correlation (r). The hybrid model performed better compared to two other models: the persistence model and the dominant harmonics model. The RMSE ranged from 10.79 to 27.04 ms^{-1} , and the correlation ranged from 0.55 to 0.94. In addition, it is observed that the prediction quality decreases as the prediction time increases. The RMSE at the first step reached 6.04 ms^{-1} with a correlation of 0.99, while at the sixteenth step, the RMSE increased up to 30.84 ms^{-1} with a correlation of 0.5.

Enlaces: <https://doi.org/10.3389/fspas.2024.1442315>

<http://hdl.handle.net/20.500.12816/5610>

Statistical analysis of low latitude spread F at the American, Atlantic, and Pacific sectors using digisonde observations

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Abstract

Statistical analysis of low latitude spread F is presented for three different longitudinal sectors from Jicamarca (12°S, 76.8°W, -2.5° declination angle) from 2001 to 2016, Ascension Island (7.9°S, 14.4°W, -15.09° declination angle) from 2000 to 2014, Kwajalein (8.71°N, 167.7°E, 7.5° declination angle) from 2004 to 2012. Digisonde data from these stations have been processed and analyzed to study statistical variations of equatorial spread F, a diagnostic of irregular plasma structure in the ionosphere. A new automated method of spread F detection using pattern recognition and edge detection for low latitude regions is used to determine solar and seasonal variation over these three sites. An algorithm has been developed to detect the foF2 and hpF2 parameters and this has been validated by comparisons with manually scaled data as well as with SAMI2 and International Reference Ionosphere models showing good correlation. While significant variation is not observed over the solar cycle, the different longitudes and declination angles contribute to the variations over the seasonal cycle.

Enlaces: <https://doi.org/10.3389/fspas.2024.1421733>

<http://hdl.handle.net/20.500.12816/5614>

Supernovae photometry at OAUNI

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Resumen

Analizamos los datos fotométricos de nueve supernovas en los filtros V , R e I que se obtuvieron durante las campañas observacionales de OAUNI en 2016, 2017 y 2023. Para investigar la evolución posterior a su punto máximo de brillo, se compararon las magnitudes calibradas de las supernovas observadas con sus respectivas curvas de luz disponibles en la literatura. En algunos casos, se usó el diagrama de diagnóstico color-color de supernovas para determinar nuestras fechas de observación y ubicarlas correctamente en las curvas de luz. Para este propósito también fueron de ayuda la utilización de plantillas de curvas de luz de supernovas, así como supernovas de referencia. Este trabajo permitió verificar la factibilidad de realizar fotometría astronómica de precisión en el OAUNI.

Abstract

We analyse photometric data of nine supernovae (SNe) in filters V , R and I obtained during observational campaigns at the OAUNI site in 2016, 2017 and 2023. The calibrated magnitudes of the observed SNe were compared with their respective light curves available in the literature to study their evolution after their maximum brightness. In some cases, the supernova color-color diagnostic diagram was used to determine our observation date and correctly locate our magnitudes on the light curves. For this purpose, the use of supernova light curve templates, as well as reference supernovae, was also helpful. This work allowed us to verify the feasibility of performing precision astronomical photometry at the OAUNI.

Enlaces: <https://doi.org/10.22201/ia.01851101p.2024.60.02.07>

<http://hdl.handle.net/20.500.12816/5627>

Synoptic and cloud-scale aspects related to an extreme rainfall event that occurred in April 2019 in the city of Rio de Janeiro (Brazil)

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Abstract

The development, rate, and duration of extreme rainfall events over a region depend on the coexistence and strength of multiple atmospheric physical conditions. Then, understanding the synoptic and cloud-scale aspects is a continuous, crucial integrated task between universities and operational centers aiming for early warning and risk management. This study first evaluates the large-scale atmospheric circulation, instability behavior, and moisture parameters before and after the start of rainfall. It also investigates the dynamic triggering for an extreme rainfall event in Rio de Janeiro between April 08th and 09th, 2019. Secondly, this study intended to examine the microphysics cloud aspects using data from the Geostationary Operational Environmental Satellite (GOES-16). From monthly records and the 99th percentile of accumulated daily rainfall, it was possible to highlight the spatial rainfall dependence on seasonal and topography with higher rainfall values recorded in the south portion of the city of Rio de Janeiro. From the large-scale synoptic aspects, concomitant circulations related to upper, middle, and lower atmospheric levels creating a dynamic vertical structure favorable to convective development were verified over southeastern Brazil. The thermodynamic parameters showed different characteristics before and after rainfall started, suggesting multi-parameters' importance as so-called "instability ingredients" for evaluating the atmospheric potential for clouds and rainfall development. The velocity divergence in upper atmospheric levels was a determinant dynamic forcing for deep convection evolution. Lastly, regarding the wind circulations, northwest winds before precipitation and a change in wind direction were related to the region's frontal systems passage. The cloud microphysics aspects showed that the channel differences approach showed that monitoring top cloud glaciation, vertical development, and particle size are indicators of heavy rainfall when the cloud top offering considerable vertical growth was a helpful tool to identify regions with huge potential to develop heavy rain.

Enlaces: <https://doi.org/10.1007/s00703-023-01003-x>

<https://hdl.handle.net/20.500.12542/3169>

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 km²/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.

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

The 2022-23 drought in the South American Altiplano: ENSO effects on moisture flux in the western Amazon during the pre-wet season

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Abstract

The 2022-23 hydrological year in the Lake Titicaca, Desaguadero River, and Lake Poopó hydrological system (TDPS) over the South American Altiplano constituted a historically dry period. This drought was particularly severe during the pre-wet season (October–December), when the TDPS and the adjacent Andean–Amazon region experienced as much as 60% reductions in rainfall. Consequently, Titicaca Lake water levels decreased by 0.05 m from December to January, which is part of the rising lake level period of normal conditions. Such conditions have not been seen since the El Niño-related drought of 1982–83. Using a set of hydroclimatic, Sea Surface Temperature (SST) and atmospheric reanalysis datasets, we find that this new historical drought was associated with enhanced southerly moisture flux anomalies, reducing the inflow of moisture-laden winds from the Amazon basin to the TDPS. Such anomalies in moisture transport were not seen since at least the 1950s. The atmospheric dynamics associated with this drought are related to La Niña SST anomalies via subtropical teleconnections associated with Rossby wave trains towards South America, further extended by subtropical Atlantic Ocean SST anomalies. This feature reduced the atmospheric moisture inflow from the Amazon and weakened the development of the Bolivian High in the upper troposphere. These results document a new atmospheric mechanism related to extreme droughts in the TDPS associated with La Niña SST anomalies during the pre-wet season. This goes beyond the traditional understanding of El Niño events, especially the strongest ones, being associated with dry conditions in the TDPS during the wet season (December–March).

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The impact of the Hunga Tonga–Hunga Ha’apai volcanic eruption on the Peruvian atmosphere: from the sea surface to the ionosphere

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Abstract

The eruption of the Hunga Tonga Hunga Ha’apai volcano on 15 January 2022 significantly impacted the lower and upper atmosphere globally. Using multi-instrument observations, we described disturbances from the sea surface to the ionosphere associated with atmospheric waves generated by the volcanic eruption. Perturbations were detected in atmospheric pressure, horizontal magnetic field, equatorial electrojet (EEJ), ionospheric plasma drifts, total electron content (TEC), mesospheric and lower thermospheric (MLT) neutral winds, and ionospheric virtual height measured at low magnetic latitudes in the western South American sector (mainly in Peru). The eastward Lamb wave propagation was observed at the Jicamarca Radio Observatory on the day of the eruption at 13:50 UT and on its way back from the antipodal point (westward) on the next day at 07:05 UT. Perturbations in the horizontal component of the magnetic field (indicative of EEJ variations) were detected between 12:00 and 22:00 UT. During the same period, GNSS-TEC measurements of traveling ionospheric disturbances (TIDs) coincided approximately with the arrival time of Lamb and tsunami waves. On the other hand, a large westward variation of MLT winds occurred near 18:00 UT over Peru. However, MLT perturbations due to possible westward waves from the antipode have not been identified. In addition, daytime vertical plasma drifts showed an unusual downward behavior between 12:00 and 16:00 UT, followed by an upward enhancement between 16:00 and 19:00 UT. Untypical daytime eastward zonal plasma drifts were observed when westward drifts were expected. Variations in the EEJ are highly correlated with perturbations in the vertical plasma drift exhibiting a counter-equatorial electrojet (CEEJ) between 12:00 and 16:00 UT. These observations of plasma drifts and EEJ are, so far, the only ground-based radar measurements of these parameters in the western South American region after the eruption. We attributed the ion drift and EEJ perturbations to largescale thermospheric wind variations produced by the eruption, which altered the dynamo electric field in the Hall and Pedersen regions. These types of multiple and simultaneous observations can contribute to advancing our understanding of the ionospheric processes associated with natural hazard events and the interaction with lower atmospheric layers.

Enlaces: <https://doi.org/10.1186/s40623-024-02022-7>

<http://hdl.handle.net/20.500.12816/5564>

The new record of drought and warmth in the Amazon in 2023 related to regional and global climatic features

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Abstract

In 2023 Amazonia experienced both historical drought and warm conditions. On October 26th 2023 the water levels at the port of Manaus reached its lowest record since 1902 (12.70 m). In this region, October monthly maximum and minimum temperature anomalies also surpassed previous record values registered in 2015 (+ 3 °C above the normal considering the 1981–2020 average). Here we show that this historical dry and warm situation in Amazonia is associated with two main atmospheric mechanisms: (i) the November 2022–February 2023 southern anomaly of vertical integrated moisture flux (VIMF), related to VIMF divergence and extreme rainfall deficit over southwestern Amazonia, and (ii) the June–August 2023 downward motion over northern Amazonia related to extreme rainfall deficit and warm conditions over this region. Anomalies of both atmospheric mechanisms reached record values during this event. The first mechanism is significantly correlated to negative sea surface temperature (SST) anomalies in the equatorial Pacific (November–February La Niña events). The second mechanism is significantly correlated to positive SST anomalies in the equatorial Pacific, related to the impacts of June–September El Niño on the Walker Circulation. While previous extreme droughts were linked to El Niño (warmer North Tropical Atlantic SST) during the austral summer (winter and spring), the transition from La Niña 2022–23 to El Niño 2023 appears to be a key climatic driver in this record-breaking dry and warm situation, combined to a widespread anomalous warming over the worldwide ocean.

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<https://hdl.handle.net/20.500.12542/3404>

The South American Climate During the Last Two Millennia

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Abstract

Paleoclimate reconstructions are essential for understanding the dynamics of the climate system and its past variations. By utilizing climate-dependent proxies, these reconstructions provide a comprehensive perspective on climatic variations that extend far beyond the limited scope of instrumental records, spanning centuries to millennia. Particularly, proxy-based reconstructions for the last two millennia provide valuable insights into natural climate variability during the preindustrial era and the anthropogenic influence on current climate change. As a result, paleoclimate studies are also critical for interpreting climate projections in the context of anthropogenic forcing. South America, with its vast and diverse climate conditions, is a region rich in high-resolution paleoclimate records, including marine, lacustrine, and fjord sediments, speleothems, ice cores, tree rings, glacial and aeolian deposits, archaeological evidence, and historical documents, among others, all of which capture past climate changes. However, despite numerous paleoclimate reconstructions conducted across the continent and significant advances in understanding its past climate, substantial research gaps remain. These gaps are particularly evident in understudied regions and poorly understood phenomena, hindering a comprehensive understanding of climate variability at both regional and continental scales. To advance paleoclimatic research in South America, future efforts should prioritize (a) the collection of high-resolution records from key locations, (b) the integration of diverse proxies and innovative methodologies, (c) enhancing our understanding of climate-proxy relationships, and (d) developing new proxy calibrations. Collaboration with local communities and indigenous peoples and adopting interdisciplinary approaches will be vital in driving the field forward.

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<http://hdl.handle.net/20.500.12816/5664>

To Mix or Not to Mix: Details of Magma Storage, Recharge, and Remobilization during the Pacheco Stage at Misti Volcano, Peru (≤ 21 –2 ka)

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Abstract

We investigate ten of the most recent tephra-fall deposits emplaced between ≤ 21 and 2 ka from the Pacheco stage of Misti volcano, Peru, to elucidate magma dynamics and explosive eruption triggers related to magma storage, recharge, and remobilization. Whole-rock, glass, and mineral textures and compositions indicate the presence of broadly felsic, intermediate, and mafic magmas in a chemically and thermally stratified magma storage system (Zones 1–3) that interact to differing extents prior to eruption. Intermediate magmas are defined by plagioclase + amphibole + two-pyroxenes + Fe-Ti oxides and phase equilibria indicate they formed at ~ 300 to 600 MPa and $\sim 950^\circ\text{C}$ to 1000°C . Intermediate magmas dominate the Pacheco stage and either erupted alone as hybridized magmas or mingled with minor volumes of cool felsic magmas ($\sim 800^\circ\text{C}$) in which only plagioclase + Fe-Ti oxides are stable. Felsic magmas do not exclusively comprise any tephra-fall deposit emplaced during the Pacheco stage but were remobilized by recharge and mixing with intermediate magmas in order to erupt. Furthermore, felsic-hosted amphibole cognate to the intermediate magmas are reacted despite the felsic magmas being water saturated, which suggests they are staged above the amphibole stability limit (≤ 200 MPa). The cryptic presence of mafic magmas is indicated by high-An plagioclase cores (An_{74-88}), rare anhedral olivine (Fo_{77-80}), and possibly high Mg# augite and amphibole (up to Mg# 84 and 77, respectively). The dearth of basalt to basaltic andesite melts recorded in erupted glasses and exclusivity of high-An plagioclase to crystal cores signals mafic magmas are staged deeper in the crust than the intermediate magmas. Periodic interactions between these magmas tracked via glass compositions and crystal exchange reveal an alternation between the production of mingled magmas and their eruption shortly after a recharge event, followed by a period of homogenization and eruption of hybridized magmas. As such, we identify magma recharge as a key mechanism by which half of the explosive eruptions were triggered in the Pacheco stage. A $>100^\circ\text{C}$ increase in Misti's fumarole temperatures from 1967 to 2018 coincident with changes in fumarolic gas compositions is consistent with degassing of a mafic recharge magma, signaling that Misti could produce similar explosive eruptions in the future.

Enlaces: <https://doi.org/10.1093/petrology/egae050>

<http://hdl.handle.net/20.500.12816/5573>

Understanding Spatio-Temporal Hydrological Dynamics Using SWAT: A Case Study in the Pativilca Basin

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

This study investigates the hydrological dynamics of the Pativilca Basin in the Southern Hemisphere using the SWAT (Soil and Water Assessment Tool) model. Seventy-seven watersheds across a mountainous region were analyzed using elevation data, land cover, soil type, and gridded meteorological products (RAIN4PE and PISCO) for hydrological simulations. Watershed delineation, aided by a Digital Elevation Model, enabled the identification of critical drainage points and the definition of Hydrological Response Units (HRUs). The model calibration and validation, performed using the SWAT-CUP with the SUFI-2 algorithm, achieved Nash–Sutcliffe Efficiency (NSE) values of 0.69 and 0.72, respectively. Cluster analysis categorized the watersheds into six distinct groups with unique hydrological and climatic characteristics. The results showed significant spatial variability in the precipitation and temperature, with pronounced seasonality influencing the daily flow patterns. The higher-altitude watersheds exhibited greater soil water storage and more effective aquifer recharge, whereas the lower-altitude watersheds, despite receiving less precipitation, displayed higher flows due to runoff from the upstream areas. These findings emphasize the importance of incorporating seasonality and spatial variability into water resource planning in mountainous regions and demonstrate the SWAT model's effectiveness in predicting hydrological responses in the Pativilca Basin, laying the groundwork for future research in mountain hydrology.

Enlaces: <https://doi.org/10.3390/hydrology11100165>

<https://hdl.handle.net/20.500.12542/3778>



5

**Gobernanza
ambiental**

Exploring the Antibacterial and Antiparasitic Activity of Phenylaminonaphthoquinones—Green Synthesis, Biological Evaluation and Computational Study

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Abstract

Organic compounds with antibacterial and antiparasitic properties are gaining significance for biomedical applications. This study focuses on the solvent-free synthesis (green synthesis) of 1,4-naphthoquinone or 2,3-dichloro-1,4-naphthoquinone with different phenylamines using silica gel as an acid solid support. The study also includes in silico PASS predictions and the discovery of antibacterial and antiparasitic properties of phenylaminonaphthoquinone derivatives 1–12, which can be further applied in drug discovery and development. These activities were discussed in terms of molecular descriptors such as hydrophobicity, molar refractivity, and half-wave potentials. The in vitro antimicrobial potential of the synthesized compounds 1–12 was evaluated against a panel of six bacterial strains (three Gram-positive: *Staphylococcus aureus*, *Proteus mirabilis*, and *Enterococcus faecalis*; and three Gram-negative bacteria: *Escherichia coli*, *Salmonella typhimurium*, and *Klebsiella pneumoniae*). Six compounds (1, 3, 5, 7, 10, and 11) showed better activity toward *S. aureus* with MIC values between 3.2 and 5.7 µg/mL compared to cefazolin (MIC = 4.2 µg/mL) and cefotaxime (MIC = 8.9 µg/mL), two cephalosporin antibiotics. Regarding in vitro antiplasmodial activity, compounds 1 and 3 were the most active against the *Plasmodium falciparum* strain 3D7 (chloroquine-sensitive), displaying IC₅₀ values of 0.16 and 0.0049 µg/mL, respectively, compared to chloroquine (0.33 µg/mL). In strain FCR-3 (chloroquine-resistant), most of the compounds showed good activity, with compounds 3 (0.12 µg/mL) and 11 (0.55 µg/mL) being particularly noteworthy. Additionally, docking studies were used to better rationalize the action and prediction of the binding modes of these compounds. Finally, absorption, distribution, metabolism, excretion, and toxicity (ADMET) predictions were performed.

Enlace: <https://doi.org/10.3390/ijms251910670>

Assessing Peru's Land Monitoring System Contributions towards Fulfilment of Its International Environmental Commitments

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Abstract

Land use change (LUC) is recognized as one of the major drivers of the global loss of biodiversity and represents a major threat to ecosystems. Deforestation through LUC is mainly driven by fire regimes, logging, farming (cropping and ranching), and illegal mining, which are closely linked with environmental management policies. Efficient land management strategies, however, require reliable and robust information. Land monitoring is one such approach that can provide critical information to coordinate policymaking at the global, regional, and local scales, and enable a programmed implementation of shared commitments under the Rio Conventions: the United Nations Convention on Biological Diversity (CBD), Convention to Combat Desertification (UNCCD), and Framework Convention on Climate Change (UNFCCC). Here we use Peru as a case study to evaluate how a land monitoring system enables environmental policy decisions which appear in the country's international commitment reports. Specifically, we synthesize how effective the ongoing land monitoring system has been in responding to current and future environmental challenges; and how improvements in land monitoring can assist in the achievement of national commitments under the Rio Conventions. We find that Peruvian policies and commitments need to be improved to be consistent with the 1.5 °C temperature limit of the Paris agreement. Regarding the Aichi targets, Peru has achieved 17% land area with sustainable management; however, the funding deficit is a great challenge. Even though Peru commits to reducing GHG emissions by reducing LUC and improving agricultural and land use forestry practices, it needs policy improvements in relation to land tenure, governance, and equity. Potential explanations for the observed shortcomings include the fragmentation and duplication of government roles across sectors at both a national and regional scale.

Enlace: <https://doi.org/10.3390/land13020205>

Estrategia de atracción del talento humano en el sector público: Curso de Extensión Universitaria en Fiscalización Ambiental del OEFA

Strategy for attraction of human talent in the public sector: OEFA University Extension Course on Environmental Control

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Organismo de Evaluación y Fiscalización Ambiental



Resumen

El sector público actual enfrenta un reto crítico: atraer talento excepcional. Esta tarea es crucial para robustecer la capacidad institucional y elevar la calidad de los servicios gubernamentales. Urge, por tanto, implementar estrategias efectivas para captar y mantener a profesionales de alto calibre, cuya experticia y dedicación al servicio público sean catalizadores de una administración más eficiente y orientada al ciudadano.

El estudio explora el Curso de Extensión Universitaria en Fiscalización Ambiental (CEU), diseñado y desarrollado por el Organismo de Evaluación y Fiscalización Ambiental (OEFA) del Perú. Inicialmente, el CEU tiene como objetivo promover el interés de los estudiantes universitarios en temáticas de fiscalización ambiental. Durante los últimos años, este curso se ha desarrollado como una estrategia para atracción anticipada de talento especializado en fiscalización ambiental que ha permitido a los primeros puestos de cada especialidad realizar prácticas preprofesionales o profesionales en las instalaciones del OEFA a nivel nacional.

La atracción de talento especializado es un pilar clave en el ámbito organizacional, crucial para incorporar profesionales altamente capacitados y motivados. Las estrategias en este sentido incluyen un conjunto de acciones diseñadas específicamente para atraer a estudiantes universitarios con las habilidades y competencias que se alinean con las necesidades y objetivos de la organización. Entre las principales estrategias destaca, la implementación de programas de formación y especialización dirigida a estudiantes universitarios de las áreas de ciencias, derecho y economía.

Se hace una descripción del CEU, y se proporciona una explicación general de las etapas de diseño, inscripción, participación y resultados. Estas etapas permiten comprender cómo la implementación de un programa formativo y de especialización en fiscalización ambiental contribuye con la misión de garantizar el éxito y la competitividad del OEFA. Finalmente, se muestran los resultados en términos de participación según género, tipo de universidad, regiones y especialidad. Este artículo es un aporte al debate académico sobre la gestión de recursos humanos en el ámbito público, pues ofrece valiosos insights y lecciones aprendidas que pueden servir de base a futuras prácticas y políticas en este sector.

Abstract

The current public sector faces a critical challenge: attracting exceptional talent. This task is crucial for strengthening institutional capacity and enhancing the quality of government services. Therefore, it is urgent to implement effective strategies for early attract and retain high-caliber professionals whose expertise and dedication to public service can serve as catalysts for a more efficient and citizen-oriented administration. The study explores the University Extension Course in Environmental Control (CEU, in Spanish), designed and developed by the Environmental

Assessment and Enforcement Agency (OEFA, in Spanish) of Peru. Initially, the CEU course aims to promote university students' interest in environmental oversight topics. In recent years, this course was developed as a strategy to attract specialized talent in environmental control, allowing top students from each specialty to undertake internships at OEFA facilities nationwide.

Attracting specialized talent is a key pillar in the organizational realm, essential for incorporating highly skilled and motivated professionals. Strategies in this regard include a set of actions specifically designed to attract university students with skills and competencies aligned with the organization's needs and objectives. Among the main strategies is the implementation of training and specialization programs targeting students in the fields of science, law, and economics.

A description of the CEU is provided, offering a general explanation of the stages of design, enrollment, participation, and results. These stages help to understand how the implementation of a training and specialization program in environmental oversight contributes to ensuring the success and the competitiveness of the OEFA. The results are presented in terms of participation by gender, type of university, regions, and specialty. This article contributes to the academic debate on human resource management in the public sphere, offering valuable insights and lessons learned that can inform future practices and policies in this sector.

Enlace: <https://doi.org/10.54774/ss.2024.12.04>



6

**Reducción de
emisiones de gases de
efecto invernadero**

Contribución de los fragmentos de vegetación al almacenamiento de carbono en paisajes agrícolas de la Amazonía peruana

Contribution of vegetation fragments to carbon storage in agricultural landscapes of the Peruvian Amazon

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Resumen

En el presente estudio se cuantifican las reservas de carbono existentes en siete fragmentos del paisaje agropecuario: (1) el bosque primario altamente talado, (2) bosques secundarios de 5, (3) 10 y (4) 15 años procedentes de pasturas, (5) agroforestería de cacao, (6) pastizal de *Brachiaria decumbens* en producción y (7) pastizal de *Brachiaria decumbens* degradado; estos fragmentos son característicos de los fundos agropecuarios del departamento de Ucayali, Perú. El carbono almacenado (la suma total de la parte aérea y del suelo) en el Bosque Primario fue de 267.26 t/ha; en Bosque Secundario de 15 años 232.30 t/ha; en Bosque Secundario de 10 años, 162.1 t/ha; en Bosque Secundario de 5 años, 124.42 t/ha; en agroforestería con cacao, 108.82 t/ha; en pastizal de *B. decumbens*, 72.57 t/ha; y en pastizal de *B. decumbens* degradada, 60.47 t/ha. Se observaron diferencias significativas ($p \leq 0.0001$) entre los valores de carbono almacenado de los siete fragmentos, ($R^2 = 0.51$, y CV = 53.66%). La prueba de contrastes ortogonales mostró que el carbono almacenado en el fragmento de bosque primario superó significativamente al promedio de carbono de los demás fragmentos; mientras que, el carbono almacenado en los bosques secundarios superó significativamente al carbono almacenado en el fragmento de agroforestería de cacao. No se encontraron diferencias del carbono almacenado en ambas pasturas, tampoco entre los bosques secundarios de 10 y 15 años. El incremento del número de familias y especies en relación directa a la edad del bosque secundario sería evidencia de la recuperación de la diversidad botánica.

Abstract

In the present study, carbon stocks were quantified in seven agroforestry landscape fragments: (1) heavily logged primary forest, (2) secondary forests of 5, (3) 10, and (4) 15 years originating from pastures, (5) cacao agroforestry, (6) productive *Brachiaria decumbens* grassland, and (7) degraded *Brachiaria decumbens* grassland. These fragments are characteristic of agricultural estates in the Ucayali department, Peru. The carbon stored (the total sum of aboveground and soil) in the primary forest was 267.26 t/ha; in 15-year secondary forest, 232.30 t/ha; in 10-year secondary forest, 162.1 t/ha; in 5-year secondary forest, 124.42 t/ha; in cacao agroforestry, 108.82 t/ha; in productive *B. decumbens* grassland, 72.57 t/ha; and in degraded *B. decumbens* grassland, 60.47 t/ha. Significant differences ($p \leq 0.0001$) were observed between the carbon stock values of the seven fragments ($R^2 = 0.51$, and CV = 53.66%). Orthogonal contrast tests showed that the carbon stored in the primary forest fragment significantly exceeded the average carbon of the other fragments, while the carbon stored in the secondary forests significantly exceeded that stored in the cacao agroforestry fragment. No differences were found in the carbon stored in both grasslands, nor between the 10- and 15-year secondary forests. The increase in the number of families and species directly related to the age of the secondary forest provides evidence of the recovery of botanical diversity.

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Net primary productivity and litter decomposition rates in two distinct Amazonian peatlands

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Abstract

Measurements of net primary productivity (NPP) and litter decomposition from tropical peatlands are severely lacking, limiting our ability to parameterise and validate models of tropical peatland development and thereby make robust predictions of how these systems will respond to future environmental and climatic change. Here, we present total NPP (i.e., above- and below-ground) and decomposition data from two floristically and structurally distinct forested peatland sites within the Pastaza Marañón Foreland Basin, northern Peru, the largest tropical peatland area in Amazonia: (1) a palm (largely *Mauritia flexuosa*) dominated swamp forest and (2) a hardwood dominated swamp forest (known as 'pole forest', due to the abundance of thin-stemmed trees). Total NPP in the palm forest and hardwood-dominated forest (9.83 ± 1.43 and 7.34 ± 0.84 Mg C ha⁻¹ year⁻¹, respectively) was low compared with values reported for *terra firme* forest in the region (14.21 – 15.01 Mg C ha⁻¹ year⁻¹) and for tropical peatlands elsewhere (11.06 and 13.20 Mg C ha⁻¹ year⁻¹). Despite the similar total NPP of the two forest types, there were considerable differences in the distribution of NPP. Fine root NPP was seven times higher in the palm forest (4.56 ± 1.05 Mg C ha⁻¹ year⁻¹) than in the hardwood forest (0.61 ± 0.22 Mg C ha⁻¹ year⁻¹). Above-ground palm NPP, a frequently overlooked component, made large contributions to total NPP in the palm-dominated forest, accounting for 41% (14% in the hardwood-dominated forest). Conversely, *Mauritia flexuosa* litter decomposition rates were the same in both plots: highest for leaf material, followed by root and then stem material (21%, 77% and 86% of mass remaining after 1 year respectively for both plots). Our results suggest potential differences in these two peatland types' responses to climate and other environmental changes and will assist in future modelling studies of these systems.

Enlace: <https://doi.org/10.1111/gcb.17436>

The global distribution and drivers of wood density and their impact on forest carbon stocks

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Abstract

The density of wood is a key indicator of the carbon investment strategies of trees, impacting productivity and carbon storage. Despite its importance, the global variation in wood density and its environmental controls remain poorly understood, preventing accurate predictions of global forest carbon stocks. Here we analyse information from 1.1 million forest inventory plots alongside wood density data from 10,703 tree species to create a spatially explicit understanding of the global wood density distribution and its drivers. Our findings reveal a pronounced latitudinal gradient, with wood in tropical forests being up to 30% denser than that in boreal forests. In both angiosperms and gymnosperms, hydrothermal conditions represented by annual mean temperature and soil moisture emerged as the primary factors influencing the variation in wood density globally. This indicates similar environmental filters and evolutionary adaptations among distinct plant groups, underscoring the essential role of abiotic factors in determining wood density in forest ecosystems. Additionally, our study highlights the prominent role of disturbance, such as human modification and fire risk, in influencing wood density at more local scales. Factoring in the spatial variation of wood density notably changes the estimates of forest carbon stocks, leading to differences of up to 21% within biomes. Therefore, our research contributes to a deeper understanding of terrestrial biomass distribution and how environmental changes and disturbances impact forest ecosystems.

Enlace: <https://doi.org/10.1038/s41559-024-02564-9>

The pace of life for forest trees

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Abstract

Tree growth and longevity trade-offs fundamentally shape the terrestrial carbon balance. Yet, we lack a unified understanding of how such trade-offs vary across the world's forests. By mapping life history traits for a wide range of species across the Americas, we reveal considerable variation in life expectancies from 10 centimeters in diameter (ranging from 1.3 to 3195 years) and show that the pace of life for trees can be accurately classified into four demographic functional types. We found emergent patterns in the strength of trade-offs between growth and longevity across a temperature gradient. Furthermore, we show that the diversity of life history traits varies predictably across forest biomes, giving rise to a positive relationship between trait diversity and productivity. Our pan-latitudinal assessment provides new insights into the demographic mechanisms that govern the carbon turnover rate across forest biomes.

Enlace: <https://doi.org/10.1126/science.adk9616>



Gestión integrada de los recursos naturales

Space out of joint: absurdist geographies of the Anthropocene

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Abstract

This paper seeks to demonstrate the critical utility of the concept of the absurd in the exploration of the combined and uneven apocalypse known as the Anthropocene. Drawing inspiration from absurdist literature, and based on extensive field research, it takes the form of a psychogeographical journey down a non-existent highway in the Peruvian Amazon. The route of this long-promised megaproject is inhabited by people adrift in the midst of meaningless ruins, haunted by spectral infrastructures that were promised but never came, and plagued by monstrous apparitions of extractive violence. Consistent with absurdist method, the paper resists the temptation to leap out of this disconcerting domain into the normalizing rituals of academic sensemaking, and aims instead to grasp and convey the disorienting lived experience of 'space out of joint'. In doing so, it suggests that an absurdist sensibility can contribute to current debates in cultural geography on spectrality, psychogeography, and creative writing, through its emphasis on irrationality and indeterminacy, its exploration of chaotic and disintegrating spaces, and its evocation of fragmentation and disjuncture in the form of jagged shards of stark and vivid prose.

Enlace: <https://doi.org/10.1177/14744740221138096>

GC Insights: Lessons from participatory water quality research in the upper Santa River basin, Peru

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Abstract

Here we share four key lessons from an interdisciplinary project (Nuestro Rio) that gathered community perspectives on local water quality in the Santa River basin (Peru) utilising a digital technological approach where we collected data via a novel photo elicitation app, supported by a field work campaign. The lessons explored in this article provide insights into challenges and opportunities for researchers considering developing technological tools for encouraging participation and engagement in marginalised communities.

Enlaces: <https://doi.org/10.5194/gc-7-145-2024>

<http://hdl.handle.net/20.500.12816/5616>

Sustainable land and irrigation management to limit loss of hydropower in the Andes-Amazon headwaters

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Servicio Nacional de Meteorología e Hidrología del Perú



Abstract

Water plays a critical role in adapting food and energy systems to climate change in the Andes. However, robust climate solutions that work across sectors have not been explored for these working landscapes. Here we develop a framework consisting of high-fidelity catchment and hydropower models while considering climate and other uncertainties in a robust, bottom-up manner for the upper Huallaga River in Peru. We then explore adaptation strategies across sectors. Our results highlight that irrigation will be critical for maintaining food production under climate change. Yet, an unplanned expansion of irrigation could lead to a near total loss of firm hydropower downstream. Exploring 10,080 possible landuse/management adaptation pathways, we find limited opportunities for win-win solutions under climate change. In the light of such challenges, our results highlight the need for navigating structural trade-offs between upstream land and water users and downstream interests in the Andes in a strategic and equitable manner.

Enlace: <https://doi.org/10.1038/s43247-024-01738-4>



8

**Gestión integral de
residuos sólidos**

Impact of leachate on soil microbial diversity and its treatment

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Abstract

This study analyzed the impact of leachate from a temporary landfill on soil microbial diversity in Tingo María, Huánuco region, Peru. Three treatments were used: untreated soil (S), addition of stream water (T0), leachate (T1), and leachate treated by coagulation and flocculation (T2), with 828.5 ml/week added in three weekly doses. Soil samples were collected from the Reserved Forest of the Universidad Nacional Agraria de la Selva. Twenty-one randomly distributed soil samples were taken and homogenized for analysis. Soil quality parameters measured included sand, clay, silt, texture, pH, organic matter, nitrogen, phosphorus and potassium. As for microorganisms, viable aerobes, lactobacilli, actinomycetes, fungi, nitrogen-fixing bacteria, and *Escherichia coli* were quantified using specific culture and counting methods for each of them. To evaluate the impact of the leachate on microbial diversity, equity indices (Shannon and inverse Simpson), dominance indices (complementary Simpson and Berger Parker) and the percentage composition of each microorganism per treatment were used. An ANOVA was performed to estimate differences in microbial diversity, with a Tukey test at a significance level of $\alpha = 0.05$. The study showed that leachates affect soil microbial diversity, reducing equity and increasing the dominance of certain species such as *E. coli*. They also alter physicochemical parameters, decreasing organic matter and nitrogen but increasing other elements such as phosphorus and potassium. This could have implications for soil health and functionality.

Enlace: <https://doi.org/10.17268/sci.agropecu.2024.023>

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